ORIGINAL

Florida Power & Light Company, 215 S. Monroe St., Suite 810, Tallahassee, FL 32301

FPL

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May 7, 2007

-VIA HAND DELIVERY -

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

Re: Florida Power & Light Company's Electric Infrastructure Storm Hardening Plan, filed in compliance with Rule 25-6.0342, F.A.C.

Dear Ms. Cole:

I am enclosing for filing in the above docket the original and seven (7) copies of the Petition of Florida Power & Light Company for Approval of Storm Hardening Plan, together with a diskette containing the electronic version of same. The enclosed diskette is HD density, the operating system is Windows XP, and the word processing software in which the document appears is Word 2003.

If there are any questions regarding this transmittal, please contact me at 561-304-5639.

Sincerely,

for John T. Butler

Enclosures

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: approval of Florida Power & Light Company's storm hardening plan pursuant to Rule 25-6.0342, F.A.C.	)))	Docket No. Filed: May 7, 2007

PETITION OF FLORIDA POWER & LIGHT COMPANY
FOR APPROVAL OF STORM HARDENING PLAN

Florida Power & Light Company ("FPL") hereby petitions the Commission for approval of its Electric Infrastructure Storm Hardening Plan attached hereto as Exhibit 1 (the "FPL Plan"), which is submitted in compliance with Rule 25-6.0342, F.A.C. In support of this Petition, FPL states as follows:

1. FPL is a public utility subject to the regulatory jurisdiction of the Commission under Chapter 366, Florida Statutes. The Company's principal offices are located at 9250 West Flagler Street, Miami, Florida.

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

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3. Subsection (2) of Rule 25-6.0342 requires each Florida investor-owned electric utility such as FPL to file a detailed storm hardening plan within ninety days of the rule's effective date. Pursuant to Order No. PSC-07-0043A-FOF-EI, issued in Docket Nos. 060172-

EU and 060173-EU on January 17, 2007, Rule 25-6.0342 became effective on February 5, 2007. The filing deadline is thus May 7, 2007, and the FPL Plan is timely filed.

4. Subsections (3), (4) and (5) of Rule 25-6.0342 set forth the required elements of storm hardening plans. The FPL Plan contains all of the required elements. With respect to the deployment strategy contemplated by subsection (4), the FPL Plan contains a detailed description of FPL's deployment plans for 2007, which is the only year for which FPL's planning and budgeting process has progressed to the point that such details are known. The Plan also includes a higher-level discussion of FPL's current expectations for deployment in 2008 and 2009. FPL intends to file updates to the FPL Plan annually, in which it will provide a detailed description of its deployment plans for the then-current year and a higher-level discussion of its current expectations for deployment in the subsequent two years. For example, in 2008 FPL will file an update containing a detailed description of its deployment plans for 2008 and higher-level discussions of its current expectations for deployment in 2009 and 2010.

5. As contemplated by subsection (6) of Rule 25-6.0342, FPL has sought input from joint users and third-party attachers, and FPL has attempted in good faith to accommodate their concerns. On March 22, 2007, FPL sent a detailed information package on its storm hardening plans to representatives of all known attachers, including all individuals whose contact information had been provided to FPL pursuant to subsection (6). FPL's information package, including the distribution list to which it was sent, is attached hereto as Exhibit 2. The cover letter for the information package invited comments by April 23, 2007. In addition, FPL held a meeting on April 12, 2007 to assist attachers in understanding FPL's plans for storm hardening and to answer their questions. The cover letter for the information package invited all recipients to that meeting. At the meeting, several of the attaching entities requested, and FPL agreed to

provide, additional details concerning the electric circuits that will be affected by FPL's 2007 deployment plans. On April 16, 2007, FPL provided to those attaching entities a CD containing engineering drawings, where completed, or asset management circuit drawings for those designs not completed, for all 72 circuits that FPL is planning to harden in 2007. Finally, in order to implement subsection (4)(e) of Rule 25-6.0342, the cover letter also solicited input from attachers on what the costs and benefits of FPL's storm hardening plans will be for them. To date, FPL has received comments from six attachers with only one (the Florida Cable Television Association, or FCTA) providing specific comments on FPL's construction and attachment standards. FPL has incorporated several of the FCTA's recommended changes into its standards.

6. The FPL Plan will result in an increase in the storm resilience of FPL's transmission and distribution system, with a significant part of that increase occurring in the early years of implementation. At the same time, the FPL Plan is carefully structured to achieve this increased storm resilience in a cost-effective manner. Implementation of the FPL Plan is expected to benefit FPL customers during and after future storm events by reducing the extent of power outages, especially for critical functions such as hospitals and governmental services as well as businesses such as grocery stores, gas stations and pharmacies that meet essential community needs. Moreover, to the extent that FPL's hardened electric service facilities are better able to survive storm events undamaged, customers will also benefit due to a reduction in storm restoration costs. And because of the emphasis in the FPL Plan on cost-effective implementation, the cost of achieving these benefits will be minimized.

7. In order to deliver storm resilience benefits cost-effectively, the FPL Plan contemplates a three-pronged approach to storm hardening FPL's distribution system:

a. In the first prong, FPL intends to apply the National Electrical Safety Code ("NESC") extreme wind loading ("EWL") design criteria to the electric facilities that serve critical infrastructure such as hospitals, 911 centers, special needs shelters, water treatment plants and fire stations (these critical services, and the electric facilities that serve them, are referred to as "CIFs") as well as specific poles that are important to overall restoration and relief efforts (these poles are referred to as "Targeted Critical Poles"). FPL believes that the expense of EWL design is warranted for these categories of electric facilities because the resulting storm resilience will be especially beneficial to FPL's customers.

b. In the next prong, which is referred to as "Incremental Hardening," FPL will be increasing the overall wind profile of certain main distribution lines (called "feeders") to a higher wind rating, up to and including EWL. Incremental hardening will apply appropriate combinations of cost-effective engineering options (e.g., storm guying, relocation, adding intermediate poles, upgrading the pole) to eliminate weak links and take advantage of the existing storm resilience of a circuit. The focus of Incremental Hardening will be on feeders serving businesses that meet essential community needs, such as grocery stores, gas stations and pharmacies. Additionally, Incremental Hardening will focus on poles other than Targeted Critical Poles that are nonetheless critical during storm restoration. This would include poles with additional electrical equipment attached, e.g., automated feeder switches and capacitor banks.

c. The final prong in FPL's storm hardening approach is the adoption of new design guidelines for poles that are set or replaced in conjunction with new construction, major planned work, relocation projects and daily work. The FPL Plan includes standardized pole size/type specifications to be used in those circumstances. The specifications reflect the utilization of stronger poles and shorter span lengths for the facilities that are subject to the new design guidelines. This will result in stronger designs that are consistent with EWL and are intended to facilitate the evolution of FPL's overall distribution system to EWL criteria over time.

8. FPL's transmission system is already built to EWL standards and generally fared well in the 2004 and 2005 storm seasons. Nonetheless, based on experience with the performance of the system, including specific lessons learned from those storm seasons, FPL has commenced two initiatives system-wide to further improve the storm resilience of its transmission and substation system: replacement of single pole un-guyed wood transmission structures; and replacement of ceramic post insulators on all concrete transmission poles. These types of poles and insulators were involved in a high percentage of transmission system damage in the 2004 and 2005 storm seasons. Replacing them has previously been approved by the Commission as part of FPL's "Storm Preparedness Initiatives," in Order No. PSC-06-0781-PAA-EI, Docket No. 060198-EI, dated September 19, 2006 (the "Storm Initiatives Order"). FPL incorporates its Storm Preparedness Initiatives and the Commission's Storm Initiatives Order herein by reference. FPL forecasts completion of these two transmission system hardening initiatives over the next 10 to 15 years and will prioritize the work based on factors including proximity to high wind areas, system importance, customer count, and coordination with the distribution CIF storm initiative. Other economic efficiencies, such as performing work on multiple transmission line sections within the same corridor, will also be considered.

9. As contemplated by subsection (5) of Rule 25-6.0342, the FPL Plan also addresses FPL's standards and procedures applicable to joint users and third-party attachers. These standards and procedures are intended to ensure that attachments do not interfere with or

degrade the storm resilience achieved by FPL's storm hardening initiatives. As discussed in Paragraph 5 above, FPL has solicited comments from the attachers on the FPL Plan, specifically including comments on the attachment standards and procedures.

10. In 2007, FPL plans to spend approximately $40-70 million on deploying its hardening plans for the distribution system. The CIF initiative will focus on EWL hardening of the electric circuits that serve 28 acute care facilities located throughout FPL's service territory plus four feeders critical to the operation of FPL's system. In addition, FPL plans to EWL harden Critical Poles in 43 highway crossings of I-75 and the Florida Turnpike, as well as 78 additional Critical Poles locations elsewhere in the service territory. The Incremental Hardening Initiative will focus on 34 feeder circuits that are located in the east and south regions, primarily in the Tri-County Area (*i.e.,* Miami-Dade, Broward and Palm Beach Counties). The Tri-County Area is being addressed first because it has the highest population density and is located in an area that is especially vulnerable to hurricanes (for example, it is within the highest NESC extreme wind zone). The Design Guidelines will be utilized system-wide for all new construction and daily work. In total, FPL's 2007 deployment plan for its distribution system will impact approximately 145 miles of overhead electric circuits. In addition, FPL expects to replace approximately 300 single pole un-guyed wood transmission structures and to replace ceramic insulators on about 450 concrete transmission poles in 2007. The cost of this work is projected to be approximately $7 million.

11. As discussed in Paragraph 4 above, FPL's planning and budgeting process cannot provide equivalent detail at this time about deployment plans for 2008 and 2009. In general, FPL expects to harden approximately 85-125 feeders in 2008 and to harden in the range of 80-150 feeders in 2009. For both years, most of the hardened feeders will serve CIF customers and

community projects. Of course, FPL's 2008 and 2009 deployment plans may change based on FPL's experience with deployment in 2007 and other factors. For the transmission system, FPL expects to continue implementing the two initiatives described above, at approximately the same rate in 2008 and 2009 as it is in 2007.

12. The FPL Plan should result in less storm damage to the electrical infrastructure and therefore less restoration time and cost, especially when one considers the interaction among all of FPL's Storm Secure initiatives, including the FPL Plan, pole inspections, and increased vegetation management activities.[1] The costs and benefits of FPL's "Storm Preparedness Initiatives" have been previously reviewed and approved by the Commission.[2] Of course, FPL's ability to identify and estimate benefits from storm hardening are necessarily incomplete and imprecise at this time. Actions that FPL is taking and proposing to adopt represent industry leading changes in construction standards, maintenance practices and restoration processes. While the analyses and forensic observations performed after Hurricanes Katrina and Wilma serve as the foundation for FPL's hardening efforts, there is presently limited or no historical data available for purposes of conducting overall cost/benefit analyses today on many of these actions. Nonetheless, in spite of these limitations, it is clear that FPL's Storm Secure initiatives will benefit the FPL system and FPL's customers in both storm and day-to-day operational conditions. As additional storm experience, more and better data, and new improved processes, products and materials become available, FPL will be in a better position to perform detailed cost

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1 Of course, FPL's system is very diverse and geographically large. As a result, it will take many years of sustained effort to achieve these changes in the resiliency of FPL's system.

2 The City of North Miami protested the application of a portion of FPL vegetation management initiative within the City. Staff has recommended that the City's protest be denied, and the Commission is scheduled to consider that recommendation at its May 8, 2007 agenda conference.

/benefit analyses, and these may also indicate that additional and/or different cost-effective hardening solutions can be implemented.

13. The FPL Plan also summarizes the input that FPL received from attachers about what they estimate the costs and benefits of those measures to be for them. In general, the attachers perceive that implementation of the FPL Plan will impose costs on them for relocating, modifying and/or replacing their attachments to existing poles that will be hardened to EWL or Incremental Hardening standards, as well as potential charges and increased pole rental fees associated with the hardened FPL poles.[3] They generally see the FPL Plan as benefiting them through improved service reliability that they will experience as FPL customers and through reduced damage to their equipment when it is attached to hardened FPL poles.

14. In summary, the FPL Plan is a cost-effective approach to increasing storm resilience in ways that will most benefit FPL's customers. Its deployment is structured to focus initially on providing the most critical and essential benefits to the greatest number of customers, with broader based implementation thereafter. This is the most efficient approach to achieving useful storm resilience as promptly as possible at a reasonable cost. The FPL Plan complies with

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3 Two attachers, AT&T Florida and Fibernet, provided cost estimates specifically for 2007. AT&T Florida estimated costs of $4.4 million and Fibernet estimated costs of approximately $15,600. AT&T Florida and Fibernet did not provide cost estimates for 2008 or 2009. In addition, Embarq provided cost estimates ranging from $14.0 million to $35.0 million for the period 2007-2009. At this time, FPL has not closely scrutinized the basis for the attaching entities' cost estimates. However FPL notes that Embarq's $14 million cost estimate is based on an assumption that FPL will harden 20% of its poles in the first 3 years of the plan, while the $35 million estimate is based on hardening 50% of the poles during that period. Both of these pole replacement assumptions are inconsistent with FPL's hardening plan and are substantially overstated. FPL has approximately 1.1 million poles, so Embarq's 20%-50% pole replacement assumptions would imply that FPL would replace between 220,000 and 550,000 poles over the period 2007-2009. In fact, FPL estimates that its replacements over that period will total only about 5 to 10 percent of Embarq's assumptions. The FCTA, AT&T Florida and Embarq noted that pole rental rates would likely be impacted by implementation of the FPL Plan as well.

all of the requirements of Rule 25-6.0343 and should be approved by the Commission expeditiously as a prudent commitment of resources to meeting the Commission's storm hardening goals.

WHEREFORE, FPL respectfully requests the Commission to approve FPL's storm hardening plan attached hereto as Exhibit 1.

Respectfully submitted,

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By: ______________________
John T. Butler
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Florida Power & Light Company

Electric Infrastructure Storm Hardening Plan

(Rule 25-6.0342, F.A.C.)

May 7, 2007

Florida Power & Light Company
Electric Infrastructure Storm Hardening Plan

EXECUTIVE SUMMARY

The 2004 and 2005 hurricane seasons were the most extraordinary and challenging on record for FPL and its customers. Five direct landfalls and two indirect impacts in the service territory, resulting in significant customer outages and requiring extraordinary efforts to rebuild and restore the electric infrastructure compels us to examine and evaluate the facts from this experience. A change in design, construction and operation of the electrical system infrastructure is indicated as we face, according to forecasters, two decades of heightened tropical cyclonic activity.

On January 30, 2006, FPL responded to this challenge by filing its Storm Secure Plan with the Florida Public Service Commission (FPSC). This comprehensive plan for increased storm preparedness included the following four areas: hardening the electric network; investing in underground conversions; modifying the pole inspection program; and enhancing vegetation management activities. The FPSC has subsequently approved FPL's plan for:

- 8 year distribution and 6 year transmission pole inspection cycles
- continue a three year average cycle for feeders, implement a six year average tree trimming cycle for lateral circuits, and trim all circuits serving critical customers before each storm season
- a Governmental Adjustment Factor (GAF), 25% investment, to promote applicable local government sponsored overhead to underground conversions.

On February 1, 2007, the FPSC adopted Rule 25-6.0342 which directs FPL and other investor owned utilities to file detailed electric infrastructure hardening plans by May 7, 2007. This document contains FPL's detailed plan.

Two key conclusions drawn by FPL from the 2004 and 2005 storms experience and FPL forensic data analysis form the basis for the FPL plan. They are that:

1. For Hurricane Wilma, wind was the predominant root cause of distribution pole breakage.
2. FPL's transmission poles, which are already built to the National Electrical Safety Code (NESC) extreme wind loading criteria (EWL), performed well overall.

Although no electrical system can be made fully resistant to hurricane impacts, we believe that FPL's proposed hardening plan will mitigate the impact of future storms. The following highlights FPL's proposed hardening plan for its distribution system:

- Implement a three prong approach for distribution infrastructure hardening. The three prongs, each of which serves a different purpose under the plan, are EWL; Incremental Hardening, and Design Guidelines. This approach will allow FPL to begin obtaining hardening benefits across our entire service territory promptly and cost-effectively.
- Apply EWL to existing and new feeders (main distribution lines) as well as any associated laterals directly serving Critical Infrastructure Facilities (CIF) (i.e., critical customers such as hospitals and 911 centers, and certain poles critical to operations and efficient restoration). Feeders are the backbone and therefore a critical component of FPL's overhead distribution system. Feeder performance can have a substantial impact on the overall service reliability to our customers.
- Apply Incremental Hardening to certain existing feeders so that, with targeted cost-effective modifications, the entire feeders' wind profile can be increased, up to and including EWL. Initially, Incremental Hardening will focus on "community projects", meaning feeders serving essential community needs such as grocery stores, gas stations and pharmacies.
- Implement system-wide FPL Design Guidelines containing criteria which will apply EWL to the design and construction of all new overhead facilities, major planned work, relocation projects, as well as daily work activities. These guidelines primarily are associated with changes in pole class, pole type and desired span lengths.

FPL's filing also includes information regarding research and development projects and initiatives being pursued in order to identify new ways of strengthening our electrical infrastructure. These initiatives include seeking out and evaluating new products, work methods, and construction techniques. This also includes collaborative research efforts with the Public Utility Research Center (PURC), where initial focus areas are undergrounding, wind testing and vegetation management.

In 2007, FPL plans to utilize EWL to harden 34 feeders and any associated laterals directly serving 28 CIF customers. Additionally, FPL plans to EWL harden Critical Poles in 43 highway crossings of I-75 and the Florida Turnpike, as well as 78 additional Critical Poles at locations elsewhere in the service territory. FPL plans to apply Incremental Hardening to feeders associated with 34 community projects. In total, the proposed 2007 deployment plan corresponds to approximately 145 overhead circuit miles. FPL estimates its 2007 expenditures will range from \$40 - \$70 million. These estimates are based upon current work methods, products, and equipment and assume the necessary resources will be available to execute the plan.

FPL has not yet finalized hardening plans for 2008 and 2009. At this time, our preliminary 2008 and 2009 plans propose hardening an additional 80 -150 feeders each year, impacting approximately 300-600 miles per year. Costs are estimated at this time to be $75 - $125 million in 2008 and $100 - $150 million in 2009.

As noted, FPL's transmission system is already built to EWL standards and performed well in the 2004 and 2005 storm seasons. However to further improve its transmission and substation system, FPL has commenced the replacement of single pole un-guyed wood transmission structures and ceramic post insulators on concrete poles to meet higher, more current design standards. Replacing them has previously been approved by the Commission as part of FPL's "Storm Preparedness Initiatives," in Order No. PSC-06-0781-PAA-EI, Docket No. 060198-EI, dated September 19, 2006 (the "Storm Initiatives Order"). Based on replacement over a 10-15 year period, the estimated annual cost will range from $5 million - $8 million. For 2007, FPL estimates these costs to be $7 million.

FPL's storm hardening plan should result in less storm damage to the electrical infrastructure and therefore less restoration time and cost. For example, in another Hurricane Wilma type event, FPL estimates that hardened feeder pole failure rates and associated restoration time, based on construction man-hours, will be reduced. More generally, FPL's Storm Secure initiatives, including its storm hardening plan, pole inspections, and increased vegetation management activities, can be reasonably expected to reduce future storm restoration costs compared to what they would be without those initiatives. The costs and benefits of FPL's response to the Commission's requirement in Docket No. 060198-EI for 10-point storm implementation plans are discussed in FPL's "Storm Preparedness Initiatives" document, which was filed, reviewed and approved in that docket and is incorporated herein by reference. Hardening the system, increasing pole inspections, enhancing line clearing activities, promoting underground, along with various storm preparedness initiatives will all have an impact on reducing storm damage, reducing or preventing outages, and reducing the overall storm restoration times. Additionally, there will be day-to-day reliability benefits realized. Finally, improved systems and processes, including improved storm forensics, will allow for more and better data to be collected, evaluated and analyzed. Of course, FPL's system is very diverse and geographically large so it will take many years of sustained effort to achieve the full benefits of storm hardening.

While there will be benefits from FPL's Storm Secure initiatives, it is impossible at this time to estimate the full extent of the benefits with any precision. The actions that FPL is taking and proposing to adopt pursuant to this storm hardening plan represent industry leading changes in construction standards, maintenance practices and restoration processes. The analyses and forensic observations performed after Hurricanes Katrina and Wilma serve as the foundation for FPL's hardening efforts, but there is presently limited or no historical data available for purposes of conducting overall cost/benefit analyses on many of these new actions. As additional storm experience, more and better data, new improved processes, products and materials become available, better detailed cost /benefit analysis will be able to be performed and more cost-effective hardening solutions implemented. In the meantime, FPL believes that implementing its current hardening approach (targeting critical infrastructure for EWL, the application of Incremental Hardening for community projects, and the utilization of the Design Guidelines) is in the best interest of its customers.

In conclusion, without fundamental and significant changes in the way we construct and harden our infrastructure to prevent outages, FPL believes the level of disruptions to its infrastructure from future storms would be much like that experienced in the 2004 and 2005 hurricanes season. It is important to note, however, that regardless of FPL's Storm Secure initiatives, when severe weather events impact our state – outages will occur. It is FPL's intention, however, to take the steps necessary to mitigate such impact. The tactical and strategic initiatives and plans FPL is pursuing, including the hardening plans included in this filing, not only address the resiliency of FPL's system to future severe weather events, but also provide for an increased level of day-to-day reliability for our customers. As new technologies become available and process enhancements and other improvement opportunities are identified, FPL will continue to make refinements to these plans.

INTRODUCTION

In compliance with Rule 25-6.0342, the following provides details on Florida Power & Light's (FPL) electric distribution and transmission infrastructure storm hardening plans.

DISTRIBUTION

1.0 HISTORY / BACKGROUND

Two extraordinary hurricane seasons in 2004 and 2005 have made it clear that significant changes are required in the way that Florida utilities design, construct and operate their electrical systems. This is particularly true for FPL's service territory, which during this time frame experienced the direct hit of five hurricanes and the indirect impact of two others. Standards that have worked well and provided customers with reliable service in the past need to be enhanced going forward. Florida generally, and South Florida in particular, are much more heavily and densely populated than they were at the time of Hurricane Andrew; customers' expectations have changed; and there is evidence that we are in a more active part of a multi-decade hurricane cycle and can expect more frequent storm events. Even if 2004 and 2005 were anomalies, as long-term statistics suggest, FPL must be prepared for further, significant storm activity in the years ahead.

The issue is not whether changes should be made, but what those changes should be. Although no electrical system can be rendered fully resistant to hurricane impacts, FPL's Storm Secure Plan, which was filed on January 30, 2006, outlined changes that FPL proposes to make to benefit our customers and the communities it serves. FPL's approach to new construction, system upgrades and maintenance will provide significant improvements in FPL's system's resiliency to storms and our restoration time after a storm passes. Additionally, it will ensure that a critical mass of providers of basic services, essential to the health and safety of our communities, will have electric service as promptly as possible after a hurricane strike.

The foundation for FPL's detailed hardening plan is the extensive analyses that FPL conducted either directly, or with the aid of external resources, such as KEMA Incorporated. These analyses included detailed forensic observations of how the system performed after Hurricanes Katrina and Wilma. One key finding from the Hurricane Wilma forensic data was that "wind" was the predominant root cause of distribution pole breakage as opposed to, for example, trees or other flying debris. This key data and the overall performance of FPL's transmission poles, which are already built to the NESC extreme wind criteria, forms the basis for FPL's proposal that certain parts of its distribution system be built to this highest criteria.

FPL's Storm Secure Plan contains 4 key elements: (1) hardening the electric infrastructure; (2) investing in underground conversions; (3) increasing the pole inspection program activities; and (4) enhancing our line clearing and vegetation management activities.

In 2006, FPL began to address each one of these 4 elements. For example: (1) FPL initiated and completed several "hardening" pilot projects, including work done at the Port Everglades, as well as several major hospitals; (2) FPL developed and filed a tariff, the Governmental Adjustment Factor (GAF), to promote the conversion of overhead distribution to underground, by providing a 25% investment for applicable local government-sponsored conversions; (3) FPL initiated its 8 year pole inspection program for distribution wood poles and 6 year inspection program for transmission structures; (4) FPL obtained approval to continue its 3 year average cycle for main-line feeders and implement a 6 year average trim cycle for its lateral lines. Additionally, FPL completed all of the 2005 storm repair follow-up work.

It is important to keep in mind that in order to achieve changes to the resiliency of FPL's system, it will take many years of sustained effort. FPL's system cannot be changed overnight. It is very large, geographically diverse and all parts of the system are susceptible to hurricane impact.

Additionally, it is important to not focus on any one aspect. Electrical systems are exposed to a variety of different failure modes under the stress of hurricane conditions and typically each specific failure mode only accounts for a relative small proportion of the total damage. For example, FPL and every other utility experience pole breakage during hurricane conditions. However, even if FPL had experienced zero pole failures during the 2004 and 2005 storms, there still would have been millions of customers without power.

Overtime, substantial improvements to FPL's system will have cost implications for customers. To help control those costs and to get the most system improvement possible, as soon as possible, we have carefully developed our programs to focus early efforts on those parts of the system where the greatest impacts for a given level of investment can be achieved.

2.0 NATIONAL ELECTRICAL SAFETY CODE (NESC) REQUIREMENTS

The NESC is an American National Standard Institute (ANSI – C2) standard that has evolved over the years. As stated in the NESC, "The purpose of these standards is the practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment." The standards cover a wide range of topics including grounding, overhead lines, clearances, strength and loading, underground, and rules for the operation of lines and equipment. The NESC is currently revised on a 5 year cycle, with the latest edition being 2007. This is the edition presently adopted by the Florida Administrative Code.

The NESC specifies grades of construction on the basis of the required strengths for safety. The relative order of grades of distribution construction is B, C, and N, with Grade B being the highest or strongest. The grade of construction required is determined by the voltage of the circuits involved and what they cross over. Grade C is typically the NESC minimum standard for most electrical distribution facilities. Grade B is only required when crossing railroad tracks, limited-access highways, and navigable waterways requiring waterway crossing permits.

FPL has historically designed its distribution facilities based on the loading as specified in the NESC- Rule 250 B. Combined ice and wind loading for Grade B construction. While this has resulted in a very strong and reliable distribution system, the Rule 250 B criterion is not intended to design facilities for the sorts of extreme wind speed that can be experienced during hurricanes.

2.1 Extreme Wind Loading Criteria (EWL)

EWL is calculated using the wind speeds shown in Figure 250-2(d) of the NESC for Florida. The loading increases significantly with an increase in the wind speed since the wind loading formula uses the square of the wind speed.

Once the load is determined, it is multiplied by the appropriate Load Factor based on the Grade of Construction. This "factored" load is then used to determine the required structure (pole) strength. The strength of various poles is dependent on the material from which they are made. The strength of wood poles is published in ANSI O.5. The strength of poles made from other materials is provided by the manufacturer. Once the strength of a pole is known, it is multiplied by a Strength Factor based on the grade of construction and the material from which the pole is made. This "factored" strength then has to be equal to or greater than the "factored" load.

All facilities that are to be attached to the pole must also be accounted for when determining the desired strength of the structure. This includes the wind load on the pole itself, as well as the conductors, transformers, communication cables and equipment on the pole. The design loading impact to meet EWL usually requires some combination of stronger poles and shorter span lengths (distance between poles) to reduce the wind loading imposed on the conductors and cables. The NESC requires the use of EWL for facilities that exceed 60 feet above ground or water level – normally transmission level structures.

2.2 FPL Compliance

FPL has historically utilized Grade B construction for all distribution lines, other than during a brief period (1993-2004) when, based on a probabilistic study of hurricanes at that time, a portion of FPL's territory utilized Grade C construction. Since Grade B is stronger than Grade C construction, FPL's distribution facilities comply with and, in most cases, exceed the minimum requirements of the NESC. FPL's Distribution Engineering Reference Manual (DERM) and Distribution Construction Standards (DCS) are revised as required to ensure compliance with all applicable rules and regulations. For the purpose of implementing FPL's hardening plan, addenda to the DERM and DCS have been developed to address the specific requirements needed to meet the NESC EWL.

3.0 INFRASTRUCTURE HARDENING STRATEGY

FPL's distribution infrastructure consists of feeders (main distribution lines) and laterals (fused circuits that run off feeder lines), both of which carry primary voltage, as well as lines that carry secondary voltage (e.g., services). To harden its distribution infrastructure, FPL is proposing a three pronged approach: EWL; Incremental Hardening; and revised Design Guidelines. The initial focus of applying EWL will be on feeders and any associated laterals directly serving critical customers, as well as, certain critical poles. Feeders are the backbone and therefore a critical component of FPL's overall distribution overhead system. Feeder reliability can have a substantial impact on overall service reliability to our customers. The next prong, Incremental Hardening, will target existing feeders, that with targeted modifications, the entire feeder's wind profile can be increased, up to and including EWL. The third prong will be the system-wide implementation of FPL's proposed Design Guidelines, which apply EWL criteria to the design and construction of all new overhead facilities, major planned work, relocation projects and daily work activities. This three pronged approach allows FPL to obtain hardening benefits more promptly and cost-effectively across its entire electric system. FPL will continue to evaluate its approach as new products and more cost-effective work methods are developed. The application of this three pronged approach is explained in Section 5.0 below.

4.0 EXTREME WIND SPEED REGIONS FOR APPLICATION OF EWL

To apply the NESC extreme wind map for Florida, FPL proposes to implement the application of EWL into three wind regions, corresponding to expected extreme winds of 105, 130 and 145 mph.

FPL reviewed its practices and procedures and determined that the most effective option for implementation of the extreme wind map would also be by county. Each of the counties that FPL serves was evaluated by applying the highest wind rating for that county.

FPL decided on the three extreme wind regions of 105, 130 and 145 mph for the following reasons:

- A smaller number of wind regions generate advantages through efficiency of work methods, training, engineering and administrative aspects such as standards development and deployment.
- 105, 130 and 145 mph is a well balanced approach to meet the EWL criteria in the counties within each region.

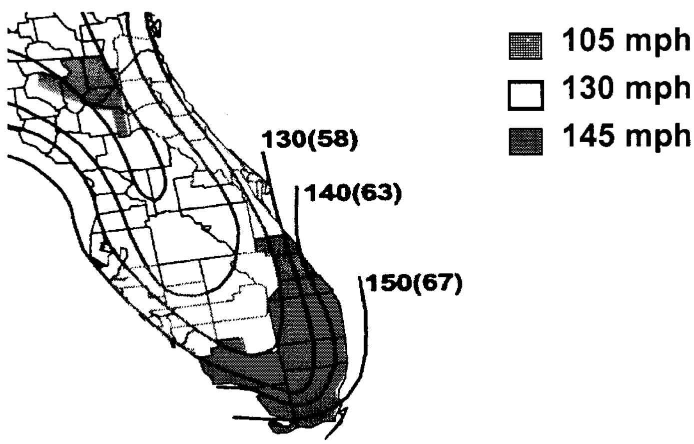


Figure 4-1 FPL Extreme Wind Regions (Meter/Sec)

Note: One exception will be made to the three wind regions, for the sparsely populated extreme southern tip of FPL's service territory. The design EWL wind speed for this area will be 150 mph.

5.0 APPLICATION OF NEW DESIGN AND CONSTRUCTION STANDARDS

5.1 EWL

EWL will be applied to Top CIF feeders and any associated laterals directly serving critical customers. These facilities are critical and essential to the health, safety, welfare and security of the public. Examples of customers served by these facilities include hospitals, 911 Centers, special needs shelters, water treatment plants, police and fire stations. To help identify these facilities, FPL has established a partnership with local Emergency Operations Centers, who assisted in providing input and selecting the most critical facilities. Based on this list, FPL's proposed plan is to harden these facilities to EWL where feasible, practical, and cost-effective. In the first phase of applying EWL, FPL is targeting acute care facilities, i.e. major hospitals.

EWL will also be applied to poles included in FPL's Targeted Critical Pole (TCP) Program. FPL's TCP Program focuses on poles that can impact restoration efforts. The initial focus of this program includes poles associated with overhead limited access highway crossings. If these poles fail they can impede the flow of traffic and emergency vehicles. Priority will be given to potential evacuation routes or those highways used to provide relief efforts soon after the storm. TCP's also include the first distribution pole out of a substation. If these poles fail, an entire feeder and associated laterals would lose service. All TCP's will be hardened to EWL where feasible, practical, and cost-effective.

5.2 Incremental Hardening

The objective of Incremental Hardening is to optimize the existing distribution infrastructure and increase the overall wind profile of a feeder to a higher wind rating, up to and including EWL. Incremental hardening will apply appropriate combinations of cost-effective engineering options (e.g., storm guying, relocation, adding intermediate poles, upgrading the pole, etc.) to eliminate weaker links and take advantage of the existing storm resilience of a feeder. Incrementally hardening a feeder may not always achieve EWL, however, this approach will position FPL to do so in the future.

Figures 5-1 and 5-2 illustrate an example of incremental hardening. In this example the wind rating of the two highlighted poles falls below the wind profile of the remaining portion of the feeder. The wind rating gap between Pole 2 and Pole 3 is considered the "natural breakpoint." All poles whose wind rating is below the rating on Pole 3 will be upgraded.

Before Incremental Hardening

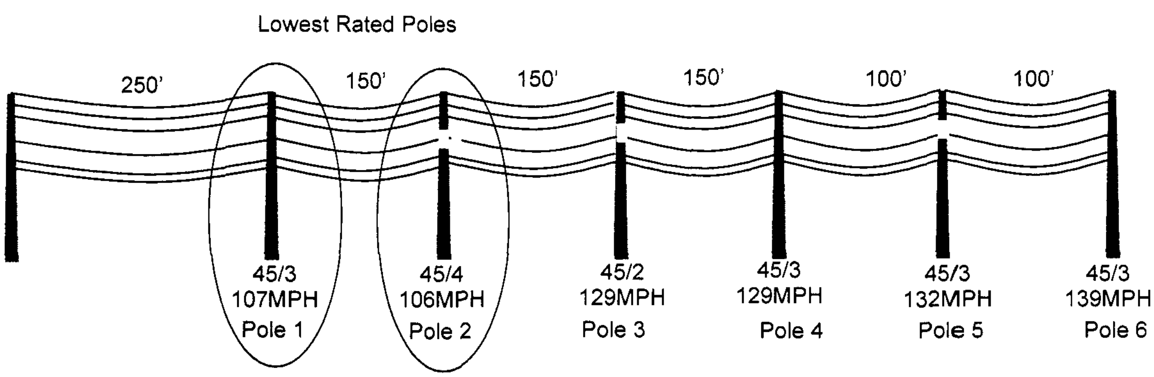


Figure 5-1: Feeder Wind Profile Before Incremental Hardening

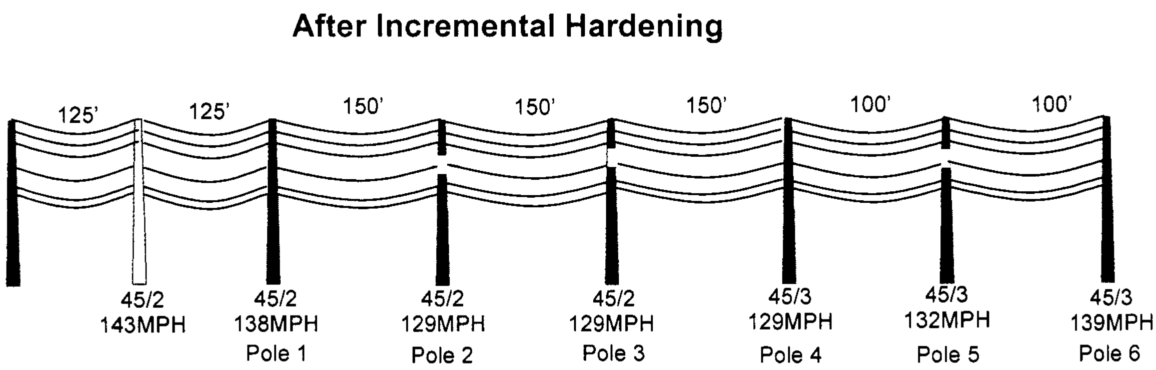


Figure 5-2: Feeder Wind Profile After Incremental Hardening

By targeting poles 1 and 2 for upgrading and installing an intermediate pole before pole 1, the feeder's overall wind profile has been raised to a higher wind rating in a cost-effective manner.

Initially, incremental hardening will target "community projects". Community Projects are associated with feeders that serve community needs such as grocery stores, gas stations and pharmacies. These types of services have also been identified as an essential need within the communities FPL serves. Typically these types of businesses are located nearby major thoroughfares and provide easy access to the community.

FPL will also focus on incremental hardening of poles that are critical during restoration events, but are not TCP's. These critical poles have additional electrical equipment or facilities attached such as automated feeder switches, capacitor banks and multiple circuits.

5.3 Design Guidelines for New Construction

FPL is proposing to utilize its revised Design Guidelines and processes to apply EWL for new construction, major planned work, relocation projects and daily work activities. Depending on the scope of the work that is performed in a particular project, this could result in EWL hardening for an entire circuit (in the case of large-scale projects) or in EWL hardening of one or a small number of poles (in the case of small projects) so that the affected circuit will be in a position to be fully EWL hardened in the future. These guidelines primarily are associated with changes in pole class, pole type and desired span lengths to be utilized. Standardizing these processes will ensure that this type of construction work aligns with FPL's hardening strategy.

FPL's pole sizing guidelines now provide for a minimum installation of Class 2 wood poles for all new feeder and three-phase lateral work in cases where previous designs might have called for a Class 3 wood pole. For two-phase and single-phase lateral work, a Class 3 wood pole is now required, where previous designs might have called for a Class 5 wood pole. For service and secondary work, a minimum of a Class 4 wood pole is to be used, where previously Class 5 or 6 wood poles could have been used. For critical poles, FPL is proposing to install concrete poles at accessible locations. These changes position FPL for hardening complete existing circuits to EWL in the future.

The following Table 5-1 illustrates a sample comparison of the Present Standard vs. Proposed Hardening Guidelines and the average percentage increase in wind rating. MPH calculations are dependent on various factors, including span length, equipment and attachments, framing, etc. Variations in any of these factors may yield different results.

Pole Type	Present Guideline	New Guideline	Average % Increase in Wind Rating
Critical Pole	Class 3 (wood)	Class III-H (concrete)	23%
Feeder Pole	Class 3 (wood)	Class 2 (wood)	11%
Lateral Pole	Class 5 (wood)	Class 3 (wood)	22%
Service Pole	Class 5 (wood)	Class 4 (wood)	11%

Table 5-1 Design Guidelines Pole Recommendations

FPL's Distribution Design Guidelines are included in the Appendix, which is attached to this filing.

5.4 Hardening Existing Facilities

To determine how a circuit or critical pole will be hardened, a field survey of the circuit facilities must be performed. By capturing detailed information at each pole location such as pole type, class, span distance, attachments, wire size and framing, a comprehensive windloading analysis can be performed to determine the current wind rating of each pole, and ultimately the circuit itself. This data is then used to identify the specific pole locations within the circuit that do not meet the desired wind rating. Once locations have been identified, recommendations to increase the allowable wind rating of the pole can be made.

FPL proposes to utilize a "design toolkit" that focuses on evaluating and using cost-effective hardening options for each location. Examples of options in the toolkit include the following:

- Storm Guying – Install one guy in each direction perpendicular to the line of lead. This is a very cost-effective option; however, proper field conditions need to be present to allow for installation.
- Equipment Relocation – Equipment on a pole may be moved to a near-by stronger pole or one with a higher allowable wind rating.
- Intermediate Pole – Install a single pole when long span lengths are present. By reducing the span length, the wind rating of both adjacent poles is increased.
- Upgrading Pole Class – Replace the existing pole for a higher class pole to increase the pole's wind rating.
- Undergrounding Facilities – Utilize if there are significant barriers to build overhead or if it is a more cost-effective option for a specific application

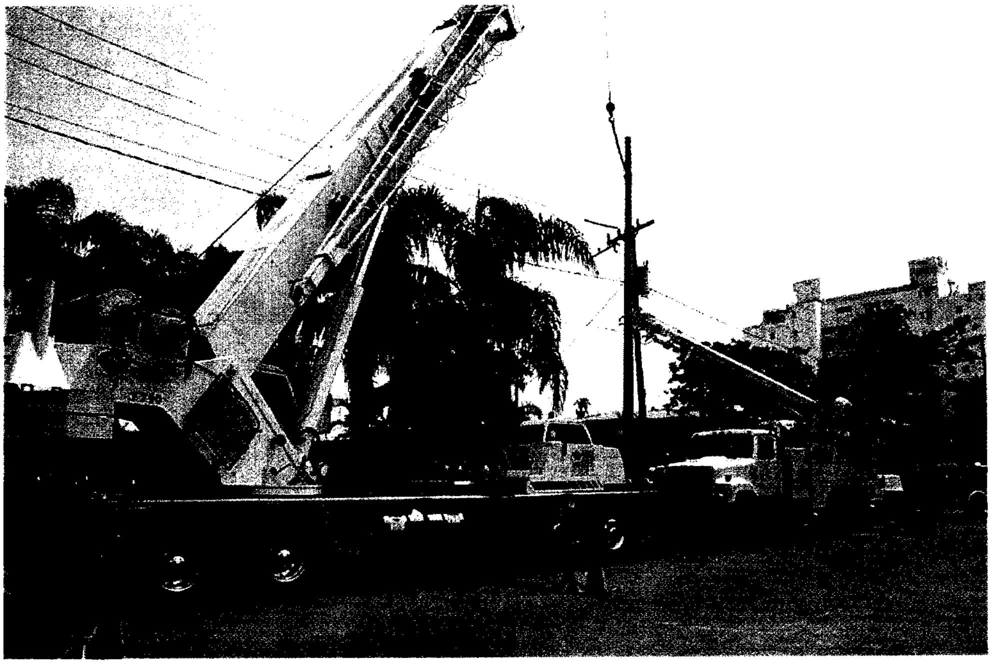
These options are not mutually exclusive and when used in combination with sound engineering practices, can provide a cost-effective method to harden a circuit.

Design recommendations on any given project, will take into account hardening (making facilities more resilient to storm force winds), mitigation (if circuit fails, how can damage be minimized), as well as restoration (improving the efficiency of restoration in the event of failure). Since multiple factors can contribute to losing power after a storm, utilizing this pronged approach will help in reducing the amount of work required to restore power to a damaged circuit.

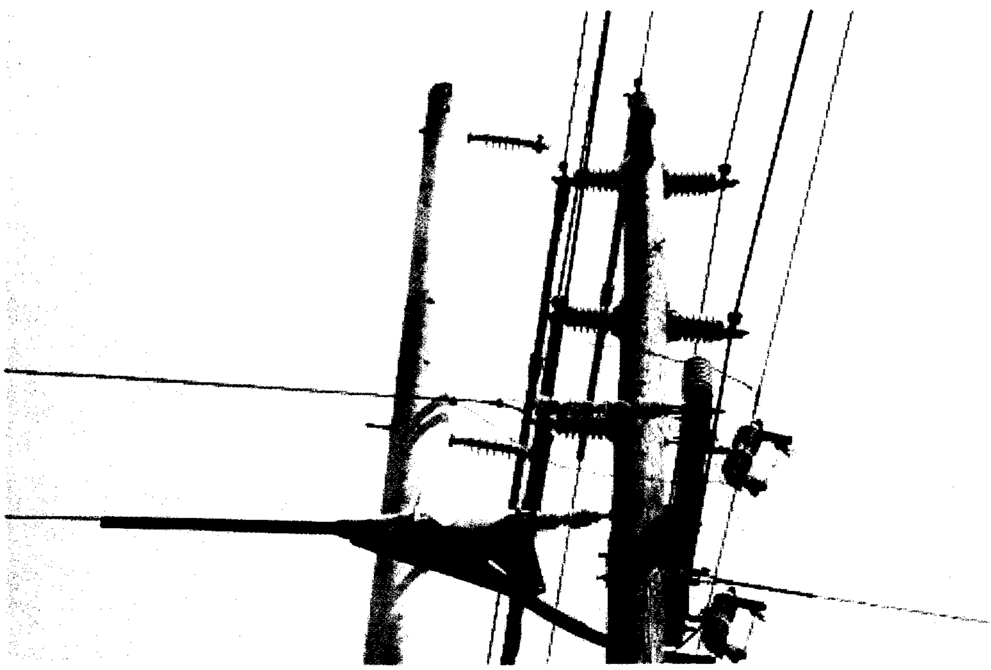
6.0 DEPLOYMENT PLANS

2006 Projects

In 2006, FPL made an industry-leading move by piloting EWL, the standard for transmission construction, in four distribution infrastructure hardening projects. These projects included hardening the distribution facilities serving: Port Everglades; Port of Palm Beach; St. Mary's Hospital; Jackson Memorial Hospital and Mount Sinai Medical Center. These facilities were initially selected because they are part of the critical South Florida infrastructure network that provides fuel and emergency health care after a hurricane. In total, these four projects required more than 30,000 man hours of work, retrofitting 14 feeders and replacing more than 500 poles. These projects brought additional challenges, such as installing larger poles in established neighborhoods, coordination with customers and maintenance of traffic. However, completing these pilot projects not only increased the storm resilience of some of Florida's most vital infrastructure, it also provided valuable insight into implementing storm hardening on a broader, system-wide effort.



Mount Sinai Hospital project on Miami Beach required special equipment, traffic control and coordination with the community.



Wood poles replaced with spun concrete on Jackson Memorial Hospital project

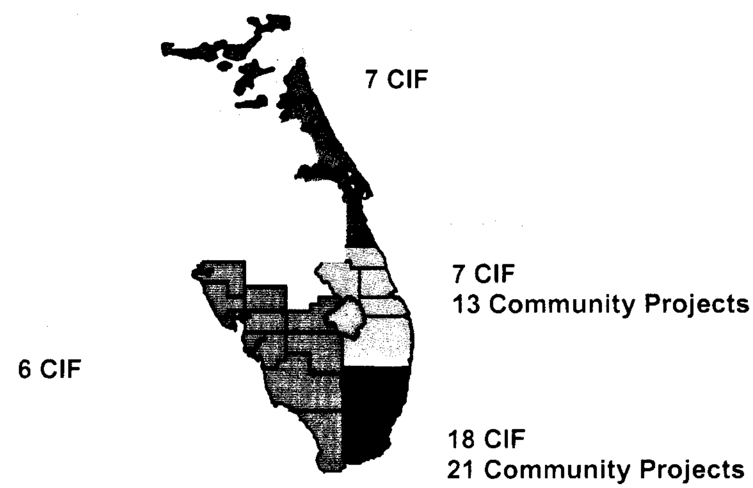
2007 Deployment Plan

In 2007, FPL proposes to utilize EWL to harden thirty four (34) feeders and the associated laterals directly serving (28) twenty eight CIF customers and four system critical facilities. The TCP Program will also focus on hardening to EWL approximately 43 overhead Highway Crossings on Interstate 75 and the Turnpike in Miami-Dade and Broward counties and seventy eight (78) additional critical poles, each being the first feeder pole outside of a substation. These 78 poles have been targeted because of their criticality in expediting restoration efforts and have been prioritized so that circuits with the largest customer counts are completed first.

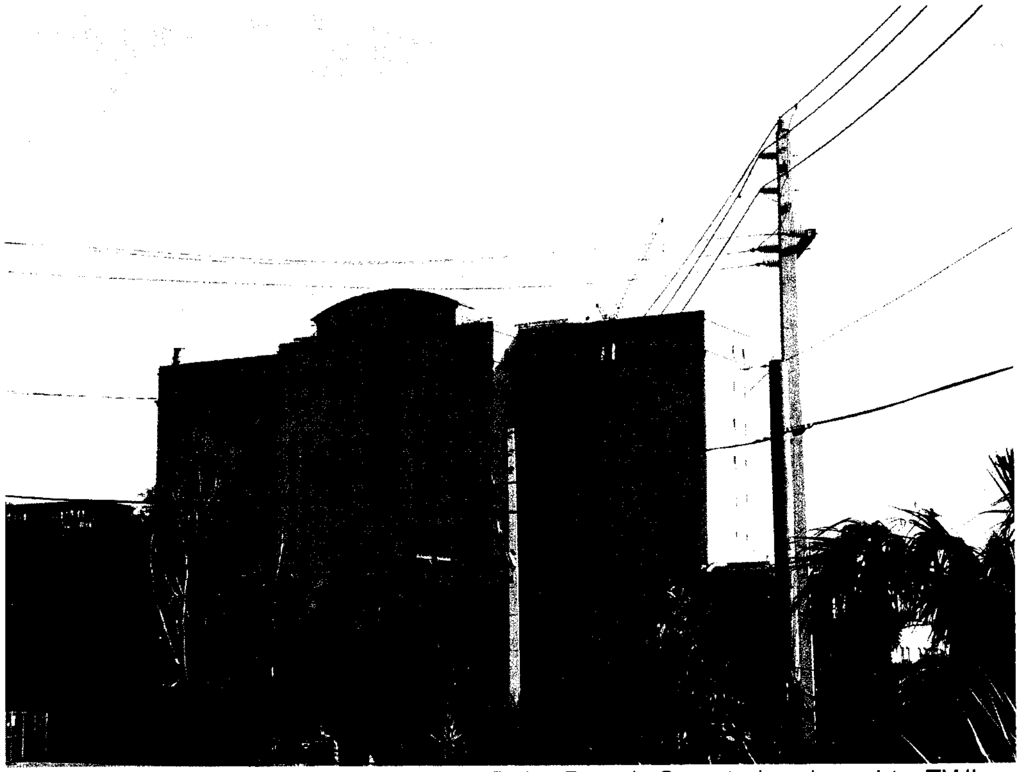
In addition to the facilities serving CIF customers, FPL plans to complete Incremental Hardening on feeders associated with thirty-four (34) community projects. The majority of these are located in the Tri-County area (Miami-Dade, Broward, and Palm Beach counties) where FPL has its highest density of customers.

Lists of the CIF Customers and Community Projects' feeders planned for 2007 are included in the Appendix to this filing. Below is map which helps to identify where these projects are located.

<u>Figure 6-1 – 2007 Feeder Hardening Map</u>



Deployment plans and estimates utilizing the application of design guidelines were developed based upon historical new pole installations and replacements, expansion plans, as well as known relocation projects. The proposed 2007 deployment plan corresponds to approximately 145 overhead circuit miles and includes approximately 5,800 poles. It is estimated that over 50% of the 5,800 poles included in the 145 overhead circuit miles already meet EWL and will not require any additional hardening.



CIF Feeder serving VA Hospital in Palm Beach County hardened to EWL

EWL hardening CIF Feeder serving Halifax Hospital in Central Florida

2008 Deployment Plan

In 2008, FPL will continue to address CIF hardening, critical poles, and community projects, and will continue to utilize the Design Guidelines. FPL estimates it will harden approximately 85-125 feeders, most of which serve CIF customers and community projects.

2009 Deployment Plan

In 2009, FPL will continue to address CIF hardening, critical poles and community projects, and will continue to utilize the Design Guidelines. FPL estimates it will harden in the range of 80-150 feeders, most of which will serve CIF customers and community projects.

7.0 DESIGN AND CONSTRUCTION STANDARDS

7.1 Distribution Engineering Reference Manual (DERM)

FPL publishes its DERM to convey the standards of distribution design. The DERM provides FPL's designers with a reference for designing distribution facilities. This reference manual contains background information, engineering considerations, examples of necessary calculations and tables developed from the calculations. The tables are a guide for general applications whereas the examples provide the designers with the method to design facilities not included in the Tables. When the proposed criteria are adopted, FPL will publish and issue an "Addendum" to its DERM as a supplemental publication to enable the designers to design distribution facilities based on the 2007 NESC EWL criteria. A copy of the proposed DERM Addendum is included in the Appendix attached to this filing.

7.2 Distribution Construction Standards (DCS)

FPL's DCS provides the designers and the construction crews with information needed to build the distribution facilities. Designers use the manual to convey instructions to the field. The field crews use the manual to construct the facilities. The DCS contains drawings and instructions on clearances, framing (how facilities will be arranged on the pole), grounding, guying, equipment, and the assembly of the various parts. When the proposed criteria are adopted, FPL will publish and issue an "Addendum" to its DCS as a supplemental publication to enable the field crews to build distribution facilities based on the 2007 NESC EWL criteria. A copy of the proposed DCS Addendum is included in the Appendix attached to this filing.

7.3 Design Guidelines

FPL has developed Design Guidelines and a Quick Reference Guide to allow the field designers a simple reference document when the details provided in the DERM and DCS are not needed to develop the design plan. The intention of this document is to standardize designs for hardening as it relates to new construction, major planned work, relocations as well as daily work activities. These guidelines are primarily associated with changes in pole class, pole type and desired span lengths for overhead construction. In addition, FPL has proposed additional hardening guidelines for poles that are deemed critical for general operations or during restoration events. A copy of the Design Guidelines and the Quick Reference Guide are included in the Appendix.

8.0 ATTACHMENTS BY OTHER ENTITIES

8.1 Attachment Standards and Procedures

There are attachments by other entities to FPL poles throughout its service area. These attachments are made by Incumbent Local Exchange Carriers (ILEC), Cable TV Companies (CATV), Telecommunication Carriers and Governmental Entities (Non-ILEC). Additionally, FPL attaches to ILEC poles. The standards and procedures for these attachments, created to ensure conformance to FPL's standards and hardening plans as required by the FPSC, are attached and included in the Appendix.

8.2 Input from Attaching Entities

On March 22, 2007, FPL mailed an informational package regarding its 2007-2009 hardening plans as well as the current draft of its "Attachment Standards and Procedures" to all attaching entities. In total, over 95 packages were sent to these entities which included cable TV, telecommunication, and telephone companies as well as city and county agencies. FPL requested attaching entities to provide their input to FPL by April 23, 2007, including their costs and benefits associated with FPL's proposed hardening plans. Additionally, to provide these attaching entities an opportunity to better understand FPL's plans, FPL held a meeting at its General Offices in Miami, Florida on April 12, 2007. 15 representatives from cable TV, telephone and telecommunication companies, as well as one city agency, attended. At the meeting, several of the attaching entities requested, and FPL agreed to provide, additional details concerning FPL's 2007 deployment plans. On April 16, 2007, FPL provided to these attaching entities a CD containing engineering drawings, where completed, or asset management circuit drawings for those designs not completed, for all 72 circuits that FPL is planning to harden in 2007.

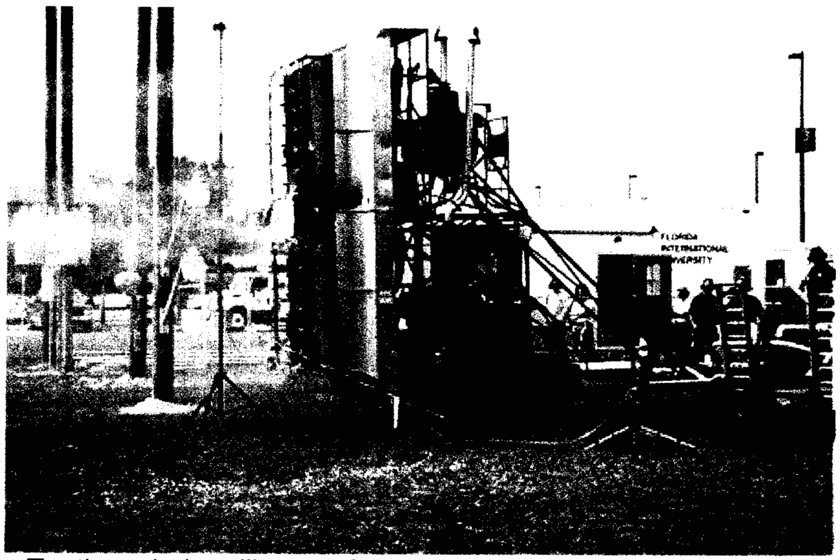
To date, FPL has received comments from 6 attaching entities. FCTA was the only attaching entity to provide specific comments on FPL's construction and attachment standards. FPL has incorporated several of the FCTA's recommended changes into its standards. For example, at FCTA's suggestion, FPL has clarified the language in its attachment standards regarding overlashing of cable. AT&T Florida (BellSouth) and Embarq expressed difficulties with providing accurate estimated cost impacts, stating that more time and/or information is required. Both AT&T Florida and FCTA also suggested further dialogue to better understand the plans and provide more accurate cost estimates. FPL agrees that a meeting or workshop would be beneficial. Palm Beach County suggested further discussions between the County and FPL regarding the selection of critical facilities and community projects in Palm Beach County. FPL will be contacting the County in the near future to have those discussions. Cost impacts and benefits that were provided are included in Section 11, Costs and Benefits. The complete comments received from attaching entities are attached and included in the Appendix.

9.0 RESEARCH AND DEVELOPMENT

Design and construction to NESC EWL involves more than just engineering reference manuals and construction standards. Efforts are also underway to seek out and evaluate new products, work methods, and construction techniques that will enable FPL to cost-effectively build to this increased standard. Concurrent with this effort, FPL is also evaluating its existing construction practices to ensure they are adequate to meet EWL. Examples of these efforts include:

- FPL conducted a supplier symposium in June 2006 that included over 50 companies that manufacture and supply electrical transmission and distribution equipment. This event highlighted FPL's effort to build to extreme wind and solicited input and assistance from these organizations to become innovative as FPL makes changes to its construction standards and methods. Some examples of ideas generated during this meeting included lighter concrete poles and composite material poles
- As part of the KEMA involvement with FPL's Storm Secure effort, additional data was gathered regarding other utilities hardening efforts. Some of the companies included in this effort were Tokyo and Chubu Electric, Guam Power, Hydro Quebec, Arizona Public Service, Southern California Edison, and Kansas City Power and Light.
- Different types of pole technologies; including steel, iron, several formulations of concrete, wood and composite materials; are presently under various stages of evaluation.

- A comprehensive evaluation of available composite material poles is underway. This has included inspections of manufacturing facilities, observation of certified strength testing to ANSI standards, installation of several poles at FPL's Miami Training and Methods Center, and engineering calculations involving flexibility of these poles.
- FPL is evaluating heavy-duty field equipment that will allow for the installation of heavier concrete poles without the use of costly cranes. At the same time, joint efforts between FPL and concrete manufacturers to develop a lighter weight/same strength concrete pole are on-going.
- Utilizing lessons learned from previous storms, FPL is also evaluating: design changes to streetlight brackets; stronger bracing of steel cross-arms on wood poles; attachment of riser shields to poles; construction techniques for slack spans: mechanical service disconnect devices. FPL is also performing tests on how best to attach wire to insulators
- As part of the efforts to strengthen existing installations, specifications and application guidelines are being written to use a newly developed pole reinforcement method called the ET Truss. This enables a pole to be strengthened cost-effectively, avoiding a pole replacement.
- For underground facilities, FPL is piloting the use of a below-grade switch that could be better able to withstand the affects of wind and flooding.
- FPL is actively engaged in a collaborative research effort with the Public Utility Research Center (PURC), all Florida investor owned utilities, Co-ops, and Municipalities. Initial focus areas are undergrounding, wind testing and vegetation management.
- FPL is involved with the Florida International University "Wall of Wind" storm hardening research project. This 2-fan system generates up to 120 mph winds and includes a water-injection system to simulate horizontally-flowing rainfall under hurricane conditions. FPL has already tested certain equipment including single and three phase transformers, capacitor bank, riser u-guard, and various streetlight brackets. Over time, this test facility will be able to generate wind speeds up to 150 mph.



Testing wind resilience of streetlights at FIU Wall of Wind

FPL expects that these efforts will lead to new standards, processes, products and work methods that will provide cost-effective measures to strengthen the electrical infrastructure.

10.0 UNDERGROUND DISTRIBUTION FACILITIES

10.1 Underground Systems

FPL's current underground construction systems include the following design applications:

- Pad-mounted, above grade transformers and switch gear for typical URD subdivision and small commercial areas.
- Concrete encased duct and manhole systems with above grade vaults in designated areas of high load density, where it is feasible, practical and cost-effective, for example, in Miami Beach, Fort Lauderdale and Sarasota.
- Secondary network systems with redundant throw-over, as in downtown Miami.

The current FPL system has approximately 66,300 total miles of distribution infrastructure. Underground power lines make up 37% (24,700 miles) of this total with about 7% (1,700 miles) being in concrete encased duct bank. In the past five years, over 60% of all new distribution construction throughout the FPL service territory has been installed underground. In the tri-county area of Miami-Dade, Broward and Palm Beach Counties, where local ordinances for Underground Residential Distribution (URD) construction exist, approximately 90% of new construction was installed underground.

10.2 Equipment Technologies

The standard FPL URD equipment for all new underground residential distribution (pad-mounted transformers, switch cabinets, etc.) is dead-front made from stainless steel, or in combination with mild steel. Stainless steel equipment has the advantage of extended service life due to its resistance to weathering and corrosion, but has a considerably higher initial cost. Dead-front equipment (i.e., without energized parts exposed on the operating side of the equipment) is more reliable, and more resistant to flooding.

FPL does not presently use submersible equipment. Past installations which were in high-density downtown sidewalk vaults have experienced reliability issues, require large installation spaces and are costly to build and maintain.

Currently, FPL has a pilot project on Jupiter Island to test a Vista Gear (i.e., a below grade, submersible URD type switch) to determine whether if offers some added storm flooding resiliency.

10.3 Installation Practices

FPL complies with existing local ordinances when constructing underground systems. The Florida Building Code leaves the responsibility of determining adequate floodplains to each municipality which usually base their local ordinances on Federal Emergency Management Agency 100-year flood criteria.

10.4 Hardening and Storm Preparedness

Approximately 20% of FPL's underground distribution infrastructure is within the Category 1 - Category 3 floodplain as defined by the Florida Department of Community Affairs. However, FPL has not historically been as severely impacted by storm surge from hurricanes as it has been by wind. Recognizing that underground equipment is less impacted by predominantly wind events, FPL proposed the Governmental Adjustment Factor (GAF) tariff to promote conversion of electric facilities from overhead to underground. Through the GAF, which was approved by the Commission on April 24, 2007, FPL provides a 25% investment for the cost of qualified local government-sponsored conversion projects.

FPL has guidelines in place for the prompt post-storm inspection and mitigation of damage to equipment exposed to flooding or storm surge. These guidelines outline the necessary steps to purge any sand and water that has invaded the equipment and to restore it to service.

11.0 PROJECTED COSTS AND BENEFITS

11.1 Costs

FPL

In 2007, FPL plans to harden 72 feeders, which provide service to critical infrastructure and special community needs. Additionally, FPL is beginning to implement hardening criteria for new construction, major relocations and other work. Utilizing current work methods, products and equipment, this work is estimated to cost from $40 to $70 million.

In 2008 and 2009, FPL expects to continue this strategy for hardening its infrastructure, including targeting 85-125 circuits in 2008 and 80-150 in 2009. Each year the plan focuses on circuits with increasing lengths, potentially translating into higher program costs. The projected costs for 2008 and 2009 are $75 to $125 million and $100 to $150 million, respectively. These estimates are based upon current work methods, products, and equipment and assume the necessary resources will be available to execute the plan.

Attaching Entities

Two of the attaching entities, AT&T Florida and Fibernet, provided cost estimates specifically for 2007. AT&T Florida estimated costs of $4.4 million and Fibernet estimated costs of approximately $15,600. AT&T Florida and Fibernet did not provide cost estimates for 2008 and 2009. In addition, Embarq provided cost estimates ranging from $14.0 million to $35.0 million for the period 2007-2009. At this time, FPL has not closely scrutinized the basis for the attaching entities' cost estimates. However FPL notes that Embarq's $14 million cost estimate is based on an assumption that FPL will harden 20% of its poles in the first 3 years of the plan, while the $35 million estimate is based on hardening 50% of the poles during that period. Both of these pole replacement assumptions are inconsistent with FPL's hardening plan and are substantially overstated. FPL has approximately 1.1 million poles, so Embarq's 20%-50% pole replacement assumptions would imply that FPL would replace between 220,000 and 550,000 poles over the period 2007-2009. In fact, FPL estimates that its replacements over that period will total only about 5 to 10 percent of Embarq's assumptions. FCTA, AT&T Florida and Embarq also noted that pole rental rates would likely be impacted. The FCTA, City of Hollywood and Palm Beach County did not quantify any estimated cost impacts. The complete comments received from attaching entities are attached and included in the Appendix.

11.2 Benefits

FPL

For category 1, 2 and 3 hurricanes, FPL's storm hardening plan should result in less storm damage to the electrical infrastructure and therefore less restoration time and cost. For example, in another Hurricane Wilma type event, FPL estimates that hardened feeder pole failure rates and associated restoration time, based on construction man-hours, will be reduced. More generally, FPL's Storm Secure initiatives, including its storm hardening plan, pole inspections, and increased vegetation management activities, can be reasonably expected to reduce future storm restoration costs compared to what they would be without those initiatives. The costs and benefits of FPL's response to the Commission's requirement in Docket No. 060198-EI for 10-point storm implementation plans are discussed in FPL's "Storm Preparedness Initiatives" document, which was filed, reviewed and approved in that docket and is incorporated herein by reference. Hardening the system, increasing pole inspections, enhancing line clearing activities, promoting underground, along with various storm preparedness initiatives will all have an impact on reducing storm damage, reducing or preventing outages, and reducing the overall storm restoration times. Additionally, there will be day-to-day reliability benefits realized. Finally, improved systems and processes, including improved storm forensics, will allow for more and better data to be collected, evaluated and analyzed. Of course, FPL's system is very diverse and geographically large so it will take many years of sustained effort to achieve the full benefits of storm hardening.

While there will be benefits from FPL's Storm Secure initiatives, it is impossible at this time to estimate the full extent of the benefits with any precision. The actions that FPL is taking and proposing to adopt pursuant to this storm hardening plan represent industry leading changes in construction standards, maintenance practices and restoration processes. The analyses and forensic observations performed after Hurricanes Katrina and Wilma serve as the foundation for FPL's hardening efforts, but there is presently limited or no historical data available for purposes of conducting overall cost/benefit analyses on many of these new actions. As additional storm experience, more and better data, new improved processes, products and materials become available, better detailed cost /benefit analysis will be able to be performed and more cost-effective hardening solutions implemented. In the meantime, FPL believes that implementing its current hardening approach (targeting critical infrastructure for EWL, the application of Incremental Hardening for community projects, and the utilization of the Design Guidelines is in the best interest of its customers.

Attaching Entities

AT&T Florida noted that the most significant benefit would be the potential reduction of storm outages at its commercial facilities; however, the benefit could not be quantified at this time. Embarq commented that benefits will not be known until the next storm. The remaining attaching entities provided no comments on benefits.

TRANSMISSION

1.0 HISTORY / BACKGROUND

While FPL's transmission facilities were also affected by the 2004 and 2005 storms, the damage experienced was significantly less than the damage experienced by distribution facilities. A primary reason for this is due to the fact that transmission structures are already constructed to meet EWL. However, FPL's Storm Secure Plan identifies several initiatives specifically addressing the transmission infrastructure. In 2006, FPL increased its inspection cycle of transmission structures to a six year cycle, consistent with the FPSC order issued in April 2006.

2.0 NESC REQUIREMENTS AND COMPLIANCE

FPL transmission line structural designs are mandated by Florida Statute Section 366.04, which requires that all high voltage transmission structures satisfy the requirements specified by the NESC. ANSI C2 addresses EWL criteria (Rule 250C) and covers all wind sensitive factors and wind related effects that need to be considered in the design calculations. FPL transmission structures are designed to meet EWL under NESC Rule 250 C and are constructed to meet Grade B Construction under NESC Sections 25 and 26.

3.0 DETERMINATION OF EXTREME WIND SPEEDS FOR APPLICATION OF EWL

For transmission structures, FPL interpolates the NESC wind load contours (Figure 250-2d) into 5 mph intervals. Based on the global position system (GPS) coordinates, transmission structures are designed for the upper wind speed of each interpolated 5 mph wind contour interval.

4.0 DESIGN AND CONSTRUCTION STANDARDS

FPL's transmission and substation system is already designed for EWL using the following design standards:

NESC

- As required by Florida Statute Section 366.04

American Society of Civil Engineers (ASCE)

- Minimum Design Loads for Buildings & Other Structures "ASCE/SEI 7-05"

- Design of Steel Transmission Pole Structures "ASCE/SEI 48-05"
- No. 74: Guidelines for Electrical Transmission Line Structural Loading
- No. 91: Design of Guyed Electrical Transmission Structures
- ASCE/PCI, Guide for the Design of Prestressed Concrete Poles

Institute of Electrical and Electronics Engineers

- IEEE Standard 751 – 1990, IEEE Trial-Use Design Guide for Wood Transmission Structures

FPL's transmission construction standards are incorporated into the following two books as summarized below:

Transmission Structure Standards (TSS)
The TSS includes drawings showing the framing and configuration of both current and historical transmission structures. Each structure standard drawing includes dimensions, material lists, and any applicable transmission installation specification (TIS) standards.

Transmission Installation Specification (TIS)
The TIS includes installation and testing procedures for various transmission components. The book contains the following sections:

1. Anchors & Foundations
2. Bonding & Grounding
3. Conductor & Conductor Fittings
4. Poles & Structures
5. Right-of-Way Items
6. Insulator & Arrester
7. Fiber Optics

Construction or installation specifications that are unique to a particular location and not incorporated in either standard referenced above are incorporated in the construction package for the individual project.

5.0 DEPLOYMENT STRATEGY

Since FPL's transmission and substation system is already designed for EWL, FPL does not believe there is a general need for further hardening of that system. However, based on experience with the performance of the system, including specific lessons learned from the 2004-2005 storm seasons FPL has the following two transmission Storm Secure initiatives which have been previously approved by the Commission as part of FPL's "Storm Preparedness Initiatives" in Order NO. PSC-06-0781-PAA-EI, Docket No. 060198-EI, dated September 19, 2006.

1. **Single Pole Un-Guyed Wood Transmission Structures**
   FPL has implemented a comprehensive plan for replacing existing single pole un-guyed wood transmission structures with FPL's current design standards. Although designed for EWL, these structures accounted for 68% of all the transmission structures requiring replacement during the 2004-2005 storm seasons.

2. **Ceramic Post Transmission Line Insulators**
   FPL has implemented a comprehensive plan for replacing existing ceramic post insulators on concrete poles with FPL's current design standards. Although designed for EWL, ceramic post insulators on concrete poles accounted for 68% of all the insulators replaced as a result of the 2004-2005 storm seasons.

FPL forecasts completion of these two storm secure initiatives over the next 10 to 15 years. For the single pole un-guyed wood transmission structure initiative, approximately 300 structures will be targeted for replacement each year. For the replacement of ceramic post insulators on square concrete poles, approximately 450 structures will be targeted for re-insulation each year.

FPL will prioritize its two transmission storm secure initiatives based on factors including proximity to high wind areas, system importance, customer count, and coordination with the distribution CIF storm initiative. Other economic efficiencies, such as performing work on multiple transmission line sections within the same corridor, are also considered.

In 2007, transmission has focused efforts starting in the tri-county areas of Miami-Dade, Broward, and Palm Beach Counties where the code specified wind speeds are higher.

FPL will provide updates of these transmission storm secure initiatives in its annual March 1 filing with the FPSC.

6.0 COSTS AND BENEFITS

FPL estimates the total cost for the two transmission structure hardening initiatives to be approximately $80 million. Based on replacement over a 10-15 year period, the estimated annual cost of the program will range from approximately $5 million to $8 million. For 2007, FPL estimates these costs to be $7 million.

DESIGN GUIDELINES

FPL

Distribution Design Guidelines

The following guidelines will be used to standardize the design of FPL's overhead distribution facilities when practical, feasible and cost effective.

General

1. Every attempt should be made to place new or replacement poles in private easements or as close to the front edge of property (right of way line) as practical.

2. Overhead pole lines should be placed in front lot lines or accessible locations where feasible.

3. Concrete poles are not to be placed in inaccessible locations or locations that could potentially become inaccessible.

4. When performing work that will affect an existing Top CIF feeder, always contact Storm Secure regional project manager prior to design.

5. When performing new construction, the new pole line will be designed to meet Extreme Wind Load (EWL).

As always, good engineering judgment, safety, reliability, and cost effectiveness should be considered.

In addition to these guidelines, all distribution facilities shall be engineered to meet the minimum requirements set forth in all applicable standards and codes including but not limited to the National Electrical Safety Code (NESC), and Utility Accommodation Guide.

FPL

New Construction / Existing / Maintenance

1. When installing and/or replacing a feeder, lateral or service pole on an existing pole line, please reference the pole sizing guidelines listed under the Hardening Design Guidelines section (page 5 of 6) to determine pole class and type.
2. When performing work that will affect a Top CIF feeder, always contact Storm Secure regional project manager prior to design.
3. When extending an existing pole line, the existing pole type, wood or concrete, should be used as a guide for the new poles, while still maintaining the minimum requirements as set forth in these guidelines.

Relocation

1. When relocating either a concrete or wood pole line for a highway improvement project, the existing type pole line should be used as a guide for replacements.
2. When performing work that will affect a Top CIF feeder, always contact Storm Secure regional project manager prior to design.
3. Agency relocation projects should be coordinated with Distribution Planning to take into account potential feeder boundary changes.

FPL

Hardening Design Guidelines

The following hardening guidelines will standardize the design of FPL's overhead distribution facilities when feasible, practical and cost effective. Foreign pole owners are required to discuss design requirements with FPL prior to construction. FPL will assist with identifying the critical poles.

1. Concrete poles are preferred in the cases where replacement costs would be extremely high (i.e. Duct system riser pole, corner poles with multiple circuits, critical poles, etc). Please reference the Critical Pole list below for more information.

2. The following list comprises what will be considered critical poles. When installing and/or replacing an accessible critical pole, use concrete. If the pole is inaccessible, use a Class 2 wood pole, or consider relocating the equipment to an accessible concrete pole.

Critical Pole List
1st switch out of the substation [1]
Automated Feeder Switches (AFS)
Interstate / Highway Crossings [1,2]
Capacitor Banks
Poles with multiple primary risers
3 Phase Reclosers
Aerial Auto Transformers
Multi-Circuit Poles [3]
3 phase transformer banks (3-100 kVA and larger)
Regulators
Primary Meter

1) *Every attempt should be made to install storm guys where feasible and practical.*
2) *Refer to the Crossing Multi-Lane Limited Access Highways section for details (pg.4 of 6)*
3) *Contact Storm Secure regional project manager before designing a new multi-circuit line.*

Crossing Multi-lane Limited Access Highways

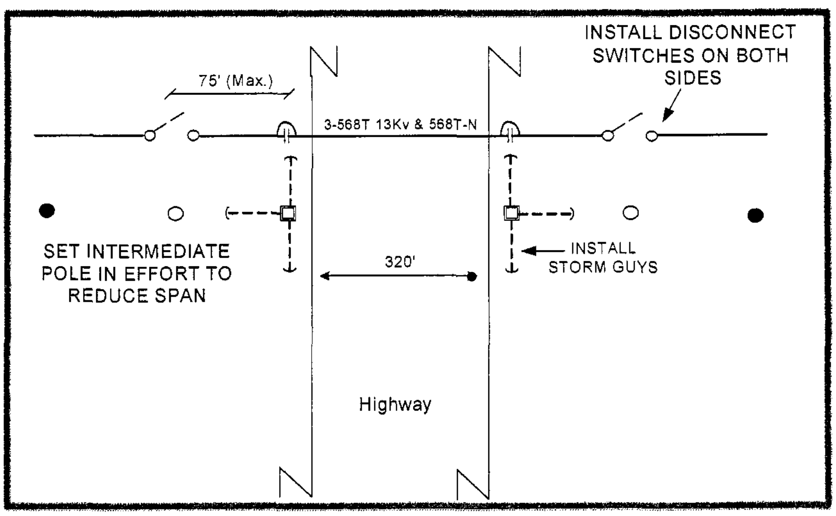
1. Underground installation is the preferred design for all NEW crossings (1, 2 or 3 phase) of multi-lane limited access highways. If underground construction is not feasible or if working on an existing overhead crossing, reference the Overhead Highway Crossing schematic as shown below.

2. Underground crossing for 1 or 2 phases should be designed for potential three phase feeder size cable.

3. For accessible overhead crossings, use concrete poles (III-H or Spun) for the crossing poles and Class 2 wood poles for the adjacent poles. For inaccessible overhead crossings, Class 2 wood poles should be used for the crossing poles and adjacent poles.

4. Every attempt should be made to install storm guys for the highway crossing poles. Storm guys are not required on the adjacent poles.

5. Install disconnect switches on adjacent poles on both sides of the crossing to isolate the feeder section in case of a restoration event. Disconnect switches are to be installed in accessible locations that can be reached with aerial equipment. If there is no load between the nearest existing disconnect switch and the crossing, an additional switch is not required.



Overhead Highway Crossing Schematic

FPL

Pole Sizing Guidelines

1. The following tables should be used as guidelines to help determine pole class and type, when installing and/or replacing a feeder, lateral or service pole.

2. When performing work that will affect a Top CIF feeder/customer always contact Storm Secure regional project manager prior to design.

Feeder or Three Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole[3]
Existing Wood	Use Class 2 Wood Pole to meet EWL	Use Class 2 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-H Concrete Pole to meet EWL	Use III-H Concrete Poles	Use III-H Concrete Poles

Single or Two Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole[3]
Existing Wood	Use Class 3 Wood Pole to meet EWL	Use Class 3 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-G[4] or III-H poles to meet EWL	Use III-G[4] or III-H poles to match existing line	Use III-H Concrete Poles

1) To be used when extending or relocating a pole line. For span length details, see table below.
2) To be used when replacing a pole or installing an intermediate pole within an existing pole line.
3) Reference Critical Pole List on pg.3 of 6.
4) Use of III-G poles should be limited to existing concrete lateral pole lines whose wire size is less than or equal to #1/0 Aluminum.

Facility	Phases(s)	Wire size	Pole size	Recommended Span Length[5] (FPL with 2 attachments – FPL ONLY) 105 MPH	130 MPH	145 MPH
Feeder		**3#568 ACAR**	**Class 2**	180' - 230'	135' - 200'	100' - 150'
		3#3/0 AAAC	**Class 2**	180' - 250'	180' - 250'	125' - 250'
Lateral	**3 PH**	**3#1/0 AAAC**	**Class 2**	180' - 250'	180' - 250'	155' - 250'
	2 PH	**2#1/0 AAAC**	**Class 3**	180' - 250'	180' - 250'	170' - 250'
	1 PH	**1#1/0 AAAC**	**Class 3**	180' - 250'	180' - 250'	180 - 250'

5 The lower number equates to the maximum span for FPL primary and 2 foreign attachments. The higher number equates to the maximum span for FPL primary only. Reference the addendum DERM tables when adding additional attachment(s) or equipment. Remember to always contact the Storm Secure regional project manager when working on a Top CIF feeder.

Service / Secondary / Street Light / Outdoor Light Poles

When installing or replacing a secondary, service or street light pole, a minimum Class 4 Wood pole should be used. Specific calculations may require a higher class pole for large Quadruplex wire.

As always, good engineering judgment, safety, reliability, and cost effectiveness should be considered.

In addition to these guidelines, all distribution facilities shall be engineered to meet the minimum requirements set forth in all applicable standards and codes including but not limited to the National Electrical Safety Code (NESC) and Utility Accommodation Guide.

2007 Hardening Design Guidelines
Quick Reference Guide

Feeder or Three Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole
Existing Wood	Use Class 2 Wood Pole to meet EWL	Use Class 2 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-H Concrete Pole to meet EWL	Use III-H Concrete Poles	Use III-H Concrete Poles

Single or Two Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole
Existing Wood	Use Class 3 Wood Pole to meet EWL	Use Class 3 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-G or III-H poles to meet EWL	Use III-G or III-H poles to match existing line	Use III-H Concrete Poles

[1]To be used when extending or relocating a pole line. For span length details, use the table below.
[2]To be used when replacing a pole or installing an intermediate pole within an existing pole line.

Facility	Phases(s)	Wire size	Pole size	Recommended Span Length[3] (FPL with 2 attachments – FPL ONLY)		
				105 MPH	130 MPH	145 MPH
Feeder		3#568 ACAR	Class 2	180' - 230'	135' - 200'	100' - 150'
		3#3/0 AAAC	Class 2	180' - 250'	180' - 250'	125' - 250'
Lateral	3 PH	3#1/0 AAAC	Class 2	180' - 250'	180' - 250'	155' - 250'
	2 PH	2#1/0 AAAC	Class 3	180' - 250'	180' - 250'	170' - 250'
	1 PH	1#1/0 AAAC	Class 3	180' - 250'	180' - 250'	180 - 250'

[3]The lower number equates to the maximum span for FPL primary and 2 foreign attachments. The higher number equates to the maximum span for FPL primary only. Reference the addendum DERM tables when adding additional attachment(s) or equipment. Remember to always contact the Storm Secure regional project manager when working on a Top CIF feeder. As always, good engineering judgment, safety, reliability, and cost effectiveness should be considered.

Critical Pole Identifier

Replace with III-H Square Concrete Pole (Class 2 if inaccessible)

Critical Poles	DCS Reference[4]	Critical Poles	DCS Reference[4]
1st switch out of substation	UH-15.0.0 Fig 2 UH-15.3.1	**Automated Feeder Switches (AFS)**	C-9.2.0
Interstate Crossings	E-10.0.0 Fig 3	**Aerial Auto Transformers**	I-9.0.0
Poles with two 3 phase risers	UH-15.2.0	**3 phase transformer banks 3 – 100 kVA and larger**	I-52.0.2
Multi-circuit poles	Frame as existing	**Capacitor Banks**	J-2.0.2 & J-2.0.3
Three-phase reclosers	C-8.0.0	**Regulators**	I-10.1.1
Primary Meter	K-28.0.0		

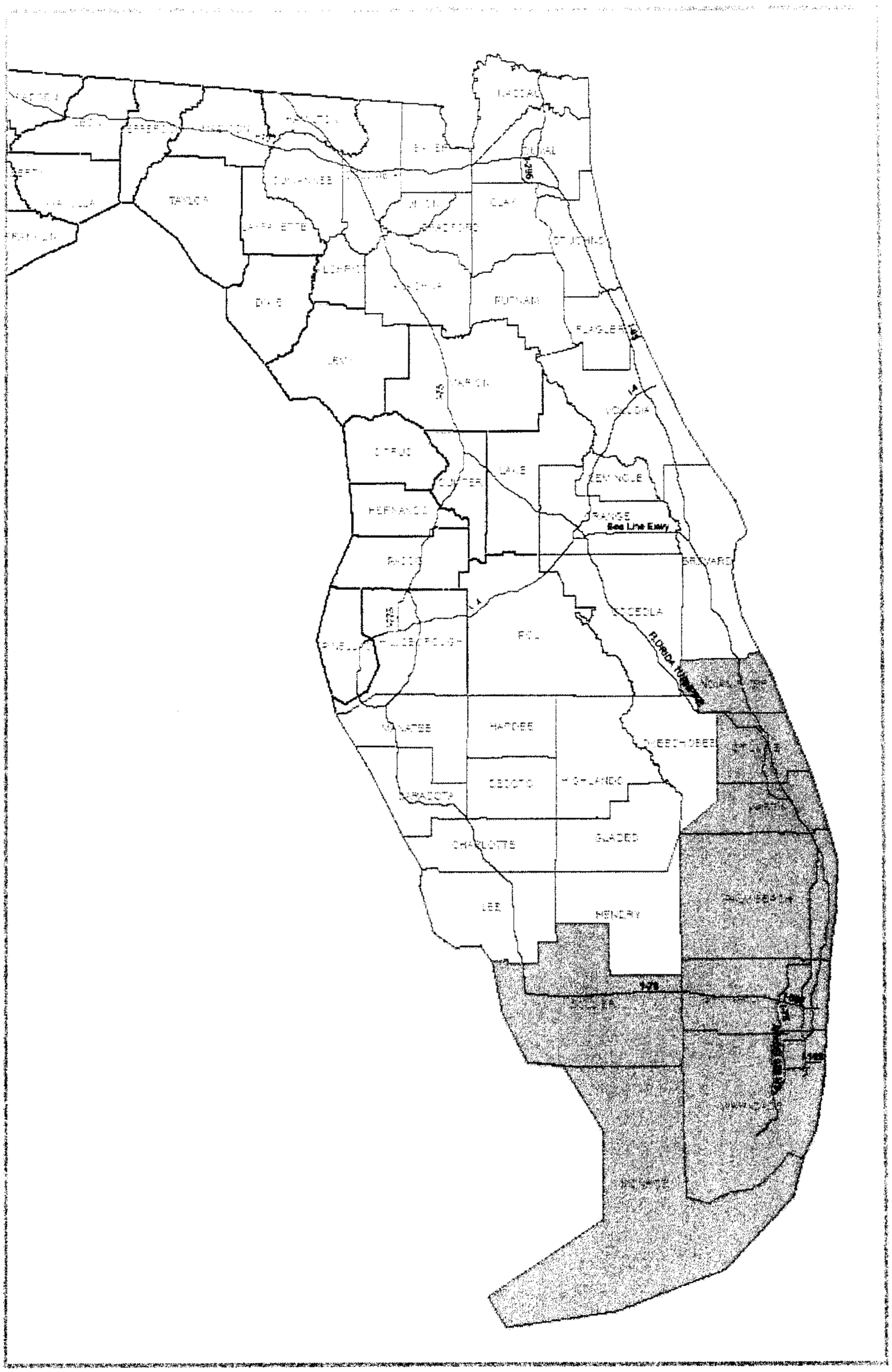
[4]All references are to the Distribution Construction Standards (DCS).

2007 Hardening Design Guidelines
Quick Reference Guide

FPL

105 MPH
130 MPH
145 MPH

Wind Zone	County
130	Alachua
105	Baker
105	Bradford
130	Brevard
145	Broward
130	Charlotte
130	Clay
145	Collier
105	Columbia
145	Miami-Dade
130	De Soto
130	Duval
130	Flagler
130	Glades
130	Hardee
130	Hendry
130	Highlands
145	Indian River
130	Lee
130	Manatee
145	Martin
145	Monroe
130	Nassau
130	Okeechobee
130	Osceola
130	Orange
145	Palm Beach
130	Putnam
130	Sarasota
130	Seminole
130	St Johns
145	St Lucie
105	Suwannee
105	Union
130	Volusia



2007 CIF Customer Circuits Planned for Hardening to EWL

2007 Community Project feeders planned for Incremental Hardening

2007 CIF Customer Circuits Planned for Hardening to EWL

Region	County	CIF Customer
North	Brevard	Cape Canaveral Hospital
	Brevard	Holmes Regional Medical Center
	Brevard	Holmes Regional Medical Center
	Columbia	VA Hospital
	Union	Lake Butler Hospital
	Volusia	Halifax Hospital
	Volusia	Halifax Hospital
East	Palm Beach	Bethesda Memorial Hospital
	Palm Beach	Columbia Hospital
	Palm Beach	Good Samaritan Hospital
	Palm Beach	Good Samaritan Hospital
	Palm Beach	VA Hospital
	St Lucie	St. Lucie Medical Center
	St Lucie	FPL System Critical
South	Broward	Cleveland Clinic
	Broward	Florida Medical Center
	Broward	Imperial Point Medical Center
	Broward	Memorial Regional Hospital
	Miami-Dade	Aventura Hospital
	Miami-Dade	Aventura Hospital
	Miami-Dade	Baptist Hospital
	Miami-Dade	Baptist Hospital
	Miami-Dade	Coral Gables Hospital
	Miami-Dade	Jackson South Community Hospital
	Miami-Dade	Larkin Community Hospital
	Miami-Dade	Mercy Hospital
	Miami-Dade	North Shore Medical Center
	Miami-Dade	Palmetto General Hospital
	Miami-Dade	Parkway Regional Medical Center
	Miami-Dade	FPL System Critical (3)
West	Collier	Naples Community Hospital
	Lee	Lee Memorial Hospital
	Manatee	Blake Medical Center
	Manatee	Manatee Memorial Hospital
	Manatee	Manatee Memorial Hospital
	Sarasota	Sarasota Memorial Hospital

2007 Community Project feeders planned for Incremental Hardening

Region	County	Feeder Number
East	Martin	401133
	Martin	407164
	Martin	408764
	Palm Beach	400433
	Palm Beach	400537
	Palm Beach	402831
	Palm Beach	403931
	Palm Beach	404032
	Palm Beach	405265
	Palm Beach	408032
	Palm Beach	409631
	Palm Beach	410663
	West Palm	407736
South	Broward	700139
	Broward	700440
	Broward	700639
	Broward	700937
	Broward	701931
	Broward	702033
	Broward	703032
	Broward	703631
	Broward	705866
	Broward	706533
	Broward	707663
	Miami-Dade	800432
	Miami-Dade	802431
	Miami-Dade	803938
	Miami-Dade	804432
	Miami-Dade	807034
	Miami-Dade	807431
	Miami-Dade	807834
	Miami-Dade	808268
	Miami-Dade	808269
	Miami-Dade	809036

Distribution Engineering Reference Manual (DERM)

Section 4 – Overhead Line Design

ADDENDUM FOR EXTREME WIND LOADING

Distribution Engineering Reference Manual (DERM)

Section 4 – Overhead Line Design

ADDENDUM FOR EXTREME WIND LOADING

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Storm Secure

Distribution Overhead Line Design for Extreme Wind Loading

ADDENDUM TO DISTRIBUTION ENGINEERING REFERENCE MANUAL (DERM)

Introduction

In 2006, FPL introduced the concept of "STORM SECURE". One part of this concept is to harden the electrical system by adopting new standards based on extreme wind velocity criteria. The Florida Public Service Commission and the Florida Administrative Code have adopted the 2007 NESC for the applicable standard of construction.

FPL designs its distribution facilities based on the loading as specified in the 2007 National Electrical Safety Code (NESC) using Grade B Construction. The NESC specifies three weather conditions to consider for calculating loads:

Rule 250 B. Combined ice and wind loading (FPL current standard construction)
Rule 250 C. Extreme wind loading
Rule 250 D. Extreme ice with concurrent wind loading (this is a new loading condition in the 2007 NESC that will not impact FPL).

Prior to the hardening effort, FPL has been designing overhead distribution using the loads calculated under Rule 250 B. This addendum provides the designers the information needed to design projects using Rule 250 C, grade B (extreme wind loading) to calculate the loads, when it is determined that the particular pole line is to be designed to meet extreme wind loading (EWL) requirements. The NESC extreme wind map identifies 7 Basic Wind Speeds throughout Florida. In order to minimize the design effort to accommodate these 7 wind speeds, FPL has created 3 wind regions with designated wind speeds of 105 mph, 130 mph, and 145 mph. The Map shown in Figure 4.2.2-1 identifies the counties within our service territory that fall into the 3 wind regions. Whenever extreme wind designs are deployed, they will be designed to the identified wind speed for the location of the work to be done.

4.2.2 Poles Structures and Guying

A. Poles, General Information

1. *Pole Brands*

The pole brand includes the pole length & class, the type of treatment, the manufacturer, the date the pole was manufactured and FPL.

Wood Poles –This brand is located at 15' from the bottom of the pole.

Square (cast) Concrete poles – the brand up until 2007 was located 15' from the bottom. New specifications now require the brand to be at 20' from the bottom of the pole.

Distribution Spun Concrete poles – The brand information is on a metal tag that is located 20' from the bottom of the pole.

2. *Design Specifications*

The NESC specifies 3 Grades of construction: Grade B, Grade C, and Grade N with Grade B being the strongest of the three. These grades of construction are the basis for the required strengths for safety. FPL uses Grade B Construction for all distribution facilities. This means that the calculated loads must be multiplied by "Load Factors" and the calculated or specified strength of structures must be multiplied by "Strength Factors". The Strength multiplied by the Strength Factor (SF) must be equal to, or greater than the Load multiplied by the Load Factor (LF).

Equation 4.2.2-1

$$\text{Strength} \times \text{Strength Factor} \geq \text{Load} \times \text{Load Factor}$$

Table 4.2.2 – 1 below lists the Load Factors and Strength Factors for Grade B Construction from NESC Table 253-1 and Table 261-1A.

Table 4.2.2 - 1 Extreme Wind
Strength Factors & Load Factors

Strength of	Strength Factor
Wood Poles	0.75
Concrete Poles	1.00
Composite Poles	1.00
Support Hardware	1.00
Guy Wire	0.90
Guy Anchor and Foundation	1.00
	Load Factor
Extreme Wind Loads	1.00

FPL uses the NESC Extreme Wind Loading for its design criteria. As such, identify the wind speed for the job location and determine the load based on the following formula.

Equation 4.2.2-2

$$\text{Load in pounds} = 0.00256 \times (V_{mph})^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$$

Where,

0.00256 - Velocity-Pressure Numerical Coefficient
V -Velocity of wind in miles per hour (3 second gust)
k_z -Velocity Pressure Exposure Coefficient
G_{RF} -Gust Response Factor
I -Importance Factor, 1.0 for utility structures and their supported facilities.
C_f - Force Coefficient (Shape Factor)
For Wood & Spun Concrete Poles = 1.0
For Square Concrete Poles = 1.6
A - Projected Wind Area, ft^2.

The NESC provides formulas for calculating k_z and G_{RF}. However, Tables are also provided and Table 4.2.2-2 below shows the values needed for most distribution structures.

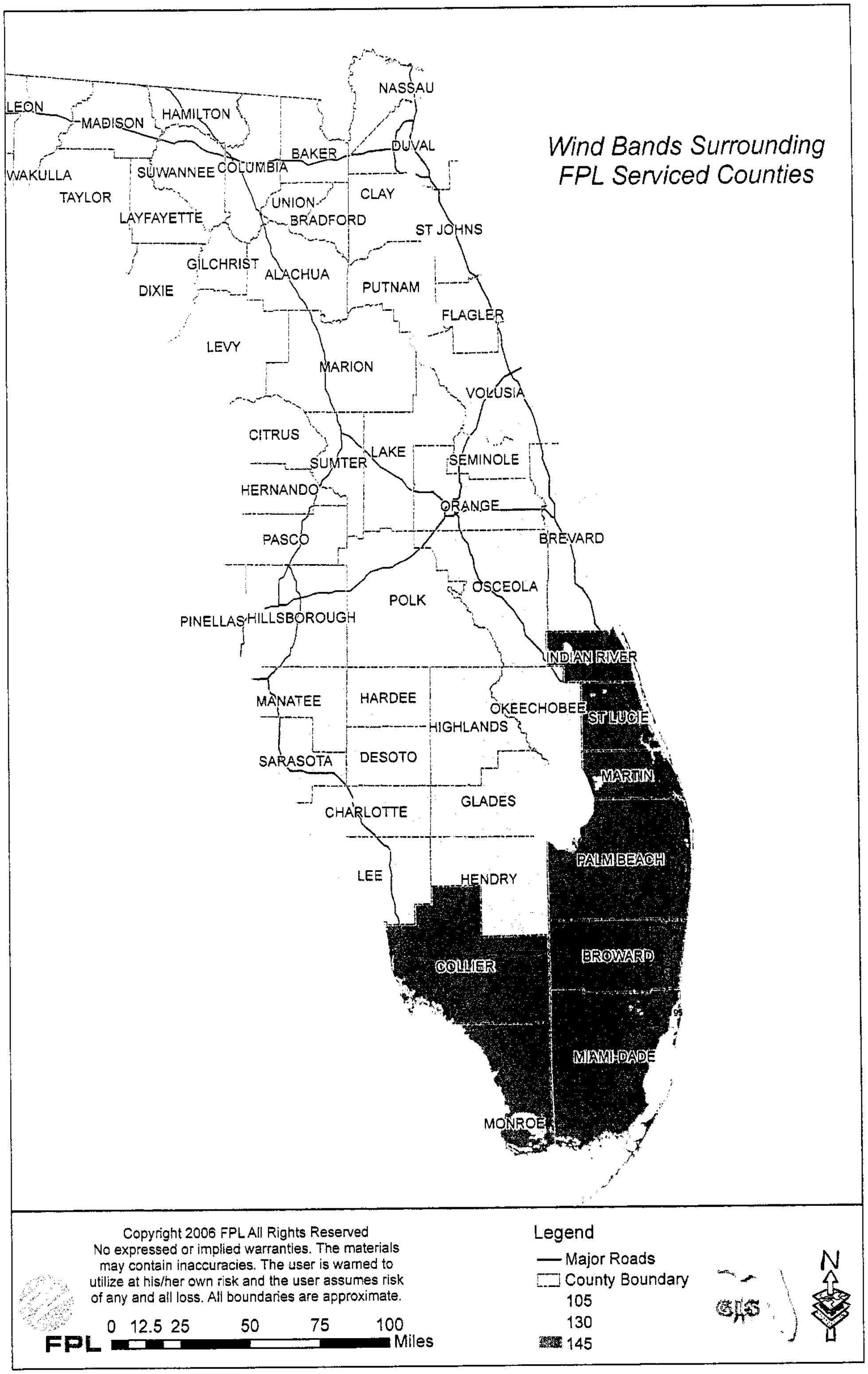
Table 4.2.2-2 Velocity pressure Exposure coefficient (k_z) and Gust Response Factors (G_{RF})

	Structure		Equipment		Wire		
Height (h)	k_z [1]	G_{RF} [4]	k_z [2]	G_{RF} [5]	k_z [3]	G_{RF} [4] (L ≤ 250 ft)	G_{RF} [4] (250 < L ≤ 500 ft)
≤ 33	0.9	1.02	1.0	1.02	1.0	0.93	0.86
>33 to 50	1	0.97	1.1	0.97	1.1	0.88	0.82
>50 to 80	1.1	0.93	1.2	0.93	1.2	0.86	0.80

1. h for the pole k_z is to be the height of the pole above ground
2. h for the equipment k_z is the height of the center of the area of the equipment above ground
3. h for the wire k_z is the height of the wire above ground
4. h for the G_{RF} is the height above ground for the structure and the wire
5. h for the G_{RF} for the equipment is based on the height of the structure above ground
6. L = design wind span (average of span on both sides of structure)

The wind speeds to be used are shown in Figure 4.2.2 – 1

Figure 4.2.2 –1 Wind Regions by County



3. *Wood Pole Strength*

The strength of wood poles is specified in the American National Standard – ANSI O5.1-2002. In addition to strength of wood poles, this standard specifies dimensions, shape, sweep spiral grain, knots, and many other characteristics of wood poles.

A change from previous calculations shown in the DERM for allowable pole strength is that the circumference to be used is now considered to be the ground line circumference rather than the "fixity" point circumference. Another change is the strength factor to be used. For extreme wind the strength factor for wood poles is 0.75 (see Table 4.2.2-1)

Example 4.2.2-1:
Determine the pole strength for wind loading on a 45'/2 wood pole that is set 7 feet.

Equation 4.2.2-3 $M_r = 0.000264fC^3$

Where

M_r = Moment (ultimate or long term bowing) measured in foot-pounds

f = Fiber Stress (8000 or 1000 psi for Southern Yellow Pine)

C = Circumference at ground Line

From Table G (DERM 4.2.2) circumference at Ground line = 40.1 inches

$$M_r = 0.000264 \times (8{,}000) \times (40.1)^3 = 136{,}184 \text{ ft.-lbs.}$$

This is the strength for the 45'/2 wood pole. However for design, apply the NESC Strength Factor of 0.75.

The strength of the 45'/2 wood pole = 136,184 x 0.75 = 102,138 ft.-lbs.

4. *Concrete Pole Strength*

The strength of concrete poles is based on the application of a designated load at a specified location on the pole. This load is measured in KIPS = 1,000 pounds per KIP. A 5 KIP pole is rated based on applying 5,000 pounds of load at two feet below the top of the pole. Most distribution poles are rated by applying the load at two feet down from the top. However, for the type "O", "S", and "SU" poles, this load is applied at one foot down from the top. Like wood poles, concrete poles have a continuous rating (loads that are always on the pole) and a temporary rating (wind loads that come and go). Spun concrete poles (unlike other FPL distribution concrete poles) are designated by their KIP rating rather than a type (i.e., O, S, SU, III, III-G, III- H). Table 4.2.2-3 List the ratings (in KIPS) for the various concrete poles.

Table 4.2.2-3 Concrete Pole Ratings

Pole Type	Temporary Rating	Continuous Rating
O	0.85	0.26
S & SU	0.90	0.30
III	1.30	0.56
III-A	1.30	0.60
III-G	2.40	0.90
III-H	4.20	1.20
12 KIP (square)	8.40	2.40
Spun Concrete		
4.0 KIP	4.00	1.73
4.7 KIP	4.70	2.54
5.0 KIP	5.00	3.03

To calculate the strength of the pole use the following:

For O, S, SU,

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 1 foot)

Example: 35' Type SU for extreme wind loading

M_r = 0.9 KIPS x (35 – 7.5 - 1) = 23,850 ft-lbs

For III, III-A, III-G, III-H

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 2 feet)

Example: 50' Type III-H for extreme wind loading

M_r = 4.2 KIPS x (50 – 11.5 – 2)) = 153,300 ft-lbs

For Spun Concrete

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 2 feet)

Example: 50'/ 4.7 KIP for extreme wind loading

M_r = 4.7 KIPS x (50 – 11 - 2) = 173,900 ft-lbs

For pre-stressed concrete poles, the NESC extreme wind strength factor = 1.0. The values calculated above will be the correct strength for concrete poles.

B. Wind Loading

1. *Wind Loading on poles.*

To calculate the wind load on the pole (see DERM 4.2.2 C3.a):

a. Calculate the area of the pole exposed to the wind

Equation 4.2.2-4 $$A = H_1\left(\frac{a+b}{2}\right)\left(\frac{1}{12}''\right)$$

A = projected area above ground line in square feet.
H_1 = the pole's height above the ground line in feet.

For wood and spun concrete poles,
a = diameter at top of pole in inches.
b = diameter of pole at ground line in inches.

For square concrete poles, dimensions a and b are the widths of one face at top and ground line respectively.

b. Calculate the center of the area.

Equation 4.2.2-5 $$H_{CA} = \frac{H_1(b+2a)}{3(b+a)}$$

H_{CA} is used to calculate the ground line moment due to the wind force.

c. Calculate the wind force acting on the area (see Equation 4.2.2-2 with explanation of terms)

Load in pounds = $0.00256 \cdot (V_{mph})^2 \cdot k_z \cdot G_{RF} \cdot I \cdot C_f \cdot A(ft^2)$

<u>Example Calculation for Wood Pole</u>

Pole Length/Class = 45'/2
Setting depth = 7' (from DCS D-3.0)
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1(ft.) x \frac{1\,ft}{12\,in} x \left[\frac{a+b(inches)}{2}\right]$$

$$From\ Table\ G,\ Page\ 71,\ the\ circumference\ at\ the\ top\ of\ a\ 45'/2\ pole\ is\ 25",$$

$$a = \frac{25"}{\pi} = 7.96"$$

$$The\ circumference\ at\ 38\ ft.\ below\ the\ pole\ top\ 40.1", b = \frac{40.1"}{\pi} = 12.76"$$

$$A = \frac{38}{12} x \left[\frac{7.96+12.76}{2}\right] = 32.81\,sq.ft.$$

$$Height\ of\ center\ of\ area, H_{CA} = \frac{H_1(b+2a)}{3(b+a)} = \frac{38(12.76+15.92)}{3(12.76+7.96)}$$

$$H_{CA} = Moment\ Arm = 17.53\ ft.$$

Wind Load on Pole =

0.00256 x $(145)^2$ x 1.0 x 0.97 x 1.0 x 1.0 x 32.81 = **1713 lbs**

Where:

k_z is based on h = 38'; k_z = 1.0

G_{RF} is based on h = 38'; G_{RF} = 0.97

C_f = 1.0 for wood and spun concrete poles

C_f = 1.6 for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

Equation 4.2.2-6

M_P = Wind Load x Load Factor x Moment Arm.

M_P = 1713 lbs x 1 x 17.53 ft. = 30,030 ft. lbs.

The strength of this pole, previously calculated is 102,138 ft.-lbs. The pole itself has used up 29% (30,030/102,138) of its capacity for 145 mph extreme wind. Subtracting the wind load from the strength leaves 72,108 ft-lbs (102,138 – 30,030) for conductors and other attachments.

Example Calculation for Square Concrete Pole

Pole Length/Class = 50'/III-H
Setting depth = 11.5' (from DCS D-3.0)
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1(ft.)x\frac{1\,ft}{12\,in}x\left[\frac{a+b(inches)}{2}\right]$$

From Table H, the width of the pole at the top a = 9.00"
The width at ground line, b = 15.75"

$$A = \frac{38.5}{12}x\left[\frac{15.75+9.00}{2}\right] = 39.70\,sq.ft.$$

$$Height\ of\ center\ of\ area,\ H_{CA} = \frac{H_1(b+2a)}{3(b+a)} = \frac{38.5(15.75+18.00)}{3(15.75+9.00)}$$

$$H_{CA} = Moment\ Arm = 17.5\ ft.$$

Wind Load on Pole =
$0.00256 \times (145)^2 \times 1.0 \times 0.97 \times 1.0 \times 1.6 \times 39.7 =$ **3317 lbs**
Where:
k_z is based on h = 38.5'; $k_z = 1.0$
G_{RF} is based on h = 38.5'; $G_{RF} = 0.97$
$C_f = 1.0$ for wood and spun concrete poles
$C_f = 1.6$ for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

M_P = Wind Load x Load Factor x Moment Arm.
M_P = 3317 lbs x 1 x 17.5 ft. = 58,040 ft. lbs.

The strength of this pole, previously calculated is 153,300 ft.-lbs. The pole itself has used up 38% (58,040/153,300) of its capacity for 145 mph extreme wind. Subtracting the wind load from the strength leaves 95,260 ft-lbs (153,300 – 58,040) for conductors and other attachments.

Example Calculation for Spun Concrete Pole

Pole Length/Class = 50'/4.7 KIP
Setting depth = 11' (from DCS D-3.0)
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1(ft.)\,x\,\frac{1\,ft}{12\,inc.}\,x\left[\frac{a+b(inches)}{2}\right]$$

From Table H, the diameter of the pole at the top a = 9.55"
The diameter at ground line, b = 16.57"

$$So\ A = \frac{39}{12}\,x\left[\frac{9.55+16.57}{2}\right] = 42.45\,sq.\,ft.$$

$$Height\ of\ center\ of\ area,\ H_{CA} = \frac{H_1(b+2a)}{3(b+a)} = \frac{39(16.57+19.1)}{3(16.57+9.55)}$$

$$H_{CA} = Moment\ Arm = 17.75\ ft.$$

Wind Load on Pole =
0.00256 x $(145)^2$ x 1.0 x 0.97 x 1.0 x 1.0 x 42.45 = **2,216 lbs**
Where:
k_z is based on h = 39'; k_z = 1.0
G_{RF} is based on h = 39'; G_{RF} = 0.97
C_f = 1.0 for wood and spun concrete poles
C_f = 1.6 for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

M_P = Wind Load x Load Factor x Moment Arm.
M_P = 2,216 lbs x 1 x 17.75 ft. = 39,341 ft. lbs.

The strength of this pole, previously calculated is 173,900 ft.-lbs. The pole itself has used up 23% (39,341/173,900) of its capacity for 145 mph extreme wind. Subtract the wind load from the strength leaves 134,559 ft-lbs (173,900 – 39341) for conductors and other attachments.

Table 4.2.2-4 Lists the allowable groundline moments for various pole sizes.

Table 4.2.2-4 Allowable Ground Line Moments

Wood Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
35/5	6	32178	28738	26324
35/4	6	42429	38656	36007
40/5	6.5	36936	31956	28460
40/4	6.5	48263	42812	38986
40/3	6.5	61567	55646	51489
40/2	6.5	76998	70607	66119
45/3	7	66363	58624	53190
45/2	7	86391	78000	72108
50/2	7	93535	82611	74941
55/2	7.5	99693	86174	76682
60/1	8	131634	113020	99951

Table 4.2.2-4 Allowable Ground Line Moments (cont.)

Square Concrete Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
35/Type O	7	15426	11417	8602
35/SU	7.5	15323	10778	7588
35/III-G	9	48907	44275	41022
40/III-A	10	23777	17050	12327
40/III-G	9	56781	49950	45154
40/III-H	11.5	96450	88537	82981
40/12 KIP	13	191480	181610	174681
45/III-A	10	24142	14146	7127
45/III-G	9	62676	52592	45511
45/III-H	11.5	110053	98198	89874
45/12 KIP	13.5	222175	208520	198933
50/III-A	10	24111	10635	1173
50/III-G	9.5	67701	54539	45297
50/III-H	11.5	123164	107106	95831
50/12 KIP	13.5	252789	233067	219219
55/III-G	9.5	72176	55004	42947
55/III-H	12	133764	113283	98902
55/12 KIP	14	280155	254873	237121
60/III-H	12	144138	117993	99637
60/12 KIP	14	308835	276454	253719
65/III-H	12	149613	115197	91032

Spun Concrete Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
50/4.7 KIP	11	153270	142277	134559
55'/4.7 KIP	12	167116	153482	143910
60'/5.0 KIP	12.5	190953	171477	157803
65'/5.0 KIP	13	202928	177845	160233
70'/5.0 KIP	13.5	214369	183392	161642

2. ***Wind Loading on conductors.***

The wind loading on conductors is calculated in a similar method to the wind loading on the pole. The load in pounds per conductor uses Equation 4.2.2-2 with the appropriate factors for the attachment heights a shown in Table 4.2.2-2.

To calculate the wind load on the conductor:

a. Determine the wind region (105 mph, 130 mph, or 145 mph)
b. Calculate the attachment height to determine the k_z *and* G_{RF} (Table 4.2.2-2)
c. The Importance Factor (I) and the Force Coefficient (C_f) are both equal to 1 for conductors.
d. Calculate the area per foot of conductor
e. Calculate the wind load per foot of conductor
f. Calculate the total wind load on the conductor for the length of conductor exposed to the wind (Average of the Spans on either side of the pole).

Example:
Determine the wind load on a 170 foot length [(180'span + 160'span)/2] of 568.3 ACAR conductor that is attached at 30 feet above the ground in the 145 mph wind region.
From Table 4.2.2-2:

$K_z = 1.0$
$G_{RF} = 0.93$

Calculate the area per foot of conductor
Diameter = 0.879 inches (ref DCS F-7.0.0)

For a 1 foot length of conductor:
Projected Area.

$$A = 1(ft.)x\left[\frac{Conductor\ Diameter(inches)}{12(inches/ft)}\right]$$

$$A = 1(ft.)x\left[\frac{0.879(inches)}{12(inches/ft)}\right]$$

A = 0.073 Square Ft. for each foot of span length

The wind load in pounds per foot of span length (from Equation 4.2.2-2) is

Load in pounds $= 0.00256 \times (Vmph)^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$

Load in pounds = $0.00256 \times (145)^2 \times 1 \times .93 \times 1 \times 1 \times .073$
Load = 3.667 pounds per foot

Total Load	=	Length of conductor x Load per foot of conductor
	=	170 x 3.667
Total Load	=	623.3 pounds

This is the load that the wind exerts on the conductor attached at 30 above ground. This load will have to be applied to the pole to determine if the pole has the strength to support the load.

The wind load per foot of conductor for the three wind regions can be found in Table 4.2.2-5, Table 4.2.2- 6 and Table 4.2.2-7.

3. *Wind Loading on equipment.*

The wind loading on equipment is calculated in a similar method to the wind loading on the pole and the conductors. The load in pounds uses Equation 4.2.2-2 with the appropriate factors for the attachment heights a shown in Table 4.2.2-2 and the area of the equipment.

To calculate the wind load on the equipment:

a. Determine the wind region (105 mph, 130 mph, or 145 mph)
b. Calculate the attachment height to determine the k_z (Table 4.2.2-2) (For equipment, use the top mounting hole of the equipment bracket.)
c. Use the height of the pole above ground to determine G_{RF} (Table 4.2.2-2)
d. The Importance Factor (I) is equal to 1.
e. The Force Coefficient (C_f) is equal to 1.0 for cylindrical equipment and 1.6 for rectangular equipment.
f. Calculate the area of the equipment
g. Calculate the wind load on the equipment

Example:
Determine the wind load on a 50 kVA transformer mounted at 28 feet on a pole that is 38 feet above the ground in the 145 mph wind region.

From Table 4.2.2-2:

K_z = 1.0 (Equipment ≤ 33' above ground)
G_{RF} = 0.97 (Equipment based on Pole height > 33' to 50' above ground)
C_f = 1.0
A = 4.44 square feet

The wind load in pounds from Equation 4.2.2-2 is

$$\textit{Load in pounds} = 0.00256 \times (V_{mph})^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$$

Load in pounds = $0.00256 \times (145)^2 \times 1 \times .97 \times 1 \times 1 \times 4.44$
Load = 231.8 pounds

This is the load that the wind exerts on the transformer attached at 28 feet above ground. This load will have to be applied to the pole to determine if the pole has the strength to support the load.
The wind load on equipment for the three wind regions can be found in Table 4.2.2-5 (105 mph), Table 4.2.2- 6 (130 mph) and Table 4.2.2-7 (145 mph).

Table 4.2.2-5 Wind Force on Conductors & Equipment

Wind Speed = 105 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	1.923	2.001	2.134
3/0 AAAC	0.502	1.098	1.143	1.218
1/0 AAAC	0.398	0.871	0.906	0.966
#4 AAAC	0.250	0.547	0.569	0.607
3/0 TPX	1.238	2.708	2.819	3.005
1/0 TPX	1.026	2.244	2.336	2.490
6 DPX	0.496	1.085	1.129	1.204
CATV				
Feeder w/1/4"Msgnr	0.750	1.641	1.708	1.820
Trunk w/1/4"Msgnr	1.000	2.187	2.277	2.427
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	2.100	2.186	2.330
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	5.020	5.225	5.571

Wind Speed = 105 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht ≤33'
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	
25	3.75	108.0	112.9	118.1	102.7
50	4.44	127.8	133.7	139.9	121.6
75	4.81	138.5	144.9	151.5	131.7
100	6.55	188.6	197.3	206.3	179.3
167	10.83	311.8	326.1	341.1	296.5
Capacitors					
Switched (1)	19.91	573.2	599.6	627.1	545.1
Fixed (1)	16.89	486.2	508.6	532.0	462.4
Reclosers					
1 phase	4.00	115.2	120.5	126.0	109.5
3 phase (1)	16.89	486.2	508.6	532.0	462.4
Automation Switches					
Joslyn	8.89	255.9	267.7	280.0	243.4
Cooper	10.56	304.0	318.0	332.6	289.1
S&C	15.60	449.1	469.8	491.4	427.1
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.19	5.4	5.6	5.9	5.1
5" U-Guard	0.46	12.8	13.8	14.4	13.2

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

ADDENDUM FOR EXTREME WIND LOADING

Table 4.2.2-6 Wind Force on Conductors & Equipment

Wind Speed = 130 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	2.947	3.068	3.270
3/0 AAAC	0.502	1.683	1.752	1.868
1/0 AAAC	0.398	1.334	1.389	1.481
#4 AAAC	0.250	0.838	0.872	0.930
3/0 TPX	1.238	4.151	4.321	4.606
1/0 TPX	1.026	3.440	3.581	3.817
6 DPX	0.496	1.663	1.731	1.845
CATV				
Feeder w/1/4"Msgnr	0.750	2.515	2.617	2.791
Trunk w/1/4"Msgnr	1.000	3.353	3.490	3.721
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	3.219	3.350	3.572
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	7.695	8.009	8.539

Wind Speed = 130 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht ≤33'
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	
25	3.75	165.5	173.1	181.1	157.4
50	4.44	195.9	205.0	214.4	186.3
75	4.81	212.3	222.0	232.2	201.9
100	6.55	289.0	302.4	316.3	274.9
167	10.83	477.9	499.9	522.9	454.5
Capacitors					
Switched (1)	19.91	878.6	919.1	961.3	835.5
Fixed (1)	16.89	745.3	779.7	815.5	708.8
Reclosers					
1 phase	4.00	176.5	184.7	193.1	167.9
3 phase (1)	16.89	745.3	779.7	815.5	708.8
Automation Switches					
Joslyn	8.89	392.3	410.4	429.2	373.1
Cooper	10.56	466.0	487.5	509.9	443.2
S&C	15.60	688.4	720.1	753.2	654.7
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.19	8.3	8.7	9.1	7.9
5" U-Guard	0.46	20.2	21.2	22.1	19.2

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

Table 4.2.2-7 Wind Force on Conductors & Equipment

Wind Speed = 145 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	3.667	3.816	4.069
3/0 AAAC	0.502	2.094	2.180	2.324
1/0 AAAC	0.398	1.660	1.728	1.842
#4 AAAC	0.250	1.043	1.085	1.157
3/0 TPX	1.238	5.164	5.375	5.731
1/0 TPX	1.026	4.280	4.455	4.749
6 DPX	0.496	2.069	2.154	2.296
CATV				
Feeder w/1/4"Msgnr	0.750	3.129	3.256	3.472
Trunk w/1/4"Msgnr	1.000	4.171	4.342	4.629
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	4.005	4.168	4.444
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	9.573	9.964	10.623

Wind Speed = 145 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	≤33'
25	3.750	205.9	215.4	225.3	195.8
50	4.440	243.8	255.0	266.7	231.8
75	4.810	264.1	276.2	288.9	251.1
100	6.550	359.6	376.2	393.4	342.0
167	10.830	594.6	622.0	650.5	565.4
Capacitors					
Switched (1)	19.910	1093.1	1143.4	1195.9	1039.5
Fixed (1)	16.890	927.3	970.0	1014.5	881.8
Reclosers					
1 phase	4.000	219.6	229.7	240.3	208.8
3 phase (1)	16.890	927.3	970.0	1014.5	881.8
Automation Switches					
Joslyn	8.890	488.1	510.6	534.0	464.1
Cooper	10.560	579.7	606.5	634.3	551.3
S&C	15.600	856.4	895.9	937.1	814.5
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.188	10.3	10.8	11.3	9.8
5" U-Guard	0.458	25.2	26.3	27.5	23.9

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

ADDENDUM FOR EXTREME WIND LOADING

The methodology to determine if a pole has the strength for a specific design or to determine the maximum span distance a specific size pole can support for framing, is the same as shown in the DERM 4.2.2 pages 12-15. The examples shown below show the calculations based on using the new tables for extreme wind loading. Note that the ground line is now the point used for the calculations rather than the "fixity" point.

Example:

Conductor: 3-568.3 MCM ACAR and #3/0 AAAC - Neutral

Framing: DCS page E-5.0.0 (Modified Vertical) and I-41.0.1 (for single phase transformer)

Transformer: 50 kVA

CATV: Trunk

Telephone: 1-600 pair, 24 gauge, BKMA

Average Span Length = 150 feet

Attachment heights must be calculated using the framing identified and the pole setting depths as shown in the Revised DCS page D-3.0.0

ADDENDUM FOR EXTREME WIND LOADING

Case I: Determine if a 45'/2 wood pole is strong enough for this design.

Calculate the moments on the pole.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	39.00	=	22324
568.3	1	x	3.816	x	150	x	36.60	=	20950
568.3	1	x	3.816	x	150	x	34.60	=	19805
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	29.4	=	9235
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	23.6	=	14765
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	22.6	=	32452
					TOTAL MOMENT DUE TO CONDUCTOR			=	119531
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		29.9	=	6931
					TOTAL MOMENT DUE TO EQUIPMENT			=	6931 ft.-lb.
							TOTAL ALL MOMENTS	=	**126462 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 45'/2 wood pole in a 145 mph wind region is 72,108 ft-lbs. A 45'/2 wood pole cannot be used.

Case II: Determine if a 50'/III-H square concrete pole is strong enough for this design

DCS D-3.0.0 shows a revised setting depth for square concrete poles. The new setting depth is generally 5 feet deeper than previous. A 50'/III-H square concrete pole is set 11.5 feet deep.

Re-calculate the moments based on attachment heights.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	39.50	=	22610
568.3	1	x	3.816	x	150	x	37.08	=	21225
568.3	1	x	3.816	x	150	x	35.08	=	20080
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	29.92	=	9398
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	24.08	=	15066
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	23.08	=	33142
					TOTAL MOMENT DUE TO CONDUCTOR			=	121519
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.42	=	7051
					TOTAL MOMENT DUE TO EQUIPMENT			=	7051 ft.-lb.
						TOTAL ALL MOMENTS		**=**	**128571 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 50'/III-H square concrete pole in a 145 mph wind region is 95,831 ft-lbs. A 50'/III-H square concrete pole cannot be used.

ADDENDUM FOR EXTREME WIND LOADING

Case III: Determine if a 50'/4.7 KIP spun concrete pole is strong enough for this design.

DCS D-3.0.0 shows the setting depths for spun concrete poles. A 50'/4.7 KIP spun concrete pole is set 11 feet deep.

Re-calculate the moments based on attachment heights.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	40.00	=	22896
568.3	1	x	3.816	x	150	x	37.58	=	21511
568.3	1	x	3.816	x	150	x	35.58	=	20366
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	30.42	=	9555
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	24.58	=	15378
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	23.58	=	33860
					TOTAL MOMENT DUE TO CONDUCTOR			=	123566
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.92	=	7167
					TOTAL MOMENT DUE TO EQUIPMENT			=	7167 ft.-lb.
					TOTAL ALL MOMENTS			=	**130733 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 50'/4.7 KIP spun concrete pole in a 145 mph wind region is 134,559 ft-lbs. A 50'/4.7 KIP spun concrete pole can be used.

Using similar calculations from DERM 4.2.2 page 13, the maximum span distance for each of the poles above can be determined.

Determine the moment due to 1 foot of conductor moments
Subtract the moment due to the transformer from the total allowable moment
Divide the remaining allowable moment by the total 1 foot conductor moments.

ADDENDUM FOR EXTREME WIND LOADING

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	39.00	=	149
568.3	1	x	3.816	x	1	x	36.60	=	140
568.3	1	x	3.816	x	1	x	34.60	=	132
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	29.4	=	62
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	23.6	=	98
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	22.6	=	216
					TOTAL MOMENT DUE TO CONDUCTOR			=	797
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		29.9	=	6931
					TOTAL MOMENT DUE TO EQUIPMENT			=	6931 ft.-lb.
						TOTAL ALL MOMENTS		**=**	**7728 ft.-lb.**

Maximum Allowable moment on 45'/2 pole =	72108
Transformer Moment	6931
Available for conductors	65177
Conductor Moments per foot of span =	797
Maximum span distance =	**82 ft.**

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	39.50	=	151
568.3	1	x	3.816	x	1	x	37.08	=	141
568.3	1	x	3.816	x	1	x	35.08	=	134
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	29.92	=	63
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	24.08	=	100
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	23.08	=	221
					TOTAL MOMENT DUE TO CONDUCTOR			=	810
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.42	=	7051
					TOTAL MOMENT DUE TO EQUIPMENT			=	7051 ft.-lb.
						TOTAL ALL MOMENTS		**=**	**7861 ft.-lb.**

Maximum Allowable moment on 50/III-H pole =	95831
Transformer Moment	7051
Available for conductors	88780
Conductor Moments per foot of span =	810
Maximum span distance =	**110 ft.**

ADDENDUM FOR EXTREME WIND LOADING

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	40.00	=	153
568.3	1	x	3.816	x	1	x	37.58	=	143
568.3	1	x	3.816	x	1	x	35.58	=	136
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	30.42	=	64
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	24.58	=	103
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	23.58	=	226
					TOTAL MOMENT DUE TO CONDUCTOR			=	824
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.92	=	7167
					TOTAL MOMENT DUE TO EQUIPMENT			=	7167 ft.-lb.
					TOTAL ALL MOMENTS			**=**	**7991 ft.-lb.**

Maximum Allowable moment on 50'/4.7 KIP po	134559
Transformer Moment	7167
Available for conductors	127392
Conductor Moments per foot of span =	824
Maximum span distance =	**155 ft.**

Maximum span distances for Modified Vertical Framing with various pole sizes and types, conductor sizes, CATV and Telephone Cables are listed in Table 4.2.2-8 (105 mph), Table 4.2.2-9 (130 mph), and Table 4.2.2-10 (145 mph). The span distances shown were calculated using 95% of the span distance calculated using the KEMA" Pole Design Calculation Toolkit" program. This will allow for slight variation in field conditions and rounding of values. Using the calculations described in this document may be slightly different than the table values. In some cases, the limiting factor is not the wind loading, but the required clearance above the ground and above other conductors or cables. For all joint use clearance calculations, the top joint user is considered to be attached at 23 feet above ground. When clearance is the limiting factor, the maximum span length for a specific pole is shown in bold italics. In some cases, the joint use clearance criteria cannot be met using the pole height indicated.

One other criterion incorporated in the tables is a maximum design span of 350 feet. Longer spans may be achieved, but need to be addressed on an individual basis.

Table 4.2.2-8

Transverse Pole Loading due to Extreme Wind - 105 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors		Wood Pole Height and Class					
		40/3	45/3	45/2	50/2	55/2	60/1
3-568 ACAR & 3/0 AAAC-N	**FPL Only**	296	281	350	342	324	350
	FPL With						
	1-100 pair	*100*	211	*250*	275	259	307
	1-600 pair	*100*	165	216	200	191	223
	1-CATV	*100*	209	*250*	273	257	304
	1-100 pair & 1 CATV	*100*	176	230	213	202	255
	1-600 pair & 1 CATV	*100*	144	188	174	166	194
3-568 ACAR & 3/0 AAAC-N & 3/0 TPX	**FPL Only**	206	195	273	256	224	283
	FPL With	(2)					
	1-100 pair		*150*	*150*	202	191	224
	1-600 pair		137	*150*	166	158	184
	1-CATV		*150*	*150*	200	190	222
	1-100 pair & 1 CATV		144	*150*	175	166	194
	1-600 pair & 1 CATV		123	*150*	148	142	164
3-3/0 & 1/0 N	**FPL Only**	350	350	350	350	350	350
	FPL With						
	1-100 pair	*100*	*250*	*250*	350	350	350
	1-600 pair	*100*	223	*250*	290	276	322
	1-CATV	*100*	*250*	*250*	350	350	350
	1-100 pair & 1 CATV	*100*	*250*	*250*	350	300	350
	1-600 pair & 1 CATV	*100*	186	*250*	283	215	268
3-3/0 & 1/0 N & 3/0 TPX	**FPL Only**	*250*	299	350	350	344	350
	FPL With	(2)					
	1-100 pair		*150*	*150*	*250*	276	323
	1-600 pair		*150*	*150*	212	201	234
	1-CATV		*150*	*150*	*250*	275	320
	1-100 pair & 1 CATV		*150*	*150*	225	214	268
	1-600 pair & 1 CATV		143	*150*	172	164	190

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-8

Transverse Pole Loading due to Extreme Wind - 105 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors		Wood Pole Height and Class					
		40/3	45/3	45/2	50/2	55/2	60/1
3-1/0 & 1/0 N	**FPL Only**	350	350	350	350	350	350
	FPL With						
	1-100 pair	*100*	*250*	*250*	350	350	350
	1-600 pair	*100*	*250*	*250*	325	311	350
	1-CATV	*100*	*250*	*250*	350	350	350
	1-100 pair & 1 CATV	*100*	*250*	*250*	350	340	350
	1-600 pair & 1 CATV	*100*	205	*250*	265	237	295
3-1/0 & 1/0 N & 3/0 TPX	**FPL Only**	*250*	348	350	350	350	350
	FPL With	(2)					
	1-100 pair		*150*	*150*	*250*	311	350
	1-600 pair		*150*	*150*	232	220	275
	1-CATV		*150*	*150*	*250*	308	350
	1-100 pair & 1 CATV		*150*	*150*	*250*	236	295
	1-600 pair & 1 CATV		*150*	*150*	199	189	219
2-1/0 & 1/0 N	**FPL Only**	350	350	350	350	350	350
	FPL With						
	1-100 pair	*150*	350	350	350	350	350
	1-600 pair	*150*	290	350	350	333	350
	1-CATV	*150*	350	350	350	350	350
	1-100 pair & 1 CATV	*150*	322	350	350	350	350
	1-600 pair & 1 CATV	*150*	214	301	284	266	308
2-1/0 & 1/0 N & 3/0 TPX	**FPL Only**	*300*	350	350	350	350	350
	FPL With	(2)					
	1-100 pair		*200*	*200*	*300*	333	350
	1-600 pair		198	*200*	262	229	285
	1-CATV		*200*	*200*	*300*	331	350
	1-100 pair & 1 CATV		*200*	*200*	281	265	308
	1-600 pair & 1 CATV		167	*200*	204	193	224
1-1/0 & 1/0 N	**FPL Only**	350	350	350	350	350	350
	FPL With						
	1-100 pair	*250*	350	350	350	350	350
	1-600 pair	*250*	306	350	350	350	350
	1-CATV	*250*	350	350	350	350	350
	1-100 pair & 1 CATV	*250*	345	350	350	350	350
	1-600 pair & 1 CATV	235	218	307	291	274	317
1-1/0 & 1/0 N & 3/0 TPX	**FPL Only**	350	350	350	350	350	350
	FPL With						
	1-100 pair	*150*	*250*	*250*	*300*	350	350
	1-600 pair	*150*	202	*250*	268	234	294
	1-CATV	*150*	*250*	*250*	*300*	350	350
	1-100 pair & 1 CATV	*150*	220	*250*	290	273	317
	1-600 pair & 1 CATV	*150*	168	219	207	194	226

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-8

Transverse Pole Loading due to Extreme Wind - 105 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SQUARE CONCRETE POLE HEIGHT AND CLASS				
		45IIIG	45IIIH	50IIIH	55IIIH	60IIIH
3-568 & 3/0 N	FPL Only	274	350	350	350	350
	FPL With					
	1-100 pair	208	*100*	*250*	350	350
	1-600 pair	165	*100*	*250*	305	289
	1-CATV	206	*100*	*250*	350	350
	1-100 pair & 1 CATV	176	*100*	*250*	325	307
	1-600 pair & 1 CATV	144	*100*	*250*	266	235
3-568 & 3/0 N & 3/0 TPX	FPL Only	192	*250*	*300*	350	339
	FPL With	(2)	(2)			
	1-100 pair			*150*	*250*	289
	1-600 pair			*150*	237	223
	1-CATV			*150*	*250*	287
	1-100 pair & 1 CATV			*150*	*250*	235
	1-600 pair & 1 CATV			*150*	211	200
3-3/0 & 1/0 N	FPL Only	350	350	350	350	350
	FPL With					
	1-100 pair	*200*	*100*	*300*	*350*	*350*
	1-600 pair	*200*	*100*	*300*	*350*	*350*
	1-CATV	*200*	*100*	*300*	*350*	*350*
	1-100 pair & 1 CATV	*200*	*100*	*300*	*350*	*350*
	1-600 pair & 1 CATV	187	*100*	*300*	*350*	325
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	297	*250*	350	350	350
	FPL With		(2)			
	1-100 pair	*100*		*150*	*250*	350
	1-600 pair	*100*		*150*	*250*	305
	1-CATV	*100*		*150*	*250*	350
	1-100 pair & 1 CATV	*100*		*150*	*250*	325
	1-600 pair & 1 CATV	*100*		*150*	*250*	266
3-1/0 & 1/0 N	FPL Only	350	350	350	350	350
	FPL With					
	1-100 pair	*200*	*100*	*300*	350	350
	1-600 pair	*200*	*100*	*300*	350	350
	1-CATV	*200*	*100*	*300*	350	350
	1-100 pair & 1 CATV	*200*	*100*	*300*	350	350
	1-600 pair & 1 CATV	*200*	*100*	*300*	350	350
3-1/0 & 1/0 N & 3/0 TPX	FPL Only	350	*250*	350	350	350
	FPL With		(2)			
	1-100 pair	*100*		*150*	*250*	350
	1-600 pair	*100*		*150*	*250*	350
	1-CATV	*100*		*150*	*250*	350
	1-100 pair & 1 CATV	*100*		*150*	*250*	350
	1-600 pair & 1 CATV	*100*		*150*	*250*	297

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-8

Transverse Pole Loading due to Extreme Wind - 105 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SPUN CONCRETE POLE HEIGHT AND CLASS			
		50' 4.7kip	55' 4.7kip	60' 5kip	65' 5kip
3-568 & 3/0 N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*250*	350	350	350
	1-600 pair	*250*	350	350	350
	1-CATV	*250*	350	350	350
	1-100 pair & 1 CATV	*250*	350	350	350
	1-600 pair & 1 CATV	*250*	333	339	321
3-568 & 3/0 N & 3/0 TPX	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*150*	*250*	*300*	350
	1-600 pair	*150*	*250*	*300*	305
	1-CATV	*150*	*250*	*300*	350
	1-100 pair & 1 CATV	*150*	*250*	*300*	321
	1-600 pair & 1 CATV	*150*	*250*	288	272
3-3/0 & 1/0 N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*300*	350	350	350
	1-600 pair	*300*	350	350	350
	1-CATV	*300*	350	350	350
	1-100 pair & 1 CATV	*300*	350	350	350
	1-600 pair & 1 CATV	*300*	429	438	411
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*150*	*250*	*350*	350
	1-600 pair	*150*	*250*	*350*	350
	1-CATV	*150*	*250*	*350*	350
	1-100 pair & 1 CATV	*150*	*250*	*350*	350
	1-600 pair & 1 CATV	*150*	*250*	*350*	334
3-350 CU & 2/0 CU N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*250*	350	350	350
	1-600 pair	*250*	350	350	350
	1-CATV	*250*	350	350	350
	1-100 pair & 1 CATV	*250*	350	350	350
	1-600 pair & 1 CATV	*250*	350	350	350
3-350 CU & 2/0 CU N & 3/0 TPX	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*200*	*250*	*350*	350
	1-600 pair	*200*	*250*	*350*	343
	1-CATV	*200*	*250*	*350*	350
	1-100 pair & 1 CATV	*200*	*250*	*350*	350
	1-600 pair & 1 CATV	*200*	*250*	323	302

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-9

Transverse Pole Loading due to Extreme Wind - 130 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	WOOD POLE HEIGHT AND CLASS					
		40/3	45/3	45/2	50/2	55/2	60/1
3-568 & 3/0 N	FPL Only	162	151	201	183	170	200
	FPL With						
	1-100 pair	*100*	122	162	147	137	160
	1-600 pair	*100*	95	127	115	107	125
	1-CATV	*100*	121	161	146	136	159
	1-100 pair & 1 CATV	*100*	102	135	123	114	133
	1-600 pair & 1 CATV	91	83	111	100	94	108
3-568 & 3/0 N & 3/0 TPX	FPL Only	122	112	149	137	126	148
	FPL With	(2)					
	1-100 pair		95	127	116	107	125
	1-600 pair		79	105	96	89	104
	1-CATV		95	126	116	107	124
	1-100 pair & 1 CATV		83	110	101	93	108
	1-600 pair & 1 CATV		70	94	86	80	92
3-3/0 & 1/0 N	FPL Only	295	274	364	333	308	350
	FPL With						
	1-100 pair	*100*	181	*250*	219	203	237
	1-600 pair	*100*	128	171	155	145	167
	1-CATV	*100*	179	*250*	216	201	234
	1-100 pair & 1 CATV	*100*	140	186	168	158	182
	1-600 pair & 1 CATV	*100*	107	143	128	121	139
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	175	161	214	198	181	211
	FPL With	(2)					
	1-100 pair		128	171	157	145	168
	1-600 pair		101	134	122	113	131
	1-CATV		127	169	156	143	166
	1-100 pair & 1 CATV		106	143	130	121	139
	1-600 pair & 1 CATV		87	117	105	99	113
3-1/0 & 1/0 N	FPL Only	350	350	350	350	350	350
	FPL With						
	1-100 pair	*100*	214	*250*	278	258	301
	1-600 pair	*100*	144	193	174	163	188
	1-CATV	*100*	211	*250*	275	256	297
	1-100 pair & 1 CATV	*100*	159	212	191	180	207
	1-600 pair & 1 CATV	*100*	118	158	142	133	153

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-9

Transverse Pole Loading due to Extreme Wind - 130 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	WOOD POLE HEIGHT AND CLASS					
		40/3	45/3	45/2	50/2	55/2	60/1
3-1/0 & 1/0 N & 3/0 TPX	FPL Only	203	186	267	230	211	264
	FPL With	(2)					
	1-100 pair		144	*150*	177	163	189
	1-600 pair		110	146	134	124	143
	1-CATV		143	*150*	175	162	187
	1-100 pair & 1 CATV		118	*150*	143	133	153
	1-600 pair & 1 CATV		94	126	114	106	123
2-1/0 & 1/0 N	FPL Only	350	350	350	350	350	350
	FPL With						
	1-100 pair	*200*	265	*350*	325	298	348
	1-600 pair	170	155	206	192	175	202
	1-CATV	*200*	261	347	318	294	340
	1-100 pair & 1 CATV	189	172	230	213	195	225
	1-600 pair & 1 CATV	136	123	163	153	139	161
2-1/0 & 1/0 N & 3/0 TPX	FPL Only	226	208	298	276	236	296
	FPL With	(2)					
	1-100 pair		155	*200*	191	175	203
	1-600 pair		114	151	142	129	149
	1-CATV		153	204	189	173	201
	1-100 pair & 1 CATV		123	163	151	139	161
	1-600 pair & 1 CATV		96	128	118	109	125
1-1/0 & 1/0 N	FPL Only	350	350	350	350	350	350
	FPL With						
	1-100 pair	*250*	308	*350*	*350*	349	*350*
	1-600 pair	179	163	218	202	186	216
	1-CATV	*250*	348	*350*	*350*	*350*	*350*
	1-100 pair & 1 CATV	222	203	292	271	232	288
	1-600 pair & 1 CATV	147	134	179	166	153	177
1-1/0 & 1/0 N & 3/0 TPX	FPL Only	274	257	341	309	285	333
	FPL With						
	1-100 pair	*150*	166	221	202	187	217
	1-600 pair	126	117	156	143	132	153
	1-CATV	*150*	178	*250*	217	200	233
	1-100 pair & 1 CATV	146	135	181	166	152	177
	1-600 pair & 1 CATV	110	102	135	125	115	133

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-9

Transverse Pole Loading due to Extreme Wind - 130 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SQUARE CONCRETE POLE HEIGHT AND CLASS				
		45IIIG	45IIIH	50IIIH	55IIIH	60IIIH
3-568 & 3/0 N	FPL Only	143	308	290	268	227
	FPL With					
	1-100 pair	115	*100*	216	200	182
	1-600 pair	90	*100*	170	156	143
	1-CATV	114	*100*	215	198	181
	1-100 pair & 1 CATV	96	*100*	181	166	153
	1-600 pair & 1 CATV	79	*100*	148	136	125
3-568 & 3/0 N & 3/0 TPX	FPL Only	105	213	200	186	169
	FPL With	(2)	(2)			
	1-100 pair			*150*	158	143
	1-600 pair			141	130	119
	1-CATV			*150*	157	143
	1-100 pair & 1 CATV			147	137	124
	1-600 pair & 1 CATV			125	116	106
3-3/0 & 1/0 N	FPL Only	259	350	350	350	350
	FPL With					
	1-100 pair	171	*100*	*300*	318	291
	1-600 pair	123	*100*	228	210	194
	1-CATV	169	*100*	*300*	314	287
	1-100 pair & 1 CATV	133	*100*	267	228	210
	1-600 pair & 1 CATV	103	*100*	190	174	162
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	152	*150*	308	286	259
	FPL With	(2)	(2)			
	1-100 pair			*150*	213	194
	1-600 pair			*150*	165	151
	1-CATV			*150*	211	192
	1-100 pair & 1 CATV			*150*	176	161
	1-600 pair & 1 CATV			*150*	143	131
3-1/0 & 1/0 N	FPL Only	332	350	350	350	350
	FPL With					
	1-100 pair	*200*	*100*	*300*	350	345
	1-600 pair	138	*100*	277	236	218
	1-CATV	200	*100*	*300*	350	340
	1-100 pair & 1 CATV	151	*100*	*300*	280	257
	1-600 pair & 1 CATV	113	*100*	210	192	178
3-1/0 & 1/0 N & 3/0 TPX	FPL Only	177	*250*	350	334	302
	FPL With	(2)	(2)			
	1-100 pair			*150*	*250*	218
	1-600 pair			*150*	181	166
	1-CATV			*150*	237	216
	1-100 pair & 1 CATV			*150*	194	178
	1-600 pair & 1 CATV			*150*	155	143

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-9

Transverse Pole Loading due to Extreme Wind - 130 MPH
Maximum Span Length in Feet

Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SPUN CONCRETE POLE HEIGHT AND CLASS			
		50' 4.7kip	55' 4.7kip	60' 5kip	65' 5kip
3-568 & 3/0 N	FPL Only	350	350	350	337
	FPL With				
	1-100 pair	*250*	294	289	270
	1-600 pair	223	214	213	197
	1-CATV	*250*	292	287	268
	1-100 pair & 1 CATV	*250*	227	225	209
	1-600 pair & 1 CATV	195	185	185	170
3-568 & 3/0 N & 3/0 TPX	FPL Only	284	274	269	232
	FPL With				
	1-100 pair	*150*	216	213	197
	1-600 pair	*150*	178	176	162
	1-CATV	*150*	215	211	196
	1-100 pair & 1 CATV	*150*	187	184	170
	1-600 pair & 1 CATV	*150*	159	158	144
3-3/0 & 1/0 N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*300*	350	350	350
	1-600 pair	*300*	310	307	282
	1-CATV	*300*	350	350	350
	1-100 pair & 1 CATV	*300*	336	333	307
	1-600 pair & 1 CATV	270	257	256	219
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*150*	*250*	307	283
	1-600 pair	*150*	226	224	205
	1-CATV	*150*	*250*	305	280
	1-100 pair & 1 CATV	*150*	*250*	256	219
	1-600 pair & 1 CATV	*150*	196	195	178
3-350 CU & 2/0 CU N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*250*	350	350	328
	1-600 pair	*250*	267	266	228
	1-CATV	*250*	350	350	325
	1-100 pair & 1 CATV	*250*	287	284	263
	1-600 pair & 1 CATV	221	211	211	194
3-350 CU & 2/0 CU N & 3/0 TPX	FPL Only	339	328	321	298
	FPL With				
	1-100 pair	*200*	*250*	266	228
	1-600 pair	*200*	201	200	183
	1-CATV	*200*	*250*	262	226
	1-100 pair & 1 CATV	*200*	213	210	194
	1-600 pair & 1 CATV	184	177	176	161

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

Table 4.2.2-10

Transverse Pole Loading due to Extreme Wind - 145 MPH
Maximum Span Length in Feet

Modified Vertical Construction (DCS E-5.0.0)

Conductors		Wood Pole Height and Class					
		40/3	45/3	45/2	50/2	55/2	60/1
3-568 ACAR	**FPL Only**	121	110	150	134	122	143
& 3/0 AAAC-N	FPL With						
	1-100 pair	98	88	121	107	98	114
	1-600 pair	78	69	94	84	77	88
	1-CATV	97	87	120	106	97	113
	1-100 pair & 1 CATV	83	74	101	89	82	94
	1-600 pair & 1 CATV	68	61	83	73	67	77
3-568 ACAR	**FPL Only**	90	82	111	100	90	105
& 3/0 AAAC-N	FPL With	(2)					
& 3/0 TPX	1-100 pair		69	94	85	77	89
	1-600 pair		57	78	69	64	73
	1-CATV		69	94	85	76	88
	1-100 pair & 1 CATV		61	82	73	67	77
	1-600 pair & 1 CATV		51	70	62	57	66
3-3/0	**FPL Only**	203	186	272	226	205	257
& 1/0 N	FPL With						
	1-100 pair	146	131	179	160	145	168
	1-600 pair	105	93	127	113	104	119
	1-CATV	144	130	177	158	143	166
	1-100 pair & 1 CATV	114	102	138	123	113	129
	1-600 pair & 1 CATV	88	78	106	94	86	99
3-3/0	**FPL Only**	130	117	159	143	130	150
& 1/0 N	FPL With	(2)					
& 3/0 TPX	1-100 pair		93	127	114	104	120
	1-600 pair		73	100	88	81	93
	1-CATV		93	126	113	103	119
	1-100 pair & 1 CATV		78	105	95	86	99
	1-600 pair & 1 CATV		64	86	77	70	81

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria

(2) Required clearance cannot be met with Pole length

ADDENDUM FOR EXTREME WIND LOADING

Table 4.2.2-10

Transverse Pole Loading due to Extreme Wind - 145 MPH
Maximum Span Length in Feet

Modified Vertical Construction (DCS E-5.0.0)

Conductors		Wood Pole Height and Class					
		40/3	45/3	45/2	50/2	55/2	60/1
3-1/0	**FPL Only**	282	256	348	311	282	330
& 1/0 N	FPL With						
	1-100 pair	*100*	156	212	188	173	200
	1-600 pair	*100*	105	143	126	117	134
	1-CATV	*100*	154	209	186	170	197
	1-100 pair & 1 CATV	*100*	116	157	140	128	146
	1-600 pair & 1 CATV	98	86	117	104	95	108
3-1/0	**FPL Only**	151	136	184	167	151	174
& 1/0 N	FPL With	(2)					
& 3/0 TPX	1-100 pair		105	143	128	117	134
	1-600 pair		80	108	97	89	102
	1-CATV		105	142	127	116	133
	1-100 pair & 1 CATV		86	117	105	95	108
	1-600 pair & 1 CATV		68	93	84	76	86
2-1/0	**FPL Only**	350	334	350	350	350	350
& 1/0 N	FPL With						
	1-100 pair	200	180	262	220	199	230
	1-600 pair	126	113	153	140	125	143
	1-CATV	196	177	258	217	195	226
	1-100 pair & 1 CATV	141	125	170	155	140	161
	1-600 pair & 1 CATV	101	89	122	111	100	114
2-1/0	**FPL Only**	168	152	206	187	169	196
& 1/0 N	FPL With	(2)					
& 3/0 TPX	1-100 pair		113	153	140	125	144
	1-600 pair		83	112	103	92	105
	1-CATV		111	151	138	124	143
	1-100 pair & 1 CATV		89	122	110	100	114
	1-600 pair & 1 CATV		70	95	86	78	89
1-1/0	**FPL Only**	350	350	350	350	350	350
& 1/0 N	FPL With						
	1-100 pair	231	208	305	276	232	288
	1-600 pair	133	119	162	147	133	154
	1-CATV	226	203	297	270	227	282
	1-100 pair & 1 CATV	150	135	182	167	151	174
	1-600 pair & 1 CATV	103	91	124	114	103	118
1-1/0	**FPL Only**	188	174	237	210	191	221
& 1/0 N	FPL With						
& 3/0 TPX	1-100 pair	133	122	164	147	134	154
	1-600 pair	94	86	116	105	94	108
	1-CATV	131	120	162	146	132	152
	1-100 pair & 1 CATV	103	92	125	114	103	118
	1-600 pair & 1 CATV	78	70	96	87	78	90

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria

(2) Required clearance cannot be met with Pole length

ADDENDUM FOR EXTREME WIND LOADING

Table 4.2.2-10

Transverse Pole Loading due to Extreme Wind - 145 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SQUARE CONCRETE POLE HEIGHT AND CLASS				
		45IIIG	**45IIIH**	**50IIIH**	**55IIIH**	**60IIIH**
3-568 & 3/0 N	FPL Only	99	209	193	174	154
	FPL With					
	1-100 pair	80	*100*	155	139	124
	1-600 pair	63	*100*	122	109	97
	1-CATV	79	*100*	154	138	123
	1-100 pair & 1 CATV	67	*100*	129	116	104
	1-600 pair & 1 CATV	55	*100*	105	95	85
3-568 & 3/0 N & 3/0 TPX	FPL Only	73	157	143	130	114
	FPL With	(2)	(2)			
	1-100 pair			122	110	97
	1-600 pair			101	90	81
	1-CATV			121	109	97
	1-100 pair & 1 CATV			105	95	85
	1-600 pair & 1 CATV			90	81	72
3-3/0 & 1/0 N	FPL Only	167	350	349	314	278
	FPL With					
	1-100 pair	119	*100*	230	206	184
	1-600 pair	85	*100*	163	146	131
	1-CATV	118	*100*	227	204	181
	1-100 pair & 1 CATV	92	*100*	178	159	143
	1-600 pair & 1 CATV	71	*100*	136	122	109
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	105	225	204	186	164
	FPL With	(2)	(2)			
	1-100 pair			*150*	148	131
	1-600 pair			127	115	103
	1-CATV			*150*	147	130
	1-100 pair & 1 CATV			136	123	109
	1-600 pair & 1 CATV			111	100	89
3-1/0 & 1/0 N	FPL Only	214	350	350	350	350
	FPL With					
	1-100 pair	142	*100*	294	264	219
	1-600 pair	96	*100*	184	164	147
	1-CATV	140	*100*	290	260	215
	1-100 pair & 1 CATV	105	*100*	202	181	162
	1-600 pair & 1 CATV	79	*100*	150	134	121
3-1/0 & 1/0 N & 3/0 TPX	FPL Only	123	*250*	257	218	191
	FPL With		(2)			
	1-100 pair	96		*150*	167	147
	1-600 pair	73		140	126	112
	1-CATV	95		150	165	146
	1-100 pair & 1 CATV	78		150	135	121
	1-600 pair & 1 CATV	63		121	108	96

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

ADDENDUM FOR EXTREME WIND LOADING

Table 4.2.2-10

Transverse Pole Loading due to Extreme Wind - 145 MPH
Maximum Span Length in Feet
Modified Vertical Construction (DCS E-5.0.0)

Conductors	Attachments	SPUN CONCRETE POLE HEIGHT AND CLASS			
		50' 4.7kip	**55' 4.7kip**	**60' 5kip**	**65' 5kip**
3-568 & 3/0 N	FPL Only	291	276	267	227
	FPL With				
	1-100 pair	217	205	200	181
	1-600 pair	170	161	157	143
	1-CATV	215	203	198	181
	1-100 pair & 1 CATV	181	171	166	151
	1-600 pair & 1 CATV	148	140	137	124
3-568 & 3/0 N & 3/0 TPX	FPL Only	200	192	184	168
	FPL With				
	1-100 pair	*150*	162	157	143
	1-600 pair	141	134	130	118
	1-CATV	*150*	162	156	142
	1-100 pair & 1 CATV	147	141	137	124
	1-600 pair & 1 CATV	125	120	116	105
3-3/0 & 1/0 N	FPL Only	350	350	350	350
	FPL With				
	1-100 pair	*300*	328	317	288
	1-600 pair	229	217	212	191
	1-CATV	*300*	324	314	285
	1-100 pair & 1 CATV	267	235	230	207
	1-600 pair & 1 CATV	191	180	177	158
3-3/0 & 1/0 N & 3/0 TPX	FPL Only	309	296	283	257
	FPL With				
	1-100 pair	*150*	219	212	191
	1-600 pair	*150*	170	165	148
	1-CATV	*150*	218	210	189
	1-100 pair & 1 CATV	*150*	181	176	158
	1-600 pair & 1 CATV	*150*	147	143	128
3-350 CU & 2/0 CU N	FPL Only	350	350	341	313
	FPL With				
	1-100 pair	*250*	269	259	220
	1-600 pair	198	187	182	165
	1-CATV	*250*	266	257	219
	1-100 pair & 1 CATV	212	200	196	177
	1-600 pair & 1 CATV	168	159	156	140
3-350 CU & 2/0 CU N & 3/0 TPX	FPL Only	257	230	220	200
	FPL With				
	1-100 pair	198	189	182	165
	1-600 pair	159	151	147	132
	1-CATV	196	187	181	164
	1-100 pair & 1 CATV	168	161	156	140
	1-600 pair & 1 CATV	141	133	130	116

(1) Span Lengths Shown in *Italic* are Limited by Clearance Criteria
(2) Required clearance cannot be met with Pole length

C. *Storm Guying*

One method to overcome the overload on a pole due to transverse wind load is to add storm guys. Storm guys are installed in pairs(back to back) – one on each side of the pole perpendicular to the pole line. These guys should typically be installed 6 inches to 2 feet below the primary attachments.

Calculating the size of the guy wire is very much like calculating a deadend guy.

1. Calculate the transverse wind load on the pole, conductors and all attachments and equipment.
2. The load is then used to size the guy wire based on the load, the attachment height and lead length.
3. A final check should be made to verify that the strength of the pole above the guy attachment is adequate.

Using the example of Case I above for the 45'/2 pole, calculate the size of the storm guys and anchors required for extreme wind loading.

1. Transverse wind loads:

Pole	=	Wind load on pole
Primary conductors	=	Wind Load per ft x span length x number of
Neutral	=	Wind Load per ft x span length
CATV	=	Wind Load per ft x span length
Telephone	=	Wind Load per ft x span length
Transformer	=	Wind Load

Load on Pole	=						=	1713	pounds
Primary	=	3.816	x	170	x	3	=	1946	pounds
Neutral	=	2.094	x	170	x	1	=	356	pounds
CATV	=	4.171	x	170	x	1	=	709	pounds
Telephone	=	9.573	x	170	x	1	=	1627	pounds
Transformer	=	231.8	x	1			=	232	pounds
				Total Load			=	6583	pounds

2. Determine the guy wire size and anchor size required for this installation.

   To calculate the tension in the guy wire use the equation below

   Equation 4.2.2-7 $T_{DG} = \frac{T_{TWL}}{L} x \sqrt{H_G^{\,2} + L^2}$

Where:

T_{DG} = *Tension in down guy*
T_{TWL} = *Transverse Wind Load*
L = *The down guy Lead length*
H_G = *The attachment Height of the down guy*

Use the total transverse wind load for the load to be guyed with the guy attached 6 inches below C phase primary (34.1') and a lead length of 20 feet.

$$T_{DG} = \frac{6583}{20}\sqrt{(34.1)^2 + (20)^2}$$

T_{DG} = 13,013 Pounds

For extreme wind loading, the required strength of the guy wire is equal to the rated breaking strength of the guy wire x 0.9.

Table 4.2.2-11 Storm Guy Strength

Guy Size	Rated Breaking Strength (RBS)	Allowable Guy Tension .9 X RBS
5/16	11200	10080
7/16	20800	18720
9/16	33700	30330

For this example, a 7/16" guy will be installed in each direction perpendicular to the pole line. Use the tension in the down guy to select the appropriate anchor from DCS D-4.0.2. In this case, a 10" screw anchor will do the job.

3. One final check is to be sure that the pole length above the storm guy attachment has sufficient strength to support the load above it. Basically, this is just like calculating the strength of the total pole but now the "ground line" is at the storm guy attachment height and all of the facilities above this point will create a moment here.

With the top of the pole at 38' and the down guy at 34.1 feet, the length of pole exposed to the wind is now 38-34.1 = 3.9 ft.

Use equation 4.2.2-3 to determine the strength of this section of pole.

From Table G (DERM 4.2.2) circumference at 3.9 feet down from the top of the pole = 26.5 inches

M_r = 0.000264 x (8,000) x $(26.5)^3$ x 0.75 = 29,478 ft.-lbs.

Use equation 4.2.2-4 to find the area of this section of pole

$$A = 3.9(\frac{25+26.5}{2})(\frac{1}{12}'') = 2.66 sqft$$

Use equation 4.2.2-5 to find the center of the area of this section of pole

$$Height\ of\ center\ of\ area, H_{CA} = \frac{3.9(8.44+2(7.96))}{3(8.44+7.96)} = 1.93 ft$$

Use equation 4.2.2-2 to find the wind load on this section of pole

Load in pounds = 0.00256 x $(145)^2$ x1.0 x0.97 x 1 x 1x 2.66= 139 pounds

Use equation 4.2.2-6 to determine the moment due to the wind load on this section of the pole at the guy attachment point

Moment = 1.93 x 139 = 269 ft lbs

Determine the moment created by the wind load on the conductors

Primary	=	3.816	x	170	x	1	x	4.9	=	3179	Ft-Lbs
	=	3.816	x	170	x	1	x	2.5	=	1622	Ft-Lbs
	=	3.816	x	170	x	1	x	0.5	=	324	Ft-Lbs
										5125	Ft-Lbs

Total Moment = 269 + 5125 = 5393 Ft-Lbs

This load is well under the strength calculated above and the design using storm guys will meet requirements.

4.2.3 Pole Framing

A. Slack Span Construction

Slack span construction is employed where it is impractical to follow conventional guying practices. The proper application is a pull-off from either a tangent pole or a properly guyed deadend pole to another properly guyed deadend pole. The intent is not to slack span to a stand alone (self-support) pole unless that pole has been properly sized for this application. Improper use of slack span construction can cause a pole to bow or lean which then can cause more slack in the conductors. More slack in the conductors can result in improper clearances and increased potential for conductors to make contact with each other.

DERM 4.4.5 page 1 shows the initial sag to be used when installing slack spans. The amount of sag shown, limits the per conductor tension to 50 pounds.

Slack Span design criteria:

1. Vertical construction is preferred for two and three phase installations (DCS E-5.7.1).
   Maintain 36" separation between phases at the poles.
2. Limit the span lengths to

Table 4.2.2-12 Slack Span Length & Sag

SLACK SPAN		
CONDUCTOR	MAXIMUM LENGTH	INITIAL SAG
568.3 ACAR	50'	3'-7"
3/0 AAAC	75'	2'-9"
1/0 AAAC	95'	2'-10"

3. Use class 2 poles minimum.
4. If crossarm construction is used, use the 9 foot heavy duty wood crossarms or the 8'6" steel crossarm for added horizontal spacing (DCS E-29.0.0 and E-29.1.0).

B. ***Targeted Poles***

There are many poles in the distribution system identified as Targeted Poles. These poles are deemed critical by virtue of the equipment mounted on them or their importance to maintaining the system. As stated in The Distribution Design Guide "The following list comprises what will be considered targeted poles. When installing and/or replacing an accessible targeted pole, use a III-H concrete pole or a spun concrete pole for spans greater than 300 feet. If the pole is inaccessible, use a Class 2 pole, or consider relocating the equipment to an accessible concrete pole."

Targeted Pole List

"01" Feeder Switch Poles (first pole outside the substation)
Automated Feeder Switches
Interstate/Highway Crossings
Capacitor Banks
Multiple Primary Risers
3 Phase Reclosers
Aerial Auto Transformers
Multiple Circuits
3 phase Transformer Banks (3-100 kVA and larger)
Regulators
Primary Meter

The targeted pole also should meet the design criteria for wind loading as previously shown.

C. ***Distribution Design Guidelines***

The Storm Secure Organization has developed a set of guidelines for Distribution Designers to use when designing or maintaining distribution facilities. The designer can go online to see the most current version.

Power Systems

Distribution Construction Standards

ADDENDUM TO
DECEMBER 2005 EDITION
(FOR 2007 HARDENING APPLICATIONS)

FPL

Power Systems

Distribution Construction Standards

ADDENDUM TO

DECEMBER 2005 EDITION

(FOR 2007 HARDENING APPLICATIONS)

This book contains the current standards of distribution construction that have been updated to accommodate "Hardened" installations for Florida Power & Light Company. These standards are updated periodically by the staff of the Distribution Product Engineering and Reliabilty Engineering departments. Changed or updated standards are denoted with an asterisk (*) in the table of contents. Non-standard field situations may arise that are not covered by this book. In those instances, please contact the Distribution Product Engineering department at 561 845-4831for assistance. Current information on individual Product Engineers Responsibilities can be found in IN-FPL under Business Units Power Systems Distribution Reliability Products. This publication is also available in IN-FPL under Business Units Power Systems Reference Information Distribution Manuals Distribution Construction Standards (DCS) Drawings.

Distribution Product Engineer (DEO/PDC) 2456 Port West Boulevard, West Palm Beach, FL. 33407-1298

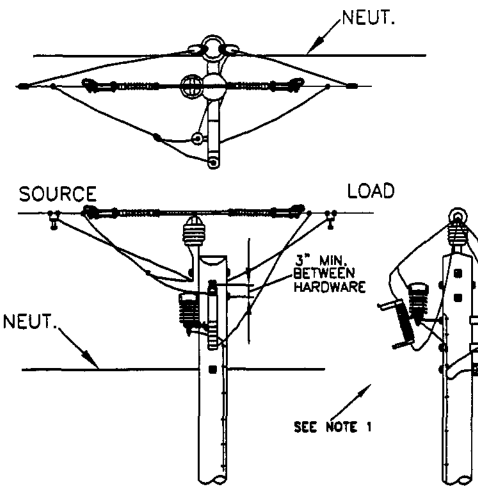
DISTRIBUTION CONSTRUCTION STANDARDS
ADDENDUM TO DECEMBER 2005 EDITION

Section-Page	Title	Description of Revision
C-7.0.0	Single Phase Recloser	1 or 2 phases on class 3 and 3 phase on Concrete Pole
C-8.0.0	Three Phase Recloser on Concrete Poles	3 Phase on concrete poles
C-9.0.4	Distribution Automation Switches	New or Replacement poles to be concrete
C-9.0.5	Distribution Automation Switches	New or Replacement poles to be concrete
C-9.1.0	Commercial/Industrial Load Control	New or Replacement poles to be concrete
C-9.1.1	Wiring Diagram for CILC	New drawing
C-9.2.0	SCADA-MATE Switch	Added notes
C-9.2.1	SCADA-MATE Switch	New page with notes
C-9.2.2	SCADA-MATE Radio Repeater	Update drawing and notes
D-2.0.0	Pole Setting, Guying & Bracing	Revised criteria for guy strain insulators
D-3.0.0	Pole Setting Depths	New setting Depths and Soil Conditions
D-7.0.0	Method of attaching guys	Added spun concrete installation
D-7.0.1	Method of attaching guys	Revised criteria for guy strain insulators
D-13.0.0	Storm Guying	New standard for storm guys
E-3.0.0	Overhead Equipment Dimensions	Add drawing for spun concrete pole
E-5.0.0	Post Insulator Construction	Add insulator bracket for spun concrete pole
E-5.0.2	Installation of Hardware	Add insulator bracket for spun concrete pole
E-5.7.1	Slack Span Construction Vertical	Add table and minimum pole size. Revised note for FGI's
E-6.0.0	Tangent Construction Wood Crossarm	Added note for use of Steel Crossarm
E-6.0.1	Tangent Construction Steel Crossarm	Change for mounting Pole top bracket opposite of steel crossarm
E-8.0.0	Angle Construction Concrete Pole	Change for mounting Pole top bracket opposite of steel crossarm
E-5.29.0.0	Slack Span Construction	Add table and minimum pole size. Revised note for FGI's
E-5.29.1.0	Slack Span Construction Concrete Pole Installation Only	Add table
G-3.0.2	Pole Grounding	Added figure for spun concrete pole
H-4.0.0	Street Light Pole Weights	New setting depths
I-3.2.0	Transformer Pole Weight Loading	Revised Table and added note for New or Replacement Poles for 3-100kVA Transformer Banks to be concrete poles
I-9.0.0	Single Phase Step Down Transformer on URD Terminator Pole	Removed wood pole class
I-10.0.0	Single Phase Line Regulator Installation (Alternate Method)	Removed wood pole class
I-51.0.0	Wye Closed Delta Bank - Modified Vertical	New or Replacement Poles for 3-100kVA and larger Transformer Banks to be concrete poles
I-52.0.0	Wye-Wye Bank Crossarm Construction	New or Replacement Poles for 3-100kVA and larger Transformer Banks to be concrete poles
I-52.0.2	Wye-Wye Bank Modified Vertical Construction	New or Replacement Poles for 3-100kVA and larger Transformer Banks to be concrete poles
J-1.0.2	Capacitor Banks General	New or Replacement poles to be concrete
J-2.0.2	Capacitor Banks Single Phase Units	New or Replacement poles to be concrete
J-2.0.3	Capacitor Banks Single Phase w/Puts	New or Replacement poles to be concrete
K-28.0.0	Outdoor Primary Metering Cluster Mounted Underground Service	Changed to Maintenance Only for underground - use URD primary to pad mounted metering cabinet. Replacement poles to be concrete.
K-28.1.0	Outdoor Primary Metering Cluster Mounted Overhead Service	New or Replacement poles to be concrete
M-2.0.0	Distribution Circuits on Transmission Poles Universal Spun Concrete Pole	Added notes to reflect that no additional holes can be added to a Universal Spun Concrete Transmission Pole
UH-15.0.0	Primary and Feeder Riser Pole	New or Replacement poles to be concrete
UH-15.3.1	Three Phase Feeder Riser	New or Replacement poles to be concrete
Z-12.0.1	Spun Concrete Pole Diameter & weight	New page with spun concrete pole information

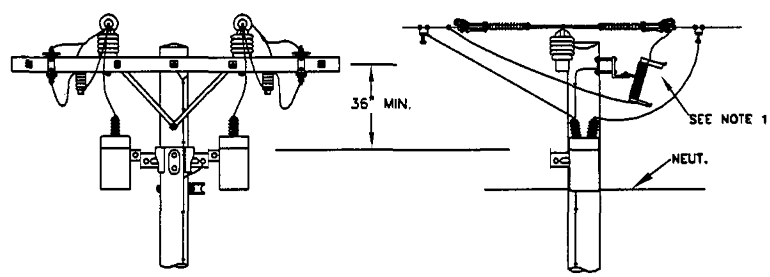
INSTALLATION OF SINGLE PHASE POLE MOUNTED RECLOSERS

C-7.0.0

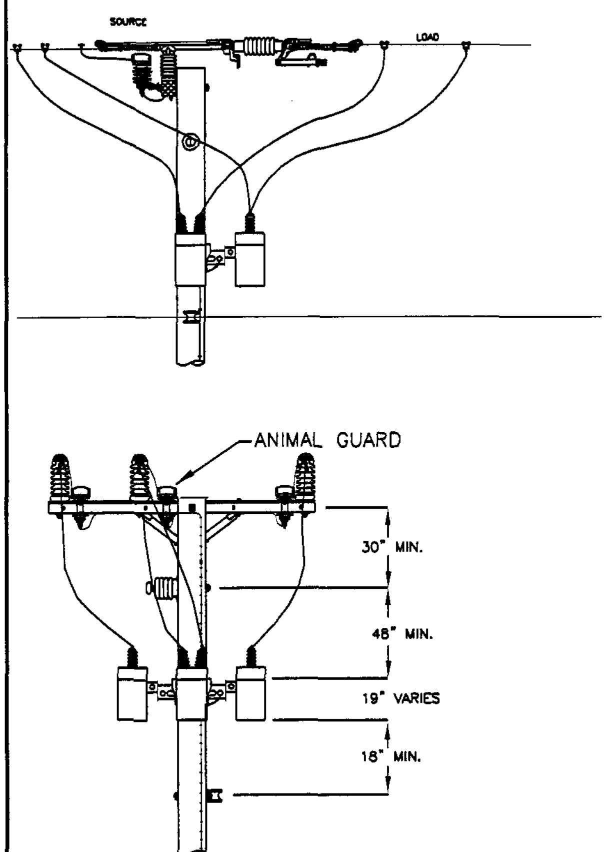
C



SINGLE PHASE INSTALLATION



TWO PHASE INSTALLATION



THREE PHASE INSTALLATION
(USE CONCRETE POLE)

NOTES:

1. WHERE CUTOUT IS USED AS A BY-PASS SWITCH, FUSE HOLDER SHALL BE REMOVED AND KEPT IN A CONVENIENT LOCATION ON THE POLE, FOR USE WHEN BY-PASSING RECLOSER. FASTEN FUSE HOLDER TO POLE WITH OPEN END OF BARREL DOWN.
2. LARGER RECLOSERS MUST BE PROPERLY ORIENTED WITH RESPECT TO SOURCE AND LOAD SIDES. KYLE TYPE H RECLOSERS DO NOT HAVE TO BE SO ORIENTED. BUT THEY SHOULD BE INSTALLED SO THAT THE COUNTER IS TOWARD THE POLE, MAKING IT EASIER TO READ.
3. INSTALL ARRESTERS ON SOURCE AND LOAD SIDE OF ALL RECLOSERS, TWO (2) REQUIRED PER PHASE. WHERE SPACE IS NOT AVAILABLE, INSTALL ARRESTERS ON ADJACENT POLE.
4. THREE PHASE INSTALLATIONS ARE TO BE IN ACCESSIBLE LOCATIONS ON CONCRETE POLES, CLASS III-H, 4.7 KIP SPUN, OR STRONGER WITH 8'-6" STEEL CROSSARM.
5. SINGLE PHASE OR TWO PHASE INSTALLATIONS ARE TO BE ON CLASS 3 WOOD POLES OR STRONGER.

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

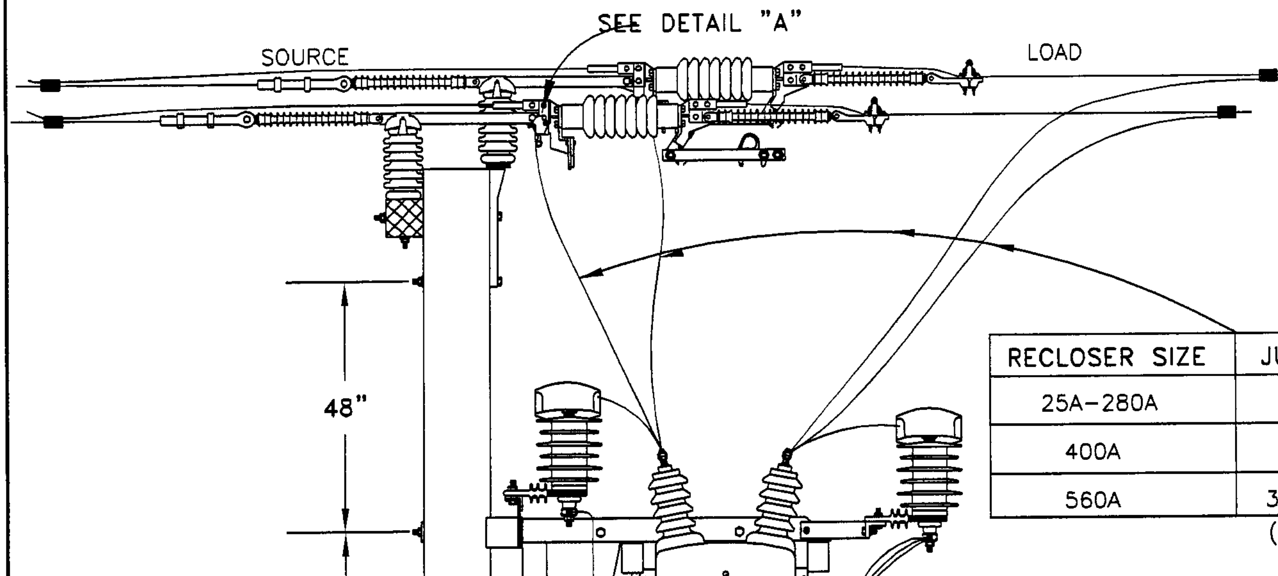
NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	1/9/07	ADDED POLE INFORMATION, NOTES 4 & 5	CEA	ELS	JJM
3	9/22/04	ADD ANIMAL GUARD	LFV	ELS	JJM
2	10/23/01	UPDATE DRAWING (TITLE CHANGE, NOTES, AND SHOW 3 SINGLE PHASE RECLOSERS)	CEA	JES	JJM
1	10/13/99	REMOVE BARREL FROM SINGLE & DOUBLE PHASE DETAIL	CEA	PRH	JNM

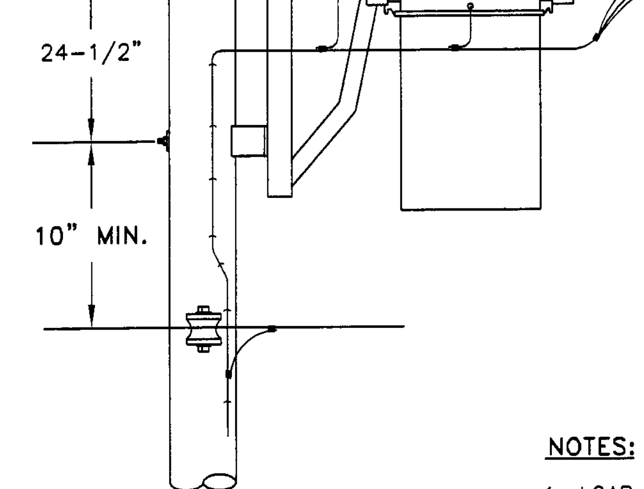
ORIGINATOR: ERB
DRAWN BY: H.V.
DATE: 11/11/64 APPROVED: J.J. MCEVOY
SUPERVISOR OH/UG PRODUCT SUPPORT SERVICES
NO SCALE

C-8.0.0

THREE PHASE RECLOSER ON CONCRETE POLES TYPES 3H, 6H, R, RX, RV, W, AND WV

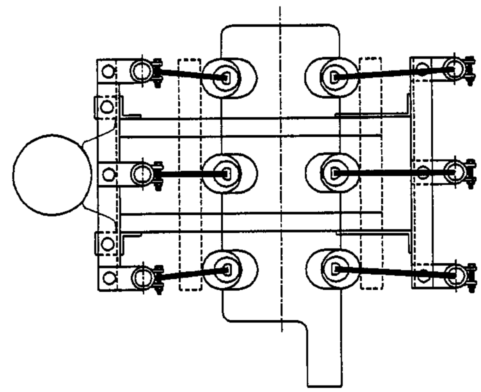
C-8.0.0



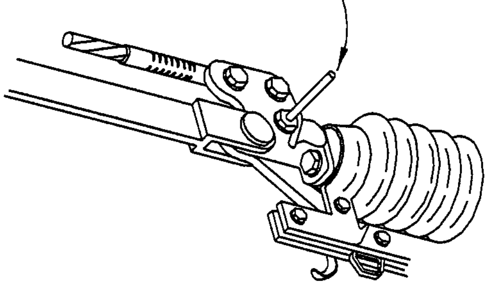


RECLOSER SIZE	JUMPER SIZE
25A-280A	#2/0 CU.
400A	#4/0 CU.
560A	350 KCMIL CU.

(SEE NOTE 4.)



PLAN VIEW



DETAIL "A"

NOTES:

1. LOAD/SOURCE BUSHINGS MAY NOT BE REVERSED.
2. INSTALL ARRESTERS ON SOURCE AND LOAD SIDE OF ALL RECLOSERS. ARRESTER MOUNTING BRACKET M&S# 334-552-001. TWO (2) REQUIRED. WHERE THIS ARRANGEMENT IS NOT UTILIZED, INSTALL INBOARD ARRESTERS ON ADJACENT POLE.
3. RELOSER MOUNTING BRACKET M&S# 142-260-009.
4. A STIRRUP-HOTLINE CLAMP SYSTEM IS NOT AVAILABLE FOR 560A RECLOSURES. USE MECHANICAL CONNECTOR M&S# 102-700-008.
5. THREE PHASE RECLOSERS ARE TO BE INSTALLED IN ACCESSIBLE LOCATIONS ON CONCRETE POLES, CLASS III-H, 4.7 KIP SPUN, OR STRONGER, WITH 8'-6' STEEL CROSSARM.

SUPERSEDES C-8A LAST REVISED ON 7-1-86

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	1/9/07	ADDED POLE INFORMATION, NOTE 5	CEA	ELS	JJM
3	9/28/05	UPDATE DRAWING	CEA	ELS	JJM
2	9/22/04	ADD ANIMAL GUARD	LFV	ELS	JJM
1	6/30/93	REDRAW ON CAD, ADD TABLE FOR RECLOSER/JUMPER SIZE	IA	EMH	RJS

ORIGINATOR: IA

DRAWN BY: EMH

DATE: 7/01/86

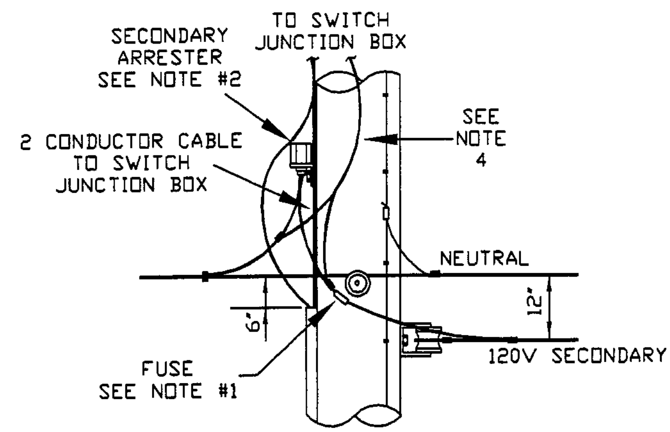
APPROVED: R.J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

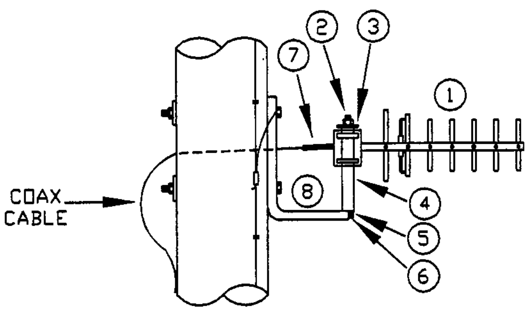
C

DISTRIBUTION AUTOMATION SECTIONALIZING SWITCHES NOTES AND DETAILS

C-9.0.4

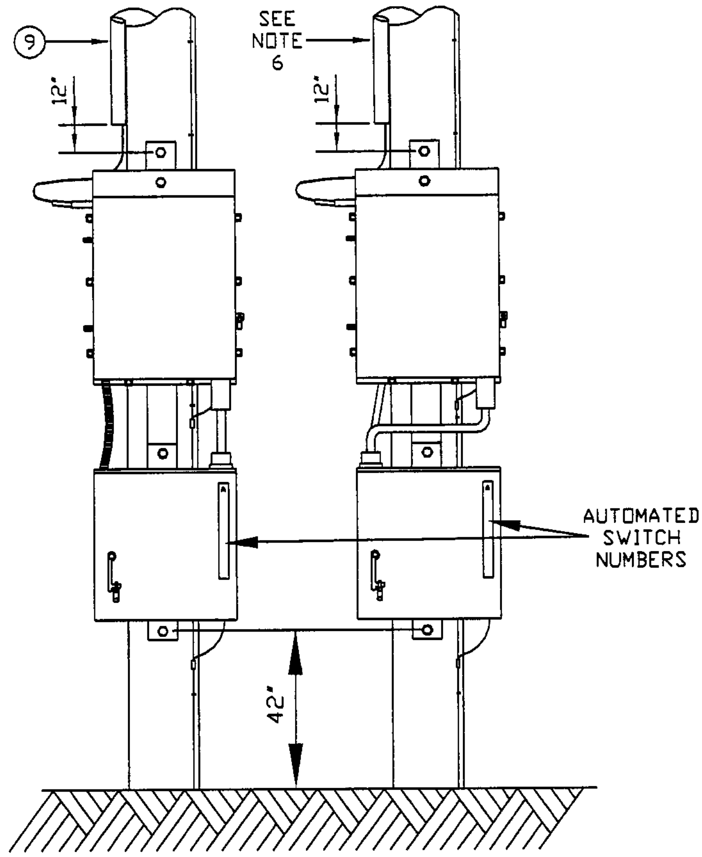


DETAIL "B"



DETAIL "A"

No.	DESCRIPTION
1	YAGI ANTENNA
2	10" X 1/2" BOLT
3	1 1/2" ROUND FLAT WASHER
4	1 1/4" GALVANIZED PIPE
5	1/2" SPRING WASHER
6	1/2" NUT
7	COAX CABLE
8	8" L-BRACKET
9	2" GALVANIZED PIPE



COOPER POWER SYSTEM VACUUM SWITCH

JOSLYN VACUUM SWITCH

DETAIL "C"

NOTES:

1. USE M&S #531-57000-4, AND 8A FUSE, M&S #531-07800-2.
2. USE SECONDARY ARRESTER M&S #334-08500-3.
3. INSTALL CONTROL CABINETS OPPOSITE TO VEHICLE TRAFFIC FLOW.
4. DUE TO IMPEDANCE REQUIREMENTS, LENGTH OF 120V AC LINE CONDUCTOR SHALL BE 54 INCHES MINIMUM BETWEEN SECONDARY AND SWITCH JUNCTION BOX.
5. INSTALL SWITCHES IN ACCESSIBLE AREAS ONLY.
6. BOND 2" CONDUIT SIMILAR TO STANDARD G-9 AND G-10.
7. DESIGNER TO SPECIFY DIRECTION OF ANTENNA.
8. DUE TO CONTROL CABLE LENGTHS, POLE LENGTHS SHOULD NOT EXCEED 45' FOR WOOD POLES AND 50' FOR CONCRETE POLES.
9. GROUND DISTRIBUTION AUTOMATION SWITCH BRACKETS, SWITCH CONTROL CABINETS, AND RTU CABINETS.
10. NEW OR REPLACEMENT POLES ARE TO BE CONCRETE, CLASS III-H, 4.7 KIP SPUN, OR STRONGER.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	12/15/06	ADDED INFORMATION ON POLES	CEA	ELS	JJM

ORIGINATOR: C.A.

DRAWN BY: H. OHARRIZ

DATE: 4/18/90

APPROVED: J. McEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

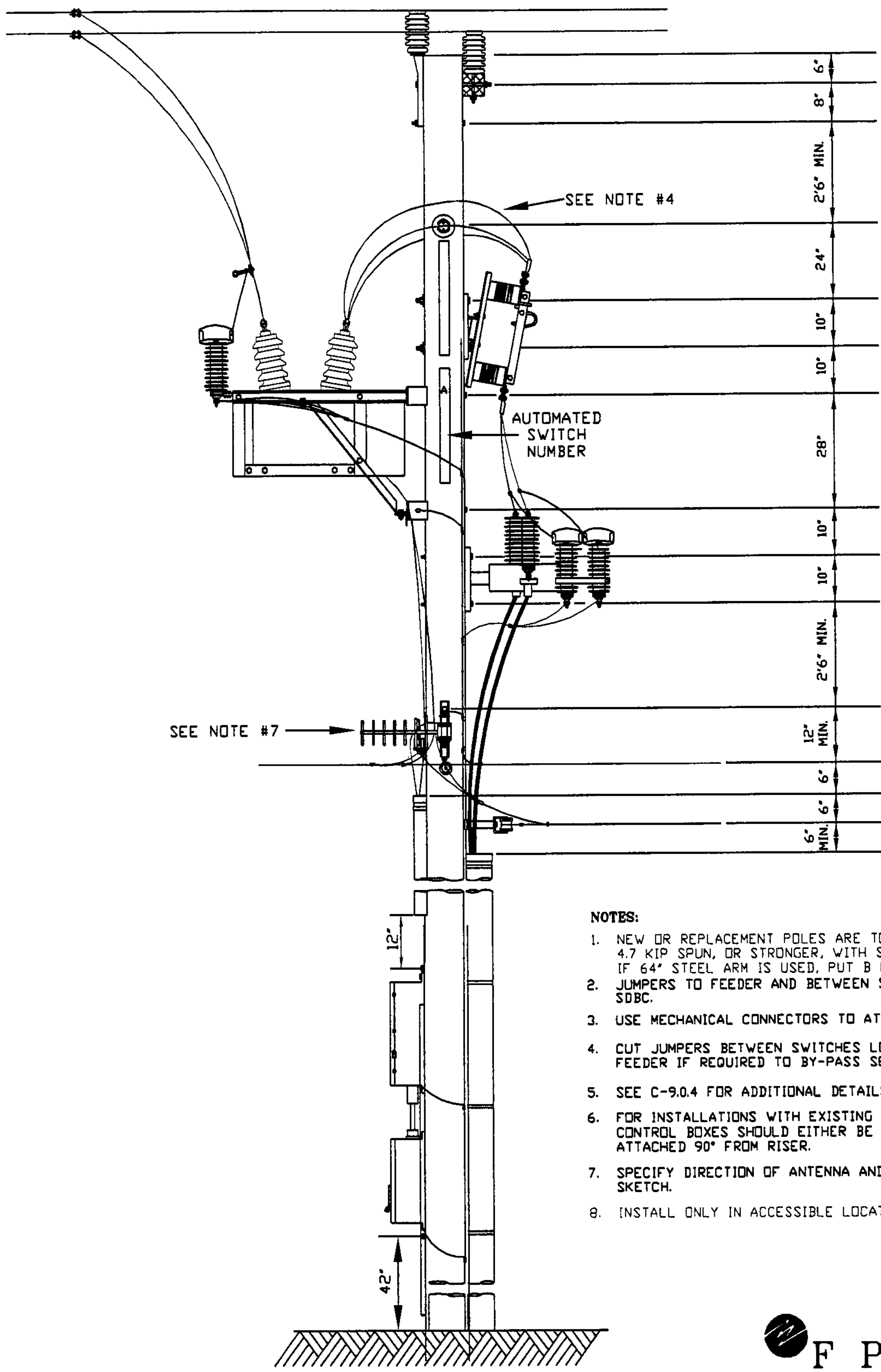
NO SCALE

DISTRIBUTION AUTOMATION SECTIONALIZING SWITCHES, RISER INSTALLATION

C-9.0.5

COOPER POWER SYSTEM VACUUM SWITCH 13 & 23 KV

C



NOTES:

1. NEW OR REPLACEMENT POLES ARE TO BE CONCRETE, CLASS III-H, 4.7 KIP SPUN, OR STRONGER, WITH STEEL CROSSARMS. IF 64" STEEL ARM IS USED, PUT B PHASE IN POLE TOP POSITION.
2. JUMPERS TO FEEDER AND BETWEEN SWITCHES TO BE 350 MCM SDBC.
3. USE MECHANICAL CONNECTORS TO ATTACH JUMPER TO FEEDER.
4. CUT JUMPERS BETWEEN SWITCHES LONG ENOUGH TO CONNECT TO FEEDER IF REQUIRED TO BY-PASS SECTIONALIZING SWITCH.
5. SEE C-9.0.4 FOR ADDITIONAL DETAILS.
6. FOR INSTALLATIONS WITH EXISTING RISER, THE RTU AND SWITCH CONTROL BOXES SHOULD EITHER BE BANDED TO THE POLE OR ATTACHED 90° FROM RISER.
7. SPECIFY DIRECTION OF ANTENNA AND MOUNTING FACE ON JOB SKETCH.
8. INSTALL ONLY IN ACCESSIBLE LOCATIONS.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	11/15/06	ADDED INFORMATION ON POLES	CEA	ELS	JJM
1	10/7/04	ADD ANIMAL GUARD	LFV	ELS	JJM

ORIGINATOR: CA

DRAWN BY: H. OHARRIZ

DATE: 10/02/90

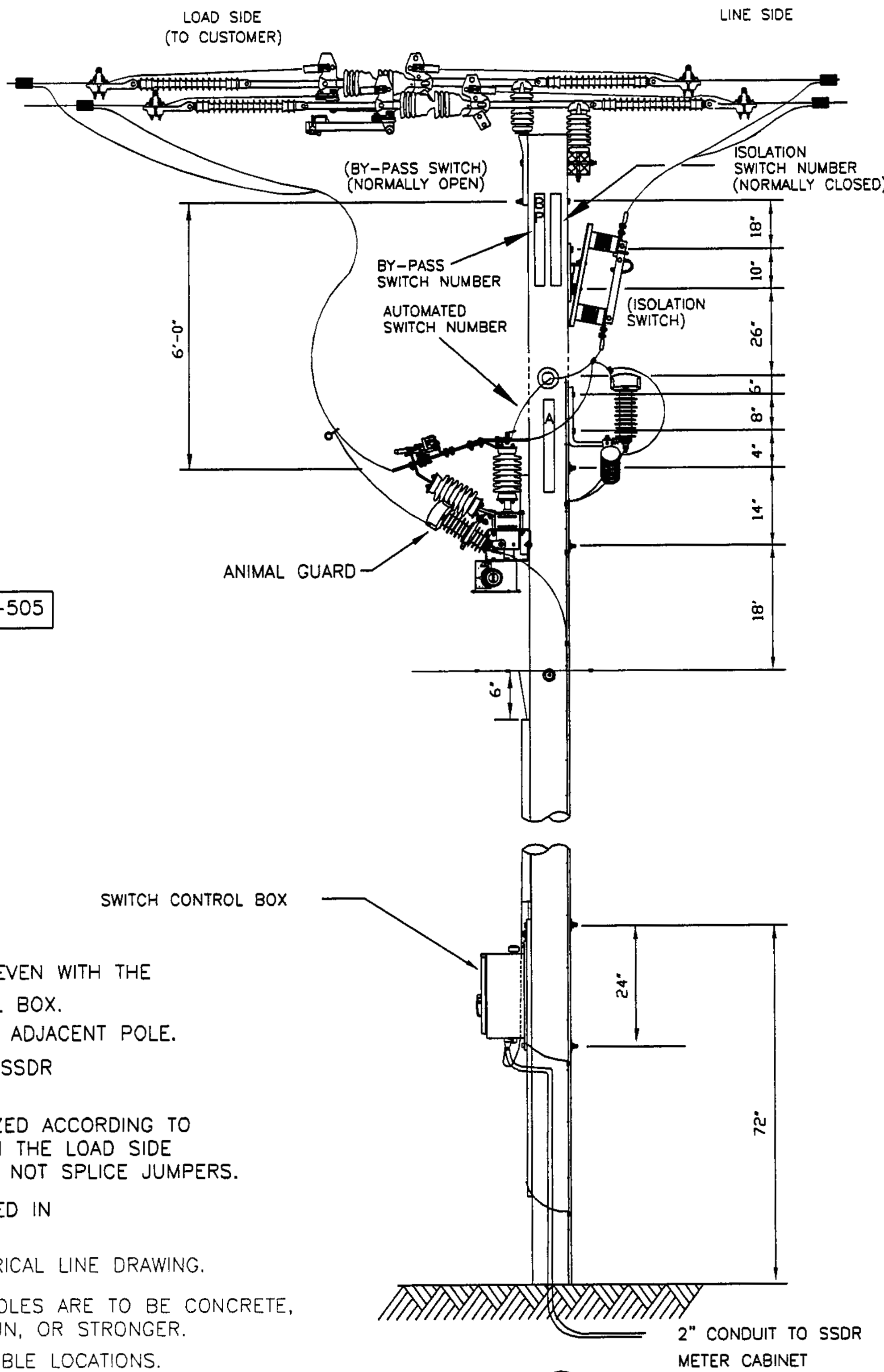
APPROVED: R.K. CIELO
DIRECTOR, DISTRIBUTION ENGINEERING AND SERVICE PLANNING

NO SCALE

COMMERCIAL/INDUSTRIAL LOAD CONTROL (CILC) DISCONNECTING SWITCHES (BRIDGES HORIZONTAL AUTO-VECTOR SWITCHES)

C-9.1.0

C



M&S # 270-274-505

NOTES:

1. BRING RISER SHIELD TO EVEN WITH THE BOTTOM OF THE CONTROL BOX.
2. SSDR METER CABINET ON ADJACENT POLE.
3. BRING 120V SERVICE TO SSDR METER CABINET
4. JUMPERS SHOULD BE SIZED ACCORDING TO CONDUCTOR AMPACITY ON THE LOAD SIDE (TO THE CUSTOMER). DO NOT SPLICE JUMPERS.
5. CONTROL BOX IS INCLUDED IN SWITCH M&S NUMBER.
6. SEE C-9.1.1 FOR ELECTRICAL LINE DRAWING.
7. NEW OR REPLACEMENT POLES ARE TO BE CONCRETE, CLASS III-H, 4.7 KIP SPUN, OR STRONGER.
8. INSTALL ONLY IN ACCESSIBLE LOCATIONS.

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
5	11/15/06	ADDED INFROMATION ON POLES	CEA	ELS	JJM
4	10/6/05	UPDATE DRAWING	JFD	ELS	JJM
3	9/28/05	UPDATE DRAWING	CEA	ELS	JJM
2	10/07/04	ADD ANIMAL GUARD	LFV	ELS	JJM
1	6/17/03	ADD NOTE 5 AND M&S NUMBER	CEA	ELS	JJM

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: CA

DRAWN BY: J. SHOUP

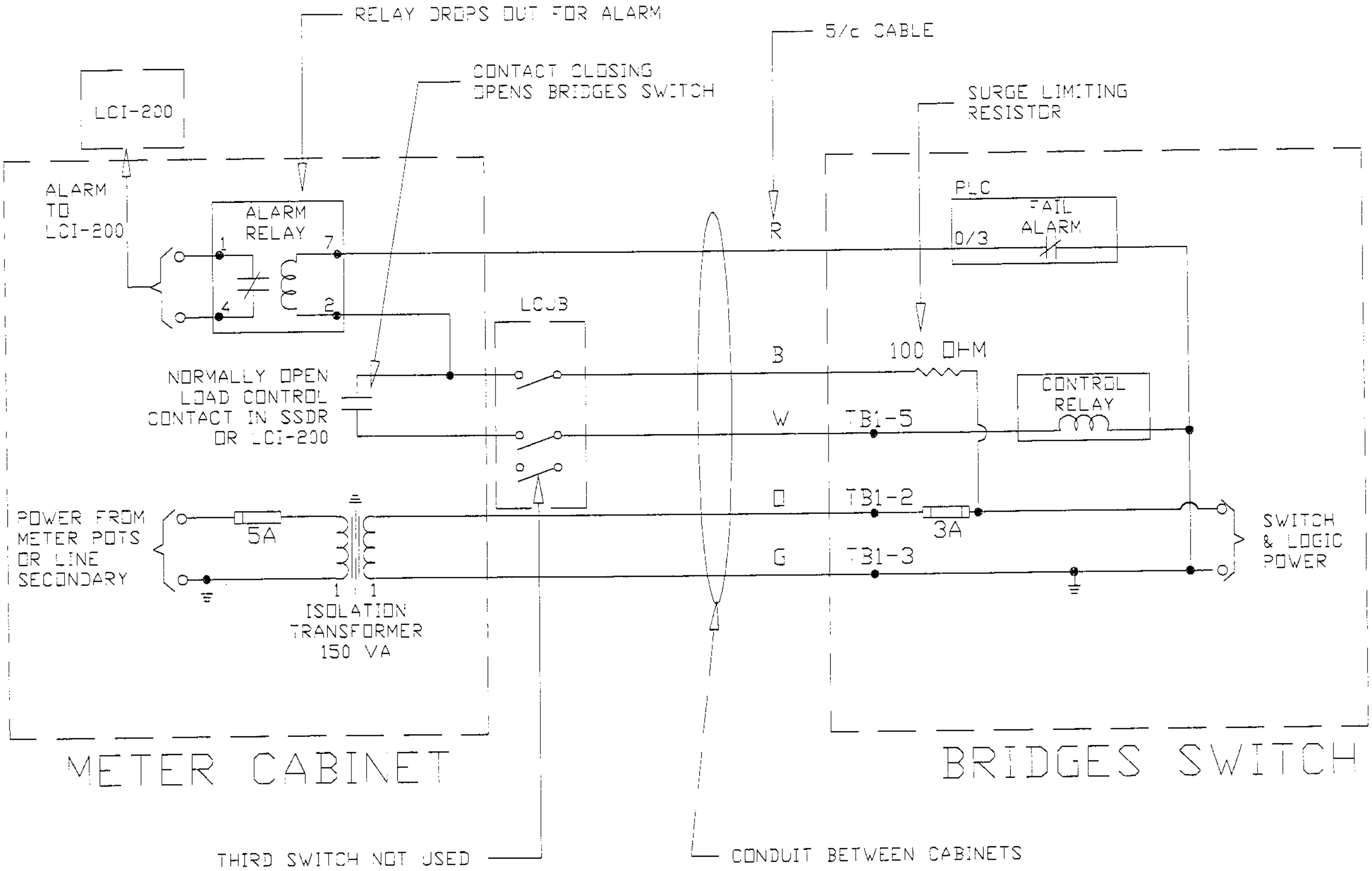
DATE: 9/16/99

APPROVED: J. McEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

C

WIRING DIAGRAM FOR CILC SWITCH AND SSDR CABINET



NOTES:

1. THE ADDED ISOLATION TRANSFORMER AND RELAY IS TO MITIGATE SURGES THAT HAVE BLOWN FUSES IN THE PAST.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: CEA

DRAWN BY: E. SCHILLING

DATE: 11/15/06 APPROVED: J. McEVOY, SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

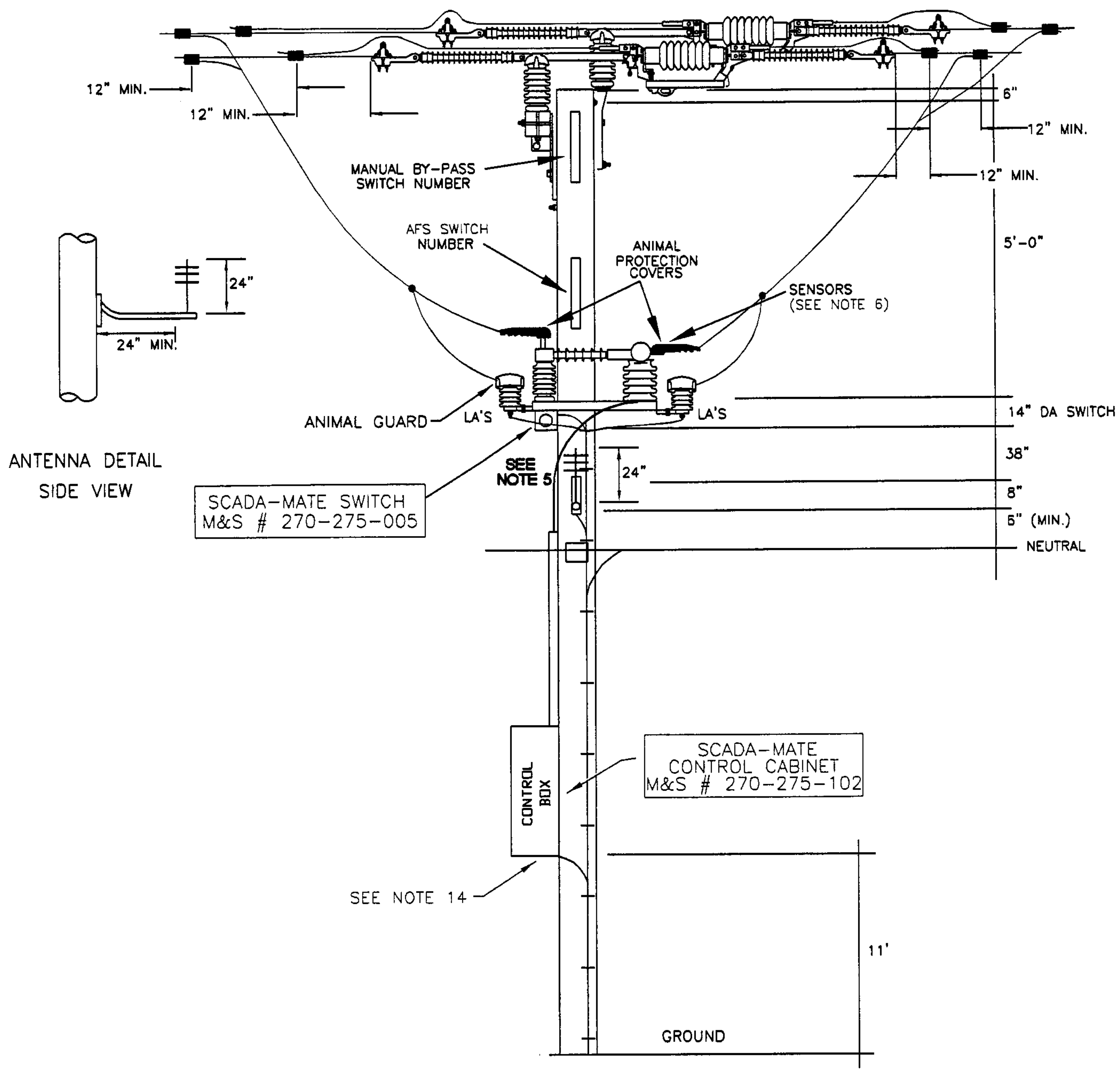
NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	11/15/06	ORIGINAL DRAWING	CEA	ELS	JJM

C-9.2.0

SCADA-MATE SWITCH

C-9.2.0

C



NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
8	11/16/06	MOVED NOTES TO NEXT PAGE	CEA	ELS	JJM
7	9/28/05	UPDATE DRAWING	CEA	ELS	JJM
6	8/16/05	POLE, CROSSARM & ANIMAL GUARD INFORMATION	CEA	ELS	JJM
5	10/7/04	ADD ANIMAL GUARD	LFV	ELS	JJM
4	3/8/04	REVISE FRAMING AND NOTES	CEA	ELS	JJM
3	10/30/03	UPDATE DRAWING (DIMENSIONS AND NOTES)	CEA	ELS	JJM
2	6/16/03	UPDATE DRAWING (DIMENSIONS AND NOTES)	CEA	ELS	JJM
1	09/19/02	UPDATE DRAWING (DIMENSIONS AND NOTES)	CEA	JES	JJM

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: CEA

DRAWN BY: J. SHOUP

DATE: 06/06/01

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

SCADA-MATE SWITCH

C-9.2.1

NOTES:

1. SCADA-MATE SWITCHES ARE TO BE INSTALLED IN ACCESSIBLE LOCATIONS ONLY.

2. ALL NEW OR REPLACEMENT POLES ARE TO BE CONCRETE, CLASS III-H, 4.7 KIP SPUN CONCRETE, OR STRONGER. POLE CLASSES ARE TO BE INCREASED IF WIND LOADING GUILDLINES DICTATE.

3. USE 8'-6" STEEL CROSSARMS.

4. FRAME IN-LINE BY-PASS SWITCHES ON CROSSARM WITH B PHASE IN POLE TOP POSITION (SIMILAR TO C-4.1.1, EXCEPT NO ARRESTERS ON CROSSARM).

5. BY-PASS SWITCHES MAY BE LOCATED ON EITHER SIDE OF POLE.

6. CONTACT DISTRIBUTION RELIABILITY PLANNING FOR SWITCH AND VOLTAGE SENSOR ORIENTATION.

7. ANIMAL PROTECTION COVERS FOR THE TERMINAL PADS ARE STANDARD FOR NEW AND RETROFIT INSTALLATIONS AND ARE INCLUDED WITH THE SWITCH.

8. INSTALL RISER POLE TYPE ARRESTERS, ONE PER PHASE, ON EACH SIDE OF THE AFS SWITCH BRACKET (TOTAL OF SIX ARRESTERS).
   - 18KV FOR USE IN 23KV AREAS, M&S # 334-228-556

9. JUMPERS TO BE 568T FOR ALUMINUM FEEDERS, AMPACT TO FEEDER.

10. GROUND AFS SWITCH BRACKETS, CONTROL CABINET, AND ASSOCIATED EQUIPMENT (ANTENNA BRACKET, ETC.)

11. MOUNT ANTENNA VERTICALLY ON INVERTED 2'-6" STREET LIGHT BRACKET ON STREET SIDE OF POLE. CLAMP ANTENNA SO FIBERGALASS PORTION IS FULLY ABOVE THE FLAT STEEL MOUNTING PLATE.

12. MAINTAIN AT LEAST 18 INCHES CLEARANCE FROM TOP AND SIDE OF ANTENNA.

13. PUT AFS SWITCH NUMBER ON DOOR OF CONTROL BOX.

14. BOND #6 CU TO POLE BOND, USING CONNECTOR AT BOTTOM OF THE CONTROL BOX.

15. SCADA-MATE VISIBLE AIR-GAP TO REMAIN CLOSED, UNLESS REQUIRED FOR VISIBLE ISOLATION.

16. CONNECT THE BATTERY TO THE CHARGING CIRCUIT INSIDE THE CONTROLLER BY FIRST OPENING THE CONTROL CABINET DOOR, OPENING THE SWING-OUT CONTROL PANEL, THEN CONNECTING THE BATTERY PLUG CONNECTOR TO THE BATTERY.

NEW STANDARD, PREVIOUSLY PART OF C-9.2.0

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	11/16/06	ORIGINAL DRAWING	CEA	ELS	JJM

ORIGINATOR: CEA

DRAWN BY: E.SCHILLING

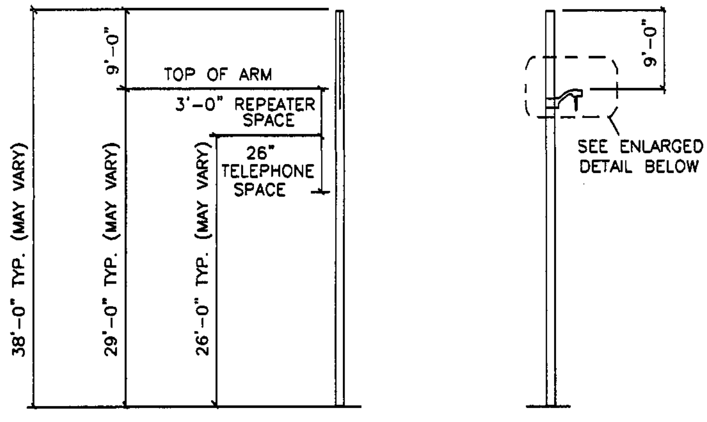
DATE: 11/16/06

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

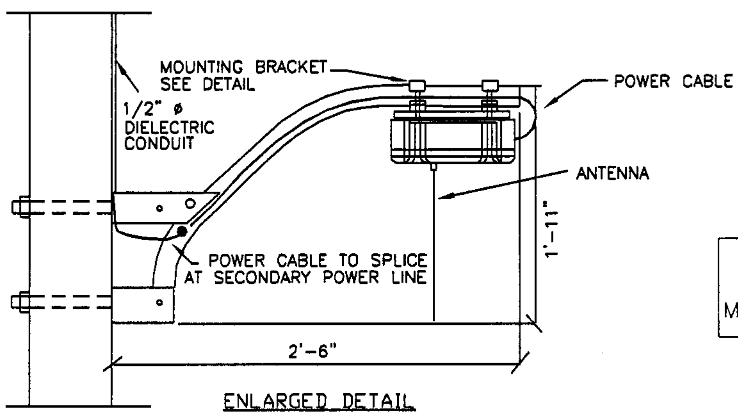
NO SCALE

S & C "SCADA-MATE" RADIO REPEATER

C-9.2.2

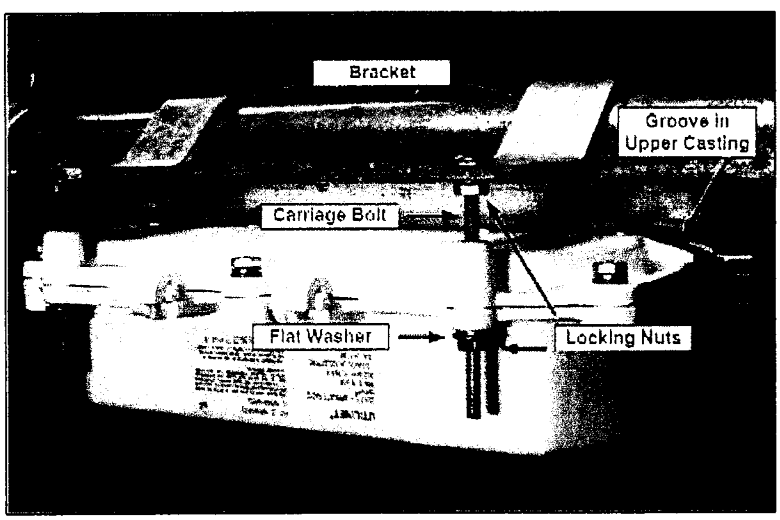


JOINT USE POLE-WITH 2' - 6' STREET LIGHT BRACKET
SCALE: N.T.S.



ENLARGED DETAIL
SCALE: N.T.S.

SCADA-MATE REPEATER RADIO
M&S # 270-275-200



NOTES:

1. THE ILLUSTRATION TO THE LEFT SHOWS THE RADIO AS PROVIDED AND SHOWS THE PROPER MOUNTING TECHNIQUE, WITH THE CARRIAGE BOLTS POINTED DOWN AND A FLAT WASHER BETWEEN THE RADIO CASTING AND THE LOWER LOCKING NUT.
2. THE REPEATER IS TO BE INSTALLED ON A 2'-6" STREET LIGHT BRACKET OR ON AN EXISTING STREET LIGHT BRACKET, AS APPROPRIATE.
3. RADIO REPEATER IS TO BE INSTALLED ON HORIZONTAL PART OF BRACKET.
4. SPLICE POWER CABLE IF NEEDED. POLARITY IS NOT AN ISSUE.
5. USE 120V SOURCE.

STANDARD RENUMBERED, FORMERLY C-9.2.1

F P L
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	11/16/06	UPDATE DRAWING AND ADD NOTES	CEA	ELS	JJM
1	10/30/03	UPDATE DIMENSIONS	CEA	ELS	JJM

ORIGINATOR: CEA
DRAWN BY: J. SHOUP
DATE: 06/06/01
APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES
NO SCALE

POLE SETTING, GUYING AND BRACING

D-2.0.0

THE DRAWINGS CONTAINED IN SECTION D SHOW DATA REFERRING TO THE SETTING, GUYING AND BRACING OF POLES. THE METHODS AND DATA GIVEN SHOULD BE ADHERED TO AS CLOSELY AS FIELD CONDITIONS PEMIT IN THE INTEREST OF UNIFORM CONSTUCTION AND THE DEVELOPMENT OF MAXIMUM STRENGTH OF SUPPORTING STRUCTURES.

POLE SETTING

REFER TO STANDARD D-15 FOR INFORMATION AND DATA ON POLE AND ANCHOR STAKING.

POLES SHALL BE LOCATED IN ALIGNMENT AND SHALL BE SET TO STAND VERTICAL WHEN THE LINE IS COMPLETED. POLES LOCATED AT ANGLES, TERMINALS, CROSSINGS, OR POINTS OF EXCESSIVE STRAIN SHOULD BE CAREFULLY SELECTED FOR MAXIMUM STRENGTH.

WOOD POLES WHICH HAVE DECAYED AT THE GROUND LINE, BEYOND A POINT WHERE THEY MAY NO LONGER BE RELIED UPON AS AN ADEQUATE SUPPORT, MAY BE SPLINTED WHERE PRACTICABLE IF THEIR UPPER PORTION IS IN GOOD CONDITION AND IF SPLINTING IS NOT OBJECTIONABLE FROM THE STANDPPOINT OF APPERANCE OR OTHER REASON. AS AN EMERGENCY MEASURE, A POLE MAY BE STUBBED INSTEAD OF SPLINTED. CONCRETE POLES ARE NEVER SPLINTED EXCEPT IN EMERGENCIES.

GUYING

GUY ANCHORS SHALL, WHERE POSSIBLE, BE SO LOCATED THAT THE HORIZONTAL DISTANCE MEASURED FROM THE POLE AT THE GROUND LINE TO THE GUY ANCHOR WILL BE EQUAL TO THE HEIGHT ABOVE GROUND AT WHICH THE GUY IS ATTACHED TO THE POLE. GUYS SHALL BE ATTACHED TO THE POLES IN SUCH A MANNER AS TO INTERFERE AS LITTLE AS POSSIBLE WITH LINEMEN CLIMBING OR WORKING THEREON. THE GROUND END OF GUYS SHALL HAVE A GUY MARKER (GUY GUARD) INSTALLED AT ALL LOCATIONS.

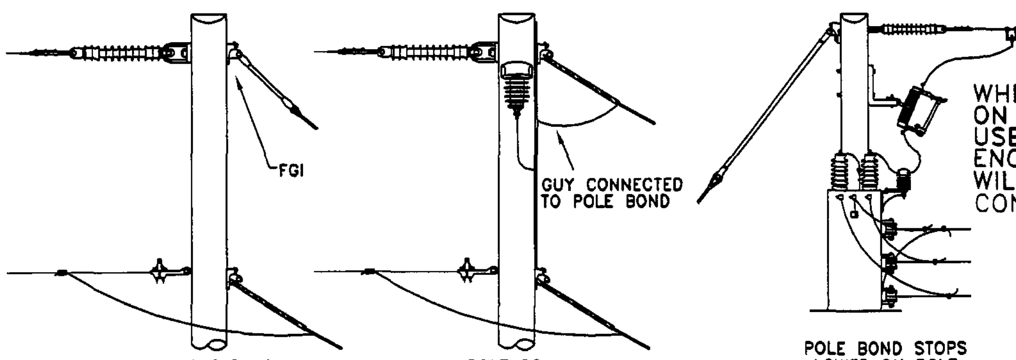
NOTE: SETTING POLES AND ANCHORS IN OR ADJACENT TO WETLANDS AREAS MAY REQUIRE ENVIRONMENTAL CONTROL MEASURES. CONTACT THE ENVIRONMENTAL SPECIALIST FOR SPECIFIC REQUIREMENTS.

GUY STRAIN INSULATORS

NESC REQUIRES THAT ALL GUYS BE EFFECTIVELY GROUNDED. EFFECTIVELY GROUNDED CAN BE ACCOMPLISHED BY CONNECTING THE GUY WIRE TO A POLE BOND WHERE THE BOND IS CONNECTED TO A DRIVEN GROUND OR CONNECTED TO THE SYSTEM NEUTRAL. GROUNDING OF THE GUY IS NOT REQUIRED IF A FIBERGLASS GUY STRAIN INSULATOR (FGI) IS INSTALLED IN A MANNER TO PREVENT ANY CONTACT BETWEEN AN ENERGIZED CONDUCTOR AND THE GUY WIRE.

APPLICATION:

GUY STRAIN INSULATORS ARE USED ON WOOD POLES WHENEVER A GUY IS INSTALLED ABOVE THE NEUTRAL FOR 13KV AND ABOVE IN NON-CONTAMINATED AREAS. UNLESS REQUIRED DUE TO REDUCED CLEARANCES, GUY STRAIN INSULATORS ARE TYPICALLY NOT REQUIRED IN CONTAMINATED AREAS OR ON CONCRETE POLES SINCE ALL THE HARDWARE INCLUDING THE GUY WIRES ARE BONDED TO THE SYSTEM NEUTRAL AND / OR A DRIVEN GROUND.



WHERE POLE BOND STOPS LOWER ON THE POLE, AN FGI SHOULD BE USED. THE FGI MUST BE LONG ENOUGH SO THAT THE METAL END WILL BE BELOW THE LAST ENERGIZED CONDUCTOR.

NO POLE BOND
FIG. 1

POLE BOND
FIG. 2

POLE BOND STOPS LOWER ON POLE
FIG 3

GUY STRAIN INSULATORS CAN BE USED TO OBTAIN A 25% REDUCTION IN THE REQUIRED CLEARANCE BETWEEN THE GUY AND CONDUCTOR(S) WHERE NEEDED (SEE B-6, NOTE 8). ALL SLACK SPAN INSTALLATIONS ARE TO USE A GUY STRAIN INSULATOR WHERE THE SLACK CONDUCTORS ARE ADJACENT TO THE DOWNGUY. INSTALLATIONS WHERE A DOWNGUY GOES BETWEEN CONDUCTORS SHOULD ALSO USE A GUY STRAIN INSULATOR.

BONDED GUYS

WHERE THE GUY IS TO BE BONDED, ATTACH THE BOND WIRE TO THE GUY WIRE USING CONNECTOR M&S #120-44700-9. DO NOT ATTACH BOND WIRE TO PREFORMED GUY GRIP.

SUPERSEDES D-2.0.0 LAST REVISED ON 1-29-92

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	1/23/07	UPDATE NOTES	JNM	ELS	JJM
2	9/22/05	UPDATE DRAWING AND NOTES	JNM	ELS	JJM
1	8/29/03	ADD REF TO WETLANDS	JNM	ELS	JJM
0	9-30-94	REDRAWN ON CAD AND ADDED NESC REQUIREMENT	ARR	EMR	RJS

ORIGINATOR: ARR DRAWN BY: EMR

DATE: 9-30-94 APPROVED: R.J. SALESKY NO SCALE

DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

D

POLE SETTING DEPTHS AND SOIL CONDITIONS

D-3.0.0

D

POLE SETTING DEPTHS

MINIMUM POLE SETTING DEPTHS IN EARTH / GOOD SOIL (FT)

	CONCRETE POLES							WOOD POLES
POLE LENGTH	TYPE "O"	SU	IIIG	IIIA	IIIH	12 KIP	SPUN	WOOD
20								4.5
25								5
30								5.5
35	7	7.5	9					6
40			9	10	11.5	13		6.5
45			9	10	11.5	13.5		7
50			9.5	10	11.5	13.5	11	7
55			9.5		12	14	12	7.5
60					12	14	12.5	8
65					12		13	8.5
70							13.5	9
75								9.5
80								10

MINIMUM POLE SETTING DEPTHS IN ROCK* (FT)

	CONCRETE POLES							WOOD POLES
POLE LENGTH	TYPE "O"	SU	IIIG	IIIA	IIIH	12 KIP	SPUN	WOOD
20								4
25								4.5
30								5
35	6	6	7.5					5.5
40			7.5	8	9.5	11		5.5
45			7.5	8.5	9.5	11		6
50			7.5	8.5	9.5	11	11	6
55			8		9.5	11.5	12	6
60					10	11.5	12.5	6.5
65					10		13	6.5
70							13.5	7
75								7.5
80								8

* FOR SOILS THAT ARE 90% ROCK OR HARD CLAY.

POLE SETTING DETAILS AND SOIL CONDITIONS:

UNDER NORMAL CONDITIONS, A CONCRETE POLE CAN BE SET DIRECTLY INTO AN AUGURED HOLE, BACKFILLING WITH THE SOIL AUGURED FROM THE HOLE, TAMPING THE SOIL IN LAYERS FOR A GOOD TIGHT FIT.

IN SITUATIONS WHERE POLES HAVE A LARGE LOAD, IMBALANCE LOAD OR WHERE SOIL CONDITIONS ARE QUESTIONABLE, IT MAY REQUIRE ADDITIONAL CONSIDERATIONS, IN MOST CASES, ALL THAT MAY BE REQUIRED IS TO INCREASE THE BEARING SURFACE BELOW GRADE. THIS CAN BE ACHIVED IN A NUMBER OF WAYS. THE EASIEST IS SETTING THE POLE DEEPER. ANOTHER METHOD IS TO AUGER THE SETTING HOLE, 8" TO 10" GREATER IN DIAMETER THAN THE POLE BUTT. BACKFILL WITH CONCRETE OR A FLOWABLE FILL, THIS WILL HELP MEET THE STRENGTH REQUIREMENTS AND ALLOW FOR EASY REMOVAL IF DAMAGE OCCURS TO THE POLE. FLOWABLE FILL IS A LOW STRENGTH, SLURRY-LIKE MATERIAL WITH THE CONSISTENCY OF PANCAKE BATTER, WHICH ARRIVES ON THE JOB SITE IN A READY MIX TRUCK. THE MATERIAL IS SELF-LEVELING AND REACHES 95 PERCENT OR MORE COMPACTION WITHIN A FEW HOURS OF PLACEMENT. IT GENERALLY IS MADE FROM A BLEND OF CEMENT, FLY ASH, SAND AND WATER.

IF FIELD CONDITIONS DICTATE THE NEED TO MAINTAIN THE WALLS OF AN AUGURED HOLE, USE A SOIL STABILIZER, M&S #522-125-575. A SODA ASH COMPOUND M&S #522-126-571 MAY BE NEEDED IN CONJUCTION WITH THIS SOIL STABILIZER.

FOR LEANING POLES IN AREAS WITH NO STANDING WATER, A POLE SETTING FOAM IS AVAILABLE, M&S #522-100-000. IT EXPANDS TO FILL THE PERIPHERAL VOID BETWEEN THE POLE AND THE HOLE.

GENERAL GUILDLINES FOR TYPICAL SOILS:

GOOD SOIL
COMPACT WELL GRADED SAND AND GRAVEL, HARD CLAY OR WELL GRADED FINE AND COARSE SAND AND NO STANDING WATER. USE AS IS FOR BACKFILL.

MEDIUM SOIL
COMPACT FINE SAND AND CLAY, COMPACT SANDY LOAM, LOOSE COARSE SAND AND GRAVEL AND NO STANDING WATER. BACKFILL WITH ROCK, A 57 STONE OR SMALLER AND TAMPING EACH LAYER VERY WELL.

POOR SOIL
SOFT CLAY, CLAY LOAM, POORLY COMPACTED SAND OR CLAYS CONTAINING LARGE AMOUNTS OF SILTS, STANDING WATER DURING WET SEASON. MAY REQUIRE BACKFILLING THE HOLE WITH CONCRETE OR A FLOWABLE FILL.

F P L
OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: A.A. DRAWN BY: J.H.

DATE: 7-1-87 APPROVED: R. K. CIELO
DIRECTOR, DISTRIBUTION ENGINEERING AND SERVICE PLANNING
NO SCALE

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	6/6/06	NEW DRAWING	RJO	ELS	JJM.

D-7.0.0	METHODS OF ATTACHING GUYS FOR WOOD AND CONCRETE POLES	D-7.0.0

D

HEAVY DUTY ATTACHMENT

FOR GUYS TO 9/16" GALV. USE 3/4" BOLTS AND 4" SQUARE WASHERS. (CURVED WASHER ON WOOD POLES) (FLAT WASHER ON CONCRETE POLES)

USE THE HEAVY DUTY ATTACHMENT WITH 6" MOUNTING HOLES ON ALL SPUN CONCRETE POLES

MEDIUM DUTY ATTACHMENT

FOR GUYS TO 7/16" GALV. USE 5/8" BOLTS AND 4" SQUARE WASHERS. (CURVED WASHER ON WOOD POLES) (FLAT WASHER ON CONCRETE POLES)

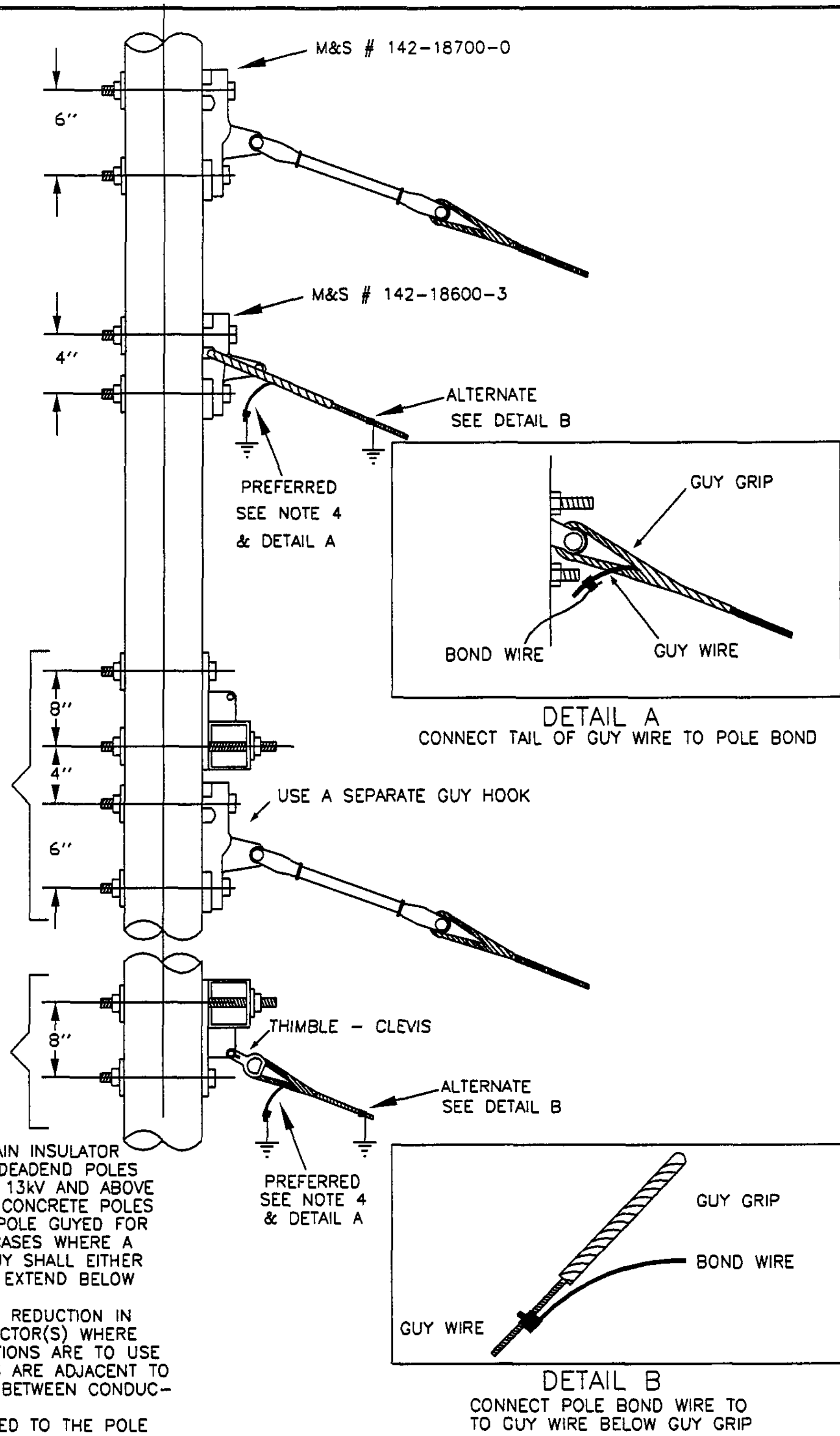
SYMBOL ⏚ MEANS TO POLE BOND

STEEL CROSSARM ATTACHMENT

(SEE NOTE 1)

WOOD POLE ARRANGEMENT

CONCRETE POLE ARRANGEMENT



NOTES:

1. ALL GUYS SHALL BE BONDED EXCEPT WHERE A GUY STRAIN INSULATOR IS USED. GUY STRAIN INSULATORS ARE USED ON WOOD DEADEND POLES WHENEVER A GUY IS INSTALLED ABOVE THE NEUTRAL FOR 13kV AND ABOVE IN NON-CONTAMINATED AREAS. THEY ARE NOT USED ON CONCRETE POLES AND ARE NOT REQUIRED ON WOOD DEADEND POLES (OR POLE GUYED FOR ANY REASON) IF PROTECTED BY SURGE ARRESTERS. IN CASES WHERE A DOWNGUY IS LOCATED ADJACENT TO CONDUCTORS, THE GUY SHALL EITHER USE A GUY STRAIN INSULATOR THAT IS LONG ENOUGH TO EXTEND BELOW THE LOWEST CONDUCTOR OR BE BONDED.
2. GUY STRAIN INSULATORS CAN BE USED TO OBTAIN A 25% REDUCTION IN THE REQUIRED CLEARANCE BETWEEN THE GUY AND CONDUCTOR(S) WHERE NEEDED (SEE B-6, NOTE 8). ALL SLACK SPAN INSTALLATIONS ARE TO USE A GUY STRAIN INSULATOR WHERE THE SLACK CONDUCTORS ARE ADJACENT TO THE DOWNGUY. INSTALLATIONS WHERE A DOWNGUY GOES BETWEEN CONDUCTORS SHOULD ALSO USE A GUY STRAIN INSULATOR.
3. GUYS WITHOUT FIBERGLASS INSULATORS ARE TO BE BONDED TO THE POLE GROUND. GUYS WITH FIBERGLASS INSULATORS WILL NOT BE BONDED. SEE SECTION "G" FOR METHODS OF BONDING.
4. WHERE THE GUY IS TO BE BONDED, ATTACH THE BOND WIRE TO THE GUY WIRE USING CONNECTOR M&S #120-44700-9. DO NOTE ATTACH BOND WIRE TO PREFORMED GUY GRIP (OR ANY OTHER PART OF THE GUYING INSTALLATION).

SUPERSEDES D-7 LAST REVISED 1-4-88
(REMOVED LIGHT DUTY ATTACHMENT)

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
5	1/23/07	ADD NOTE	JNM	ELS	JJM
4	6/30/03	ADD M&S #'S FOR GUY HOOKS	JNM	ELS	JJM
3	8/20/02	ADDED DETAILS A & B	JNM	JES	JJM
2	7/30/01	ADDED REFERENCE TO NOTE 4	JNM	JES	JJM
1	3/15/91	REVISED GUY GROUNDING	A.S	H.O.	G.W.H

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: AS DRAWN BY: JRF

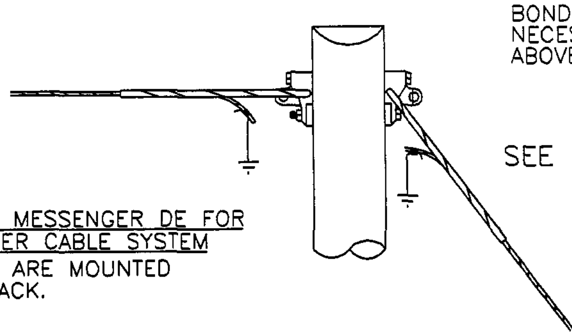
DATE: 3/01/89 APPROVED: G. W. HAMMOND III NO SCALE

DIRECTOR, DISTRIBUTION ENGINEERING AND SERVICE PLANNING

METHOD OF ATTACHING GUYS FOR WOOD OR CONCRETE POLES

D-7.0.1

BONDING OF GUYS AT STUB POLES IS NECESSARY ONLY IF THERE ARE CIRCUITS ABOVE THE GUYS ON THE STUB POLE.



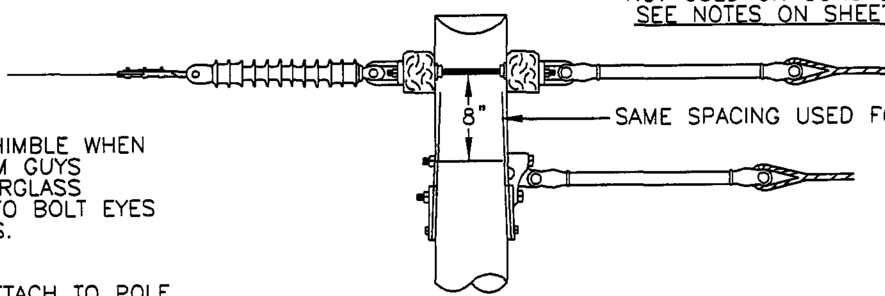
SEE NOTE 1

GUY STUB POLE OR MESSENGER DE FOR HENDRIX AERIAL SPACER CABLE SYSTEM

GUY ATTACHMENTS ARE MOUNTED BACK TO BACK.

FIBERGLASS STRAIN INSULATORS ARE NOT USED ON CONCRETE POLES

SEE NOTES ON SHEET D-7.0.0



SAME SPACING USED FOR DOWN GUYS

ARM GUYS

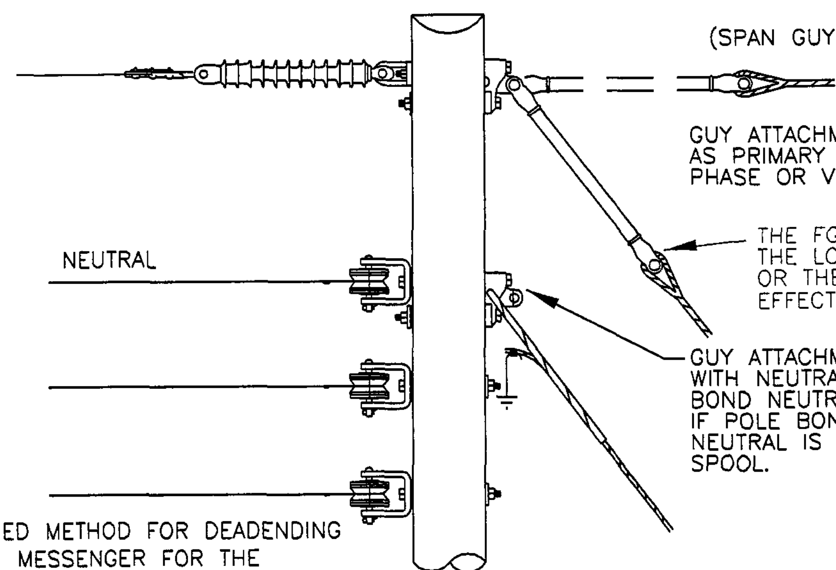
USE A GUY THIMBLE WHEN ATTACHING ARM GUYS (WITHOUT FIBERGLASS INSULATORS) TO BOLT EYES ON D.A. BOLTS.

SPAN GUYS

SPAN GUYS ATTACH TO POLE BY SAME METHODS AS SHOWN FOR DOWN GUYS.

FIBERGLASS GUY STRAIN INSULATORS				
	18"	78"	90"	120"
5/16"	131-040-002 *	131-0520-001 *	N/A	N/A
7/16" & 9/16"	131-044-008	N/A	131-060-003	131-070-009

* FOR USE WITH MEDIUM DUTY GUY ATTACHMENT ONLY (M&S 142-186-003)



GUY ATTACHMENT USES SAME BOLT AS PRIMARY DEADEND FOR SINGLE PHASE OR VERTICAL PRIMARY.

THE FGI MUST EXTEND DOWN BELOW THE LOWEST ENERGIZED CONDUCTOR OR THE GUY WIRE MUST BE EFFECTIVELY GROUNDED.

GUY ATTACHMENT MOUNTED BACK TO BACK WITH NEUTRAL FORK. BOND NEUTRAL GUY TO SYSTEM NEUTRAL IF POLE BOND IS NOT AVAILABLE AND NEUTRAL IS MOUNTED ON SECONDARY SPOOL.

NOTE:

1. SHOWN IS PREFERED METHOD FOR DEADENDING THE 1/2" (7#6 AWA) MESSENGER FOR THE HENDRIX AERIAL SPACER CABLE SYSTEM. USE HEAVY DUTY GUY HOOK (M&S 142-187-000) WITH 3/4" BOLTS.

SUPERSEDES D-7A LAST REVISED ON 7-1-88

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	1/23/07	ADD NOTE	JNM	ELS	JJM
3	9/21/05	ADD NOTE TO TABLE	JNM	ELS	JJM
2	6/30/03	ADD M&S #'S FOR GUY STRAIN INS.	JNM	ELS	JJM
1	7/28/99	ADD NOTE & CHANGE TEXT	JNM	PRH	JJM
0	8/9/96	CHANGED PORCELAIN SUSPENSION INSULATORS TO POLYMER	PMG	RAS	JJM

ORIGINATOR: PMG

DRAWN BY: RAS

DATE: 8/9/96

APPROVED: J.J. MCEVOY

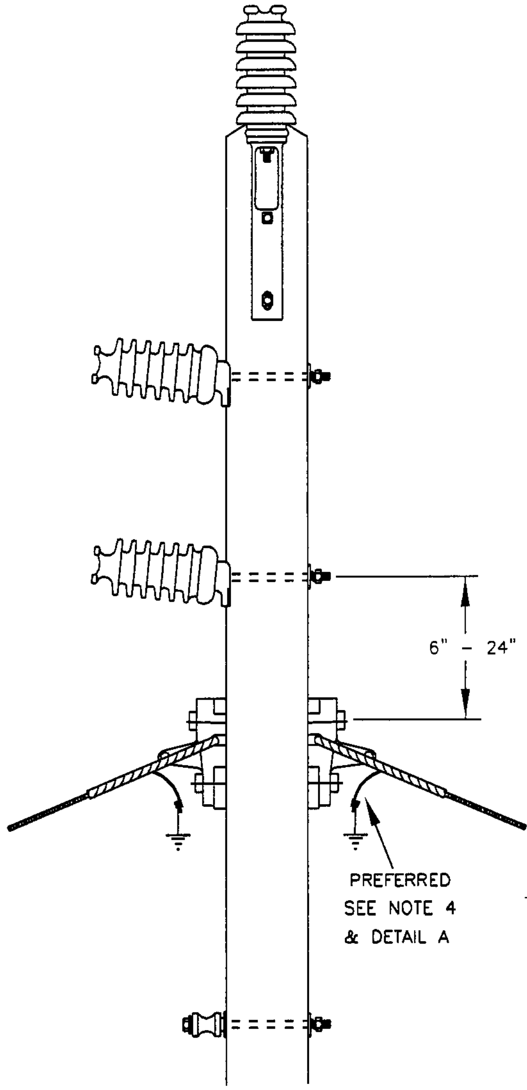
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

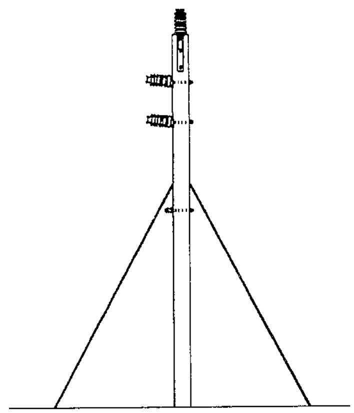
NO SCALE

D

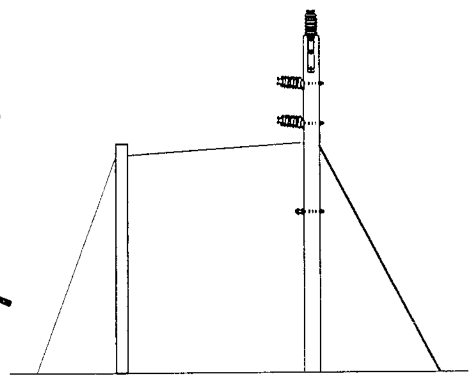
STORM GUYING

D-13.0.0





STORM GUYS USING DOWN GUYS



STORM GUY COMBINATION DOWN GUY AND SPAN GUY

STORM GUYS	
GUY SIZE	ALLOWABLE GUY TENSION
5/16	10080
7/16	18720
9/16	30330

NOTES:

1. STORM GUYS ARE INSTALLED BACK TO BACK PERPENDICULAR TO THE POLE LINE.

2. EITHER ONE OR BOTH OF THE STORM GUYS MAY BE INSTALLED AS SPAN GUYS TO A GUY STUB POLE.

3. ALL GUYS ARE TO BE EFFECTIVELY GROUNDED UNLESS FIBERGLASS GUY STRAIN INSULATORS ARE USED. (REFER TO D-2.0.0)

4. STORM GUYS ALSO MAY BE INSTALLED ON CROSSARM POLES.

5. SEE DERM ADDENDUM 4.2.2.C FOR GUY SIZE CALCULATIONS.

MINIMUM STORM GUY SIZE MODIFIED VERTICAL FRAMING WITH JOINT USE			
RATIO OF LEAD LENGTH/ATTACHMENT HEIGHT	80%	90%	100%
1 & 2 PHASE LINES	5/16	5/16	5/16
3 PHASE LINES	7/16	7/16	7/16

OPTIMUM GUY IS WHERE LEAD LENGTH = ATTACHMENT HEIGHT (RATIO=100%)
IF DOWN GUYS CANNOT BE INSTALLED, SPAN GUYS TO GUY STUB POLES CAN BE USED

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	2/27/07	UPDATE DWG AND NOTES	JNM	ELS	JJM
0	1/23/07	ORIGINAL DRAWING	JNM	ELS	JJM

ORIGINATOR: JNM

DRAWN BY: E.SCHILLING

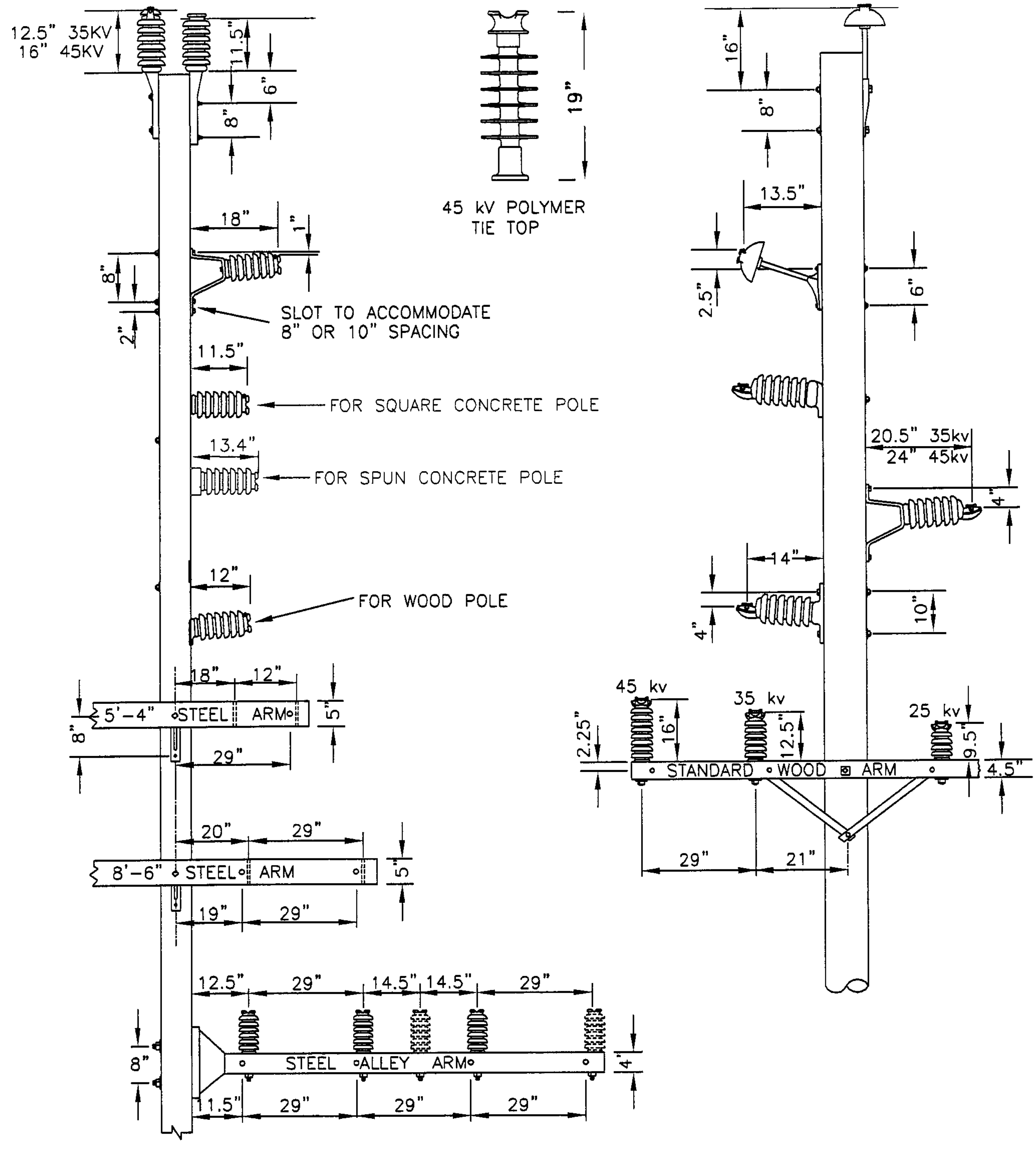
DATE: 1/23/07

APPROVED: J.J. McEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

OVERHEAD EQUIPMENT DIMENSIONS

E-3.0.0



SUPERSEDES E-3 LAST REVISED ON 3-1-89

NOTE:

SOME DIMENSIONS WILL VARY SLIGHTLY WITH MANUFACTURER, TOLERANCES, ETC., BUT

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	12/5/06	UPDATE DRAWING	LFV	ELS	JJM
1	9-7-99	ADDED DETAIL OF 45kV POLYMER TIE TOP	JNM	PRH	JJM
0	6-30-93	CONVERTED TO CAD DRAWING	ARR	EMH	RJS

ORIGINATOR: ARR

DRAWN BY: EMH

DATE: 6-30-93

APPROVED: R. J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

POST INSULATOR CONSTRUCTION EQUIPMENT & DIMENSIONS

E-5.0.0

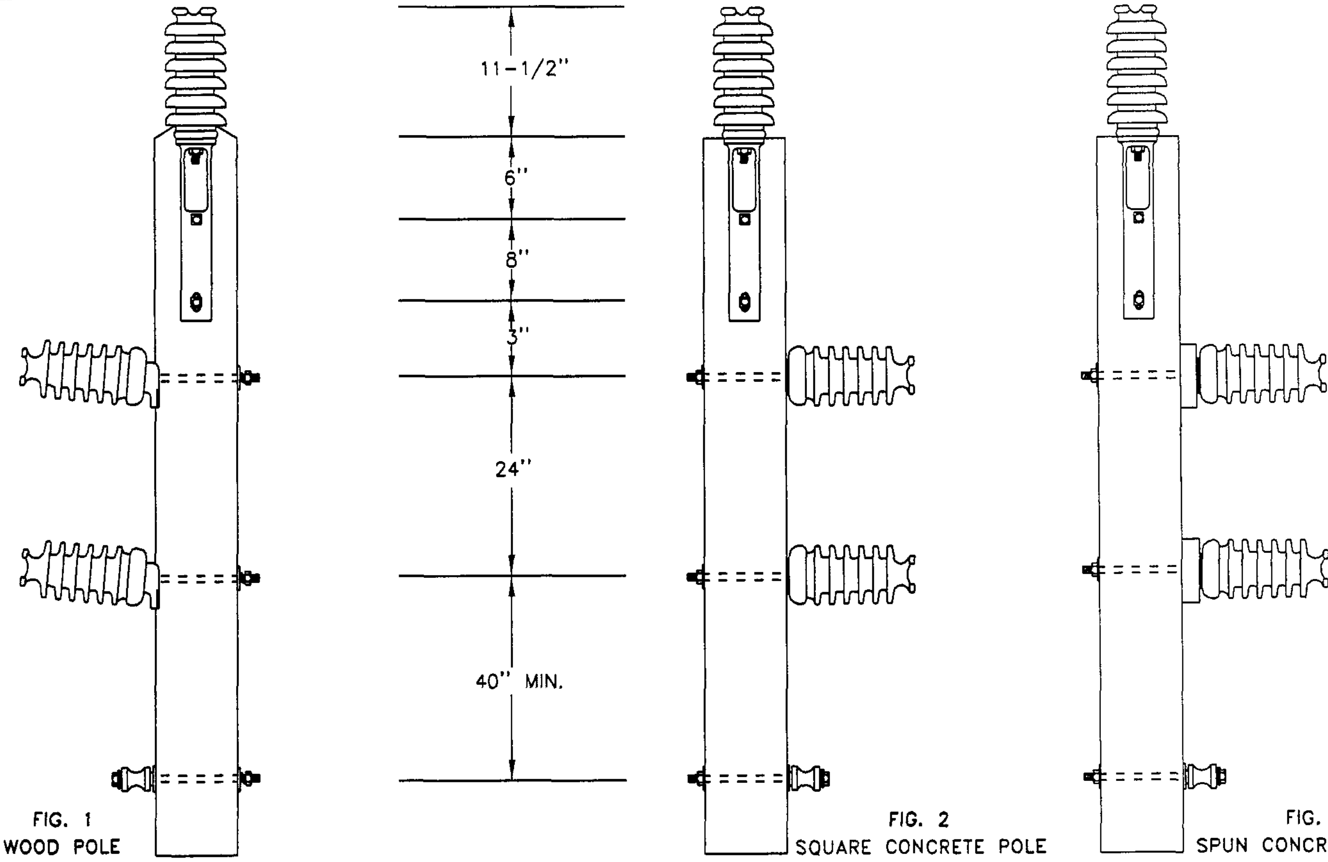
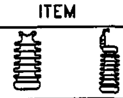
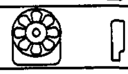
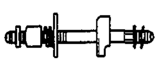
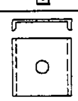


FIG. 1
WOOD POLE

FIG. 2
SQUARE CONCRETE POLE

FIG. 3
SPUN CONCRETE POLE

ITEM	MATERIAL DESCRIPTION	M&S #
	TIE TOP OR SIDE CLAMP TYPE (AS REQUIRED)	131-11600-9 (13 KV AND 23 KV AREAS) 131-11650-5 (13 KV AND 23 KV AREAS) 131-11750-1 (23 KV SALT SPRAY)
	ADAPTER TO MOUNT INSULATORS TO WOOD POLES	140-040-010
	STUD BOLTS FOR MOUNTING INSULATORS (AS REQUIRED)	3/4" x 1-3/4" 143-09800-1 3/4" x 10" 143-10202-4 3/4" x 12" 143-10200-8 3/4" x 14" 143-10201-6 3/4" x 20" 143-10204-1 3/4" x 24" 143-10203-2 3/4" x 28" 143-10205-9
	SPOOL	144-405-004
	POLE TOP PIN BRACKET	141-248-005
	C-CHANNEL ADAPTER TO MOUNT INSULATOR TO SPUN CONCRETE POLES	140-040-050

NOTES:

1. VERTICAL SEPARATION BETWEEN PRIMARY CONDUCTORS AT POLES IS TO BE 36" MINIMUM IF AN ADJACENT POLE IS FRAMED HORIZONTAL OR TRIANGULAR.
2. PRIMARY TO NEUTRAL SEPARATION AT POLE IS DETERMINED BY MINIMUM MIDSAPAN SEPARATION (DERM 4.4.1) IN NO CASE SHALL SEPARATION AT THE POLE BE LESS THAN 40" FOR WOOD AND CONCRETE POLES. FOR TYPICAL SEPARATIONS FOR VARIOUS SPAN DISTANCES REFER TO DERM 4.4.6
3. SPUN POLE INSULATOR ADAPTER MUST BE MOUNTED SUCH THAT CHANNEL SEATS VERTICALLY AGAINST POLE.

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	8/02/01	UPDATE DRAWING (REVISE NOTE 2)	JNM	JES	JJM
1	6/30/93	REV DWG TO VERTICAL FRAMING STANDARD	ARR	MM	RJS

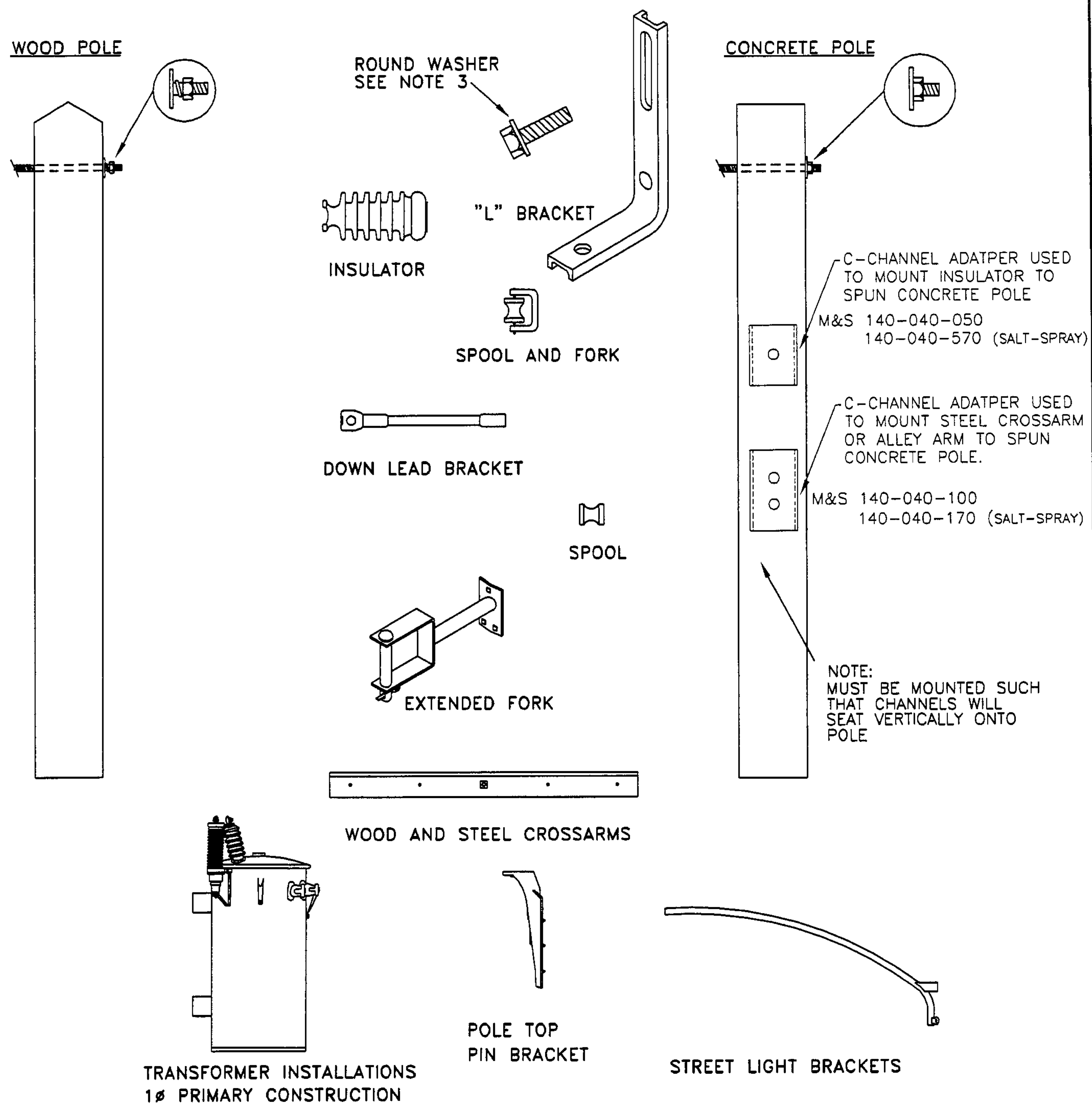
ORIGINATOR: ARR
DRAWN BY: JRF
DATE: 1/1/90
APPROVED: R.K. CIELO
DIRECTOR, DISTRIBUTION ENGINEERING AND SERVICE PLANNING
NO SCALE

E

E-5.0.2

INSTALLATION OF HARDWARE ON WOOD AND CONCRETE POLES

E-5.0.2



NOTES:

1. WHEN INSTALLING HARDWARE ON CONCRETE POLES, SPRING LOCKWASHERS ARE NOT REQUIRED.
2. USE DOUBLE COIL SPRING LOCKWASHER ON BOLTED ATTACHMENTS ON WOOD POLES.
3. USE 1 ROUND WASHER (M&S 145-3600-4) FOR 5/8" BOLT IN SLOT ONLY. WASHER NOT REQUIRED FOR 3/4" BOLT OR 5/8" BOLT IN BOTTOM HOLE.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	1/25/07	UPDATE C-CHANNEL NOTE	GAP	ELS	JJM
2	12/5/06	UPDATE DWG TO ADD SPUN CONCRETE POLE	LFV	ELS	JJM
1	5/23/03	REVISE L BRACKET & ADD 5/8" BOLT	JNM	ELS	JJM

ORIGINATOR: ARR

DRAWN BY: FRAGA

DATE: 6/30/93

APPROVED: R. J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

SLACK SPAN CONSTRUCTION VERTICAL FRAMING

E-5.7.1

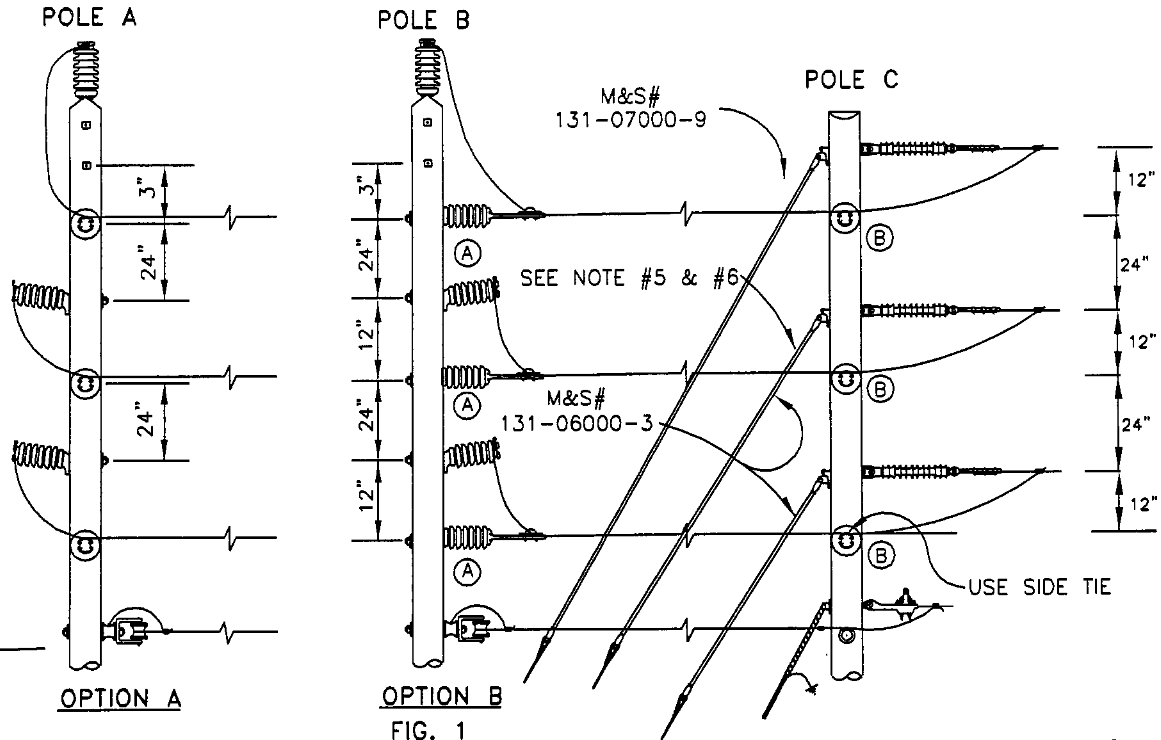
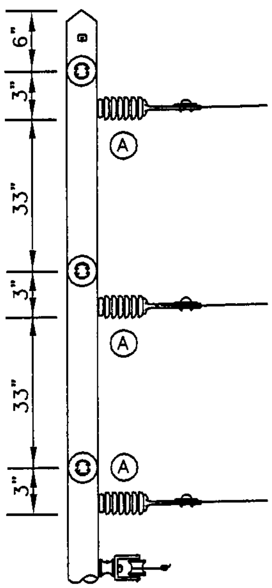


FIG. 1
THREE PHASE SLACK SPAN FROM THREE PHASE LINE, POLE A OR B TO POLE C



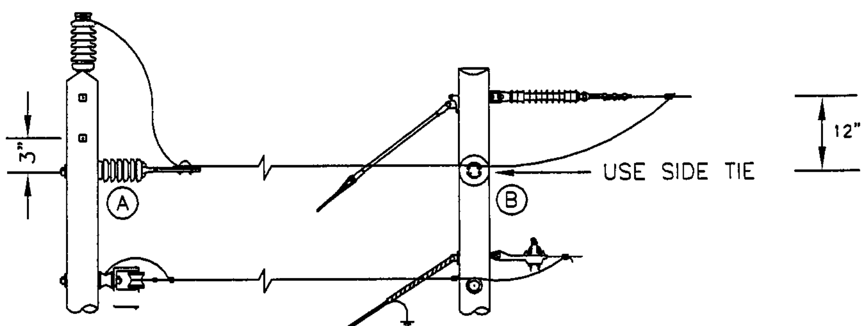


FIG. 2
SINGLE PHASE SLACK SPAN FROM SINGLE PHASE LINE

FIG. 3
THREE PHASE SLACK SPAN FROM 3Ø DEADEND

SLACK SPAN		
CONDUCTOR	MAXIMUM LENGTH	INITIAL SAG
568.3 ACAR	50'	3'-7"
3/0 AAAC	75'	2'-9"
1/0 AAAC	95'	2'-10"

(A) LINE POST, CLAMP TOP INS

(B) LINE POST, VERTICAL TIE TOP, MOUNTED HORIZONTALLY WITH FORMED TIE WIRE.

NOTES:

1. ENGINEER TO SPECIFY SLACK SPAN SAG. (SEE DERM 4.4.5, 4.4.10)
2. INSTALL INSULATOR AND CLAMP AS SHOWN IN DETAIL "A" SUCH THAT WEIGHT ON OUTER END OF CLAMP WOULD TIGHTEN RATHER THAN LOOSEN BOLT.
3. ANY INSULATORS USED AS SLACK SPAN INSULATORS MUST HAVE LONG TRUNNION BOLTS.
4. FOR PULL-OFFS INSTALL FUSE SWITCHES ON NEXT POLE.
5. SEE D-2.0.0 FOR GUYING INSTRUCTIONS AND FOR PROPER ARRESTER STATION SPACING SEE DERM 2.9.1
6. FIBERGLASS GUY INSULATORS (FGI'S) MUST EXTEND BEYOND LOWEST CONDUCTOR. FOR SLACK SPAN, FGI'S ARE REQUIRED ON BOTH WOOD AND CONCRETE POLES.
7. USE CLASS 2 POLE MINIMUM

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
5	1/23/07	ADD TABLE, NOTE 7 & REV NOTE 6	JNM	ELS	JJM
4	7/1/03	EXTEND FGI PAST ENERGIZED CONDUCTOR ADD FIG 3	JNM	ELS	JJM
3	03/22/02	ADD DIMENSIONS FIGURE 1 & 2	JNM	JES	JJM
2	08/03/01	UPDATED DRAWING (ADDED NOTE #6)	JNM	JES	JJM
1	08/09/96	CHANGED PORCELAIN SUSPENSION INSULATORS TO POLYMER AND ADDED DEAD END CLAMP	PMG	RAS	JJM

FPL

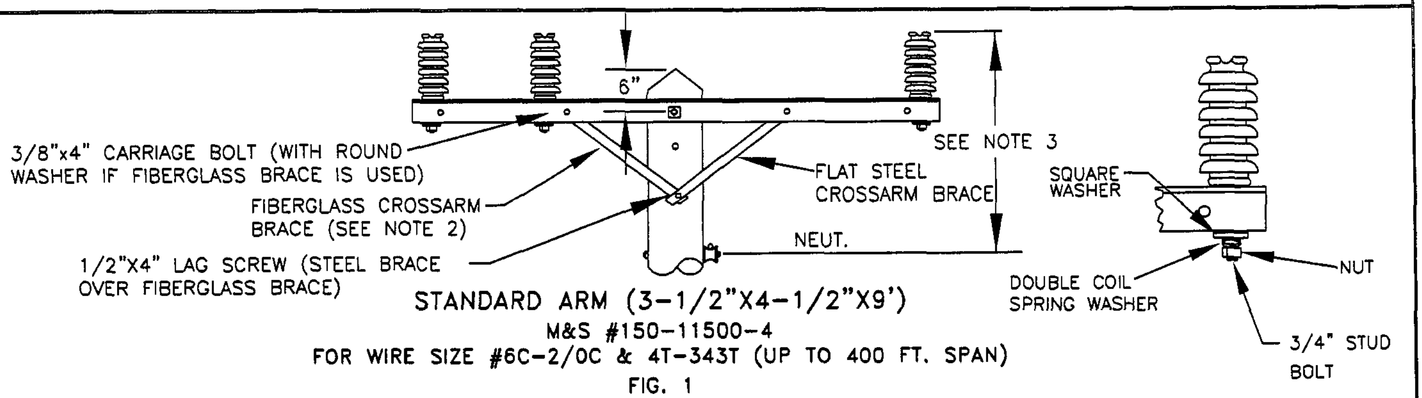
OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: PMG DRAWN BY: RAS

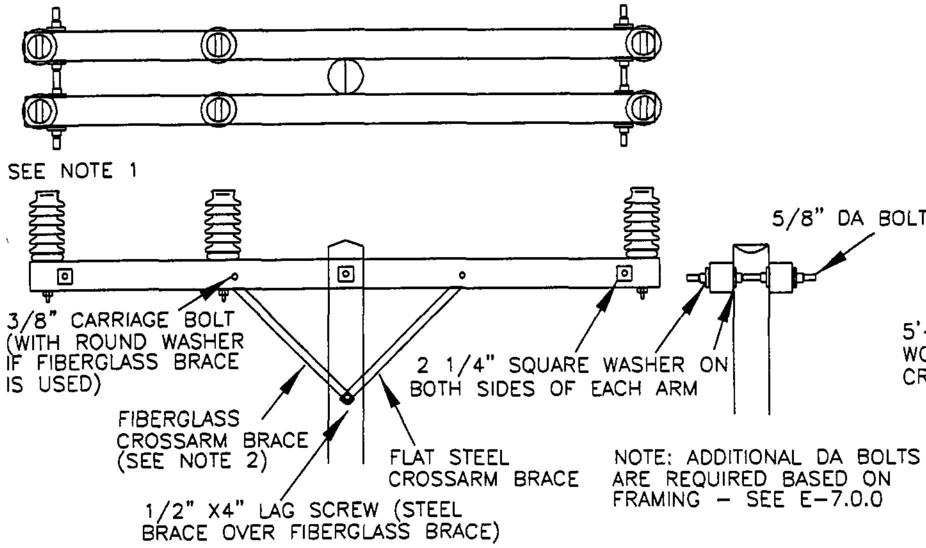
DATE: 9/30/94 APPROVED: J.J. MCEVOY, SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES NO SCALE

TANGENT CONSTRUCTION
WOOD CROSSARM

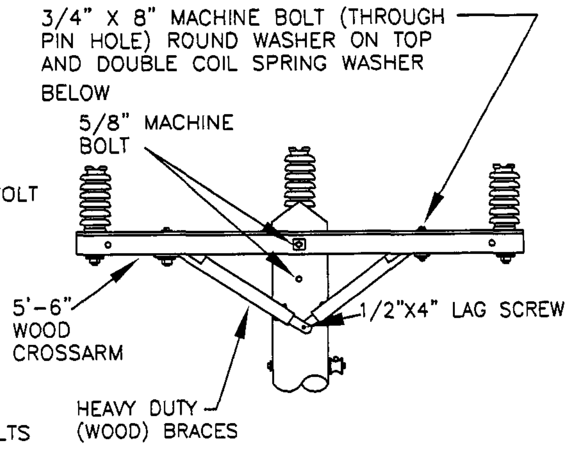
E-6.0.0



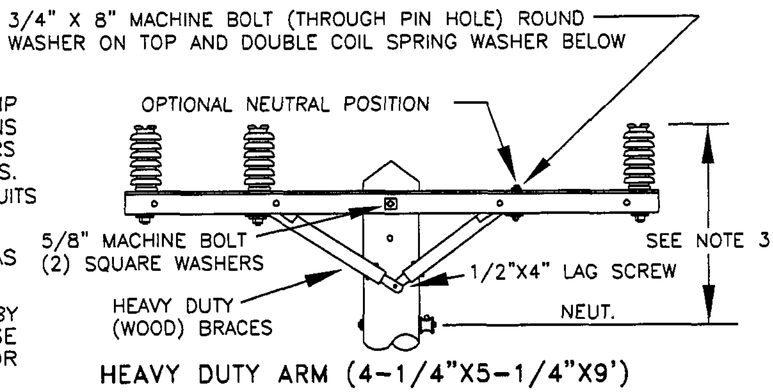
STANDARD ARM (3-1/2"X4-1/2"X9')
M&S #150-11500-4
FOR WIRE SIZE #6C-2/0C & 4T-343T (UP TO 400 FT. SPAN)
FIG. 1



DOUBLE ARM
FIG. 2



SHORT STANDARD ARM
(3-1/2" x 4-1/2" x 5'-6")
M&S #150-11400-8
FIG. 4



HEAVY DUTY ARM (4-1/4"X5-1/4"X9')
M&S #150-11600-1
FOR WIRE SIZE 343T (MORE THAN 400 FT. SPAN)
568T, 4/0C & 350C
FIG. 3

SEE NOTE 4

NOTES:

1. ALL POST INSULATORS SHOWN ARE 35KV TIE TOP. USE CLAMP TOPS WHERE INDICATED BY ANGLE AND SIDE PULL LIMITATIONS SHOWN ON E-4.0.1 THRU E-4.0.3. USE 45KV POST INSULATORS (CLAMP TYPE) ON 23KV CIRCUITS IN SALT CONTAMINATION AREAS. USE 45KV POST TIE TOP POLYMER INSULATORS ON 23KV CIRCUITS IN SEVERE SALT CONTAMINATED AREAS.
2. FIBERGLASS BRACE IS NOT REQUIRED IN SALT SPRAY AREAS WHERE HARDWARE IS BONDED.
3. PRIMARY TO NEUTRAL SEPARATION AT POLE IS DETERMINED BY MINIMUM MIDSPAN SEPARATION (DERM 4.4.1), IN NO CASE SHALL SEPARATION AT THE POLE BE LESS THAN 40" FOR WOOD POLES OR CONCRETE POLES.
4. WHEN INSTALLING AN 8'-6" STEEL CROSSARM (M&S 141-512-004) ON A WOOD POLE, USE HEAVY DUTY WOOD BRACES (M&S 141-084-002).

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

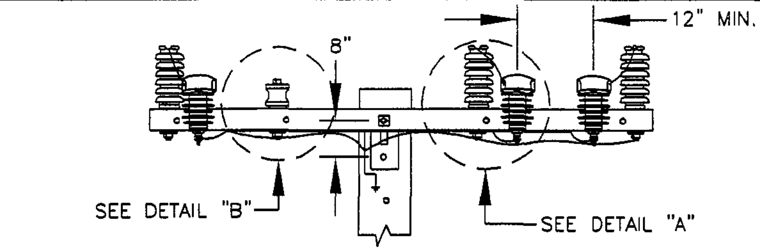
NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
5	12/13/06	ADD NOTE 4	GAP	ELS	JJM
4	4/1/04	REVISE FIG. 2	JNM	ELS	JJM
3	8/29/03	ADD M&S NUMBERS	JNM	ELS	JJM
2	8/04/01	UPDATE DRAWING (GENERAL TEXT REVISION)	JNM	JES	JJM
1	9/7/99	ADD REF TO 45KV POLYMER INSULATORS	JM	DLW	JJM
0	8/9/96	ADDED FIGURE 4	PMG	RAS	JJM

ORIGINATOR: PMG
DRAWN BY: RAS
DATE: 8/9/96
APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES
NO SCALE

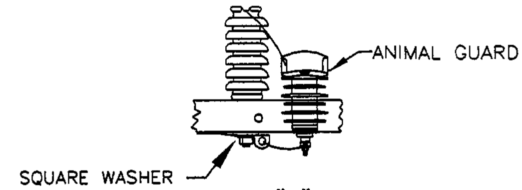
E

TANGENT CONSTRUCTION STEEL CROSSARM

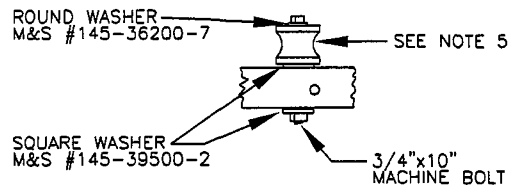
E-6.0.1



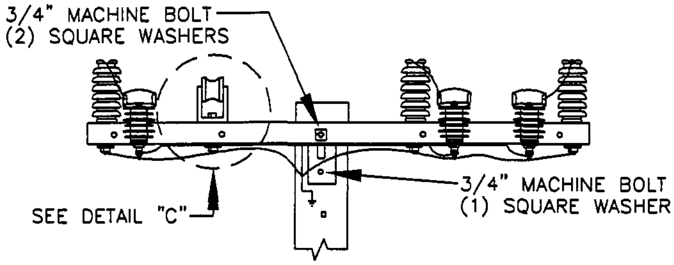
4 CONDUCTOR STEEL ARM (5"x5"x8'6") WITH
ALTERNATE ARRESTER INSTALLATION (SEE NOTE 6)
FIG. 4A



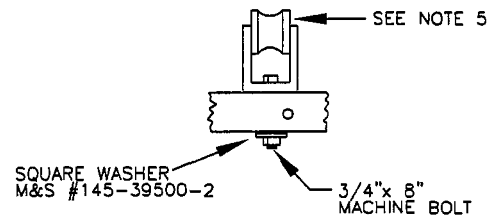
DETAIL "A"



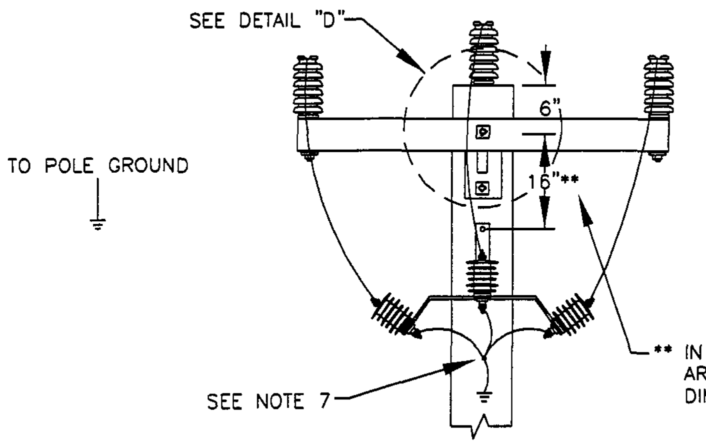
DETAIL "B"



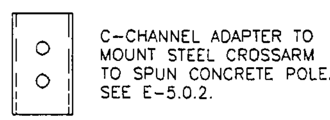
4 CONDUCTOR STEEL ARM (5"x5"x8'6") WITH
ALTERNATE ARRESTER INSTALLATION (SEE NOTE 6)
FIG. 4B

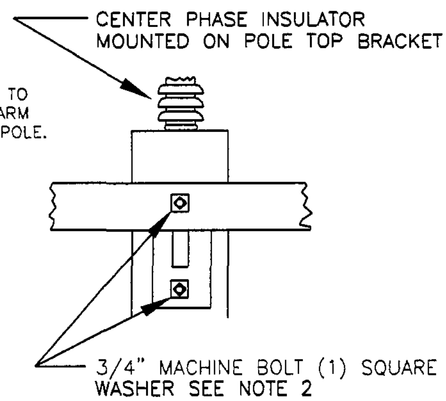


DETAIL "C"



3 CONDUCTOR STEEL ARM (5"x5"x5'4") SHOWN WITH
PREFERRED ARRESTER INSTALLATION
FIG. 5





DETAIL "D"

NOTES:

1. ALL POST INSULATORS SHOWN ARE 35 KV TIE TOP. USE CLAMP TOPS WHERE INDICATED BY ANGLE AND SIDE PULL LIMITATIONS SHOWN ON E-4. USE 45 KV POST INSULATORS (CLAMP TYPE) ON 23 KV CIRCUITS IN SALT CONTAMINATION AREAS. INSULATORS ON 23KV CIRCUITS IN SEVERE SALT CONTAMINATED AREAS.
2. WHEN INSTALLING A STEEL ARM OPPOSITE A POLE TOP BRACKET, A LARGER POLE TOP BRACKET, M&S 141-248-007, SHOULD BE USED THAT ACCEPTS 3/4" BOLTS. THIS WOULD APPLY TO TANGENT, ANGLE, OR DOUBLE DEADEND CONSTRUCTION.
3. PRIMARY TO NEUTRAL SEPARATION AT POLE IS DETERMINED BY MINIMUM MIDSPAN SEPARATION (DERM 4.4.1). IN NO CASE SHALL SEPARATION AT THE POLE BE LESS THAN 40" FOR CONCRETE POLES OR WOOD POLES.
4. STEEL ARMS MUST BE SOLIDLY GROUNDED WHEN INSTALLED ON CONCRETE POLES.
5. *IF THE NEUTRAL IS INSTALLED ON THE CROSSARM AND AN ARRESTER STATION IS REQUIRED ON THE POLE, THE ARRESTERS MUST BE* INSTALLED ON THE ARM. OTHERWISE, ARRESTERS MAY BE INSTALLED AS SHOWN IN FIG. 5. WHEN ARRESTERS ARE INSTALLED ON THE ARM USE LUG CONNECTORS M&S #120-95000-2 OR 120-96000-8 TO SECURE GROUND LEADS.
6. IF NEUTRAL IS INSTALLED ON THE CROSSARM AT AN ANGLE USE FIG. 4A AS A FRAMING STANDARD. USE FIG 4B IF NO ANGLE IS PRESENT.
7. EACH ARRESTER GROUND LEAD SHOULD BE INDIVIDUALLY ATTACHED TO POLE BOND.

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
6	1/25/07	ADD C-CHANNEL DWG & NOTE	GAP	ELS	JJM
5	11/27/06	SHIFT CROSSARM & BRACKET DOWN ON FIG 5 AND DETAIL	GAP	ELS	JJM
4	10/11/04	ADD ANIMAL GUARD	LFV	ELS	JJM
3	6/18/03	UPDATE DRAWING (NOTES)	LFV	ELS	JJM
2	9/7/99	ADD BOND WIRE UNDER CROSSARM	JM	DLW	JJM
1	9/7/99	ADD REF TO 45KV POLYMER INSULATORS	JM	DLW	JJM
0	9/30/94	ORIGINAL DRAWING	ARR	RAS	RJS

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: ARR DRAWN BY: RAS

DATE: 9/30/94 APPROVED: R. J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

E-8.0.0

ANGLE CONSTRUCTION
CONCRETE POLE-STEEL CROSSARM

E-8.0.0

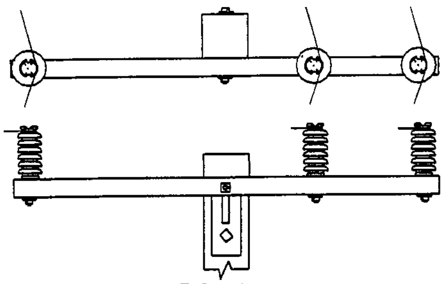


FIG. 1
8'6" STEEL ARM, ANGLE TO 5 DEGREES, SINGLE ARM

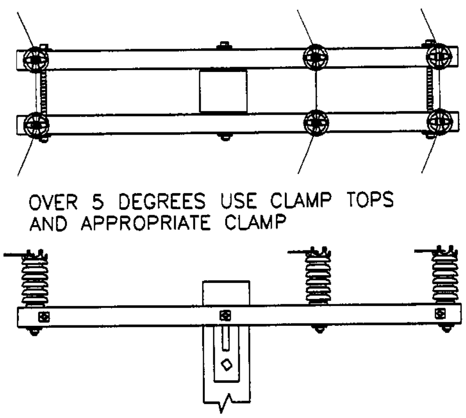


FIG. 2
8'6" STEEL ARM
MEDIUM ANGLES, MAX 45 DEGREES
DOUBLE ARM

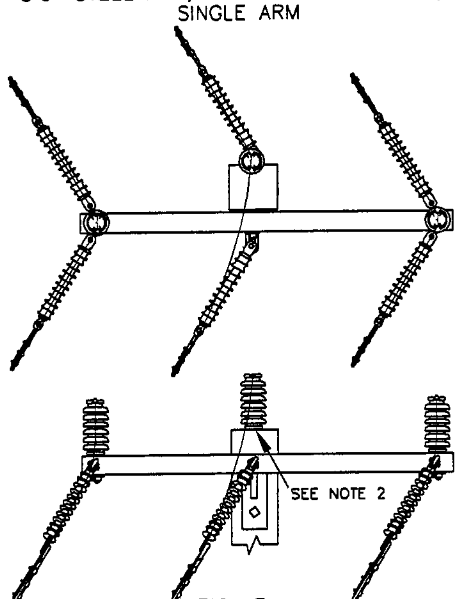


FIG. 3
5'4" STEEL ARM. 2 OR 3 CONDUCTORS, LARGE ANGLES, MAXIMUM 60 DEGREES

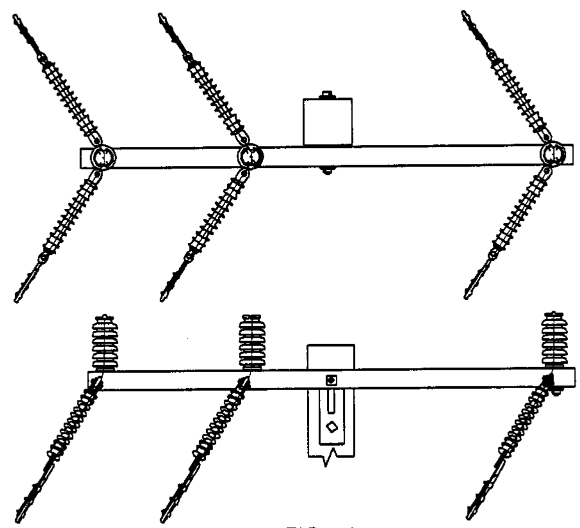


FIG. 4
8'6" STEEL ARM, 2 OR 3 CONDUCTORS, LARGE ANGLES, MAXIMUM 60 DEGREES

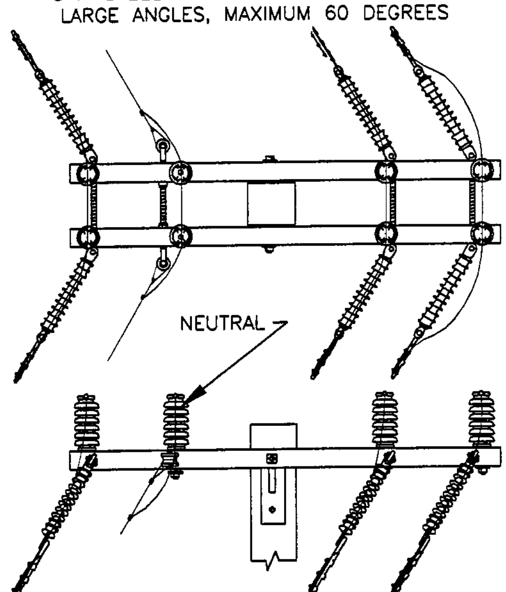


FIG. 5
8'6" STEEL ARM, 4 CONDUCTORS, LARGE ANGLES, MAXIMUM 60 DEGREES

NOTES:

1. ALL POST INSULATORS SHOWN ARE 35 KV. USE 45 KV POST INSULATORS AND 4 JD'S OR ONE POLYMER SUSPENSION INSULATOR ON 23KV CIRCUITS IN SALT CONTAMINATED AREAS. USE 45KV POST TIE TOP POLYMER INSULATORS ON 23KV CIRCUITS IN SEVERE SALT CONTAMINATED AREAS.
2. WHEN INSTALLING A STEEL ARM OPPOSITE A POLE TOP BRACKET, SEE E-6.0.1 FIG 5.
3. STEEL CROSSARMS ARE NOT RECOMMENDED FOR ANGLE CONSTRUCTION ON WOOD POLES.
4. FOR JUMPER SIZE SEE F-6.0.2.
5. FOR SPUN CONCRETE POLE INSTALLATIONS, USE THE C-CHANNEL ADAPTER SHOWN IN E-6.0.1.

F P L
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	1/25/07	ADD NOTE 5	GAP	ELS	JJM
2	10/27/06	UPDATE NOTE 2	GAP	ELS	JJM
1	9/7/99	ADD REF TO 45KV POLYMER INSULATORS	JM	DLW	JJM
0	8/9/96	CHANGED PORCELAIN SUSPENSION INSULATORS TO POLYMER	PMG	RAS	JJM

ORIGINATOR: PMG

DRAWN BY: RAS

DATE: 8/9/96

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

E

SLACK SPAN CONSTRUCTION

E-29.0.0

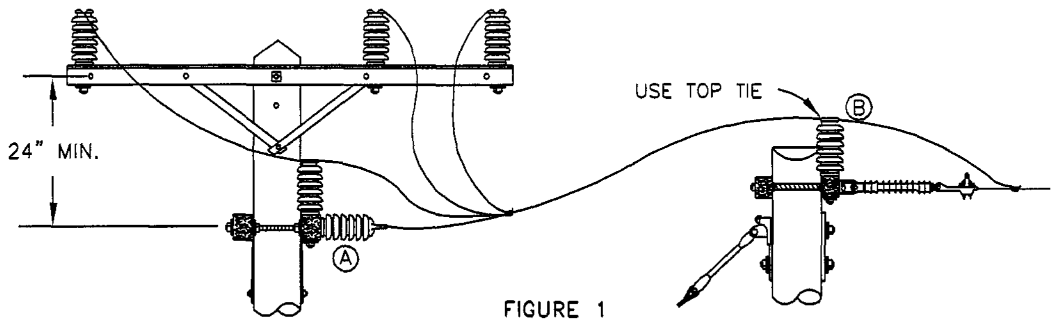


FIGURE 1
THREE PHASE SLACK SPAN FROM THREE PHASE LINE

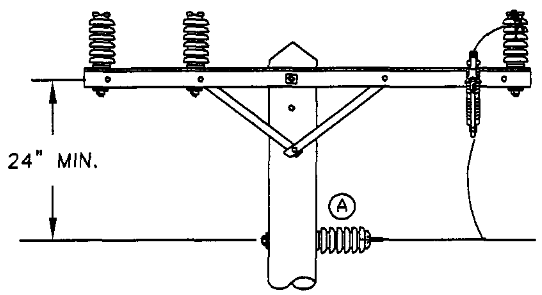


FIGURE 2
SINGLE PHASE SLACK SPAN
FROM THREE PHASE LINE

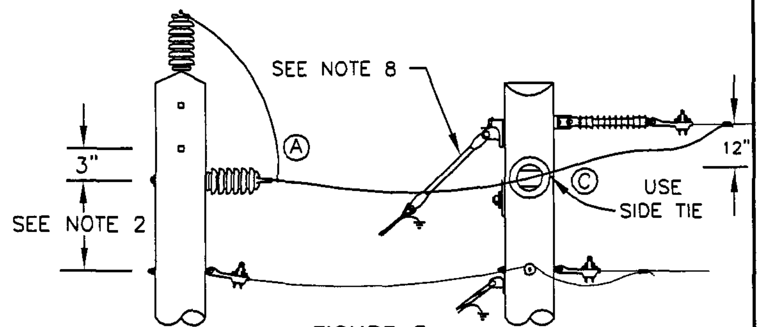


FIGURE 3
SINGLE PHASE SLACK SPAN
FROM SINGLE PHASE LINE

SLACK SPAN		
CONDUCTOR	MAXIMUM LENGTH	INITIAL SAG
568.3 ACAR	50'	3'-7"
3/0 AAAC	75'	2'-9"
1/0 AAAC	95'	2'-10"

Ⓐ LINE POST, CLAMP TOP INSULATOR
Ⓑ LINE POST, VERTICAL TIE-TOP, WITH FORMED TIE WIRE.
Ⓒ LINE POST, VERTICAL TIE TOP, MOUNTED HORIZONTALLY WITH FORMED TIE WIRE.

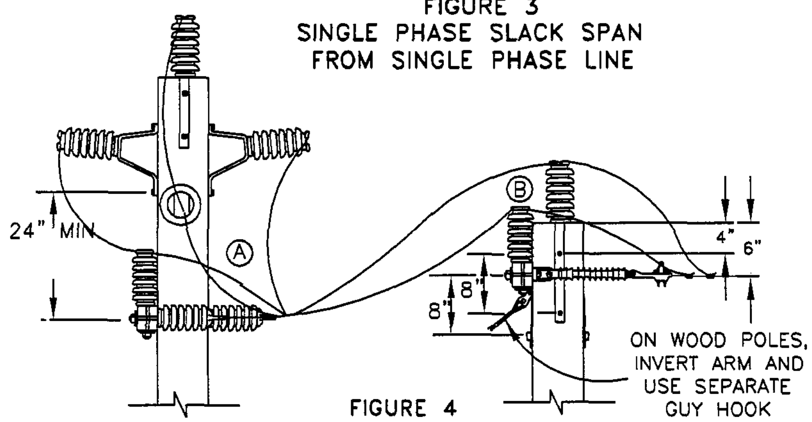


FIGURE 4
THREE PHASE SLACK SPAN FROM
THREE PHASE LINE USING STEEL CROSSARM
(FOR MAINTENANCE ONLY)

NOTES:

1. ALL POST INSULATORS SHOWN ARE 35 kV TIE TOP OR CLAMP TOP. USE 45 kV POST INSULATORS ON 23 kV CIRCUITS IN SALT CONTAMINATED AREAS. USE 45KV POST TIE TOP POLYMER INSULATORS ON 23KV CIRCUITS IN SEVERE SALT CONTAMINATED AREAS.
2. PRIMARY TO NEUTRAL SEPARATION AT POLE IS DETERMINED BY MINIMUM MIDSPAN SEPARATION (DERM 4.4.1). IN NO CASE SHALL SEPARATION AT THE POLE BE LESS THAN 40" FOR WOOD OR CONCRETE POLES.
3. BASE OF INSULATOR MUST BE INSTALLED TIGHTLY AGAINST CROSSARM OR POLE
4. ENGINEER TO SPECIFY SLACK SPAN SAG. (SEE DERM 4.4.5, 4.4.10).
5. INSTALL INSULATOR AND CLAMP AS SHOWN IN DETAIL "A" SUCH THAT WEIGHT ON OUTER END OF CLAMP WOULD TIGHTEN RATHER THAN LOOSEN BOLT.
6. ANY INSULATORS USED AS SLACK SPAN INSULATORS MUST HAVE LONG TRUNNION BOLTS WITH LOCKNUT.
7. FOR JUMPER SIZE INFORMATION SEE F-6.0.2.
8. FIBERGLASS GUY INSULATOR (FIGURE 1) MUST EXTEND BELOW LOWEST ENERGIZED CONDUCTOR, OR THE GUY MUST BE BONDED.
9. USE CLASS 2 POLE MINIMUM.

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	1/23/07	ADD TABLE, NOTE 9 & REV NOTE 8	JNM	ELS	JJM
2	03/22/02	ADD DIMENSIONS TO FIGURE 3.	JNM	JES	JJM
1	09/08/99	INSULATORS TO POLYMER	JNM	DLW	JJM
0	08/09/96	CHANGED PORCELAIN SUSPENSION INSULATORS TO POLYMER	PMG	RAS	JJM

ORIGINATOR: PMG DRAWN BY: RAS

DATE: 8/9/96 APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES
NO SCALE

SLACK SPAN CONSTRUCTION
CONCRETE POLE INSTALLATION ONLY

E-29.1.0

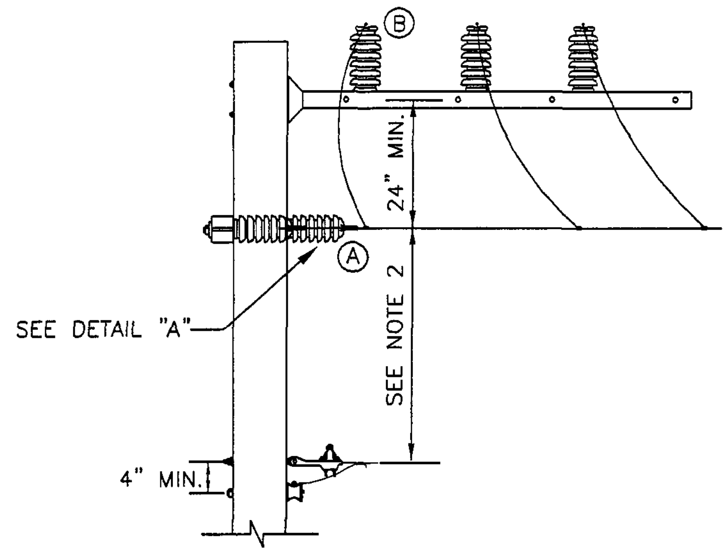


FIGURE 1

3ø 102" STEEL ARM DEAD END OFF 3ø TANGENT ALLEY ARM

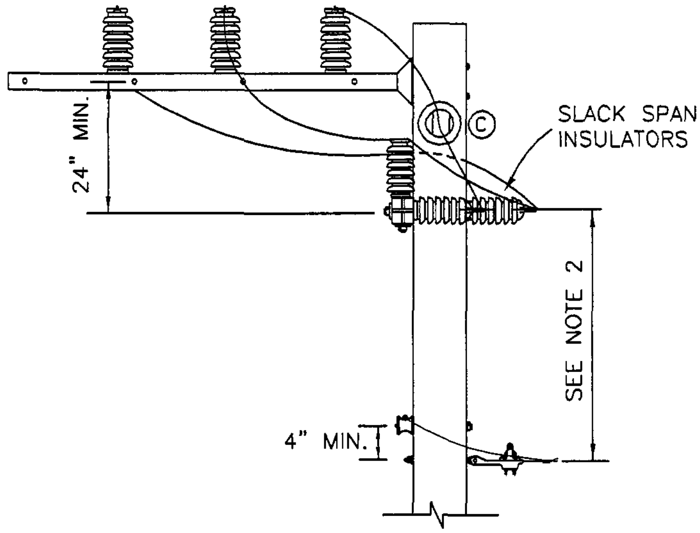


FIGURE 2

3ø 102" STEEL ARM DEAD END OFF 3ø TANGENT ARM

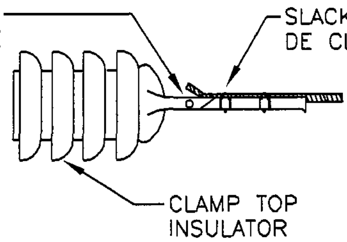
E

Ⓐ LINE POST, CLAMP TOP INS

Ⓑ LINE POST, VERTICAL TIE-TOP, WITH FORMED TIE WIRE.

Ⓒ LINE POST, VERTICAL TIE TOP, MOUNTED HORIZONTALLY WITH FORMED TIE WIRE.

SLACK SPAN		
CONDUCTOR	MAXIMUM LENGTH	INITIAL SAG
568.3 ACAR	50'	3'-7"
3/0 AAAC	75'	2'-9"
1/0 AAAC	95'	2'-10"



DETAIL "A"

NOTES:

1. ALL POST INSULATORS SHOWN ARE 35 kV TIE TOP OR CLAMP TOP. USE 45 kV POST INSULATORS ON 25 kV CIRCUITS IN SALT CONTAMINATED AREAS. USE 45KV POST TIE TOP POLYMER INSULATORS ON 23KV CIRCUITS IN SEVERE SALT CONTAMINATED AREAS.
2. PRIMARY TO NEUTRAL SEPARATION AT POLE IS DETERMINED BY MINIMUM MIDSPAN SEPARATION (DERM 4.4.1) IN NO CASE SHALL SEPARATION AT THE POLE BE LESS THAN 40" FOR WOOD OR CONCRETE POLES.
3. BASE OF INSULATOR MUST BE INSTALLED TIGHTLY AGAINST CROSSARM OR POLE.
4. ENGINEER TO SPECIFY SLACK SPAN SAG. (SEE DERM 4.4.5, 4.4.10).
5. INSTALL INSULATOR AND CLAMP AS SHOWN IN DETAIL "A" SUCH THAT WEIGHT ON OUTER END OF CLAMP WOULD TIGHTEN RATHER THAN LOOSEN BOLT.
6. ANY INSULATORS USED AS SLACK SPAN INSULATORS MUST HAVE LONG TRUNNION BOLTS.
7. FOR JUMPER SIZE INFORMATION SEE F-6.0.2.

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	1/23/07	ADD TABLE	JNM	ELS	JJM
1	9/8/99	ADD REF TO 45KV POLYMER INSULATORS	JM	DLW	JJM
0	9/30/94	REVISED FIG 1 & 2 ADD BOLTED DEADEND CLAMP & NOTE 7	ARR	RAS	RJS

ORIGINATOR: ARR DRAWN BY: RAS

DATE: 9/30/94 APPROVED: R. J. SALESKY NO SCALE

DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

POLE GROUNDING

G-3.0.2

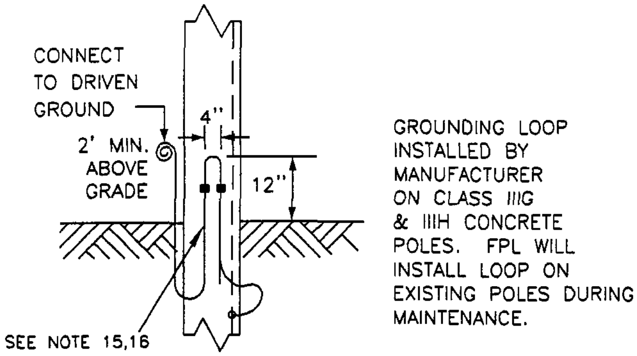


FIG. 3 CONCRETE POLE GROUNDING DETAIL

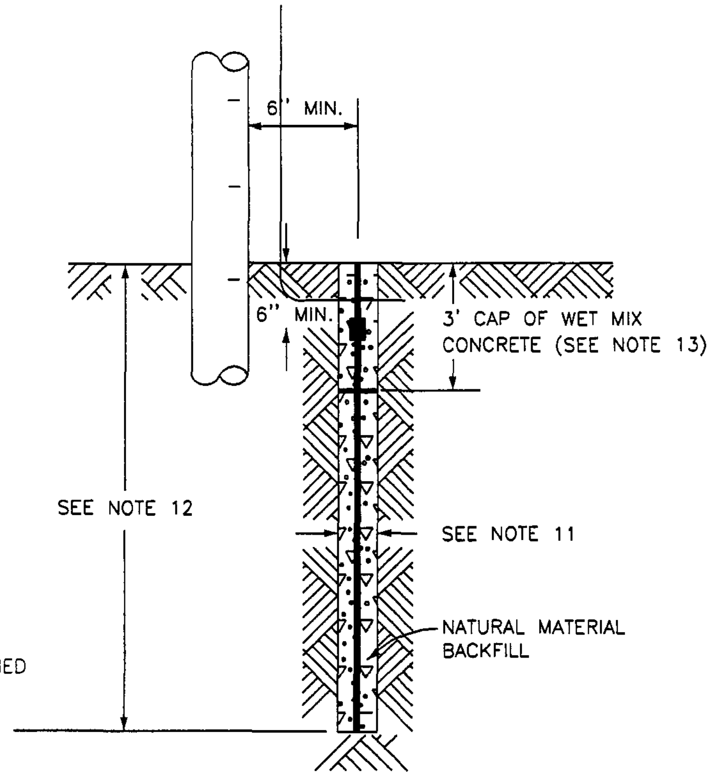


FIG. 4 DRILLING HOLE FOR GROUND ROD
(USED ONLY WHEN DRIVING ROD IS IMPOSSIBLE)

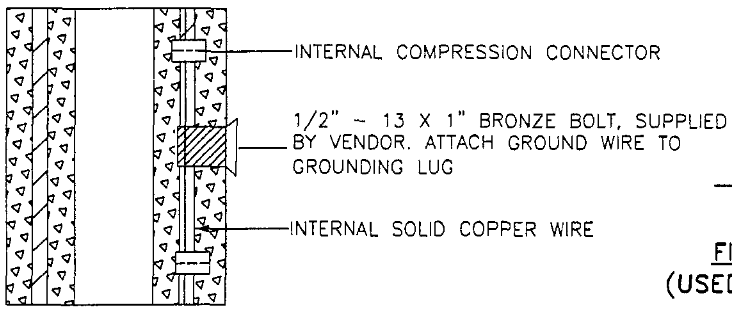


FIG. 5 SPUN CONCRETE POLE GROUNDING DETAIL

G

NOTES:

8. UNGROUNDED HARDWARE WITHIN 2" OF GROUND WIRE OR OTHER GROUNDED HARDWARE SHOULD BE BONDED TO IT EXCEPT WHERE SPECIAL INSTRUCTIONS ARE GIVEN TO ISOLATE THE SAME.
9. DRIVEN GROUND RODS, WHERE POSSIBLE, SHOULD BE LOCATED TO AVOID INTERFERENCE WITH POSSIBLE FUTURE POLE REPLACEMENTS.
10. FOR GROUNDING REQUIREMENTS OF STREET LIGHT POLES SEE H-II.0.0 AND H-II.1.0 .
11. HOLE DIAMETER DEPENDS ON AVAILABILITY OF DRILL EQUIPMENT, WITH MAXIMUM 4" DIAMETER.
12. HOLE DEPTH DEPENDS ON ROCK DEPTH. DRILL ONLY AS DEEP AS NECESSARY TO GET THROUGH ROCK LAYERS, AND DRIVE ROD TO ADDITIONAL DEPTH NECESSARY TO ACHIEVE SPECIFIED RESISTANCE (MAXIMUM DEPTH, 40').
13. A LESSER DEPTH FOR THE CONCRETE CAP IS PERMITTED ONLY IF TOP SOIL CONDITIONS IN THE SOUTH FLORIDA AREA DO NOT PERMIT A FULL 3 FT. DEPTH.
14. GROUND LOOP SHOULD BE EXTENDED IF REQUIRED TO MAINTAIN MIN. 12" ABOVE FINAL GRADE.
15. BOTTOM OF LOOP MUST REMAIN SEPARATED FOR TEST PURPOSES.
16. LOOP TO BE INSTALLED ON EXISTING CONCRETE POLES DURING MAINTENANCE IF POSSIBLE AND PRACTICAL.

SUPERSEDES G-3.0.2 LAST REVISED ON 3-15-91

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	1/23/07	ADDED FIG 5 FOR SPUN CONCRETE POLE	RJO	ELS	JJM
1	9/30/94	REVISIED MINIMUM GROUND DEPTH AND REMOVED OLD NOTE 14	JSB	MRB	RJS
0	3/15/91	ORIGINAL DRAWING	JSB	MRB	RJS

ORIGINATOR: JSB DRAWN BY: MRB

DATE: 3/15/91 APPROVED: R.J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

STREET LIGHT POLE WEIGHTS AND SETTING DEPTHS

H-4.0.0

FIBERGLASS POLES				
LENGTH OF POLE AND FINISH	M&S NUMBER	APPROXIMATE WEIGHT	MINIMUM SETTING DEPTH IN EARTH	MINIMUM SETTING DEPTH IN ROCK
20' WITH NATURAL FINISH	154-119-004	38 lbs.	4' - 6"	4' - 0"
13' WITH SMOOTH FINISH	154-118-008	23 lbs.	3' - 0"	3' - 0"

STANDARD CONCRETE POLES				
LENGTH OF POLE AND TYPE	M&S NUMBER	APPROXIMATE WEIGHT	MINIMUM SETTING DEPTH IN EARTH	MINIMUM SETTING DEPTH IN ROCK
20' TYPE "O"	152-220-000	750 lbs.	4' - 6"	4' - 0"
35' TYPE "SU"	152-239-002	2,240 lbs.	7' - 6"	6' - 0"
35' TYPE "O"	152-225-001	2,240 lbs.	7' - 0"	6' - 0"
40' TYPE "IIIA"	152-351-007	4,674 lbs.	10' - 0"	8' - 0"
45' TYPE "IIIA"	152-352-003	4,924 lbs.	10' - 0"	8' - 6"
50' TYPE "IIIA"	152-353-000	5,324 lbs.	10' - 0"	8' - 6"

H

DECORATIVE CONCRETE POLES (SEE NOTE 1)				
LENGTH OF POLE AND TYPE	M&S NUMBER	APPROXIMATE WEIGHT	MINIMUM SETTING DEPTH IN EARTH	MINIMUM SETTING DEPTH IN ROCK
18' -6" WASHINGTON	152-230-005 152-231-508 152-231-605 152-231-700	970 lbs.	4' - 0"	4' - 0"
17" - 3" VICTORIAN	152-233-000 152-233-200 152-233-300	575 lbs.	4' - 3"	4' - 3"
37' OCTAGONAL	152-232-008	1,730 lbs.	7' - 0"	6' - 0"

NOTES:

1) THE USE OF A NYLON SLING IS REQUIRED FOR DECORATIVE CONCRETE POLES. THIS IS NECESSARY TO AVOID DAMAGING THE SURFACE OF POLES.
2) THE SETTING DEPTHS IN ROCK APPLY TO HOLES CONSISTING OF NOT LESS THAN 90% ROCK. THEY ARE ALSO APPLICABLE TO HOLES IN HARD CLAY.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	1/9/07	UPDATE CHARTS	FLM	ELS	JJM
2	8/15/05	UPDATE CHARTS	SMS	ELS	JJM
1	6/29/05	UPDATE CHARTS	SMS	ELS	JJM
0	5/29/03	ORIGINAL DRAWING	SMS	ELS	JJM

ORIGINATOR: SMS

DRAWN BY: ELS

DATE: 5/29/03

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

TRANSFORMER POLE WEIGHT LOADING

I-3.2.0

THE USUAL WIND-LOADING CALCULATIONS TO DETERMINE POLE CLASS REQUIREMENTS DO NOT CONSIDER PERMANENT LOAD SUCH AS A HEAVY TRANSFORMER. THIS TYPE OF LOAD CAN CAUSE A POLE TO BEND OR "BOW" OVER A PERIOD OF TIME, EVEN THOUGH CODE STRENGTH REQUIREMENTS ARE EXCEEDED BY A COMFORTABLE MARGIN. TO PREVENT THIS LONG-TERM DEFORMATION, THE TABLE AND CHART BELOW SHOULD BE USED TO DETERMINE THE MINIMUM CLASS OF POLE REQUIRED FOR A PARTICULAR TRANSFORMER WEIGHT. FOR INSTALLATION ON AN EXISTING POLE IN GOOD CONDITION, ONE CLASS SMALLER THAN INDICATED BELOW MAY BE USED.

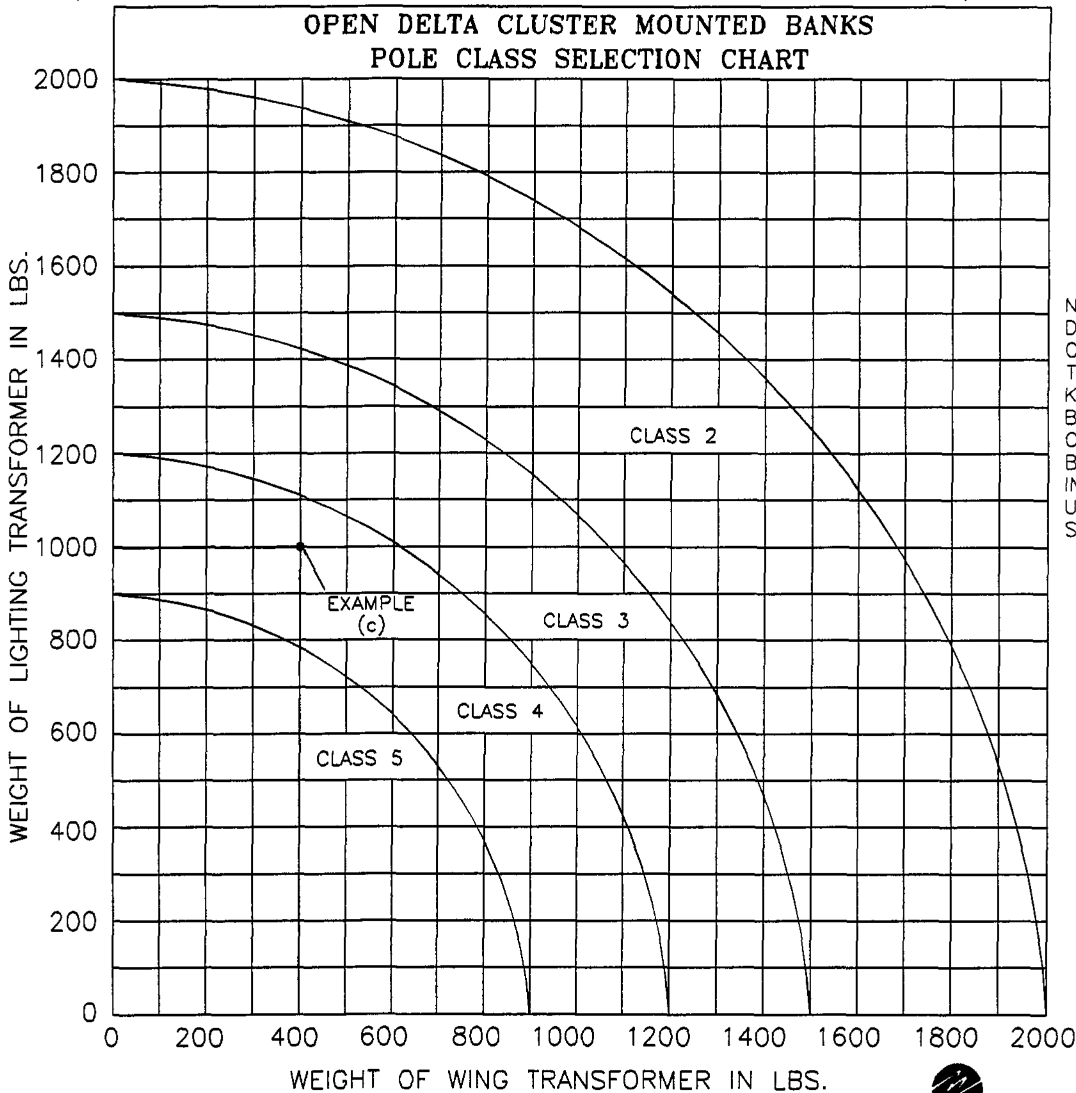
WHERE LOAD GROWTH REQUIRING FUTURE TRANSFORMER REPLACEMENT CAN BE REASONABLY ANTICIPATED, A CLASS 3 POLE SHOULD BE THE MINIMUM SET FOR A TWO TRANSFORMER BANK.

IT WILL BE NOTED THAT AN OPEN DELTA BANK WILL, IN GENERAL, REQUIRE A LARGER POLE THAN CLOSED DELTA BANK. THIS IS CAUSED BY THE FACT THAT IN A CLOSED DELTA BANK THE TWO POWER TRANSFORMERS BALANCE EACH OTHER*, AND CAUSE NO UNBALANCED MOMENT - AND IT IS THIS UNBALANCED MOMENT, NOT THE WEIGHT IN ITSELF, WHICH INITIATES POLE BOWING.

NOTE, HOWEVER, THAT THE INFORMATION BELOW CANNOT BE CONSIDERED A SUBSTITUTE FOR WIND LOADING CALCULATIONS. WIND LOADING SHOULD BE CONSIDERED SEPARATELY, AND THE METHOD DICTATING THE LARGER POLE SHOULD PREVAIL.

*NOTE - THE CHART AND TABLE BELOW ASSUME THE USE OF CLUSTER-MOUNTS. FOR ARM MOUNTED BANKS, TOTAL THE TRANSFORMER WEIGHT AND USE THE TABLE AS IF ALL WEIGHT WERE CONCENTRATED IN ONE TRANSFORMER.

EXAMPLES:
a) ONE TRANSFORMER WEIGHING 1100 LB, REQUIRES A CLASS 4 POLE. (FROM TABLE)
b) THREE CLUSTER MOUNTED TRANSFORMERS EACH WEIGHING 1100 LB, REQUIRE A CLASS 4 POLE. (FROM TABLE)
c) ONE 1000 LB. AND ONE 400 LB. TRANSFORMER CLUSTER MOUNTED REQUIRES A CLASS 4 POLE. (EXAMPLE ON CHART)
d) THREE ARM MOUNTED TRANSFORMERS EACH WEIGHING 600lb, REQUIRE A CLASS 2 POLE. (1800lb, TOTAL FROM TABLE)



TABLE

POLE CLASS	SINGLE TX. MAX. LBS.
5	900
4	1200
3	1500
2	2000

NOTE: STANDARD APPLIES TO OPEN DELTA CLUSTERS. ALL NEW CONSTRUCTION OR REPLACEMENT TRANSFORMER POLES WITH 3-100 KVA OR LARGER TRANSFORMERS TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACCESSIBLE BY AERIAL EQUIPMENT. FOR INACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	3/8/07	REMOVE REFERENCE TO 3 PHASE BANKS. INSERTED NOTE ON CONCRETE POLES.	RR	ELS	JRD
2	6/30/93	REVISE NOTES	ARR	JRG	RJS
1	1/29/92	ADDED CLASS 4 & 5 POLES	ARR	HO	RJS
0	1/29/92	ORIGINAL DRAWING	MLM	JRF	RKC

ORIGINATOR: MLM

DRAWN BY: JRF

DATE: 3/15/91

APPROVED: R.K. CIELO
DIRECTOR, DISTRIBUTION ENGINEERING AND SERVICE PLANNING

NO SCALE

SINGLE PHASE STEPDOWN TRANSFORMER ON URD TERMINATOR POLE

I-9.0.0

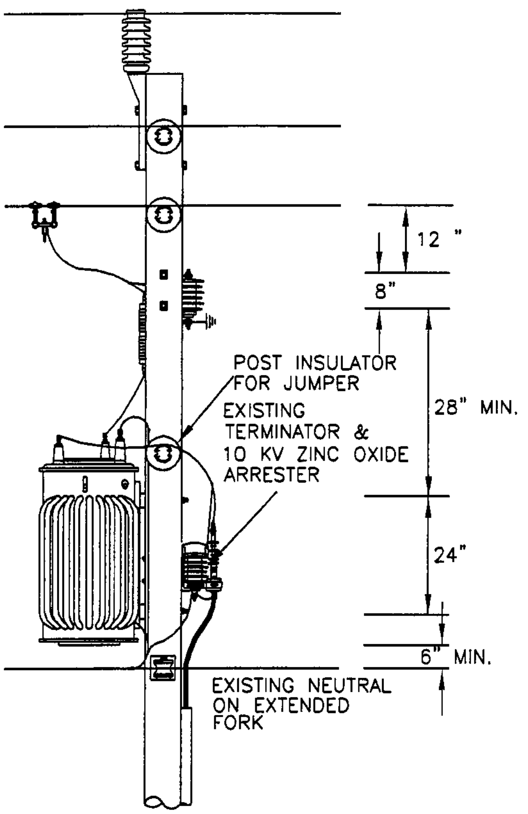


FIG. 1

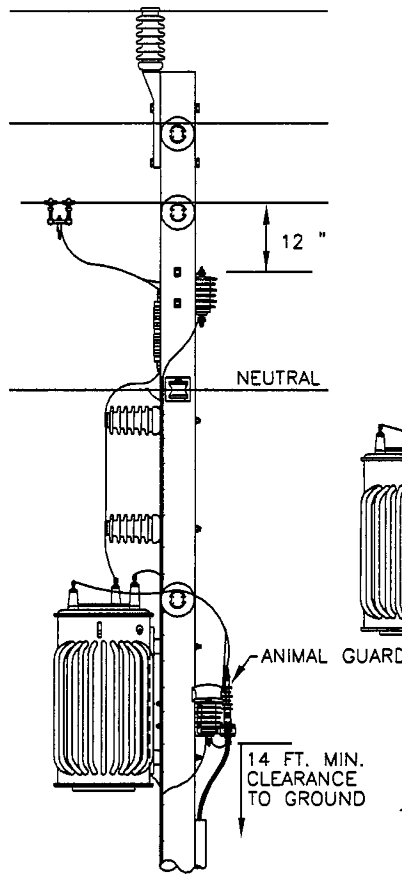


FIG. 2

ALTERNATE METHOD LOWERING TRANSFORMER AND TERMINATOR (SEE NOTE 2)

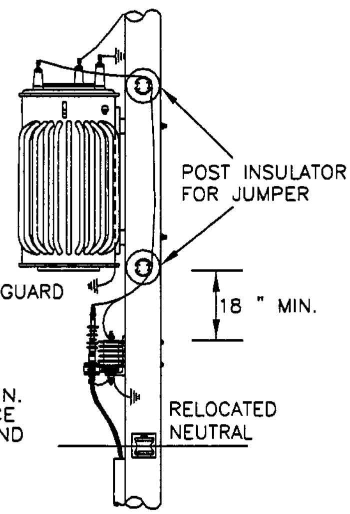


FIG. 3

ALTERNATE METHOD LOWERING TERMINATOR

TABLE 1

SIZE TX.	CONC. POLE TYPE REQ.	
	NEW	EXISTING
100 KVA	ALL TYPE III OR BETTER	
167 KVA		
333 KVA		
1000 KVA		

NOTES:

1. FRAMED ACCORDING TO FIG. 1, AN EXISTING TERMINATOR/ARRESTER NEED NOT BE RELOCATED. IF CLIMBING SPACE IS A CONCERN (AND SPACE PERMITS), LOWER THE TERMINATOR AND INSTALL THE TRANSFOMER ABOVE IT. SEE FIG. 3.
2. AUTO TRANSFORMER IS SHOWN (H2 & X2 COMMON TO ONE BUSHING), ON TWO WINDING TRANSFORMER, TIE H2 & X2 TOGETHER, AND GROUND.
3. #6 COPPER IS ADEQUATE TO CARRY THE CURRENTS INVOLVED. BECAUSE OF ITS MECHANICAL STRENGTH, #4 COPPER (OR BETTER) SHOULD BE USED FOR PRIMARY AND NEUTRAL JUMPERS.
4. VERTICAL CONFIGURATION AND A 333 KVA TRANSFORMER ARE SHOWN AS TYPICAL. ALL POLE MOUNTED STEP UP/DOWN TRANSFORMERS SHOULD HAVE MOUNTING LUGS COVERED IN DETAILS ON SHEET I-3. AVOID USING CLUSTER MOUNTS IF POSSIBLE (KEEP IT CLOSE TO POLE).
5. UNLESS OTHERWISE DIRECTED, PROTECT THE STEP DOWN TRANSFORMER WITH THE FOLLOWING FUSE SIZES AS A MINIMUM: 100 KVA, 8 AMP KS; 167 KVA, 15 AMP KS; 333 KVA, 25 AMP KS; 1000 KVA, 80 AMP KS ALSO SEE DCS I-19.0.0 AND I-19.2.0.
6. WHEN USED FOR OVERHEAD TO OVERHEAD TRANSFORMATION, THE MINIMUM FUSE SIZE IS 15 AMPS KS.
7. REFER TO I-53.1.3 FOR TRANSFOMER CONNECTION DIAGRAM.

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	2/14/07	REMOVED WOOD POLE CLASS REQ., ENGINEERS NOTE & NOTE 2	RR	ELS	JRD
3	9/16/05	UPDATE NOTE #6	IA	ELS	JJM
2	10/15/04	ADD ANIMAL GUARD	LFV	ELS	JJM
1	6/30/93	REDRAWN FROM MANUAL– COMBINED I-9.0.1 & I-9 SH. 2	MV	CB	RJS
0	3/1/89	ORIGINAL DRAWING	MV	CB	RJS

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: MV

DRAWN BY: CB

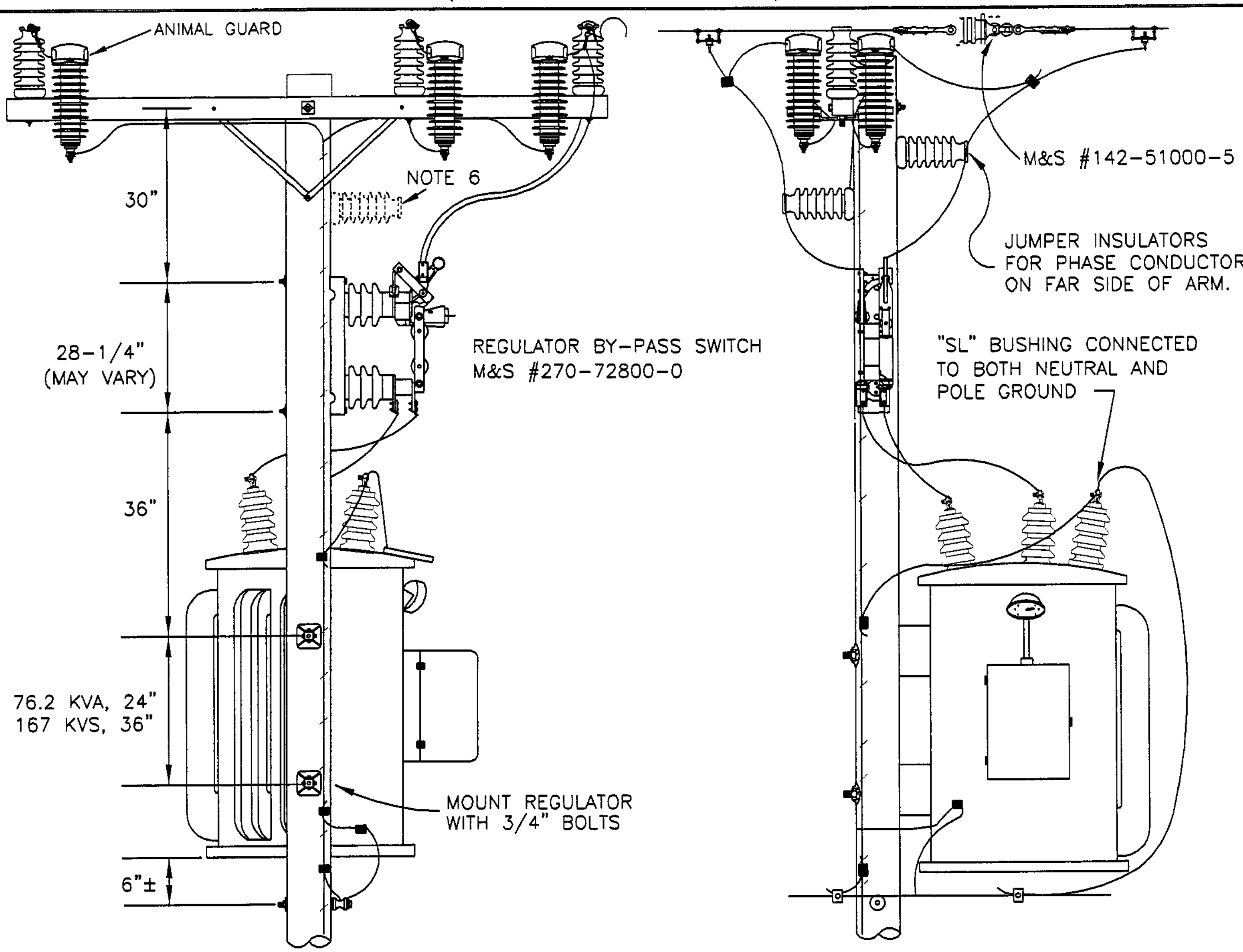
DATE: 6/30/93

APPROVED: R.J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

SINGLE PHASE LINE REGULATOR INSTALLATION (ALTERNATE METHOD)

I-10.0.0



M&S NUMBER	REGULATOR KVA	CONC. POLE TYPE REQ. NEW	EXISTING
327-070-004	76.2 (13 KV)	ALL TYPE III OR BETTER	
327-102-003	167 (13 KV)		
327-100-001	144 (23 KV)		
327-102-500	288 (23 KV)		

NOTES:

1. CROSSARM FRAMING SHOWN AS TYPICAL. MAY BE ADAPTED TO OTHER FRAMING AS REQUIRED.
2. ONE PHASE OF THREE PHASE INSTALLATION ARE ILLUSTRATED. INSTALL A, B, & C PHASE REGULATORS ON THREE ADJACENT POLES.
3. SOURCE AND LOAD SIDES MAY BE SWITCHED TO SUIT FIELD CONDITIONS. IN ANY EVENT "S" BUSHING MUST BE TAPPED SOURCE CONDUCTOR, AND "L" BUSHING TAPPED TO LOAD CONDUCTOR.
4. DIMENSIONS SHOWN ASSUME CURRENTLY PURCHASED REGULATORS. OLDER MODELS MAY REQUIRE SOME DIMENSIONAL ADJUSTMENTS.
5. INSULATOR USED WHEN CONNECTING TO MIDDLE PHASE.

SUPERSEDES I-10.0.0 LAST REVISED ON 1-29-92

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	2/14/07	REMOVED WOOD POLE CLASS REQ., ENGINEERS NOTE & NOTE 5, CHANGED POLE SYLE CONCRETE	RR	ELS	JRD
3	10/15/04	ADD ANIMAL GUARD	LFV	ELS	JJM
2	5/22/01	ADDED CASE GROUND	GJP	JES	IA
1	7/23/99	UPDATE DRAWING REMOVE SOME TEXT	WPC	JES	JM
0	6/30/93	ORIGINAL REDRAWN-REVISED M&S NO. FOR BY-PASS SWITCH	IA	CL	FOR

ORIGINATOR: IA

DRAWN BY: CL

DATE: 6/30/93

APPROVED: R.J. SALESKY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

WYE-CLOSED DELTA BANK 13 & 23KV MODIFIED VERTICAL CONSTRUCTION

I-51.0.0

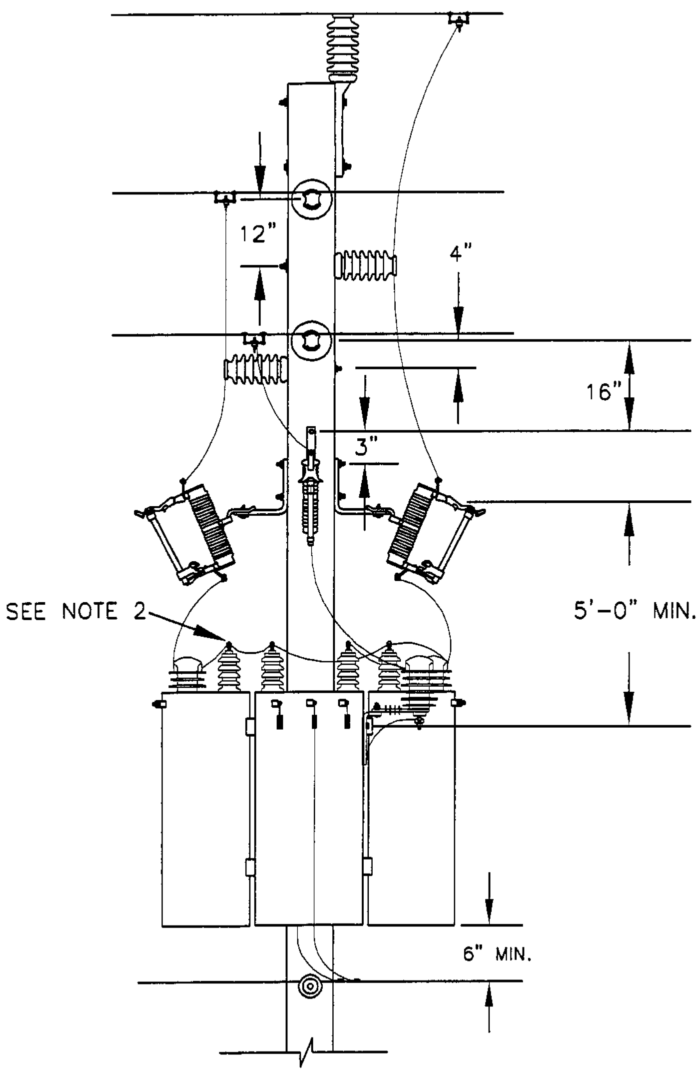


FIGURE 1

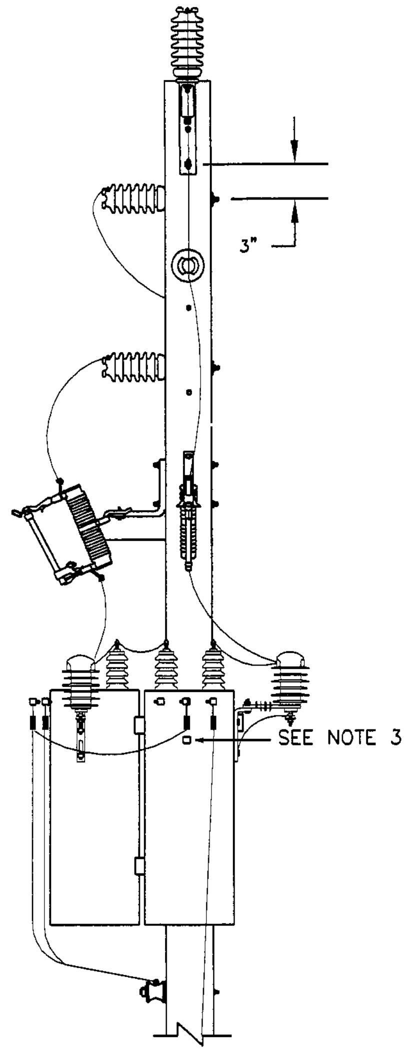


FIGURE 2

NOTES:

1. SEE SHEETS I-53.1.1 FOR SCHEMATIC DIAGRAMS OF TRANSFORMER CONNECTIONS.
2. DOUBLE PRIMARY BUSHING TRANSFORMERS ILLUSTRATED, FOR DETAILS OF SINGLE OR DOUBLE BUSHING GROUNDING. SEE SHEET I-5.0.0.
3. THE STRAP CONNECTING THE LOW VOLTAGE NEUTRAL TERMINAL TO THE TANK MUST BE REMOVED ON THE POWER TRANSFORMERS
4. SEE SECTION G-3.0.1 FOR GROUNDING DETAILS.
5. ALL NEW CONSTRUCTION OR REPLACEMENT TRANSFORMER POLES WITH 3-100 KVA OR LARGER TRANSFORMERS TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACEESSIBLE BY AERIAL EQUIPMENT. FOR INNACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.

F P L
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	3/8/07	INSERTED NOTE 5	RR	ELS	JRD
1	7/03/01	INCREASED MIN. DIMENSION	GJP	JES	IA
0	9/30/94	ORIGINAL DRAWING	ARR	RAS	RJS

ORIGINATOR: ARR

DRAWN BY: RAS

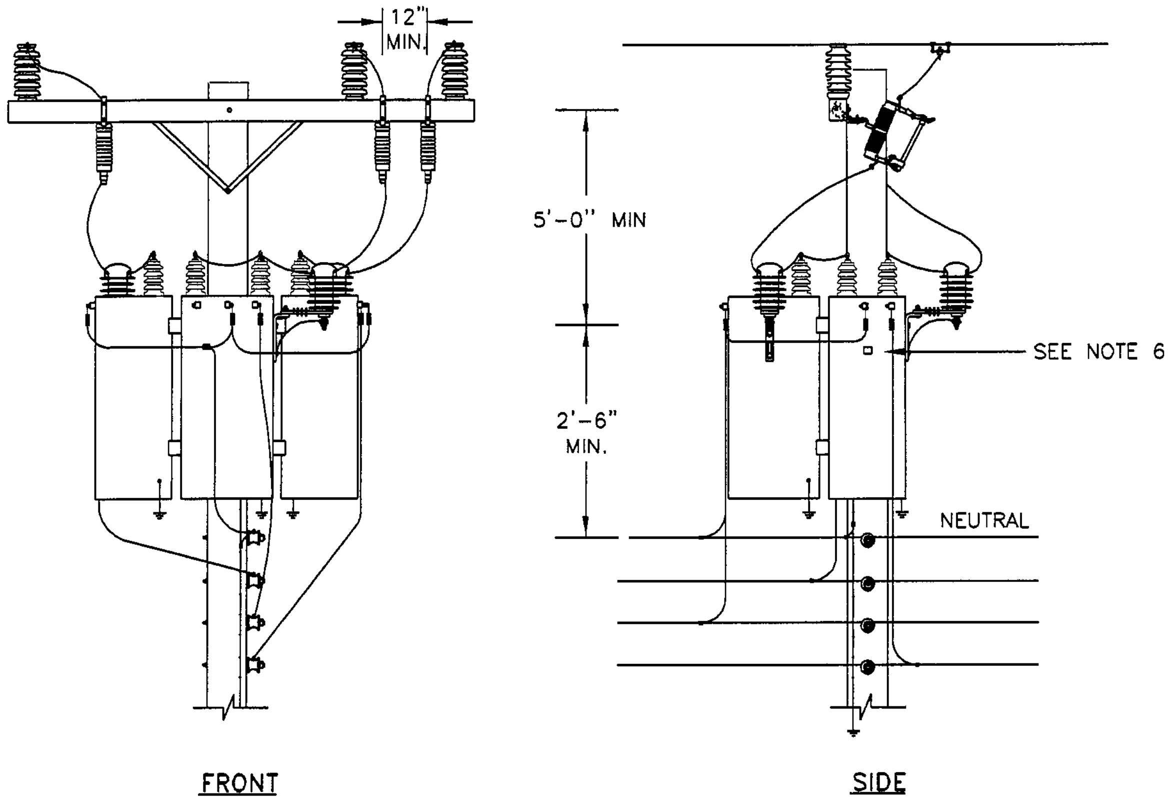
DATE: 9/30/94

APPROVED: R.J. SALESKY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

WYE-WYE BANK
13 & 23KV
CROSSARM CONSTRUCTION

I-52.0.0



NOTES

1. SEE SHEET I-3.2.0 FOR POLE CLASS REQUIRED.
2. SEE SHEET I-53.1.1 FOR SCHEMATIC DIAGRAM OF TRANSFORMER CONNECTIONS.
3. SEE PAGE I-3.0.0 FOR DETAILS OF CLUSTER BRACKET INSTALLATION.
4. SEE SECTION "G" FOR GROUNDING DETAILS.
5. IN SALT SPRAY CONTAMINATED AREAS BOND ALL STEEL PINS AND MOUNTING BRACKETS. USE SALT SPRAY ARRESTERS AND CUTOUTS AND INSTALL SALT SPRAY TYPE TRANSFORMERS.
6. THE GROUNDING STRAP FROM THE LOW VOLTAGE NEUTRAL BUSHING TO THE TANK MUST BE REMOVED ON ALL THREE TRANSFORMERS.
7. ALL NEW CONSTRUCTION OR REPLACEMENT TRANSFORMER POLES WITH 3-100 KVA OR LARGER TRANSFORMERS TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACEESSIBLE BY AERIAL EQUIPMENT. FOR INNACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.

SUPERSEDES I-52.0.0 LAST REVISED ON 3-1-89

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	3/8/07	INSERTED NOTE 7	RR	ELS	JRD
3	7/03/01	INCREASED MIN. DIMENSION	GJP	JES	IA
2	9/30/94	ADDED DIMENSION TEXT	ARR	PTH	RJS
1	9/30/94	CHANGED SPOOLS	ARR	EF	RJS
0	5/13/93	REDRAWN FROM MANUAL AND ADDED NEW FRAME	MV	EMH	RJS

ORIGINATOR: MV

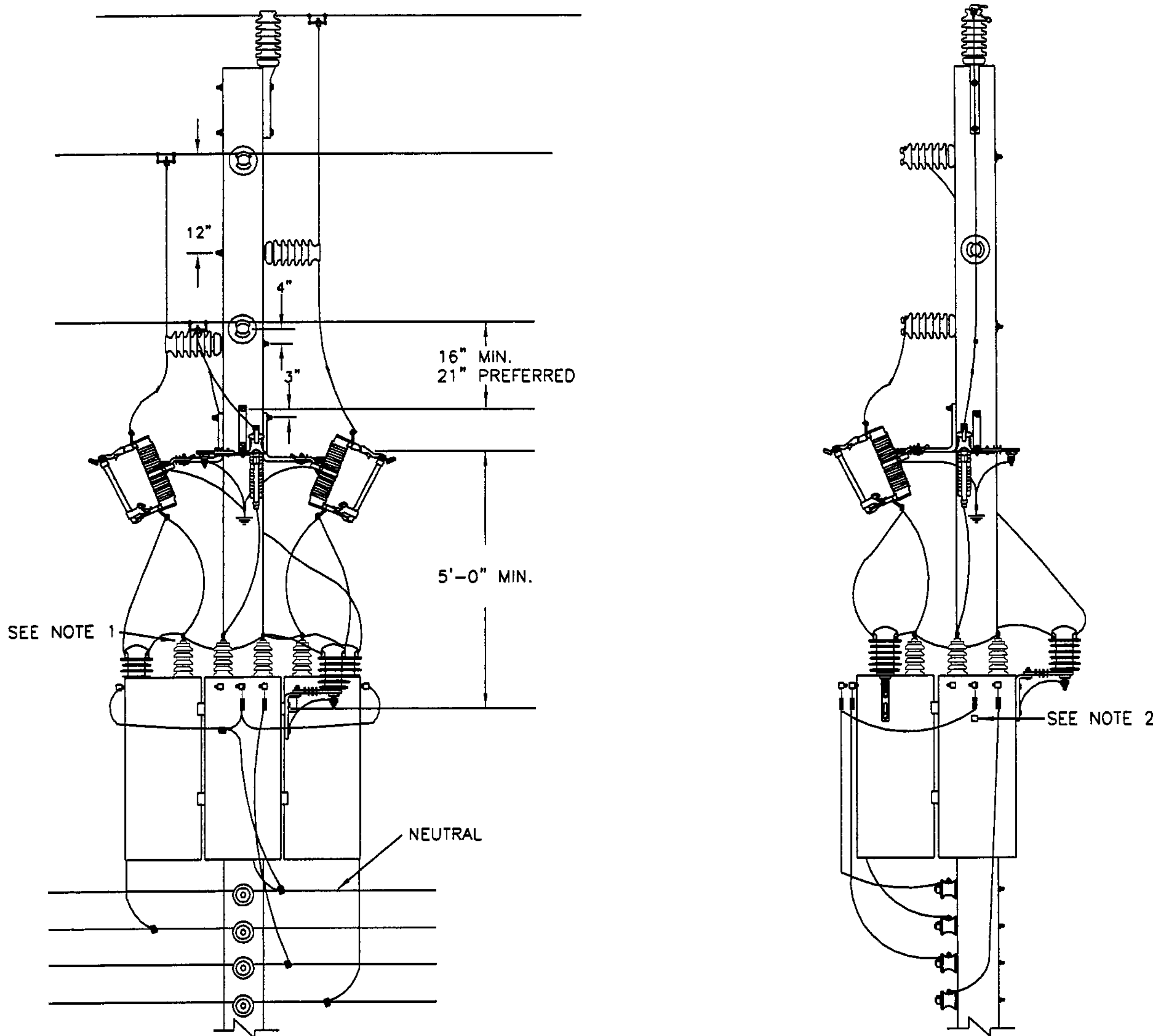
DRAWN BY: EMH

DATE: 5/13/93

APPROVED: R.J. SALESKY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

I-52.0.2	WYE-WYE BANK 13 & 23KV MODIFIED VERTICAL CONSTRUCTION	I-52.0.2



SYMBOL ⏚ MEANS TO POLE GROUND

NOTES:

1. DOUBLE PRIMARY BUSHING TRANSFORMERS ILLUSTRATED, FOR DETAILS OF SINGLE OR DOUBLE BUSHING GROUNDING. SEE SHEET I-5.0.0
2. THE STRAP CONNECTING THE LOW VOLTAGE NEUTRAL TERMINAL TO THE TANK MUST BE REMOVED ON ALL THREE TRANSFORMERS.
3. SEE SHEET I-3.2.0 FOR POLE CLASS REQUIRED.
4. SEE SHEET I-53.1.1 FOR SCHEMATIC DIAGRAM ON TRANSFORMER CONNECTIONS.
5. SEE PAGE I-3 FOR DETAILS OF CLUSTER BRACKET INSTALLATION.
6. SEE SECTION "G" FOR GROUNDING DETAILS.
7. IN SALT SPRAY CONTAMINATED AREAS BOND ALL BOLTS AND METAL MOUNTING BRACKETS.
8. ALL NEW CONSTRUCTION OR REPLACEMENT TRANSFORMER POLES WITH 3-100 KVA OR LARGER TRANSFORMERS TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACEESSIBLE BY AERIAL EQUIPMENT. FOR INNACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.

FPL

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	3/8/07	INSERTED NOTE 8	RR	ELS	JRD
3	10/20/05	ADD ARRESTERS TO TRANSFORMER TANKS	IA	ELS	JRD
2	10/18/04	ADD ANIMAL GUARD	LFV	ELS	JJM
1	7/03/01	INCREASED MIN. DIMENSION	GJP	JES	IA
0	9/30/94	ORIGINAL DRAWING	ARR	MRB	RJS

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: ARR

DRAWN BY: MRB

DATE: 9/30/94

APPROVED: R.J. SALESKY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

CAPACITOR BANKS
GENERAL

J-1.0.2

CUTOUTS AND FUSING

FOR NEW INSTALLATIONS FUSED AT 80K OR LESS, 100 AMP CUTOUTS SHALL BE USED. EXISTING 200 AMP CUTOUTS SHOULD REMAIN IN SERVICE AS LONG AS THEY ARE IN GOOD CONDITION. (FUSES RATED AT 100 AMPS OR LESS, AND USED IN A 200 AMP. BARREL, REQUIRE A SPECIAL 200 AMP BUTTONHEAD. M&S #531-8100-5). IF THE FUSETUBE ON AN EXISTING CUTOUT NEEDS TO BE REPLACED, THEN THE ENTIRE CUTOUT SHALL BE CHANGED OUT TO 100 AMPS.

CUTOUT INSTALLATION RECOMMENDATIONS

TO MINIMIZE CORROSION ON CONTACTS, CUTOUT FUSE BARRELS MUST ALWAYS REMAIN CLOSED WHEN THE BANK IS DE-ENERGIZED.

DO NOT WIREBRUSH THE CONTACTS ON THE CUTOUTS. THIS MAY DESTROY THE CONTACT PLATING AND LEAD TO POOR PERFORMANCE.

DO NOT USE INHIBITOR PASTE ON THE CONTACTS. ONLY APPROVED SWITCH LUBRICANT SHOULD BE USED WHEN REQUIRED.

FUSING TABLES

13 KV

PROTECTED BY STATION BREAKER

BANK SIZE (3 PHASE KVAR)	FUSE	FUSE M&S #
1200 KVAR	65 K	531-81300-4
600 KVAR	50 K	531-81200-8
300 KVAR	40 K	531-81700-0

23 KV

PROTECTED BY STATION BREAKER

BANK SIZE (3 PHASE KVAR)	FUSE	FUSE M&S #
1200 KVAR	40 K	531-81700-0
600 KVAR	40 K	531-81700-0

J

LARGEST SIZE OF THREE-PHASE CAPACITOR BANK BEYOND A RECLOSER.

PROTECTED BY RECLOSER (13KV)

BEYOND RECLOSER	GROUND TRIP SETTING	FUSE SIZE	MAX KVAR (3ø)	FUSE M&S #
160 RX	–	65 K	1200	531-81300-4
	154	50 K	600	531-81200-8
140 RX	–	65 K	1200	531-81300-4
	110	40 K	300	531-81700-0
	154	50 K	600	531-81200-8
100 RX	–	50 K	600	531-81200-8
	110	40 K	300	531-81700-0
70 RX	–	40 K	300	531-81700-0

PROTECTED BY RECLOSER (23KV)

BEYOND RECLOSER	GROUND TRIP SETTING	FUSE SIZE	MAX KVAR (3ø)	FUSE M&S #
160 RV THROUGH 70 RV	ALL VALUES	40 K	1200	531-81700-0

MOUNTING INSTALLATION:
ALL NEW OH CAPACITOR BANKS MUST BE INSTALLED ON CLASS III-H CONCRETE POLE OR EQUIVALENT.

SUPERSEDES J-1.0.2 LAST REVISED ON 6-22-95

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
1	12/5/06	ADD MOUNTING INSTALLATION NOTES	LFV	ELS	JJM
0	8/9/96	GENERAL REVISIONS	IA	RAS	JJM

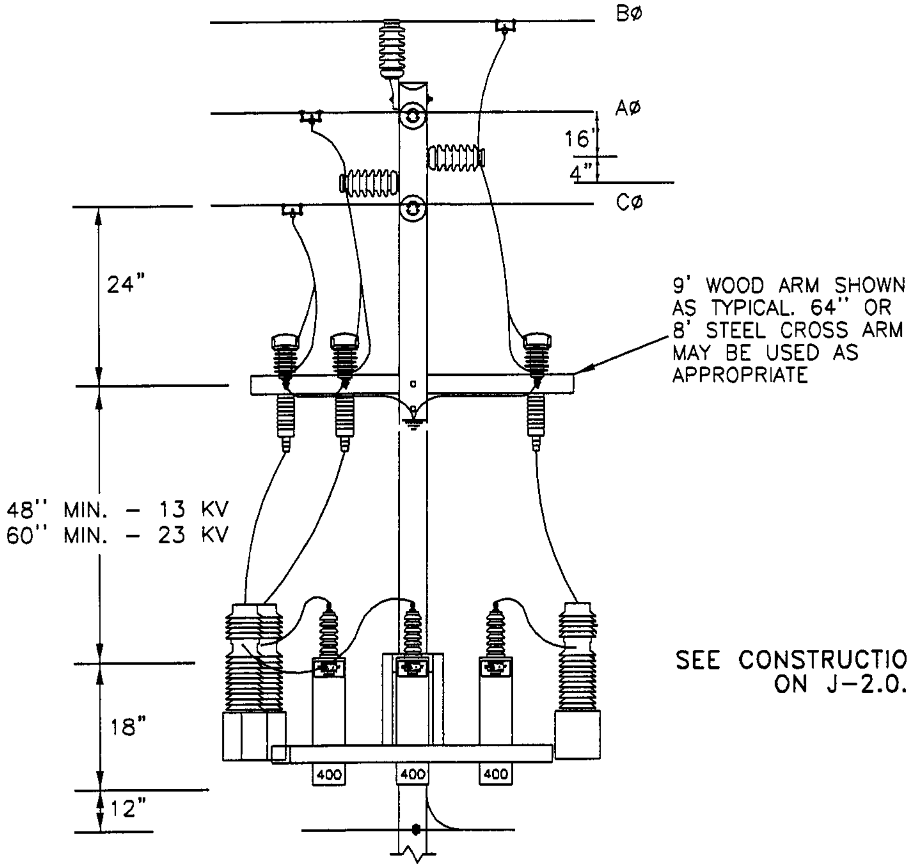
ORIGINATOR: IA DRAWN BY: RAS

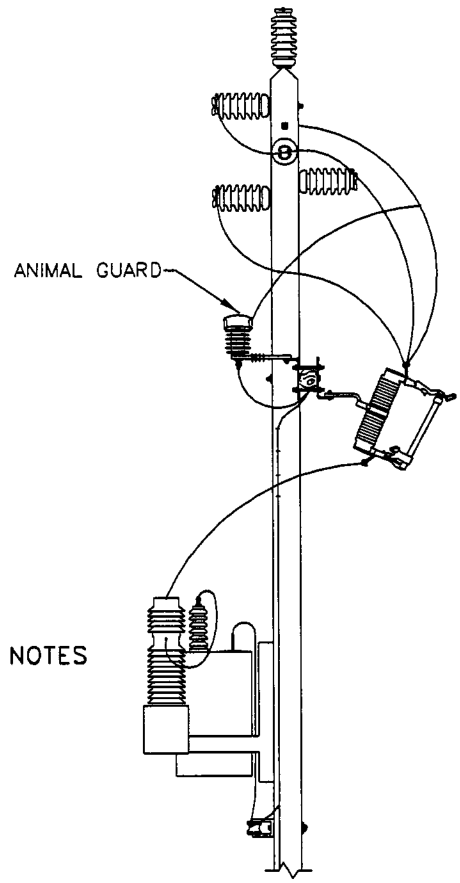
DATE: 8/9/96 APPROVED: J.J. MCEVOY NO SCALE
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

300, 600, AND 1200 KVAR CAPACITOR BANKS USING SINGLE PHASE 100 200, AND 400 KVAR UNITS 13 AND 23 KV

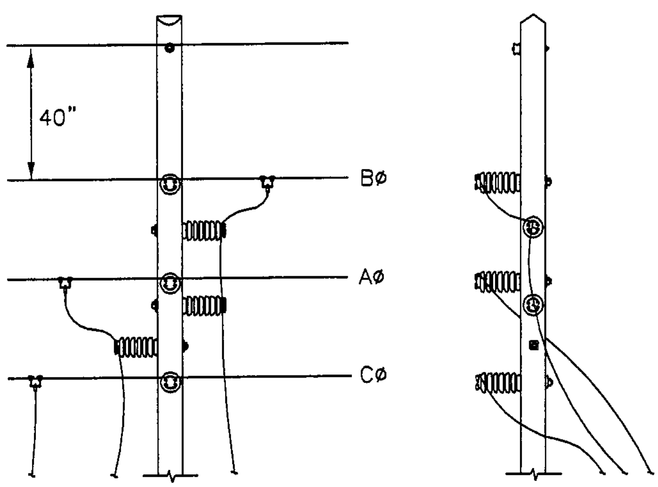
J-2.0.2

MODIFIED VERTICAL CONSTRUCTION





SEE CONSTRUCTION NOTES ON J-2.0.3



TO FUSE SWITCH SIMILAR TO J-2.0.3 FIGURE 3

OVERHEAD GROUNDWIRE VERTICAL CONSTRUCTION

NOTE:

1. ARRESTERS MUST BE CONNECTED SUCH THAT IN THE EVENT OF FAILURE, (DISCONNECTOR OPERATION) THE GROUND LEAD WILL NOT COME IN CLOSE PROXIMITY TO ENERGIZED CONDUCTORS OR EQUIPMENT.

2. POLE MUST BE CLASS III-H CONCRETE OR EQUIVALENT.

SUPERSEDES J-2.0.2 LAST REVISED ON 6-22-95

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	12/5/06	UPDATE NOTES	LFV	ELS	JJM
3	10/18/04	ADD ANIMAL GUARD	LFV	ELS	JJM
2	07/27/01	UPDATE DRAWING (ADD NOTE)	LFV	JES	JJM
1	08/09/96	GENERAL REVISION	IA	RAS	JJM

ORIGINATOR: IA

DRAWN BY: RAS

DATE: 06/22/95

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

J

J-2.0.3	300, 600, AND 1200 KVAR CAPACITOR BANK USING SINGLE PHASE 100, 200, AND 400 KVAR UNITS 13 AND 23 KV	J-2.0.3

MODIFIED VERTICAL CONSTRUCTION

CAPACITOR BANKS EQUIPPED WITH POTENTIAL TRANSFORMERS

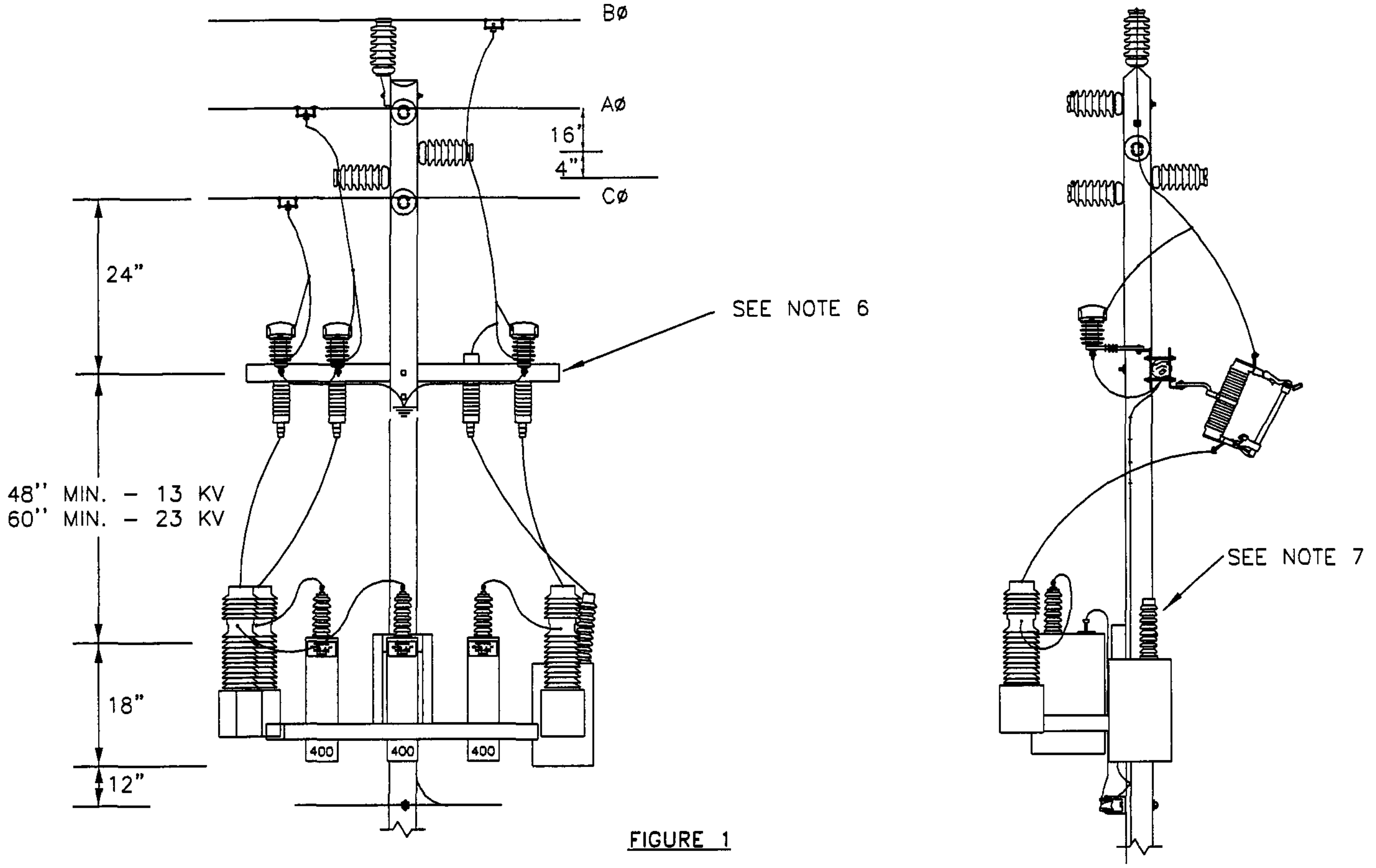


FIGURE 1

MODIFIED VERTICAL CONSTRUCTION

NOTES:
1. FOR FIXED BANKS, FUSE SWITCHES MUST BE INSTALLED ON OPPOSITE SIDE OF CAPACITOR BANK.
2. PORCELAIN ARRESTERS MUST ALWAYS REMAIN ENERGIZED EVEN WHEN THE BANK IS TAKEN OUT OF SERVICE, FOR LONG PERIODS.
3. EXISTING TRANSFORMER SERVICE FOR SWITCHED BANKS MUST NOT EXCEED 300 FEET. IF TRANSFORMER SERVICE IS NOT AVAILABLE WITHIN 300 FEET OR LESS USE CAPACITOR BANK EQUIPPED WITH RACK MOUNTED PT. SEE J-1.0.1 FOR M&S NUMBERS. DUE TO VOLTAGE REQUIREMENTS, FOR BANK SERVICES GREATER THAN 175 FEET USE #2 TRIPLEX INSTEAD OF #6 DUPLEX. FOR POTENTIAL REQUIREMENTS FOR CONTROLS OTHER THAN TIME OR RADIO CONSULT PLANNING DEPARTMENT.
4. FOR CONTROL CIRCUIT WIRING SEE J-3.0.2.
5. CLEARANCES SHOWN BETWEEN DEVICE ARM AND CAPACITOR BANK ARE RECOMMENDED FOR OPERATIONAL PURPOSES ONLY. REFER TO APPROPRIATE T&D PROCEDURES AND THE CAPACITOR SECTION OF SWITCHING MANUAL FOR INFORMATION PERTAINING TO SWITCHING CAPACITOR BANKS.
6. USE 9' ARM FOR ALL NEW CONSTRUCTION.
7. FOR 13KV AND 23KV APPLICATIONS, USE 3/4 A X FUSE M&S #531-600000-1 FOR RACK MOUNTED PT M&S #461-08813-0 (13KV) OR M&S #461-08823-7 (23KV).
8. THE CAPACITORS AND RACK SHALL BE GROUNDED PER THE BONDING NOTE ON J-1.0.1 AND THE PT SHALL BE GROUNDED PER I-5.0.0
9. *POLE MUST BE CLASS III-H CONCRETE OR EQUIVALENT*

SUPERSEDES J-2.0.3 LAST REVISED ON 6/22/95

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
6	12/5/06	ADD NOTE 9	LFV	ELS	JJM
5	10/18/04	ADD ANIMAL GUARDS	LFV	ELS	JJM
4	7/18/03	UPDATE DWG & REVISED NOTE 7	LFV	ELS	JJM
3	07/27/01	REVISED NOTES 2 AND 8	LFV	JES	JJM
2	9/22/99	REVISED NOTES 6 AND 8	LFV	JES	JJM
1	8/09/96	PLACED DRAWING IN REVISED FRAME	IA	RAS	JJM

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: IA DRAWN BY: RAS

DATE: 6/22/95 APPROVED: J.J. MCEVOY, SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES NO SCALE

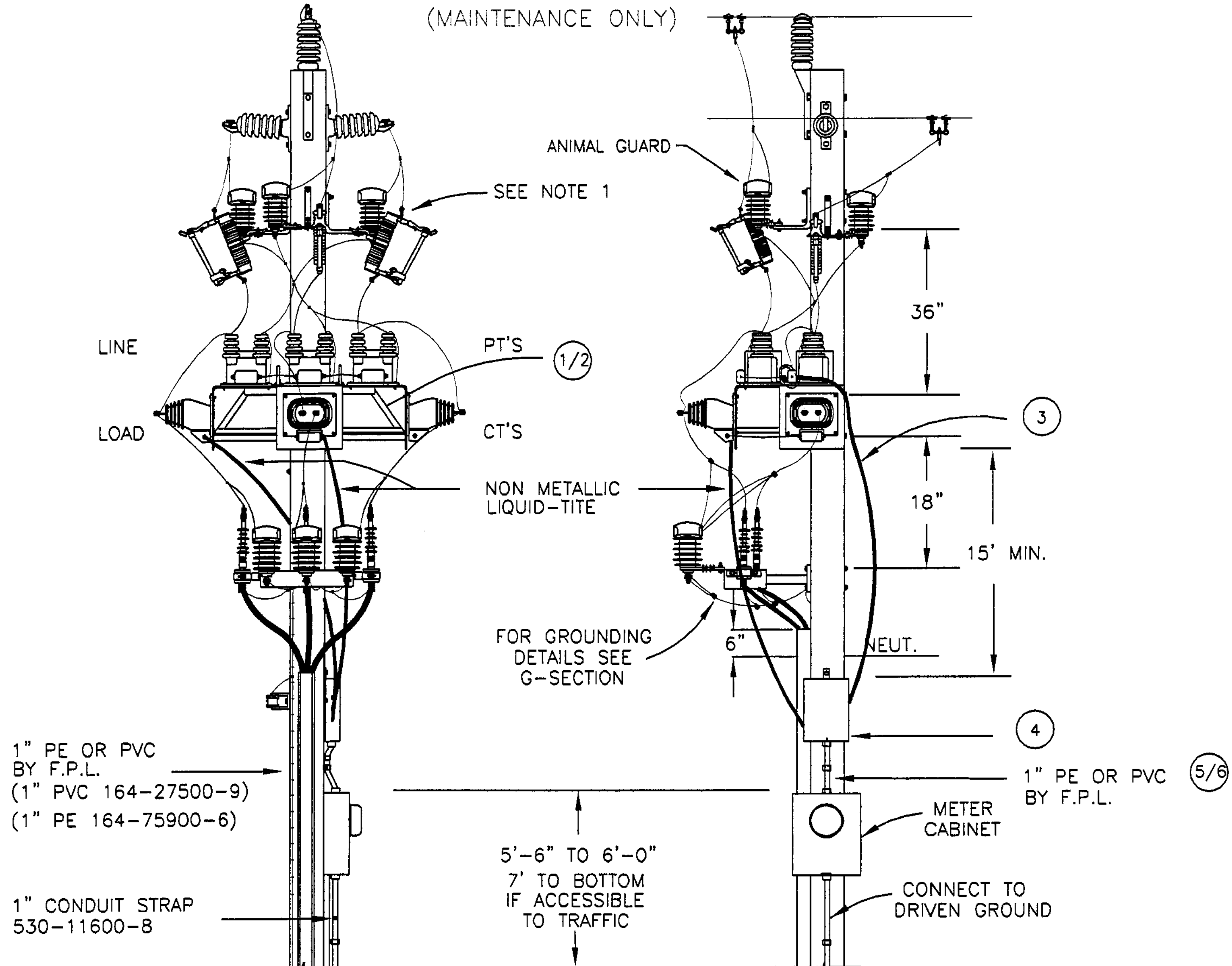
J

K-28.0.0

OUTDOOR PRIMARY METERING INSTALLATION 13 & 23 KV CLUSTER MOUNTED UNDERGROUND SERVICE

K-28.0.0

(MAINTENANCE ONLY)



NOTES:

1. THIS TYPE CONSTRUCTION CAN BE USED ON WOOD OR CONCRETE POLES. ON WOOD POLES WHICH NEED NOT BE CLIMBED, CONSTRUCTION MAY BE AS SHOWN ABOVE CONCRETE POLE. ON WOOD POLES WHICH MUST BE CLIMBED, PROTECTIVE DEVICES SHOULD BE CROSSARM MOUNTED TO FACILITATE OPERATION. REPLACEMENT POLES TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES. FOR INACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE.
2. ALL CONDUIT, METER CABINETS, RACK AND ONE PRIMARY TERMINAL OF PT'S TO BE GROUNDED TO SYSTEM NEUTRAL.
3. METER CABINET AND CONDUT MAY BE MOUNTED ON ANY QUARTER OF POLE AS NECESSARY TO CLEAR OTHER EQUIPMENT.
4. PT'S ARE TO BE TAPPED TO LINE SIDE.
5. PLEASE SEE K-28.1.1 FOR WIRING DETAILS
6. PREFERRED INSTALLATION IS TO RUN URD PRIMARY TO PAD MOUNTED PRIMARY METER.

ITEM	DESCRIPTION	M & S NUMBER
1	15 KV, 3 POSITION PRI METERING MOUNTS	420-71000-6
2	25 KV, 3 POSITION PRI METERING MOUNTS	420-71010-3
3	9/C CONTROL CABLE-NON METALLIC LIQUID-TITE	422-42000-5
4	UTB CABINET	420-00098-0
5	1 INCH PVC SCHEDULE 40	164-27500-9
6	1-1/4 INCH PVC SCHEDULE 40	164-27600-5

SUPERSEDES K-28 LAST REVISED ON 2-28-72

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
6	2/23/07	UPDATE NOTE1 & ADD NOTE 6	JNM	ELS	JJM
5	10/19/04	ADD ANIMAL GUARDS	LFV	ELS	JJM
4	9/5/03	UPDATE DRAWING	JFD	ELS	JJM
3	8/16/01	UPDATE DRAWING (TEXT AND CHART)	JFD	JES	JJM
2	10/6/99	MOVE UBT CAN AND UPDATE WIRING	JFD	JES	JJM
1	6/30/93	UPDATE ORIGINAL DRAWING	EM	EH	RJS

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: EM

DRAWN BY: E. HESS

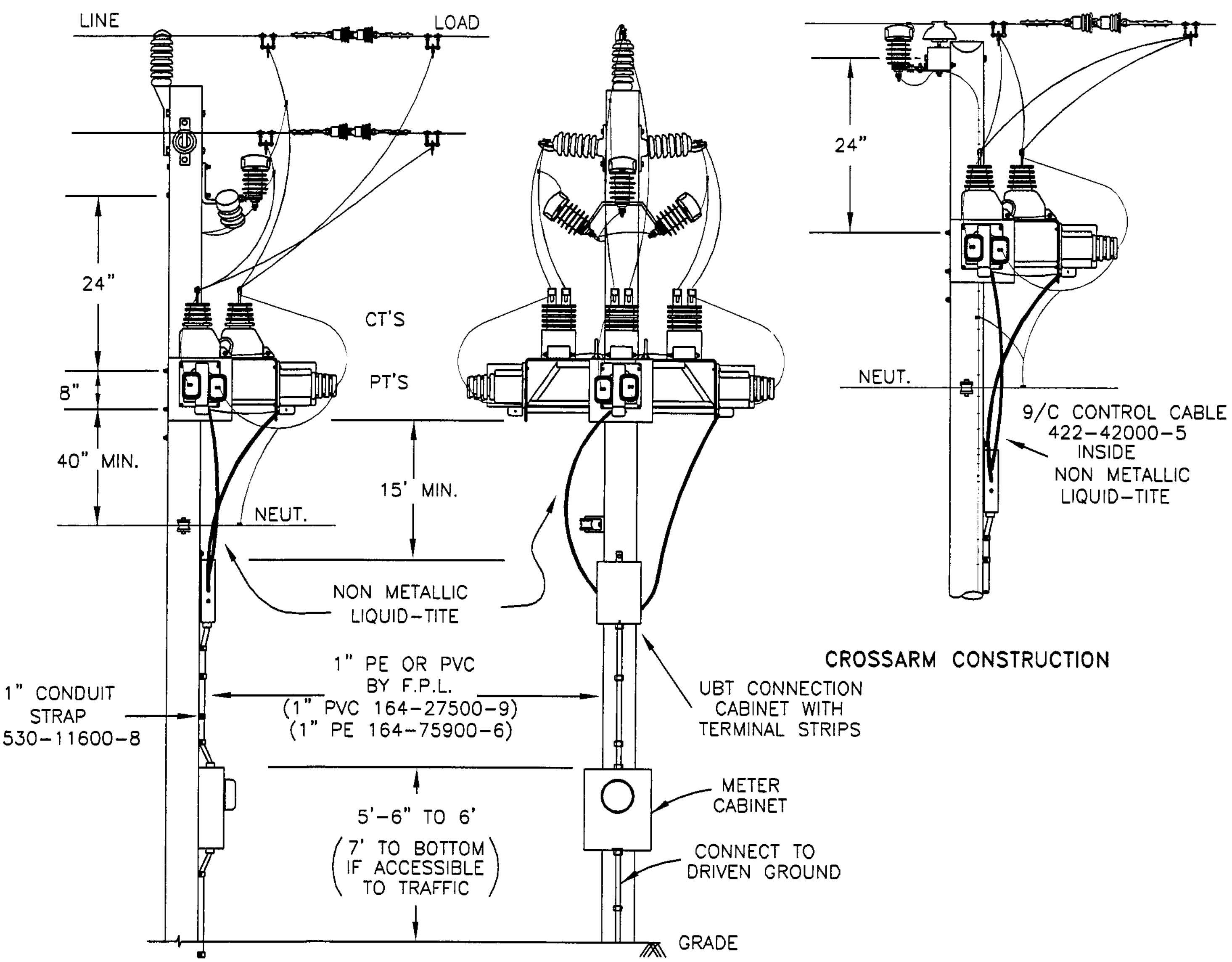
DATE: 7/28/72

APPROVED: R.J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

K

K-28.1.0	OUTDOOR PRIMARY METERING INSTALLATION 13 & 23 KV - CLUSTER MOUNTED OVERHEAD SERVICE	K-28.1.0



POST INSULATOR CONSTRUCTION

NOTES:

1. THIS TYPE CONSTRUCTION CAN BE USED ON WOOD OR CONCRETE POLES. ALL NEW CONSTRUCTION OR REPLACEMENT POLES TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES. FOR INACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE.
2. ALL CONDUIT, METER CABINETS, RACK AND ONE PRIMARY TERMINAL OF PT'S TO BE GROUNDED TO SYSTEM NEUTRAL.
3. METER CABINET AND CONDUIT MAY BE MOUNTED ON ANY QUARTER OF POLE AS NECESSARY TO CLEAR OTHER EQUIPMENT.
4. PT'S ARE TO BE TAPPED TO LINE SIDE.
5. PLEASE SEE K-28.1.1 FOR WIRING DETAILS
6. FUSE SWITCHES OR DISCONNECT SWITCHES ARE TO BE INSTALLED ON THE LINE SIDE AHEAD OF THIS POLE.

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
7	2/23/07	REVISE NOTE 1	JNM	ELS	JJM
6	10/19/04	ADD ANIMAL GUARDS	LFV	ELS	JJM
5	10/30/03	UPDATE DRAWING	JFD	ELS	JJM
4	9/5/03	UPDATE DRAWING	JFD	ELS	JJM
3	7/23/01	UPDATE DRAWING (TEXT)	RAP	JES	JJM
2	10/6/99	MOVE UBT CAN AND UPDATE WIRING	JFD	JES	JJM
1	6/30/93	REDRAWN ON CAD ADD CABINETS	EM	EH	RJS

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: EM

DRAWN BY: E. HESS

DATE: 2/28/72

APPROVED: R.J. SALESKY
DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

NO SCALE

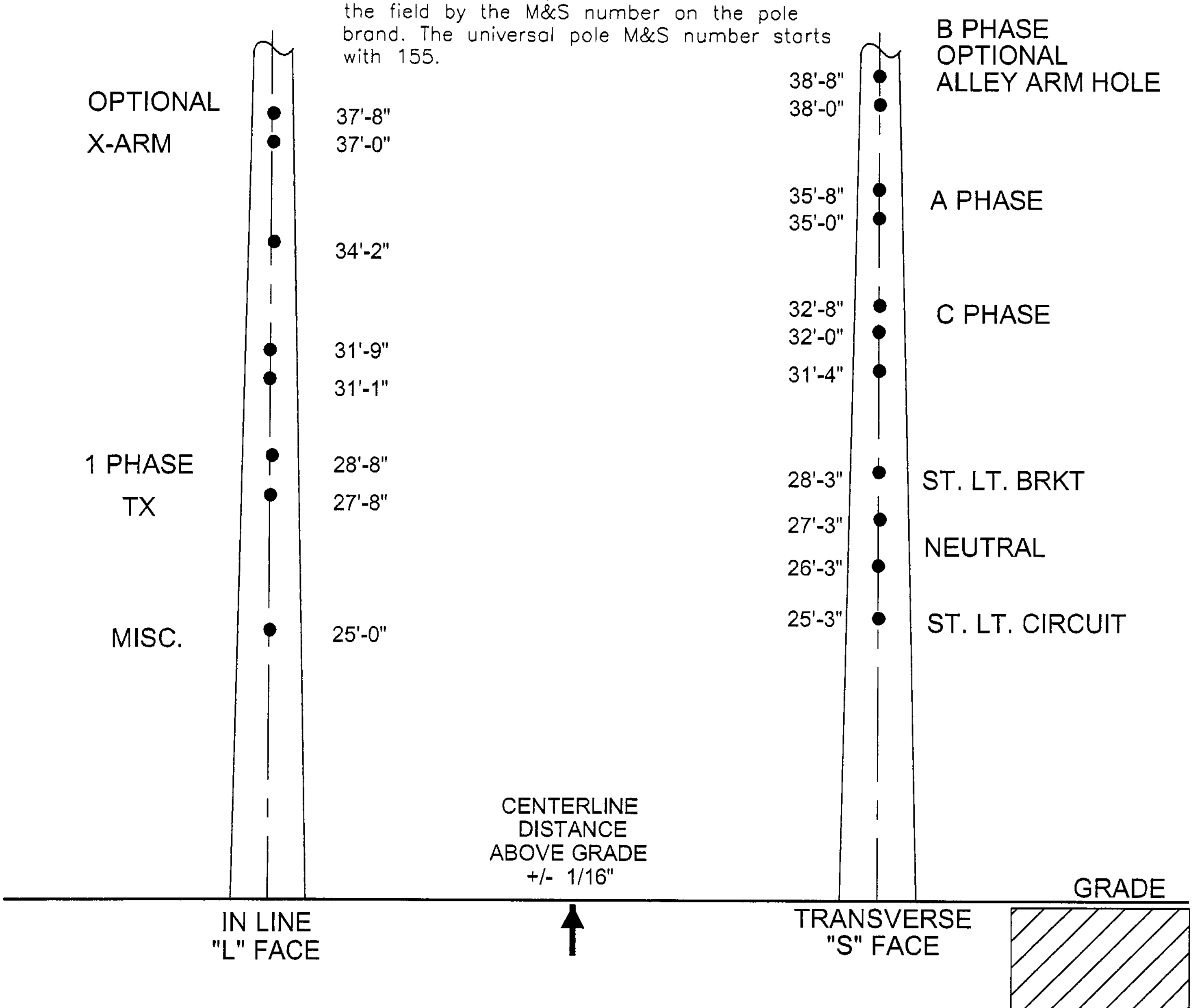
DISTRIBUTION CIRCUITS ON TRANSMISSION POLES UNIVERSAL SPUN CONCRETE POLE

M-2.0.0

The universal pole has holes arranged as shown below. The Universal pole is designed specifically with the holes shown. NO additional holes can be added either in the field or the manufacturing stage. This hole arrangement will allow for standard distribtuion framing:

1. Vertical with 36" separation between Phases
2. Tangent on 8'-6" Steel Crossarm
3. Tangent on 8'-6" Steel Alley Arm
4. Single phase Transformer
5. Lightning arrester Station

NOTE: UNIVERSAL POLES CANNOT BE FIELD DRILLED. Universal pole can be identified in the field by the M&S number on the pole brand. The universal pole M&S number starts with 155.



M

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
3	2/14/07	UPDATE DRAWING (TEXT)	JNM	ELS	JJM
2	3/15/04	UPDATE DRAWING (TEXT)	JNM	ELS	JJM
1	9/8/03	ORIGINAL DRAWING	JNM	ELS	JJM

ORIGINATOR: JNM

DRAWN BY: ELS

DATE: 9/8/03

APPROVED: J.J. MCEVOY
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES

NO SCALE

PRIMARY AND FEEDER RISER POLE POST INSULATOR AND VERTICAL DEADEND CONSTRUCTION

UH-15.0.0

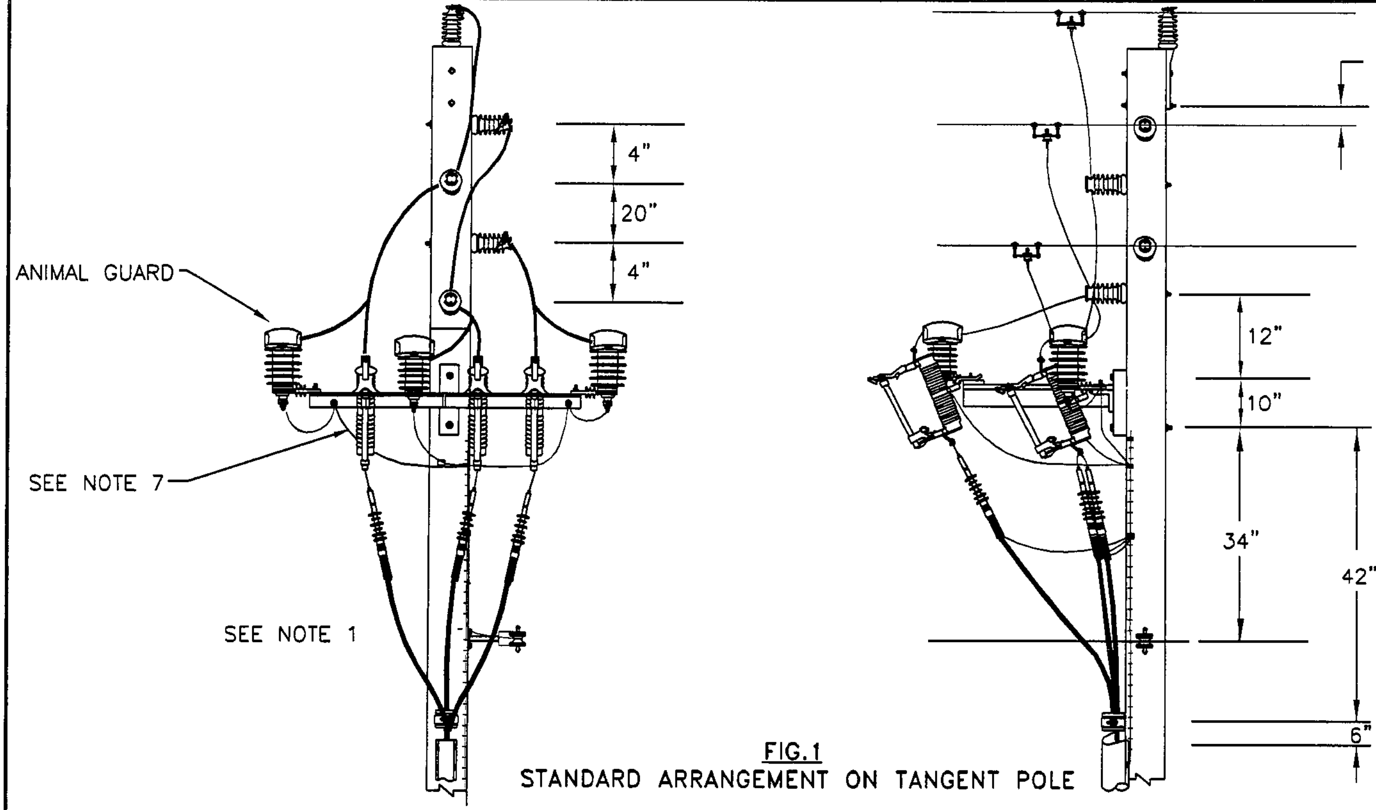


FIG.1
STANDARD ARRANGEMENT ON TANGENT POLE

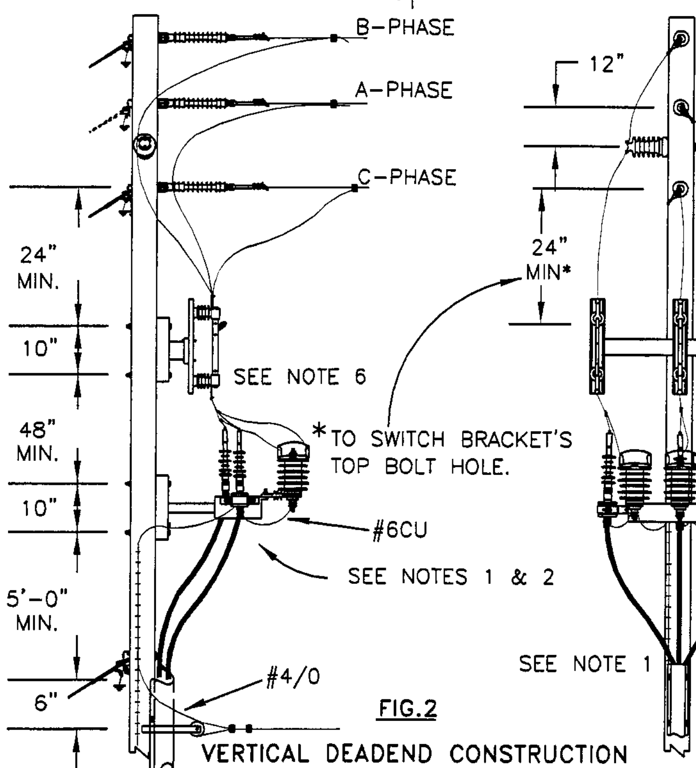


FIG.2
VERTICAL DEADEND CONSTRUCTION
WOOD OR CONCRETE POLE (SEE NOTE 8&9)

NOTES:

1. FOR BONDING AND GROUNDING DETATILS REFER TO SECTION "G".
2. INDIVIDUAL ARRESTER GROUND LEADS MUST BE LONG ENOUGH TO PERMIT PROPER OPERATION OF ISOLATOR.
3. PVC U-GUARD RISER SHOULD BE LOCATED ON POLE TO LEAVE SPACE FOR FUTURE STREET LIGHT BRACKETS.
4. PHASE IDENTIFICATION OF SWITCHES AND TERMINATORS SHOULD BE DETERMINED BY THE ASSOCIATED LINE CONDUCTORS RATHER THAN BY GEOGRAPHICAL LOCATION.
5. ADJUST MOUNTING ANGLE OF ARRESTERS SO SPACING BETWEEN LIVE PARTS IS 12" MIN.
6. USE ONLY DISCONNECT SWITCHES WITH 90° STOPS.
7. EACH ARRESTER GROUND LEAD SHOULD BE INDIVIDUALLY ATTACHED TO POLE BOND.
8. ALL NEW CONSTRUCTION OR REPLACEMENT "01" FEEDER SWITCH POLES TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACCESSIBLE BY AERIAL EQUIPMENT. FOR INACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.
9. ALL NEW CONSTRUCTION FEEDER SWITCH POLES ARE TO BE ACCESSIBLE.

SUPERSEDES UH-15.0.0 LAST REVISED ON 9-30-94

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
7	2/27/07	ADD NOTE 8 AND 9	JNM	ELS	JJM
6	9/17/03	UPDATE DRAWING	CEA	ELS	JJM
5	9/17/03	ADD ANIMAL GUARDS	LFV	ELS	JJM
4	8/27/03	UPDATE DRAWING (NOTES)	LFV	ELS	JJM
3	6/18/03	UPDATE DRAWING (NOTES)	LFV	ELS	JJM
2	8/07/01	UPDATE DRAWING (TITLE AND DIMENSIONS)	RCB	JES	JJM
1	8/09/96	CHANGED PORCELAIN SUSPENSION INSULATORS TO POLYMER AND ADDED NEW MOUNTING BRACKET.	PMG	RAS	JJM

FPL
OH & UG DISTRIBUTION SYSTEM STANDARDS

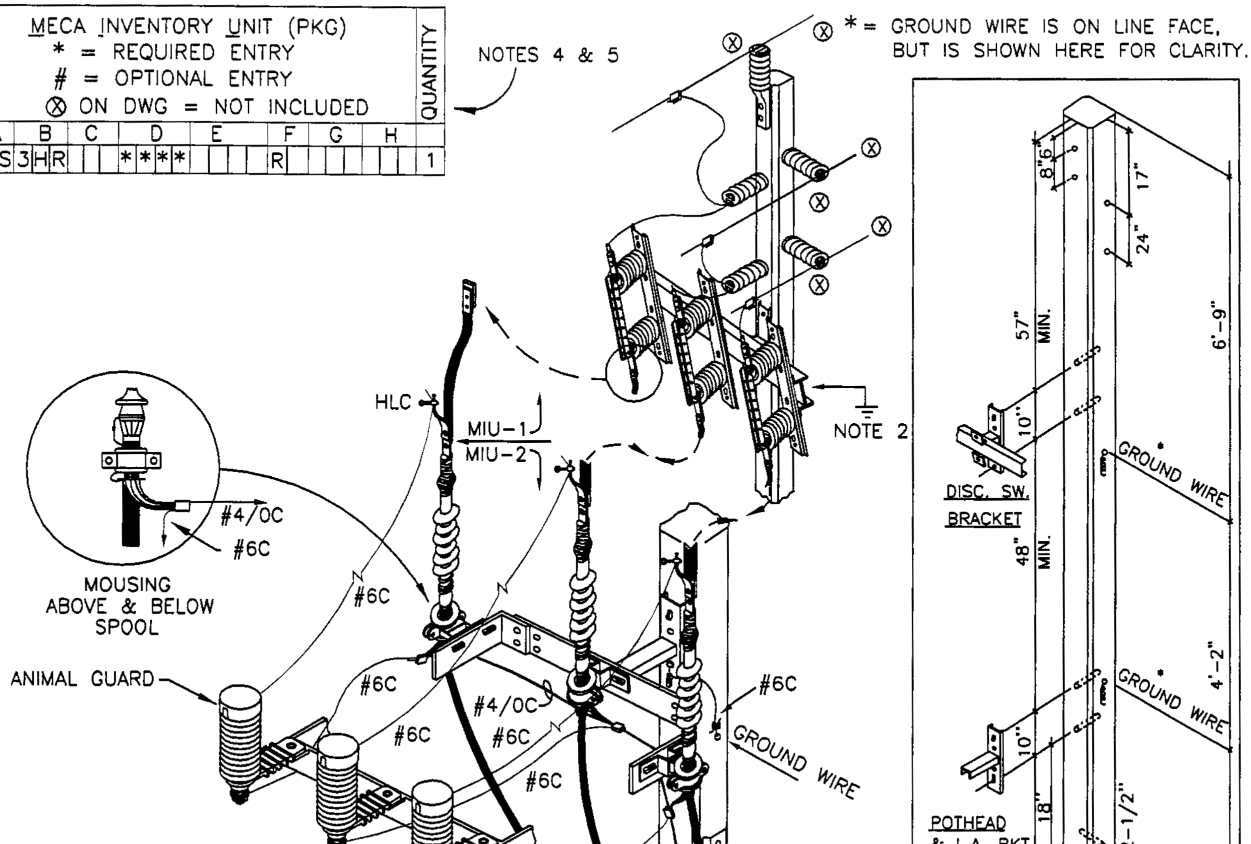
ORIGINATOR: PMG
DRAWN BY: RAS

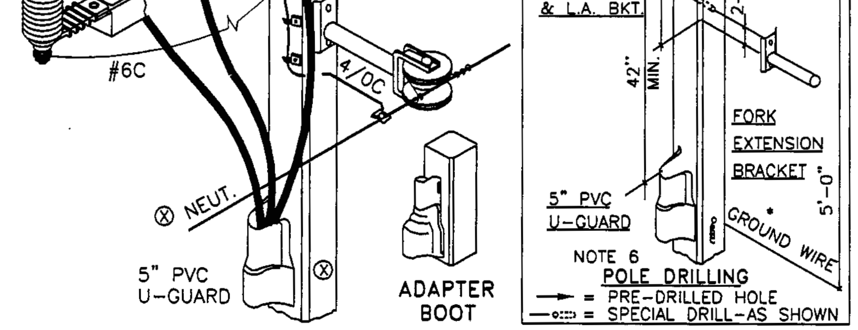
DATE: 9/30/94
APPROVED: JOSE R. DIAZ
SUPERVISOR, OH/UG PRODUCT SUPPORT SERVICES
NO SCALE

THREE PHASE FEEDER RISER
1000 KCMIL 15 OR 25 KV CABLE
FOR SALT SPRAY AND NON SALT SPRAY AREAS

UH-15.3.1

PROCEDURE 49	MIU N°	MECA INVENTORY UNIT (PKG)								QUANTITY
		* = REQUIRED ENTRY # = OPTIONAL ENTRY ⊗ ON DWG = NOT INCLUDED								
		A	B	C	D	E	F	G	H	
09.3	1	DS3	HR		*** *		R			1





NOTES:

1. ALL NEW CONSTRUCTION OR REPLACEMENT "01" FEEDER SWITCH POLES TO BE TYPE III-H OR 4.7 KIP SPUN CONCRETE POLES AND ACCESSIBLE BY AERIAL EQUIPMENT. FOR INACCESSIBLE REPLACEMENT POLE USE A CLASS 2 WOOD POLE OR STRONGER.
2. ALL NEW CONSTRUCTION FEEDER SWITCH POLES ARE TO BE ACCESSIBLE.
3. U-GUARD INSTALLATION SEE UH-14.0.1, UH-14.0.2 DETAILS.
4. FOR BONDING AND GROUNDING, SEE G-9.0.1 PVC U-GUARD DOES NOT REQUIRE BONDING.
5. INSTALL PVC U-GUARD ON POLE QUADRANTS OPPOSITE TRAFFIC FLOW WHENEVER POSSIBLE.
6. INVENTORY UNITS DO NOT INCLUDE PVC U-GUARD RISER.
7. PULL UNITS REQUIRED FOR PRIMARY CONDUCTORS. SEE MECA PROCEDURE 4931.1 FOR EXPLANATION.
8. ILLUSTRATIONS ARE PROPORTIONALLY DRAWN, PRODUCT CONFIGURATION MAY VARY PER SUPPLIER. DIMENSIONS SHALL TAKE PRECEDENCE.

MAJOR MATERIAL	NON-SALT SPRAY AREAS 15 KV	NON-SALT SPRAY AREAS 25 KV	SALT SPRAY AREAS 15 KV	SALT SPRAY AREAS 25 KV
3 SWITCHES	270-38800-4	270-38800-4	270-39000-9	270-39000-9
1 SWITCH BRACKET	141-18200-4	141-18200-4	141-18200-4	141-18200-4
1 POTHEAD EXTENSION BRACKET	163-47400-8	163-47400-8	163-47400-8	163-47400-8
1 L.A. BRACKET	334-55100-4	334-55100-4	334-55100-4	334-55100-4
3 TERMINATORS	163-51100-1	163-51100-1	*163-51100-1	*163-51100-1
3 ZINC OXIDE RISER POLE ARRESTERS	334-22100-4	334-22800-9	334-22100-4	334-22800-9
3 SINGLE SPOOLS, 2-1/2"	160-30600-7	160-30600-7	160-30600-7	160-30600-7
3 U-SUPPORTS	161-50700-6	161-50700-6	161-50700-6	161-50700-6
3 BRAIDS	103-92000-1	103-92000-1	103-92000-1	103-92000-1
3 GROUND STUDS	122-65000-6	122-65000-6	122-65000-6	122-65000-6

* TERMINATOR 163-51100-1 CAN BE UTILIZED IN EITHER SALT SPRAY OR NON-SALT SPRAY AREAS.

SUPERSEDES UH-15-3-1 LAST REVISED ON 6-30-93

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
4	2/27/07	REVISE NOTES & ADD NOTE 1 & 2	JNM	ELS	JJM
3	9/18/03	ADD ANIMAL GUARDS	LFV	ELS	JJM
2	8/27/03	UPDATE NOTE 2	LFV	ELS	JJM
1	9/30/94	REVISED SWITCH M&S NO., RESIZED DRAWING TO FIT & ADDED BORDER	RWS	RAS	RJS

FPL

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: RWS DRAWN BY: RAS

DATE: 6/30/93 APPROVED: R.J. SALESKY NO SCALE

DIRECTOR, DISTRIBUTION ENGINEERING AND OPERATIONS SERVICES

Z-12.0.1	SPUN CONCRETE POLE POLE DIAMETER AND WEIGHT	Z-12.0.1

Spun Concrete Poles Dimensions					Spun Concrete Poles Approximate Weights in Pounds	
	50' and 55' Spun Concrete Pole	60' and 65' Spun Concrete Pole	70' Spun Concrete Pole		Length of Pole	Pole Weights
Distance From Top of Pole in Feet	Outside Dia.	Outside Dia.	Outside Dia.		50'	5,650
	(Inches)	(Inches)	(Inches)		55'	6,410
0 (Top)	9.55	11.35	11.07		60'	8,770
2	9.91	11.71	11.50		65'	9,790
4	10.27	12.07	11.93		70'	12,230
6	10.63	12.43	12.37			
8	10.99	12.79	12.80			
10	11.35	13.15	13.23			
12	11.71	13.51	13.66			
14	12.07	13.87	14.09			
16	12.43	14.23	14.53			
18	12.79	14.59	14.96			
20	13.15	14.95	15.39			
22	13.51	15.31	15.82			
24	13.87	15.67	16.25			
26	14.23	16.03	16.69			
28	14.59	16.39	17.12			
30	14.95	16.75	17.55			
32	15.31	17.11	17.98			
34	15.67	17.47	18.41			
36	16.03	17.83	18.85			
38	16.39	18.19	19.28			
40	16.75	18.55	19.71			
42	17.11	18.91	20.14			
44	17.47	19.27	20.57			
46	17.83	19.63	21.01			
48	18.19	19.99	21.44			
50	18.55	20.35	21.87			
52	18.91	20.71	22.30			
54	19.27	21.07	22.73			
56	19.63	21.43	23.17			
58		21.79	23.60			
60		22.15	24.03			
62		22.51	24.46			
64		22.87	24.89			
66		23.23	25.33			
68			25.76			
70			26.19			
Taper (in/ft)	0.18	0.18	0.216			

NOTE: POLE BRAND IS LOCATED 20' FROM THE BUTT OF THE POLE ON ALL SIZES.

F P L

OH & UG DISTRIBUTION SYSTEM STANDARDS

ORIGINATOR: RJO DRAWN BY: E.SCHILLING

DATE: 6/7/06 APPROVED: J.J. McEVOY NO SCALE

SUPERVISOR, OH / UG PRODUCT SUPPORT SERVICES

NO.	DATE	REVISION	ORIG.	DRAWN	APPR.
2	12/18/06	UPDATE CHART	RJO	ELS	JJM
1	6/7/06	ORIGINAL	RJO	ELS	JJM

Attachment Guidelines and Procedures

ADDENDUM

TO FPL'S PERMIT APPLICATION PROCESS MANUALS,
ATTACHMENT AGREEMENTS AND JOINT USE AGREEMENTS

FPL ATTACHMENT STANDARDS AND PROCEDURES

MAY 4, 2007

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I. SAFETY

SAFETY

It is the responsibility of the attacher to ensure that all persons involved with the application for attachment to FPL poles, and all persons involved with the field engineering, design, installation, construction and ongoing maintenance of these attachments, comply with all applicable federal, state and local safety laws and regulations including the Occupational Safety and Health Act, the National Electrical Safety Code (NESC), any requirements of FPL and any additional safety requirements requested by FPL.

It is also the responsibility of the attacher to warn its employees and contractors that electrical facilities are high voltage facilities and to inform these persons as to safety and precautionary measures which he or she must use when working on or near FPL poles and other facilities.

Proper guying of cables must be accomplished by the attacher.

To ensure that poles are always accessible for workers, particularly in locations inaccessible to bucket trucks, cable risers installed on FPL poles must not interfere with climbing space on the pole.

In all cases, second and third party attachments will be limited to the NESC designated communication space below the electrical supply space on all distribution carried poles with FPL attached. At no time may the communication/CATV worker encroach upon the electric supply space on the pole. Governmental Entities requesting attachments to FPL street light facilities may have certain attachments (i.e. banners, holiday decorations, etc) to those facilities provided that the attachments are installed in accordance with the terms and conditions of their agreements for the use of such facilities.

For any device emitting radio frequency (RF) radiation, to ensure the health and safety of utility workers, attacher shall install electric service disconnects as part of attacher's equipment to enable utility crews and personnel to disconnect power when working on the poles used for attacher's devices. FPL crews will be instructed to disconnect power to attacher's devices prior to working on the pole and to reconnect power to the devices when the work is complete. Furthermore, the attacher MUST label the device with language that advises the utility worker of the emission of RF radiation and advises the utility worker to disable the device.

II. STANDARDS

II. A. ATTACHMENT CRITERIA

No attachment or increase in bundle size of an existing attachment may be made to an FPL pole without prior approval by FPL's permit application vendor or an FPL engineer. (See the Procedures section.) Wireline and telecommunication antenna attachments may only be made to FPL distribution poles. Wireline attachments may be made to transmission poles ONLY if FPL distribution facilities are also attached to the pole. Electric service will be provided to an off-pole location. Power Supplies are not allowed on the pole. Governmental Entities requesting attachments to FPL street light facilities may have certain attachments (i.e. banners, holiday decorations, etc) to those facilities provided that the attachments are installed in accordance with the terms and conditions of their agreements for the use of such facilities.

Attachment Criteria

NON JOINT USE POLE
(no telephone)

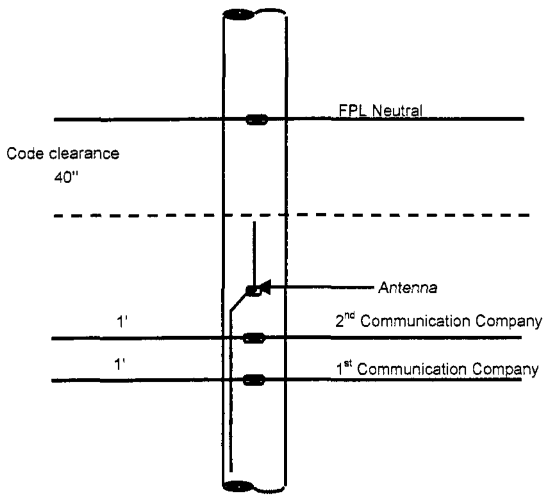


Fig. 1

1. The 1st cable attachment will be located at a height providing minimum clearance over roads, obstacles, etc.
2. All additional cable or antenna attachments will be located 1' above the highest existing communication cable, with antenna highest

JOINT USE POLE
(power & telephone)

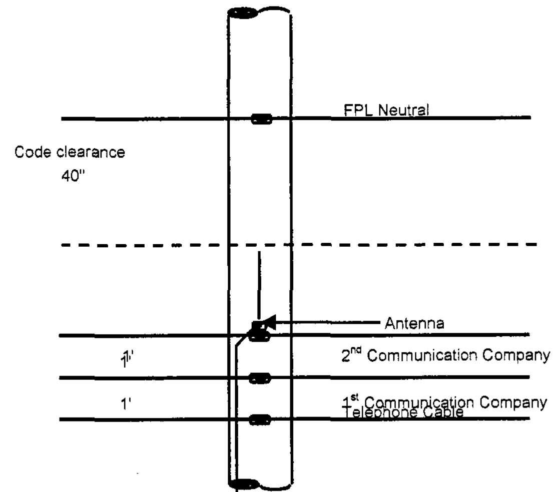


Fig. 2

1. The 1st cable attachment will be located 1' above Telephone's highest cable Attachment
2. The 2nd cable attachment will be located 1' above the existing communication cable
3. The antenna attachment will be a minimum of 1' above highest communication cable

NOTE: No communication cable or antenna attachment will intrude on the 40" NESC code clearance space.

Space Allocation

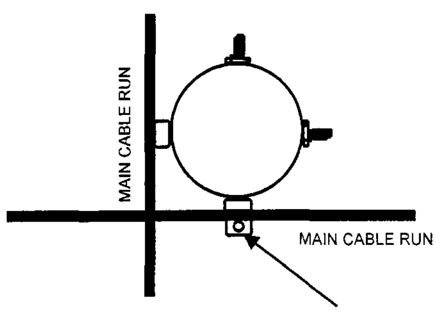


Fig. 3

Antenna

POLE ATTACHMENT LOCATION

1. Attachment is limited to the communication space or lower.
2. All main cable attachments shall be located either on the same side of the pole as FPL's neutral or on one adjacent side.
3. No main line cable attachments shall be located on the side of the pole opposite FPL's neutral.
4. Only 2 sides of the pole, FPL's neutral and one adjacent side, shall be occupied on any given pole.
5. All electrical connections must be made off the pole.
6. No more than two risers will be allowed per pole. FPL's service to Licensee may be one of these risers.

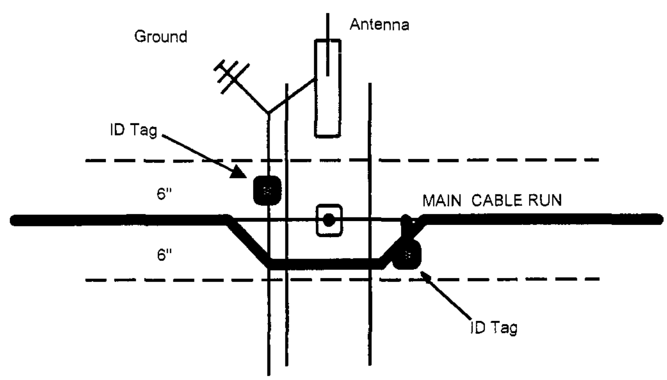


Fig. 4

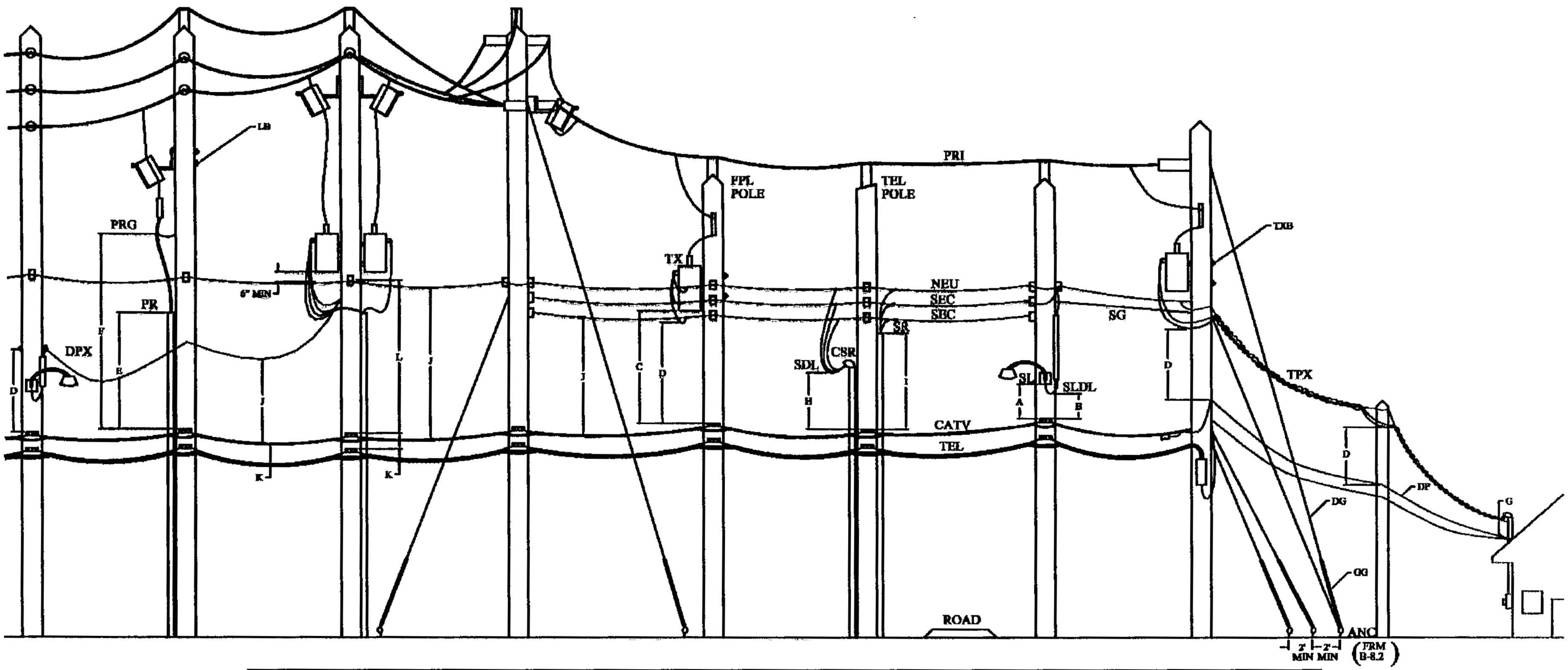
IDENTIFICATION TAG

1. Each separate attachment shall be identified in accordance with FUCC's Foreign Attachment Guidelines specifications.
2. Each company shall register their unique ID tag with the FUCC's Joint Use Subcommittee
3. An ID Tag will be installed at every pole attachment.

II.B. ATTACHMENT CLEARANCES

It is the responsibility of the attacher to ensure that attachments are designed and constructed in accordance with the National Electrical Safety Code and these guidelines, and to secure any necessary permit, consent or certification from state, county or municipal authorities or from the owners of the property to construct and maintain attachments to FPL poles. Wireless antenna clearance requirements are the same as the clearance requirements for CATV and telecommunications facilities.

CLEARANCES OF COMMUNICATION CABLES TO FPL & OTHER FOREIGN UTILITIES



CLEARANCES OF COMMUNICATION CABLES TO FPL & OTHER FOREIGN UTILITIES				
DIMENSION (LETTER)	SEPARATION FROM FOREIGN UTILITIES TO ..	* FPL MINIMUM REQUIREMENT	** NESC MINIMUM REQUIREMENT	NESC APPLICABLE REFERENCE SECTION
A	STREETLIGHT BRACKET	4 INCHES	4 INCHES	238 C. TABLE 238-2
B	STREETLIGHT DRIP LOOP	12 INCHES	12 INCHES	238 D
C	TRANSFORMER BOTTOM	30 INCHES	30 INCHES	238 B. TABLE 238-1
D	SVC DRP LP, SECONDARY	40 INCHES	40 INCHES	235, TABLE 235-5
E	PRIMARY RISER SHIELD	3 INCHES	NONE	239 G1, EXCEPTION 1
F	PRIMARY RISER GROUND	40 INCHES	40 INCHES	239 G1
G	SVC DROP AND DRIP LOOP	12 INCHES	12 INCHES	235 C1, EXCEPTION 3
H	CUSTOMER OWNED SERVICE DRIP LOOP	40 INCHES 16" IF COMMUNICATION CABLE AND RISER OPERATED BY SAME UTILITY	40 INCHES	TABLE 235-5 TABLE 235-5 EXCEPTION 3
I	SERVICE RISER	40 INCHES	40 INCHES	239 G7
J	MID SPAN	30 INCHES	30 INCHES	238-1
K	FOREIGN UTILITIES	12 INCHES	12 INCHES AT POLE; 4 INCHES ALONG SPAN	235 H
L	NEUTRAL	40 INCHES ***	30 INCHES	TABLE 235-5 EXCEPTION 6

* FOLLOW FPL MINIMUM ** NESC INFORMATION PROVIDED FOR REFERENCE ONLY *** WHERE NO SEC IS PLANNED BY FPL, 30" MIN CLEARANCE IS PERMISSABLE IF COMMUNICATION IS BONDED TO FPL'S GROUNDING SYSTEM

II.C. WINDLOADING CRITERIA AND CALCULATIONS

Distribution Design Guidelines

The following guidelines will be used to standardize the design of FPL's overhead distribution facilities when practical, feasible and cost effective.

General

1. Every attempt should be made to place new or replacement poles in private easements or as close to the front edge of property (right of way line) as practical.

2. Overhead pole lines should be placed in front lot lines or accessible locations where feasible.

3. Concrete poles are not to be placed in inaccessible locations or locations that could potentially become inaccessible.

4. When performing work that will affect an existing Top CIF feeder, always contact Storm Secure regional project manager prior to design.

5. When performing new construction, the new pole line will be designed to meet Extreme Wind Load (EWL).

As always, good engineering judgment, safety, reliability, and cost effectiveness should be considered.

In addition to these guidelines, all distribution facilities shall be engineered to meet the minimum requirements set forth in all applicable standards and codes including but not limited to the National Electrical Safety Code (NESC), and Utility Accommodation Guide.

New Construction / Existing / Maintenance

1. When installing and/or replacing a feeder, lateral or service pole on an existing pole line, please reference the pole sizing guidelines listed under the Hardening Design Guidelines section (page 5 of 6) to determine pole class and type.

2. When performing work that will affect a Top CIF feeder, always contact Storm Secure regional project manager prior to design.

3. When extending an existing pole line, the existing pole type, wood or concrete, should be used as a guide for the new poles, while still maintaining the minimum requirements as set forth in these guidelines.

Relocation

1. When relocating either a concrete or wood pole line for a highway improvement project, the existing type pole line should be used as a guide for replacements.

2. When performing work that will affect a Top CIF feeder, always contact Storm Secure regional project manager prior to design.

3. Agency relocation projects should be coordinated with Distribution Planning to take into account potential feeder boundary changes.

Hardening Design Guidelines

The following hardening guidelines will standardize the design of FPL's overhead distribution facilities when feasible, practical and cost effective. Foreign pole owners are required to discuss design requirements with FPL prior to construction. FPL will assist with identifying the critical poles.

1. Concrete poles are preferred in the cases where replacement costs would be extremely high (i.e. Duct system riser pole, corner poles with multiple circuits, critical poles, etc). Please reference the Critical Pole list below for more information.

2. The following list comprises what will be considered critical poles. When installing and/or replacing an accessible critical pole, use concrete. If the pole is inaccessible, use a Class 2 wood pole, or consider relocating the equipment to an accessible concrete pole.

Critical Pole List
1st switch out of the substation [1]
Automated Feeder Switches (AFS)
Interstate / Highway Crossings [1,2]
Capacitor Banks
Poles with multiple primary risers
3 Phase Reclosers
Aerial Auto Transformers
Multi-Circuit Poles [3]
3 phase transformer banks (3-100 kVA and larger)
Regulators
Primary Meter

1) *Every attempt should be made to install storm guys where feasible and practical.*
2) *Refer to the Crossing Multi-Lane Limited Access Highways section for details (pg.4 of 6)*
3) *Contact Storm Secure regional project manager before designing a new multi-circuit line.*

Crossing Multi-lane Limited Access Highways

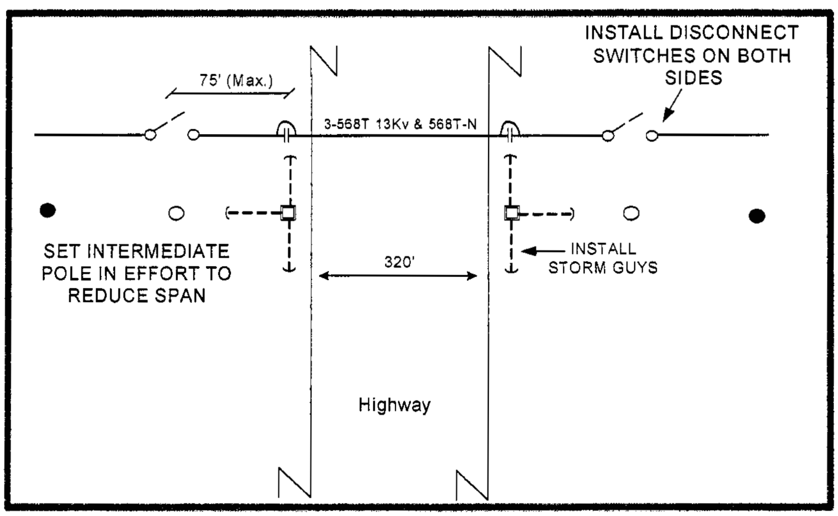
1. Underground installation is the preferred design for all NEW crossings (1, 2 or 3 phase) of multi-lane limited access highways. If underground construction is not feasible or if working on an existing overhead crossing, reference the Overhead Highway Crossing schematic as shown below.

2. Underground crossing for 1 or 2 phases should be designed for potential three phase feeder size cable.

3. For accessible overhead crossings, use concrete poles (III-H or Spun) for the crossing poles and Class 2 wood poles for the adjacent poles. For inaccessible overhead crossings, Class 2 wood poles should be used for the crossing poles and adjacent poles.

4. Every attempt should be made to install storm guys for the highway crossing poles. Storm guys are not required on the adjacent poles.

5. Install disconnect switches on adjacent poles on both sides of the crossing to isolate the feeder section in case of a restoration event. Disconnect switches are to be installed in accessible locations that can be reached with aerial equipment. If there is no load between the nearest existing disconnect switch and the crossing, an additional switch is not required.



Overhead Highway Crossing Schematic

Pole Sizing Guidelines

1. The following tables should be used as guidelines to help determine pole class and type, when installing and/or replacing a feeder, lateral or service pole.
2. When performing work that will affect a Top CIF feeder/customer always contact Storm Secure regional project manager prior to design.

Feeder or Three Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole[3]
Existing Wood	Use Class 2 Wood Pole to meet EWL	Use Class 2 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-H Concrete Pole to meet EWL	Use III-H Concrete Poles	Use III-H Concrete Poles

Single or Two Phase Lateral:

Pole Line Description	New Construction[1]	Existing Infrastructure[2]	Installing or Replacing a Critical Pole[3]
Existing Wood	Use Class 3 Wood Pole to meet EWL	Use Class 3 Wood Poles	Use III-H (Accessible) or Use Class 2 Wood (Inaccessible)
Existing Concrete	Use III-G[4] or III-H poles to meet EWL	Use III-G[4] or III-H poles to match existing line	Use III-H Concrete Poles

1) To be used when extending or relocating a pole line. For span length details, see table below.
2) To be used when replacing a pole or installing an intermediate pole within an existing pole line.
3) Reference Critical Pole List on pg.3 of 6.
4) Use of III-G poles should be limited to existing concrete lateral pole lines whose wire size is less than or equal to #1/0 Aluminum.

Facility	Phases(s)	Wire size	Pole size	Recommended Span Length[5] (FPL with 2 attachments – FPL ONLY) 105 MPH	130 MPH	145 MPH
Feeder		3#568 ACAR	Class 2	180' - 230'	135' - 200'	100' - 150'
		3#3/0 AAAC	Class 2	180' - 250'	180' - 250'	125' - 250'
Lateral	3 PH	3#1/0 AAAC	Class 2	180' - 250'	180' - 250'	155' - 250'
	2 PH	2#1/0 AAAC	Class 3	180' - 250'	180' - 250'	170' - 250'
	1 PH	1#1/0 AAAC	Class 3	180' - 250'	180' - 250'	180 - 250'

5The lower number equates to the maximum span for FPL primary and 2 foreign attachments. The higher number equates to the maximum span for FPL primary only. Reference the addendum DERM tables when adding additional attachment(s) or equipment. Remember to always contact the Storm Secure regional project manager when working on a Top CIF feeder.

Service / Secondary / Street Light / Outdoor Light Poles

When installing or replacing a secondary, service or street light pole, a minimum Class 4 Wood pole should be used. Specific calculations may require a higher class pole for large Quadruplex wire.

As always, good engineering judgment, safety, reliability, and cost effectiveness should be considered.

In addition to these guidelines, all distribution facilities shall be engineered to meet the minimum requirements set forth in all applicable standards and codes including but not limited to the National Electrical Safety Code (NESC) and Utility Accommodation Guide.

<u>**Storm Secure**</u>

Distribution Overhead Line Design for Extreme Wind Loading

ADDENDUM TO
DISTRIBUTION ENGINEERING REFERENCE MANUAL (DERM)

Introduction

In 2006, FPL introduced the concept of "STORM SECURE". One part of this concept is to harden the electrical system by adopting new standards based on extreme wind velocity criteria. The Florida Public Service Commission and the Florida Administrative Code have adopted the 2007 NESC for the applicable standard of construction.

FPL designs its distribution facilities based on the loading as specified in the 2007 National Electrical Safety Code (NESC) using Grade B Construction. The NESC specifies three weather conditions to consider for calculating loads:

Rule 250 B. Combined ice and wind loading (FPL current standard construction)
Rule 250 C. Extreme wind loading
Rule 250 D. Extreme ice with concurrent wind loading (this is a new loading condition in the 2007 NESC that will not impact FPL).

Prior to the hardening effort, FPL has been designing overhead distribution using the loads calculated under Rule 250 B. This addendum provides the designers the information needed to design projects using Rule 250 C, grade B (extreme wind loading) to calculate the loads, when it is determined that the particular pole line is to be designed to meet extreme wind loading (EWL) requirements. The NESC extreme wind map identifies 7 Basic Wind Speeds throughout Florida. In order to minimize the design effort to accommodate these 7 wind speeds, FPL has created 3 wind regions with designated wind speeds of 105 mph, 130 mph, and 145 mph. The Map shown in Figure 4.2.2-1 identifies the counties within our service territory that fall into the 3 wind regions. Whenever extreme wind designs are deployed, they will be designed to the identified wind speed for the location of the work to be done.

4.2.2 Poles Structures and Guying

A. Poles, General Information

1. *Pole Brands*

The pole brand includes the pole length & class, the type of treatment, the manufacturer, the date the pole was manufactured and FPL.

Wood Poles –This brand is located at 15' from the bottom of the pole.

Square (cast) Concrete poles – the brand up until 2007 was located 15' from the bottom. New specifications now require the brand to be at 20' from the bottom of the pole.

Distribution Spun Concrete poles – The brand information is on a metal tag that is located 20' from the bottom of the pole.

2. *Design Specifications*

The NESC specifies 3 Grades of construction: Grade B, Grade C, and Grade N with Grade B being the strongest of the three. These grades of construction are the basis for the required strengths for safety. FPL uses Grade B Construction for all distribution facilities. This means that the calculated loads must be multiplied by "Load Factors" and the calculated or specified strength of structures must be multiplied by "Strength Factors". The Strength multiplied by the Strength Factor (SF) must be equal to, or greater than the Load multiplied by the Load Factor (LF).

Equation 4.2.2-1

$$\text{Strength x Strength Factor} \geq \text{Load x Load Factor}$$

Table 4.2.2 – 1 below lists the Load Factors and Strength Factors for Grade B Construction from NESC Table 253-1 and Table 261-1A.

Table 4.2.2 - 1 Extreme Wind
Strength Factors & Load Factors

Strength of	Strength Factor
Wood Poles	0.75
Concrete Poles	1.00
Composite Poles	1.00
Support Hardware	1.00
Guy Wire	0.90
Guy Anchor and Foundation	1.00
	Load Factor
Extreme Wind Loads	1.00

FPL uses the NESC Extreme Wind Loading for its design criteria. As such, identify the wind speed for the job location and determine the load based on the following formula.

Equation 4.2.2-2

$$Load\ in\ pounds = 0.00256 \times (V_{mph})^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$$

Where,

0.00256 - Velocity-Pressure Numerical Coefficient
V -Velocity of wind in miles per hour (3 second gust)
k_z -Velocity Pressure Exposure Coefficient
G_{RF} -Gust Response Factor
I -Importance Factor, 1.0 for utility structures and their supported facilities.
C_f - Force Coefficient (Shape Factor)
For Wood & Spun Concrete Poles = 1.0
For Square Concrete Poles = 1.6
A - Projected Wind Area, ft^2.

The NESC provides formulas for calculating k_z and G_{RF}. However, Tables are also provided and Table 4.2.2-2 below shows the values needed for most distribution structures.

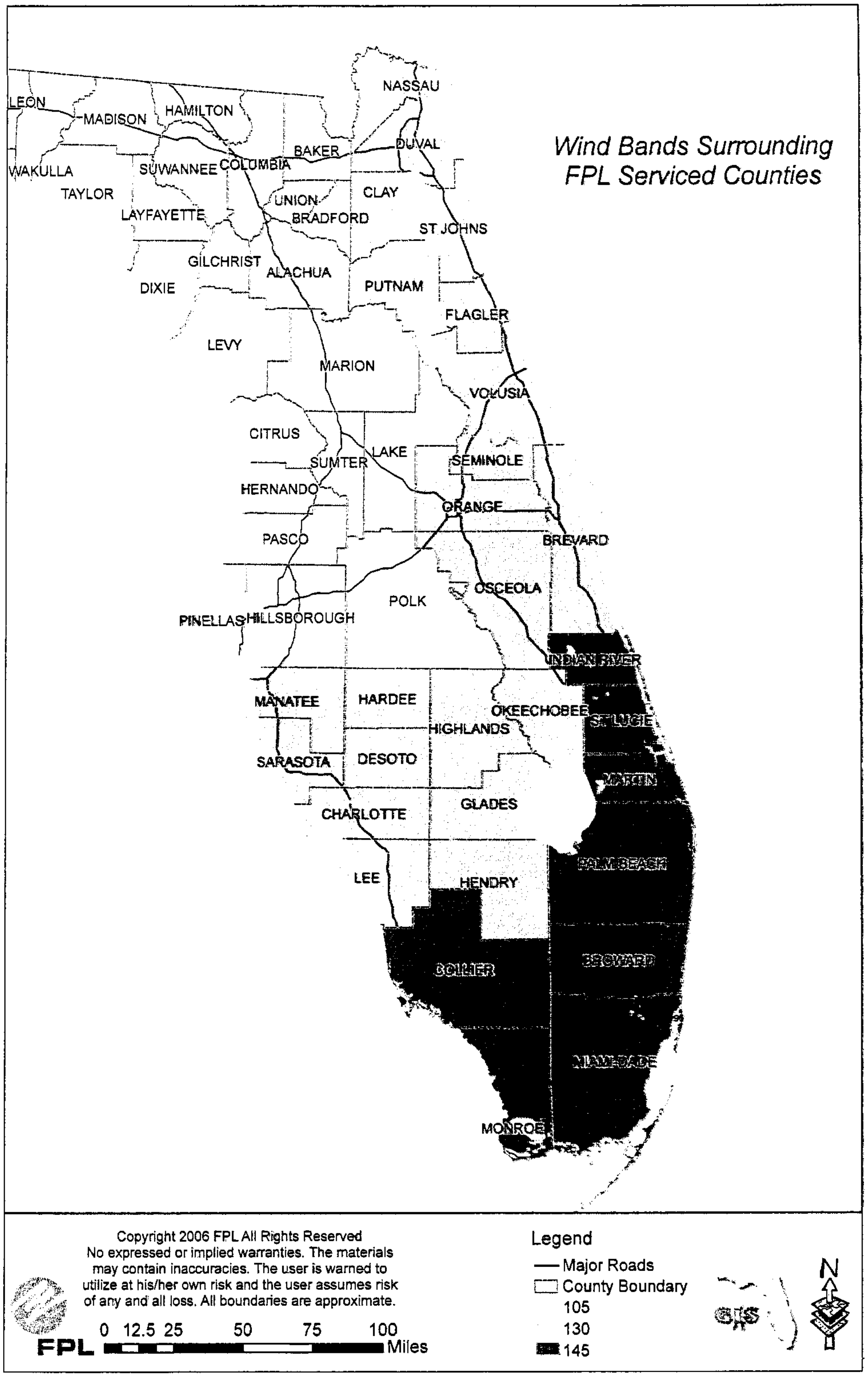
Table 4.2.2-2 Velocity pressure Exposure coefficient (k_z)
and Gust Response Factors (G_{RF})

	Structure		Equipment		Wire		
Height (h)	k_z [1]	G_{RF} [4]	k_z [2]	G_{RF} [5]	k_z [3]	G_{RF} [4] ($L \le 250$ ft)	G_{RF} [4] ($250 < L \le 500$ ft)
≤ 33	0.9	1.02	1.0	1.02	1.0	0.93	0.86
>33 to 50	1	0.97	1.1	0.97	1.1	0.88	0.82
>50 to 80	1.1	0.93	1.2	0.93	1.2	0.86	0.80

1. h for the pole k_z is to be the height of the pole above ground
2. h for the equipment k_z is the height of the center of the area of the equipment above ground
3. h for the wire k_z is the height of the wire above ground
4. h for the G_{RF} is the height above ground for the structure and the wire
5. h for the G_{RF} for the equipment is based on the height of the structure above ground
6. L = design wind span (average of span on both sides of structure)

The wind speeds to be used are shown in Figure 4.2.2 – 1

Figure 4.2.2 –1 Wind Regions by County



3. Wood Pole Strength

The strength of wood poles is specified in the American National Standard – ANSI O5.1-2002. In addition to strength of wood poles, this standard specifies dimensions, shape, sweep spiral grain, knots, and many other characteristics of wood poles.

A change from previous calculations shown in the DERM for allowable pole strength is that the circumference to be used is now considered to be the ground line circumference rather than the "fixity" point circumference. Another change is the strength factor to be used. For extreme wind the strength factor for wood poles is 0.75 (see Table 4.2.2-1)

Example 4.2.2-1:

Determine the pole strength for wind loading on a 45'/2 wood pole that is set 7 feet.

Equation 4.2.2-3 $M_r = 0.000264fC^3$

Where

M_r = Moment (ultimate or long term bowing) measured in foot-pounds

f = Fiber Stress (8000 or 1000 psi for Southern Yellow Pine)

C = Circumference at ground Line (in this example circumference = 40.1 inches)

$M_r = 0.000264 \times (8,000) \times (40.1)^3 = 136,184$ ft.-lbs.

This is the strength for the 45'/2 wood pole. However for design, apply the NESC Strength Factor of 0.75.

The strength of the 45'/2 wood pole = 136,184 x 0.75 = 102,138 ft.-lbs.

4. Concrete Pole Strength

The strength of concrete poles is based on the application of a designated load at a specified location on the pole. This load is measured in KIPS = 1,000 pounds per KIP. A 5 KIP pole is rated based on applying 5,000 pounds of load at two feet below the top of the pole. Most distribution poles are rated by applying the load at two feet down from the top. However, for the type "O", "S", and "SU" poles, this load is applied at one foot down from the top. Like wood poles, concrete poles have a continuous rating (loads that are always on the pole) and a temporary rating (wind loads that come and go). Spun concrete poles (unlike other FPL distribution concrete poles) are designated by their KIP rating rather than a type (i.e., O, S, SU, III, III-G, III- H). Table 4.2.2-3 List the ratings (in KIPS) for the various concrete poles.

Table 4.2.2-3 Concrete Pole Ratings

Pole Type	Temporary Rating	Continuous Rating
O	0.85	0.26
S & SU	0.90	0.30
III	1.30	0.56
III-A	1.30	0.60
III-G	2.40	0.90
III-H	4.20	1.20
12 KIP (square)	8.40	2.40
Spun Concrete		
4.0 KIP	4.00	1.73
4.7 KIP	4.70	2.54
5.0 KIP	5.00	3.03

To calculate the strength of the pole use the following:

For O, S, SU,

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 1 foot)

Example: 35' Type SU for extreme wind loading

M_r = 0.9 KIPS x (35 – 7.5 - 1) = 23,850 ft-lbs

For III, III-A, III-G, III-H

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 2 feet)

Example: 50' Type III-H for extreme wind loading

M_r = 4.2 KIPS x (50 – 11.5 – 2)) = 153,300 ft-lbs

For Spun Concrete

M_r = Rating (Table 4.2.2-3) x (Pole Length – setting depth - 2 feet)

Example: 50'/ 4.7 KIP for extreme wind loading

$$M_r = 4.7 \text{ KIPS} \times (50 - 11 - 2) = 173{,}900 \text{ ft-lbs}$$

For pre-stressed concrete poles, the NESC extreme wind strength factor = 1.0. The values calculated above will be the correct strength for concrete poles.

B. Wind Loading

1. *Wind Loading on poles.*

To calculate the wind load on the pole:

a. Calculate the area of the pole exposed to the wind

Equation 4.2.2-4 $$A = H_1\left(\frac{a+b}{2}\right)\left(\frac{1}{12}''\right)$$

A = projected area above ground line in square feet.
H_1 = the pole's height above the ground line in feet.

For wood and spun concrete poles,
a = diameter at top of pole in inches.
b = diameter of pole at ground line in inches.

For square concrete poles, dimensions a and b are the widths of one face at top and ground line respectively.

b. Calculate the center of the area.

Equation 4.2.2-5 $$H_{CA} = \frac{H_1(b+2a)}{3(b+a)}$$

H_{CA} is used to calculate the ground line moment due to the wind force.

c. Calculate the wind force acting on the area (see Equation 4.2.2-2 with explanation of terms)

Load in pounds = $0.00256 \cdot (V_{mph})^2 \cdot k_z \cdot G_{RF} \cdot I \cdot C_f \cdot A(ft^2)$

<u>Example Calculation for Wood Pole</u>

Pole Length/Class = 45'/2
Setting depth = 7'
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1(ft.)\ x\ \frac{1\ ft}{12\ in}\ x \left[\frac{a + b(inches)}{2}\right]$$

The circumference at the top of a 45'/2 pole is 25",

$$a = \frac{25"}{\pi} = 7.96"$$

The circumference at 38 ft. below the pole top 40.1", $b = \frac{40.1"}{\pi} = 12.76"$

$$A = \frac{38}{12}\ x \left[\frac{7.96 + 12.76}{2}\right] = 32.81\ sq.ft.$$

$$Height\ of\ center\ of\ area, H_{CA} = \frac{H_1(b + 2a)}{3(b + a)} = \frac{38(12.76 + 15.92)}{3(12.76 + 7.96)}$$

$$H_{CA} = Moment\ Arm = 17.53\ ft.$$

Wind Load on Pole =

> 0.00256 x $(145)^2$ x 1.0 x 0.97 x 1.0 x 1.0 x 32.81 = **1713 lbs**
> Where:
> k_z is based on h = 38'; k_z = 1.0
> G_{RF} is based on h = 38'; G_{RF} = 0.97
> C_f = 1.0 for wood and spun concrete poles
> C_f = 1.6 for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

Equation 4.2.2-6

> *M_P = Wind Load x Load Factor x Moment Arm.*
> M_P = 1713 lbs x 1 x 17.53 ft. = 30,030 ft. lbs.

The strength of this pole, previously calculated is 102,138 ft.-lbs. The pole itself has used up 29% (30,030/102,138) of its capacity for 145 mph extreme wind. Subtracting the wind load from the strength leaves 72,108 ft-lbs (102,138 – 30,030) for conductors and other attachments.

Example Calculation for Square Concrete Pole

Pole Length/Class = 50'/III-H
Setting depth = 11.5'
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1(ft.)x\frac{1\,ft}{12\,in}x\left[\frac{a+b(inches)}{2}\right]$$

From Table H, the width of the pole at the top a = 9.00"
The width at ground line, b = 15.75"

$$A = \frac{38.5}{12}x\left[\frac{15.75+9.00}{2}\right] = 39.70\,sq.ft.$$

$$Height\ of\ center\ of\ area,\ H_{CA} = \frac{H_1(b+2a)}{3(b+a)} = \frac{38.5(15.75+18.00)}{3(15.75+9.00)}$$

$$H_{CA} = Moment\ Arm = 17.5\ ft.$$

Wind Load on Pole =

0.00256 x $(145)^2$ x 1.0 x 0.97 x 1.0 x 1.6 x 39.7 = **3317 lbs**

Where:

k_z is based on h = 38.5'; k_z = 1.0

G_{RF} is based on h = 38.5'; G_{RF} = 0.97

C_f = 1.0 for wood and spun concrete poles

C_f = 1.6 for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

M_P = Wind Load x Load Factor x Moment Arm.

M_P = 3317 lbs x 1 x 17.5 ft. = 58,040 ft. lbs.

The strength of this pole, previously calculated is 153,300 ft.-lbs. The pole itself has used up 38% (58,040/153,300) of its capacity for 145 mph extreme wind. Subtracting the wind load from the strength leaves 95,260 ft-lbs (153,300 – 58,040) for conductors and other attachments.

Example Calculation for Spun Concrete Pole

Pole Length/Class = 50'/4.7 KIP
Setting depth = 11'
Wind Region = 145 mph

$$Projected\ Area.\ A = H_1\,(ft.)\,x\,\frac{1\,ft}{12\,inc.}\,x\left[\frac{a+b(inches)}{2}\right]$$

From Table H, the diameter of the pole at the top a = 9.55"
The diameter at ground line, b = 16.57"

$$So\ A = \frac{39}{12}\,x\left[\frac{9.55+16.57}{2}\right] = 42.45\,sq.\,ft.$$

$$Height\ of\ center\ of\ area,\ H_{CA} = \frac{H_1(b+2a)}{3(b+a)} = \frac{39(16.57+19.1)}{3(16.57+9.55)}$$

$$H_{CA} = Moment\ Arm = 17.75\ ft.$$

Wind Load on Pole =
$0.00256 \times (145)^2 \times 1.0 \times 0.97 \times 1.0 \times 1.0 \times 42.45 =$ **2,216 lbs**
Where:
k_z is based on h = 39'; $k_z = 1.0$
G_{RF} is based on h = 39'; $G_{RF} = 0.97$
$C_f = 1.0$ for wood and spun concrete poles
$C_f = 1.6$ for square concrete poles

This load must then be multiplied by the Load Factor, which for extreme wind equals 1.0 and the moment arm to obtain the Ground Line Moment (M_P) of the wind acting on the pole only.

M_P = Wind Load x Load Factor x Moment Arm.
M_P = 2,216 lbs x 1 x 17.75 ft. = 39,341 ft. lbs.

The strength of this pole, previously calculated is 173,900 ft.-lbs. The pole itself has used up 23% (39,341/173,900) of its capacity for 145 mph extreme wind. Subtract the wind load from the strength leaves 134,559 ft-lbs (173,900 – 39341) for conductors and other attachments.

Table 4.2.2-4 Lists the allowable groundline moments for various pole sizes.

Table 4.2.2-4 Allowable Ground Line Moments

Wood Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
35/5	6	32178	28738	26324
35/4	6	42429	38656	36007
40/5	6.5	36936	31956	28460
40/4	6.5	48263	42812	38986
40/3	6.5	61567	55646	51489
40/2	6.5	76998	70607	66119
45/3	7	66363	58624	53190
45/2	7	86391	78000	72108
50/2	7	93535	82611	74941
55/2	7.5	99693	86174	76682
60/1	8	131634	113020	99951

Table 4.2.2-4 Allowable Ground Line Moments (cont.)

Square Concrete Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
35/Type O	7	15426	11417	8602
35/SU	7.5	15323	10778	7588
35/III-G	9	48907	44275	41022
40/III-A	10	23777	17050	12327
40/III-G	9	56781	49950	45154
40/III-H	11.5	96450	88537	82981
40/12 KIP	13	191480	181610	174681
45/III-A	10	24142	14146	7127
45/III-G	9	62676	52592	45511
45/III-H	11.5	110053	98198	89874
45/12 KIP	13.5	222175	208520	198933
50/III-A	10	24111	10635	1173
50/III-G	9.5	67701	54539	45297
50/III-H	11.5	123164	107106	95831
50/12 KIP	13.5	252789	233067	219219
55/III-G	9.5	72176	55004	42947
55/III-H	12	133764	113283	98902
55/12 KIP	14	280155	254873	237121
60/III-H	12	144138	117993	99637
60/12 KIP	14	308835	276454	253719
65/III-H	12	149613	115197	91032

Spun Concrete Poles (in earth)				
Pole Size	Setting Depth	Allowable Moment for Attachments at Designated Wind Speeds		
		105 mph	**130 mph**	**145 mph**
50/4.7 KIP	11	153270	142277	134559
55'/4.7 KIP	12	167116	153482	143910
60'/5.0 KIP	12.5	190953	171477	157803
65'/5.0 KIP	13	202928	177845	160233
70'/5.0 KIP	13.5	214369	183392	161642

2. ***Wind Loading on conductors.***

The wind loading on conductors is calculated in a similar method to the wind loading on the pole. The load in pounds per conductor uses Equation 4.2.2-2 with the appropriate factors for the attachment heights a shown in Table 4.2.2-2.

To calculate the wind load on the conductor:

a. Determine the wind region (105 mph, 130 mph, or 145 mph)
b. Calculate the attachment height to determine the k_z *and* G_{RF} (Table 4.2.2-2)
c. The Importance Factor (I) and the Force Coefficient (C_f) are both equal to 1 for conductors.
d. Calculate the area per foot of conductor
e. Calculate the wind load per foot of conductor
f. Calculate the total wind load on the conductor for the length of conductor exposed to the wind (Average of the Spans on either side of the pole).

Example:
Determine the wind load on a 170 foot length [(180'span + 160'span)/2] of 568.3 ACAR conductor that is attached at 30 feet above the ground in the 145 mph wind region.
From Table 4.2.2-2:

$K_z = 1.0$
$G_{RF} = 0.93$

Calculate the area per foot of conductor
Diameter = 0.879 inches

For a 1 foot length of conductor:
Projected Area.

$$A = 1(ft.)x\left[\frac{Conductor\ Diameter(inches)}{12(inches/ft)}\right]$$

$$A = 1(ft.)x\left[\frac{0.879(inches)}{12(inches/ft)}\right]$$

A = 0.073 Square Ft. for each foot of span length

The wind load in pounds per foot of span length (from Equation 4.2.2-2) is

Load in pounds $= 0.00256 \times (Vmph)^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$

Load in pounds = 0.00256 x $(145)^2$ x 1 x .93 x 1 x 1 x .073
Load = 3.667 pounds per foot

Total Load	=	Length of conductor x Load per foot of conductor
	=	170 x 3.667
Total Load	=	623.3 pounds

This is the load that the wind exerts on the conductor attached at 30 above ground. This load will have to be applied to the pole to determine if the pole has the strength to support the load.

The wind load per foot of conductor for the three wind regions can be found in Table 4.2.2-5, Table 4.2.2- 6 and Table 4.2.2-7.

3. ***Wind Loading on equipment.***
The wind loading on equipment is calculated in a similar method to the wind loading on the pole and the conductors. The load in pounds uses Equation 4.2.2-2 with the appropriate factors for the attachment heights a shown in Table 4.2.2-2 and the area of the equipment.

To calculate the wind load on the equipment:

a. Determine the wind region (105 mph, 130 mph, or 145 mph)
b. Calculate the attachment height to determine the k_z (Table 4.2.2-2)
(For equipment, use the top mounting hole of the equipment bracket.)
c. Use the height of the pole above ground to determine G_{RF} (Table 4.2.2-2)
d. The Importance Factor (I) is equal to 1.
e. The Force Coefficient (C_f) is equal to 1.0 for cylindrical equipment and 1.6 for rectangular equipment.
f. Calculate the area of the equipment
g. Calculate the wind load on the equipment

Example:
Determine the wind load on a 50 kVA transformer mounted at 28 feet on a pole that is 38 feet above the ground in the 145 mph wind region.

From Table 4.2.2-2:
K_z = 1.0 (Equipment ≤ 33' above ground)
G_{RF} = 0.97 (Equipment based on Pole height > 33' to 50' above ground)

$C_f = 1.0$
A = 4.44 square feet

The wind load in pounds from Equation 4.2.2-2 is

$$\textit{Load in pounds} = 0.00256 \times (Vmph)^2 \times k_z \times G_{RF} \times I \times C_f \times A(ft^2)$$

Load in pounds = $0.00256 \times (145)^2 \times 1 \times .97 \times 1 \times 1 \times 4.44$
Load = 231.8 pounds

This is the load that the wind exerts on the transformer attached at 28 feet above ground. This load will have to be applied to the pole to determine if the pole has the strength to support the load.
The wind load on equipment for the three wind regions can be found in Table 4.2.2-5 (105 mph), Table 4.2.2- 6 (130 mph) and Table 4.2.2-7 (145 mph).

Table 4.2.2-5 Wind Force on Conductors & Equipment

Wind Speed = 105 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	1.923	2.001	2.134
3/0 AAAC	0.502	1.098	1.143	1.218
1/0 AAAC	0.398	0.871	0.906	0.966
#4 AAAC	0.250	0.547	0.569	0.607
3/0 TPX	1.238	2.708	2.819	3.005
1/0 TPX	1.026	2.244	2.336	2.490
6 DPX	0.496	1.085	1.129	1.204
CATV				
Feeder w/1/4"Msgnr	0.750	1.641	1.708	1.820
Trunk w/1/4"Msgnr	1.000	2.187	2.277	2.427
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	2.100	2.186	2.330
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	5.020	5.225	5.571

Wind Speed = 105 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	≤33'
25	3.75	108.0	112.9	118.1	102.7
50	4.44	127.8	133.7	139.9	121.6
75	4.81	138.5	144.9	151.5	131.7
100	6.55	188.6	197.3	206.3	179.3
167	10.83	311.8	326.1	341.1	296.5
Capacitors					
Switched (1)	19.91	573.2	599.6	627.1	545.1
Fixed (1)	16.89	486.2	508.6	532.0	462.4
Reclosers					
1 phase	4.00	115.2	120.5	126.0	109.5
3 phase (1)	16.89	486.2	508.6	532.0	462.4
Automation Switches					
Joslyn	8.89	255.9	267.7	280.0	243.4
Cooper	10.56	304.0	318.0	332.6	289.1
S&C	15.60	449.1	469.8	491.4	427.1
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.19	5.4	5.6	5.9	5.1
5" U-Guard	0.46	12.8	13.8	14.4	13.2

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

Table 4.2.2-6 Wind Force on Conductors & Equipment

Wind Speed = 130 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	2.947	3.068	3.270
3/0 AAAC	0.502	1.683	1.752	1.868
1/0 AAAC	0.398	1.334	1.389	1.481
#4 AAAC	0.250	0.838	0.872	0.930
3/0 TPX	1.238	4.151	4.321	4.606
1/0 TPX	1.026	3.440	3.581	3.817
6 DPX	0.496	1.663	1.731	1.845
CATV				
Feeder w/1/4"Msgnr	0.750	2.515	2.617	2.791
Trunk w/1/4"Msgnr	1.000	3.353	3.490	3.721
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	3.219	3.350	3.572
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	7.695	8.009	8.539

Wind Speed = 130 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht ≤33'
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	
25	3.75	165.5	173.1	181.1	157.4
50	4.44	195.9	205.0	214.4	186.3
75	4.81	212.3	222.0	232.2	201.9
100	6.55	289.0	302.4	316.3	274.9
167	10.83	477.9	499.9	522.9	454.5
Capacitors					
Switched (1)	19.91	878.6	919.1	961.3	835.5
Fixed (1)	16.89	745.3	779.7	815.5	708.8
Reclosers					
1 phase	4.00	176.5	184.7	193.1	167.9
3 phase (1)	16.89	745.3	779.7	815.5	708.8
Automation Switches					
Joslyn	8.89	392.3	410.4	429.2	373.1
Cooper	10.56	466.0	487.5	509.9	443.2
S&C	15.60	688.4	720.1	753.2	654.7
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.19	8.3	8.7	9.1	7.9
5" U-Guard	0.46	20.2	21.2	22.1	19.2

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

Table 4.2.2-7 Wind Force on Conductors & Equipment

Wind Speed = 145 mph
CONDUCTORS

		Force in pounds per foot Conductor Height Above Ground		
Conductor	Diameter	≤33'	>33' to 50'	>50' to 80'
568.3 MCM ACAR	0.879	3.667	3.816	4.069
3/0 AAAC	0.502	2.094	2.180	2.324
1/0 AAAC	0.398	1.660	1.728	1.842
#4 AAAC	0.250	1.043	1.085	1.157
3/0 TPX	1.238	5.164	5.375	5.731
1/0 TPX	1.026	4.280	4.455	4.749
6 DPX	0.496	2.069	2.154	2.296
CATV				
Feeder w/1/4"Msgnr	0.750	3.129	3.256	3.472
Trunk w/1/4"Msgnr	1.000	4.171	4.342	4.629
Telephone				
100 pr (24 GA BKMS) Self-Support	0.960	4.005	4.168	4.444
600 pr (24 GA BKMA w/3/8" Msgnr	2.295	9.573	9.964	10.623

Wind Speed = 145 mph
EQUIPMENT

		Pole Height in same range as Equipment Force in pounds at top mounting Bolt Height Above Ground			Pole height >33' to 50' Equipment Ht
Transformers	Sq. Ft.	≤33'	>33' to 50'	>50' to 80'	≤33'
25	3.750	205.9	215.4	225.3	195.8
50	4.440	243.8	255.0	266.7	231.8
75	4.810	264.1	276.2	288.9	251.1
100	6.550	359.6	376.2	393.4	342.0
167	10.830	594.6	622.0	650.5	565.4
Capacitors					
Switched (1)	19.910	1093.1	1143.4	1195.9	1039.5
Fixed (1)	16.890	927.3	970.0	1014.5	881.8
Reclosers					
1 phase	4.000	219.6	229.7	240.3	208.8
3 phase (1)	16.890	927.3	970.0	1014.5	881.8
Automation Switches					
Joslyn	8.890	488.1	510.6	534.0	464.1
Cooper	10.560	579.7	606.5	634.3	551.3
S&C	15.600	856.4	895.9	937.1	814.5
Riser - PVC U-Guard		Force in pounds per foot of riser Height Above Ground			
2" U-Guard	0.188	10.3	10.8	11.3	9.8
5" U-Guard	0.458	25.2	26.3	27.5	23.9

(1) The 1.6 C_f factor for rectangular shape is included in the Area shown for Capacitors and 3 Phase Recloser

The methodology to determine if a pole has the strength for a specific design or to determine the maximum span distance a specific size pole can support for framing, is shown in the examples below. The calculations are based on using the new tables for extreme wind loading. Note that the ground line is now the point used for the calculations rather than the "fixity" point.

Example:

Conductor: 3-568.3 MCM ACAR and #3/0 AAAC - Neutral

Framing: Modified Vertical and single phase transformer

Transformer: 50 kVA

CATV: Trunk

Telephone: 1-600 pair, 24 gauge, BKMA

Average Span Length = 150 feet

Attachment heights must be calculated using the framing identified and the pole setting depths as shown in table 4.2.2-4.

Case I: Determine if a 45'/2 wood pole is strong enough for this design.

Calculate the moments on the pole.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	39.00	=	22324
568.3	1	x	3.816	x	150	x	36.60	=	20950
568.3	1	x	3.816	x	150	x	34.60	=	19805
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	29.4	=	9235
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	23.6	=	14765
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	22.6	=	32452
					TOTAL MOMENT DUE TO CONDUCTOR			=	119531
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		29.9	=	6931
					TOTAL MOMENT DUE TO EQUIPMENT			=	6931 ft.-lb.
							TOTAL ALL MOMENTS	=	**126462 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 45'/2 wood pole in a 145 mph wind region is 72,108 ft-lbs. A 45'/2 wood pole cannot be used.

Case II: Determine if a 50'/III-H square concrete pole is strong enough for this design

Table 4.2.2-4 shows a revised setting depth for square concrete poles. The new setting depth is generally 5 feet deeper than previous. A 50'/III-H square concrete pole is set 11.5 feet deep.

Re-calculate the moments based on attachment heights.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	39.50	=	22610
568.3	1	x	3.816	x	150	x	37.08	=	21225
568.3	1	x	3.816	x	150	x	35.08	=	20080
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	29.92	=	9398
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	24.08	=	15066
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	23.08	=	33142
					TOTAL MOMENT DUE TO CONDUCTOR			=	121519
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.42	=	7051
					TOTAL MOMENT DUE TO EQUIPMENT			=	7051 ft.-lb.
							TOTAL ALL MOMENTS	=	**128571 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 50'/III-H square concrete pole in a 145 mph wind region is 95,831 ft-lbs. A 50'/III-H square concrete pole cannot be used.

Case III: Determine if a 50'/4.7 KIP spun concrete pole is strong enough for this design.

Table 4.2.2-4 shows the setting depths for spun concrete poles. A 50'/4.7 KIP spun concrete pole is set 11 feet deep.

Re-calculate the moments based on attachment heights.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	150	x	40.00	=	22896
568.3	1	x	3.816	x	150	x	37.58	=	21511
568.3	1	x	3.816	x	150	x	35.58	=	20366
Neut., Sec., St Lt									
3/0	1	x	2.094	x	150	x	30.42	=	9555
CATV - PROPOSED									
Trunk	1	x	4.171	x	150	x	24.58	=	15378
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	150	x	23.58	=	33860
					TOTAL MOMENT DUE TO CONDUCTOR			=	123566
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.92	=	7167
					TOTAL MOMENT DUE TO EQUIPMENT			=	7167 ft.-lb.
					TOTAL ALL MOMENTS			**=**	**130733 ft.-lb.**

From Table 4.2.2-4, the allowable moment for attachments to a 50'/4.7 KIP spun concrete pole in a 145 mph wind region is 134,559 ft-lbs. A 50'/4.7 KIP spun concrete pole can be used.

The maximum span distance for each of the poles above can be determined.

Determine the moment due to 1 foot of conductor moments

Subtract the moment due to the transformer from the total allowable moment

Divide the remaining allowable moment by the total 1 foot conductor moments.

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	39.00	=	149
568.3	1	x	3.816	x	1	x	36.60	=	140
568.3	1	x	3.816	x	1	x	34.60	=	132
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	29.4	=	62
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	23.6	=	98
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	22.6	=	216
					TOTAL MOMENT DUE TO CONDUCTOR			=	797
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		29.9	=	6931
					TOTAL MOMENT DUE TO EQUIPMENT			=	6931 ft.-lb.
						TOTAL ALL MOMENTS		=	**7728 ft.-lb.**

Maximum Allowable moment on 45'/2 pole =	72108
Transformer Moment	6931
Available for conductors	65177
Conductor Moments per foot of span =	797
Maximum span distance =	**82 ft.**

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	39.50	=	151
568.3	1	x	3.816	x	1	x	37.08	=	141
568.3	1	x	3.816	x	1	x	35.08	=	134
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	29.92	=	63
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	24.08	=	100
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	23.08	=	221
					TOTAL MOMENT DUE TO CONDUCTOR			=	810
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.42	=	7051
					TOTAL MOMENT DUE TO EQUIPMENT			=	7051 ft.-lb.
						TOTAL ALL MOMENTS		=	**7861 ft.-lb.**

Maximum Allowable moment on 50/III-H pole =	95831
Transformer Moment	7051
Available for conductors	88780
Conductor Moments per foot of span =	810
Maximum span distance =	**110 ft.**

CONDUCTORS	Number of Conductors	x	Wind Load Per Ft. (Table 4.2.2-7)	x	Avg. Span Length	x	Height Above Ground	=	MOMENT (ft.-lb.)
Primary									
568.3	1	x	3.816	x	1	x	40.00	=	153
568.3	1	x	3.816	x	1	x	37.58	=	143
568.3	1	x	3.816	x	1	x	35.58	=	136
Neut., Sec., St Lt									
3/0	1	x	2.094	x	1	x	30.42	=	64
CATV - PROPOSED									
Trunk	1	x	4.171	x	1	x	24.58	=	103
TELEPHONE									
600 pr 24 Ga BKMA	1	x	9.573	x	1	x	23.58	=	226
					TOTAL MOMENT DUE TO CONDUCTOR			=	824
EQUIPMENT			Wind Load Force in lbs				Height Above Ground	=	MOMENT (ft.-lb.)
TRANSFORMERS	(SEE TABLE FOR INSTRUCTIONS)								
1 Phase	50 kva		231.8		x		30.92	=	7167
					TOTAL MOMENT DUE TO EQUIPMENT			=	7167 ft.-lb.
						TOTAL ALL MOMENTS		**=**	**7991 ft.-lb.**

Maximum Allowable moment on 50'/4.7 KIP po	134559
Transformer Moment	7167
Available for conductors	127392
Conductor Moments per foot of span =	824
Maximum span distance =	**155 ft.**

Note: In some cases, the limiting factor for maximum span distance is not the wind loading, but the required clearance above the ground and above other conductors or cables. The attachment heights on the pole must be determined for all facilities at the appropriate operating temperatures and sags as defined by the NESC.

C. *Storm Guying*

One method to overcome the overload on a pole due to transverse wind load is to add storm guys. Storm guys are installed in pairs(back to back) – one on each side of the pole perpendicular to the pole line. These guys should typically be installed 6 inches to 2 feet below the primary attachments.

Calculating the size of the guy wire is very much like calculating a deadend guy.

1. Calculate the transverse wind load on the pole, conductors and all attachments and equipment.
2. The load is then used to size the guy wire based on the load, the attachment height and lead length.
3. A final check should be made to verify that the strength of the pole above the guy attachment is adequate.

Using the example of Case I above for the 45'/2 pole, calculate the size of the storm guys and anchors required for extreme wind loading.

1. Transverse wind loads:

Pole	=	Wind load on pole
Primary	=	Wind Load per ft x span length x number of conductors
Neutral	=	Wind Load per ft x span length
CATV	=	Wind Load per ft x span length
Telephone	=	Wind Load per ft x span length
Transformer	=	Wind Load

Load on Pole	=							1713	pounds
Primary	=	3.816	x	170	x	3	=	1946	pounds
Neutral	=	2.094	x	170	x	1	=	356	pounds
CATV	=	4.171	x	170	x	1	=	709	pounds
Telephone	=	9.573	x	170	x	1	=	1627	pounds
Transformer	=	231.8	x	1			=	232	pounds
				Total Load			=	6583	pounds

2. Determine the guy wire size and anchor size required for this installation.

   To calculate the tension in the guy wire use the equation below

   Equation 4.2.2-7 $T_{DG} = \frac{T_{TWL}}{L} x \sqrt{H_G^{\ 2} + L^2}$

Where:

T_{DG} = Tension in down guy
T_{TWL} = Transverse Wind Load
L = The down guy Lead length
H_G = The attachment Height of the down guy

Use the total transverse wind load for the load to be guyed with the guy attached 6 inches below C phase primary (34.1') and a lead length of 20 feet.

$$T_{DG} = \frac{6583}{20}\sqrt{(34.1)^2 + (20)^2}$$

T_{DG} = 13,013 Pounds

For extreme wind loading, the required strength of the guy wire is equal to the rated breaking strength of the guy wire x 0.9.

Table 4.2.2-11 Storm Guy Strength

Guy Size	Rated Breaking Strength (RBS)	Allowable Guy Tension .9 X RBS
5/16	11200	10080
7/16	20800	18720
9/16	33700	30330

For this example, a 7/16" guy will be installed in each direction perpendicular to the pole line. Use the tension in the down guy to select the appropriate anchor. In this case, a 10" screw anchor will do the job.

3. One final check is to be sure that the pole length above the storm guy attachment has sufficient strength to support the load above it. Basically, this is just like calculating the strength of the total pole but now the "ground line" is at the storm guy attachment height and all of the facilities above this point will create a moment here.

   With the top of the pole at 38' and the down guy at 34.1 feet, the length of pole exposed to the wind is now 38-34.1 = 3.9 ft.

   Use equation 4.2.2-3 to determine the strength of this section of pole.

The circumference at 3.9 feet down from the top of the pole = 26.5 inches

M_r = 0.000264 x (8,000) x $(26.5)^3$ x 0.75 = 29,478 ft.-lbs.

Use equation 4.2.2-4 to find the area of this section of pole

$$A = 3.9(\frac{25+26.5}{2})(\frac{1}{12}'') = 2.66sqft$$

Use equation 4.2.2-5 to find the center of the area of this section of pole

$$Height\ of\ center\ of\ area, H_{CA} = \frac{3.9(8.44+2(7.96))}{3(8.44+7.96)} = 1.93ft$$

Use equation 4.2.2-2 to find the wind load on this section of pole

Load in pounds = 0.00256 x $(145)^2$ x1.0 x0.97 x 1 x 1x 2.66= 139 pounds

Use equation 4.2.2-6 to determine the moment due to the wind load on this section of the pole at the guy attachment point

Moment = 1.93 x 139 = 269 ft lbs

Determine the moment created by the wind load on the conductors

Primary	=	3.816	x	170	x	1	x	4.9	=	3179	Ft-Lbs
	=	3.816	x	170	x	1	x	2.5	=	1622	Ft-Lbs
	=	3.816	x	170	x	1	x	0.5	=	324	Ft-Lbs
										5125	Ft-Lbs

Total Moment = 269 + 5125 = 5393 Ft-Lbs

This load is well under the strength calculated above and the design using storm guys will meet requirements.

4.2.3 Pole Framing

A. *Slack Span Construction*

Slack span construction is employed where it is impractical to follow conventional guying practices. The proper application is a pull-off from either a tangent pole or a properly guyed deadend pole to another properly guyed deadend pole. The intent is not to slack span to a stand alone (self-support) pole unless that pole has been properly sized for this application. Improper use of slack span construction can cause a pole to bow or lean which then can cause more slack in the conductors. More slack in the conductors can result in improper clearances and increased potential for conductors to make contact with each other.

The initial sag when installing slack spans limits the per conductor tension to 50 pounds.

Slack Span design criteria:

1. Vertical construction is preferred for two and three phase installations. Maintain 36" separation between phases at the poles.
2. Limit the span lengths to

Table 4.2.2-12 Slack Span Length & Sag

SLACK SPAN		
CONDUCTOR	MAXIMUM LENGTH	INITIAL SAG
568.3 ACAR	50'	3'-7"
3/0 AAAC	75'	2'-9"
1/0 AAAC	95'	2'-10"

3. Use class 2 poles minimum.
4. If crossarm construction is used, use the 9 foot heavy duty wood crossarms or the 8'6" steel crossarm for added horizontal spacing.

B. ***Targeted Poles***

There are many poles in the distribution system identified as Targeted Poles. These poles are deemed critical by virtue of the equipment mounted on them or their importance to maintaining the system. As stated in The Distribution Design Guide "The following list comprises what will be considered targeted poles. When installing and/or replacing an accessible targeted pole, use a III-H concrete pole or a spun concrete pole for spans greater than 300 feet. If the pole is inaccessible, use a Class 2 pole, or consider relocating the equipment to an accessible concrete pole."

Targeted Pole List

"01" Feeder Switch Poles (first pole outside the substation)
Automated Feeder Switches
Interstate/Highway Crossings
Capacitor Banks
Multiple Primary Risers
3 Phase Reclosers
Aerial Auto Transformers
Multiple Circuits
3 phase Transformer Banks (3-100 kVA and larger)
Regulators
Primary Meter

The targeted pole also should meet the design criteria for wind loading as previously shown.

C. ***Distribution Design Guidelines***

The Storm Secure Organization has developed a set of guidelines for Distribution Designers to use when designing or maintaining distribution facilities. The designer can go online to see the most current version.

III. PROCEDURES

III.A. PROCEDURES FOR JOINT USERS

FPL and Incumbent Local Exchange Carriers (ILEC) explore the benefits of joint use and share the cost of pole ownership.

New Construction

1. Before facilities are designed and put into place, the FPL engineer and the ILEC engineer discuss the needs of both companies and the requirements for design by either the detail plans filed with the FPSC or the existing joint use agreement.
2. The joint use agreement for each company dictates which company sets the new pole(s)
3. If FPL is building the pole line, a notice of build is sent by FPL to all CATV companies and telecommunication carriers with attachment agreements in the area.
4. If FPL is building the new pole line CIAC will be collected for the increased size and strength required to accommodate the facilities of all parties requesting attachments.

There are times when the ILEC determines they would like to attach to a pole they previously were not attached to or they wish to modify their facilities, which would in turn increase the loading on a pole

Existing Poles

1. If the ILEC is increasing load on the pole, it is imperative for the ILEC engineer to learn if the pole has been hardened or if the pole now has stronger windloading requirements due to detail plans filed with the FPSC. This is true if the pole is owned by FPL or the ILEC. Discussion with the FPL engineer will help determine the design criteria of the pole.
2. If the new attachment would compromise the loading standard, the ILEC engineer may request make-ready from the FPL engineer to accommodate their attachments. A contribution will be charged in accordance with our agreement.

III.B. PROCEDURES FOR THIRD PARTIES (CATV AND TELECOMMUNICATION CARRIERS (non-ILECs))

1) **APPLY** for permit.

- When making new attachments or overlashing to existing attachments where the resulting bundle is heavier than the existing attachment or has an increased diameter over that of the existing attachment, apply for permit for attachments to FPL poles. Apply for a permit for Non-FPL poles that require FPL make-ready.

- Remember that permits are not granted for attachments to poles that are exclusively part of an FPL street lighting system.

- The attachment permit is for CATV cables, wires and supporting hardware only, not for power supplies, amplifiers or similar equipment.

- Create appropriate permit application package(s):

    - Non-make ready

    - Make ready (requires design, cost approval, invoice, payment, and construction of FPL work order prior to FPL permit approval)

    - Major rebuild or upgrade

- Review permit application package for accuracy and completeness to avoid rejection.

- Submit complete permit package.

2) **RECEIVE** approved permit. (Exhibit "A")

3) **CONSTRUCT** attachments.

- You must have an approved permit. (Exhibit "A")

- You must complete construction within 60 days of permit approval (180 days if Major rebuild permit), or permit will automatically expire, and you will need to re-apply.

- Build facilities as designed in approved permit package.

- Conform to FPL requirements (clearances, tagging, bonding, etc.) and NESC standards.

- Field review facilities for compliance upon completion of construction.

4) NOTIFY of construction completion. (Exhibit "B")

- Send notice monthly (provided there have been attachments/removals during that month). Remember to include all routine attachments to drop or lift poles.

- Notice (Exhibit "B") must be sent to permit process contractor (Alpine).

- Notice (Exhibit "B") must be sent within 30 days after construction of the attachments is complete.

III.C. PROCEDURES FOR GOVERNMENTAL ATTACHMENTS

Attachment Permits are required for:
- New attachments to FPL poles
- Overlashings of existing attachments to FPL poles where the resulting bundle is heavier than the existing attachment or has an increased diameter over that of the existing attachment
- Major rebuilds or upgrades
- Attachments to non-FPL poles that require FPL make-ready

The attachment permit is for Licensee cables, wires and supporting hardware only, not for power supplies, amplifiers or similar equipment.

Wireline attachments are not allowed to poles exclusively a part of an FPL street lighting system.

Permits requiring FPL make-ready will not be approved until FPL design, payment by the Applicant, and construction is completed by FPL.

PERMIT APPLICATION PROCESS

1. Field Survey - Identify ownership and pole size and existing attachments, conductor sizes, and span lengths.
2. Complete the Pole & Midspan Measurement Form
3. Ensure that all minimum clearances will be maintained.
4. Calculate windloading.
5. Complete the "Attachment and Application and Permit Exhibit A".
6. Assemble permit package (which may or may not include request for make ready.
7. Review completed package for accuracy
8. Submit package to FPL for approval
9. Once approved make attachments
10. When complete return Exhibit B to FPL

III.D. PROCEDURES FOR ATTACHMENTS TO TRANSMISSION POLES

Application Requirements
All applications for attachment to transmission poles require complete structural calculations. Applicant shall demonstrate that the poles can withstand the additional proposed mechanical and environmental loads. Calculations shall be provided with GT-STRUDL output forms, with non-linear analysis results, signed and sealed by a Professional Engineer – Structural, licensed in the State of Florida.

Application Costs
The cost associated with reviewing the application calculations will be the responsibility of the applicant. Review of calculations for approval is performed by FPL Transmission at a cost of $96 per manhour (regardless of final approval or disapproval of the request). A deposit of $2,000 dollars, payable to FPL, is required for quantities of up to 50 poles.

Application Process
Submit completed application to FPL Representative (same as for distribution attachments). Your representative will review the application for completeness. Completed applications will be forwarded to FPL's Transmission Projects Group for review.

1.0 DESIGN CRITERIA

When more than one code applies, the more stringent criteria shall govern.

1.1 CLEARANCES

Any overhead cable installation shall comply with FPL 2007 NESC Basic Clearances for Overhead Transmission Lines, the National Electric Safety Code (NESC)-2007 or other governmental agency codes.

1.2 DESIGN LOADS

1.2.1 POLE DESIGN

Design loads shall meet the specifications defined in the National Electric Safety Code (NESC)-2007, the American Society of Civil Engineer (ASCE) latest edition "Minimum Design Loads for Buildings and Other Structures" and ASCE Manuals #74, "Guidelines for Electrical Transmission Line Structural Loading".

STEEL TRANSMISION STRUCTURES
Designs shall meet the specifications defined in the ASCE/SEI 48-05 "Design of Steel Transmission Pole Structures" latest edition, and ASCE Standard latest edition, "Design of Latticed Steel Transmission Structures".

CONCRETE TRANSMISSION POLES
Designs shall meet the specification defined in the ASCE-PCI "Guide for the Design of Prestressed Concrete Pole".

WOOD TRANSMISSION POLES
Designs shall meet the specification defined in the IEEE Standard 751 "Trial-Use Design Guide for Wood Transmission Structures".

1.2.2 WEATHER RELATED LOADS
Transmission poles are required to resist the weather-related loads (Extreme Wind and Ice/Wind). The applied wind load cases that need to be considered for transmission structures from ALL angles are defined as follows:

Under Combined Ice/Wind loads (NESC Section 250 B)
FPL service territory is classified as the "Light Loading District".

Under Extreme Wind Loads (NESC Section 250 C)
ASCE latest edition "Minimum Design Loads for buildings and Other Structures" and ASCE Manuals #74, "Guidelines for Electrical Transmission Line Structural Loading" are the basis of this control criteria.

Under Serviceability Requirements (FPL Policy for Concrete Pole)

45 mph wind load is considered as the minimum wind load applied for this zero-tension condition, which is only applied to prestressed concrete poles. The calculation of the wind pressure also follows the requirements of ASCE latest edition "Minimum Design Loads for Buildings and Other Structures" and ASCE latest edition Manuals #74, "Guidelines for Electrical Transmission Line Structural Loading".

Basic Wind Speeds (ANS/ASCE latest edition). Refer to enclosed drawings showing Basic Wind Speeds(within FPL Service Territory. Map file name: wind_cont_FL-1.g12 created 10-22-02 attached.

1.2.3 OSHA REQUIREMENTS

This project shall be designed to meet all Occupations Safety and Health Administration (OSHA) rules and regulations.

2.0 PERMIT PACKAGE

A permit application shall consist of two (2) complete packages in the following order:

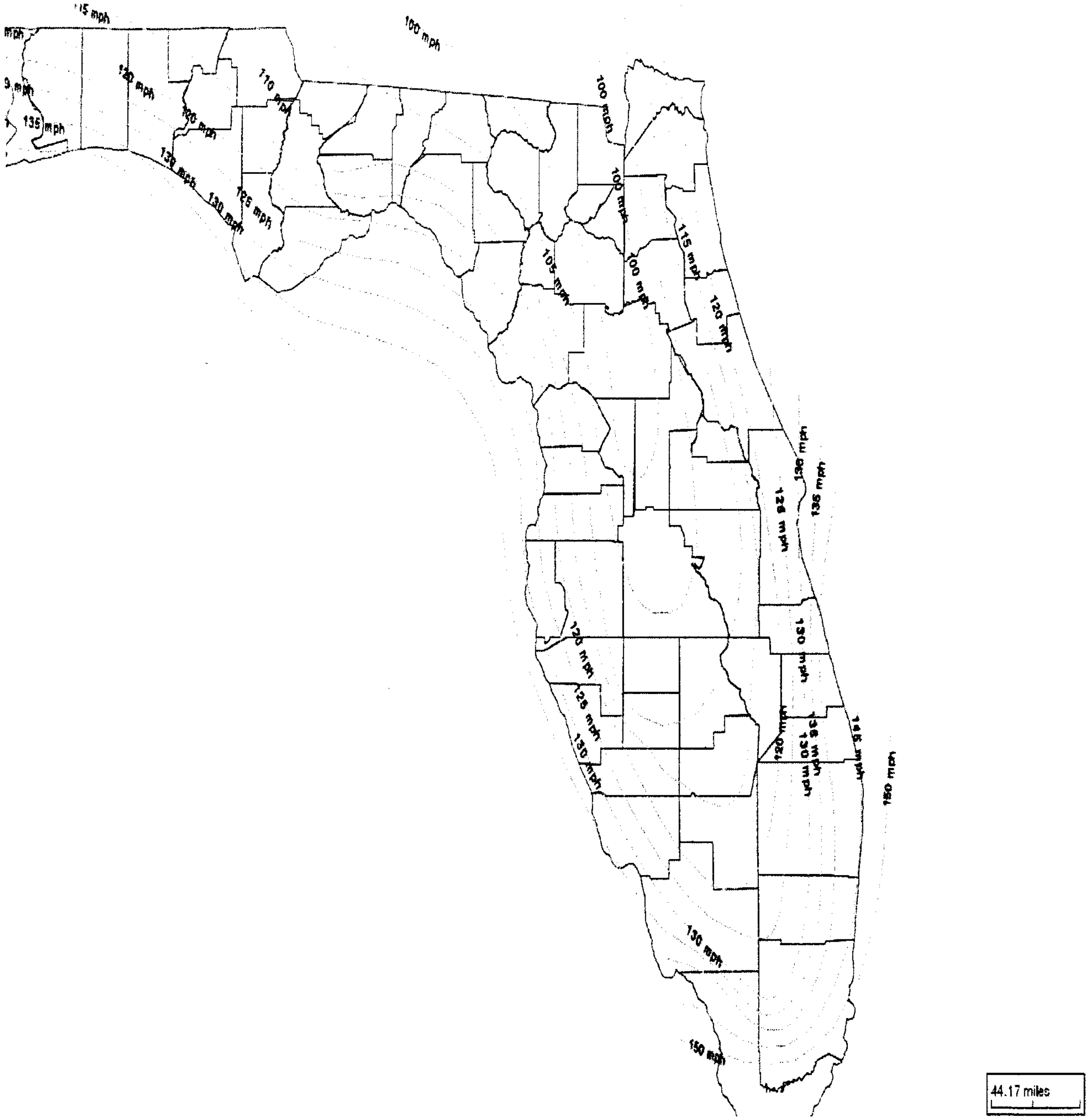
1) Payment for Permit (payable to FPL)
2) Original, signed Exhibit "A" (front and back)
3) Calculations (signed and sealed)
4) Field Notes
5) Pictures of all affected poles, with corresponding pole identification numbers (photographs or jpeg files)
6) Licensee maps (plan/profile) showing route, spans, pole heights, and the Licensee facilities proposed for installation
7) Copy of the FPL Primary Map, with the affected area highlighted

3.0 APPROVAL / DISAPPROVAL

Upon review of the permit application, a response stating approval or disapproval will be communicated by the FPL – Transmission Projects Department

FLORIDA WIND ZONES-2002

To Be Used For Transmission Attachment Permits



THIRD PARTY ATTACHERS COMMENTS

BELLSOUTH

BellSouth Telecommunications, Inc.

R. E. Christian, Jr.
State Manager – Joint Use/Right of Way

301 W. Bay Street, 15HH1
Jacksonville, FL 32202
Tel. No. (904) 798-7812
Fax No. (904) 350-2720

Email: earl.christian@bellsouth.com

April 23, 2007

Mr. R. L. Valdez
Senior Regulatory Analyst
Florida Power & Light Company
9250 West Flagler Street
Miami, Florida 33174,

Subject: Florida Power and Light Company (FPL) 2007-2009 Hardening Plans

Dear Mr. Valdez:

In response to your March 22 request for BellSouth Telecommunications, Inc., d/b/a AT&T Florida (AT&T Florida) to review and provide input to FPL's 2007-2009 Hardening Plans, attached is our initial response. Due to the scope of information provided to AT&T Florida and the timeframe in which AT&T Florida had to respond, AT&T Florida reserves its right to supplement this response.

AT&T Florida thanks FPL for the opportunity to review the hardening plans, for the opportunity to meet and discuss the various issues. AT&T Florida looks forward to continuing a dialogue with FPL regarding its hardening efforts so that the most accurate cost information and feedback can be provided to the Florida Public Service Commission prior to its review of the Hardening Plan.

Sincerely,

Earl Christian

State Manager – Joint Use/Right of Way

Attachment

BellSouth Telecommunications, Inc. d/b/a AT&T Florida's Initial Response to FPL's Proposed Electric Infrastructure Hardening Plan for 2007 – 2009

BellSouth Telecommunications, Inc. d/b/a AT&T Florida ("AT&T Florida") provides the following initial response to FPL's Electric Infrastructure Hardening Plan forwarded to AT&T Florida on March 22, 2007 ("Hardening Plan"). Due to the scope of information provided to AT&T Florida and the timeframe in which AT&T Florida had to respond, AT&T Florida reserves its right to supplement this response.

FPL's Hardening Plan

FPL plans to harden its infrastructure during 2007 through 2009 through three primary methods by: building to Extreme Wind Loading criteria ("EWL"), engaging in "incremental hardening," and implementing new design guidelines and processes for new construction and major planned work.

2007 Deployment

1. EWL:

In 2007, FPL plans to use EWL to harden twenty-eight (28) Critical Infrastructure Facilities (CIF) which are served by thirty-four (34) primary circuits. The costs that AT&T Florida potentially faces in connection with this aspect of FPL's Hardening Plan can be broken down into the following major categories:

- Costs to transfer facilities from an existing pole to a replacement pole
- Costs to replace cable in instances where FPL moves a pole line such that transfers of existing cable are not feasible
- Contribution costs FPL may seek from AT&T Florida for the replacement poles
- Increased pole rental rates

With regard to the first two items, AT&T Florida cannot accurately estimate costs because AT&T Florida does not know how many of its attachments will be impacted and the type of work that would need to be performed on those attachments. The level of detail regarding the proposed hardening projects that AT&T would need to perform this analysis is not contained in FPL's Hardening Plan. While FPL did provide more detailed information on many of the CIF projects to AT&T Florida on Tuesday, April 17, 2007, AT&T Florida has not had sufficient time to analyze this information before FPL's April 23, 2007 deadline for a response. Accordingly, AT&T Florida reserves its right to supplement this response and to request additional information from FPL if needed.

With this caveat, to facilitate the exchange of information contemplated by Rule 25-6.0342(6), however, AT&T Florida estimates that the transfer of facilities and the replacement of cable owned by AT&T Florida in connection with FPL's proposed hardening of 28 CIFs in 2007 would cost approximately $4.3 million. In developing this rough estimate, AT&T Florida assumed that it would have aerial facilities on 18 of the 34 circuits to be hardened, translating into 3,600 spans of AT&T Florida aerial facilities. AT&T Florida further assumed that approximately 20% of the 3,600 spans (720 spans) would involve replacing cable at an estimated cost of $4,000 per span. AT&T Florida estimated that the remaining 80% (2,880 spans) would involve transfer work at an estimated cost of $500 per span.

AT&T Florida may face additional costs if FPL seeks contribution toward the cost of new poles. In Section III(A) of its Proposed Hardening Plan entitled "Procedures for Joint Users," FPL states that Contribution In Aid of Construction (CIAC) will be collected "for the increased size and strength required to accommodate the facilities of all parties requesting attachments" and that contribution will be charged in accordance with existing joint use agreements. (*See Hardening Plan* at 47.) In the informational meeting held by FPL on April 12, 2007, FPL indicated that it was still evaluating the contribution issue. Without more specific information on this issue, AT&T Florida remains concerned of the potential for unjustified cost shifting under its existing joint use agreement with FPL.[1] AT&T Florida reserves the right to supplement this response pending further clarification of this issue.

Lastly, hardening of the electric infrastructure will likely result in increased pole rental rates. Because AT&T Florida cannot estimate the potential cost impact of increased rates until rate negotiations are initiated, AT&T Florida reserves the right to supplement its response on this issue.

2. Incremental Hardening

FPL proposes to address thirty-four (34) community projects, which FPL defines as feeders that serve community needs (e.g., grocery stores, gas stations), through incremental hardening. Again, AT&T Florida cannot accurately estimate how many of its attachments will be impacted and the type of work that would need to be performed on those attachments until it receives and analyzes more detailed information on these proposed projects. Assuming that it will have aerial facilities at ten (10) of these sites comprised of ten (10) poles per site, AT&T estimates an additional $80,000 in cable replacement costs and $40,000 in transfer costs in connection with FPL's proposed incremental hardening plans for 2007. Again, this is a rough estimate based on limited information.

3. New Design Guidelines

While AT&T Florida has communicated to FPL that AT&T Florida will voluntarily increase the class size of wood poles in its distribution system under certain circumstances, AT&T Florida objects to any references in FPL's *Addendum to FPL's*

[1] The existing joint use agreement between FPL and AT&T Florida addresses the responsibility for pole replacement costs, as well as transfer costs. AT&T Florida will attempt to resolve these issues relative to hardening projects with FPL prior to the Florida Public Service Commission's review of FPL's Hardening Plan so that more accurate cost information can be provided and considered.

Permit Application Process Manuals, Attachment Agreements and Joint Use Agreements that implies that AT&T Florida's poles are governed by FPL's design criteria. Additionally, AT&T Florida would like to have further discussions with FPL regarding how the *Addendum* will impact current joint use operating procedures. AT&T Florida reserves the right to provide further input on the *Addendum* following this dialogue.

2008 & 2009 Deployment

AT&T Florida is not able to estimate the potential cost impact of FPL's Hardening Plan for 2008 and 2009. FPL has not yet identified the locations to be hardened or the method by which the hardening will be accomplished (i.e. EWL vs. incremental hardening). AT&T Florida requests that FPL provide these detailed plans as soon as they are developed so that AT&T Florida can provide the input contemplated by Rule 25-6.0342(6). AT&T Florida reserves the right to comment on these plans once they are finalized.

Benefits of Hardening Plan

The most significant benefit AT&T Florida may recognize from implementation of the Hardening Plan would be from the potential reduction of commercial power outages. As a customer of FPL, AT&T Florida relies on electric service to power its remote terminals. AT&T Florida cannot quantify this potential benefit as it would be difficult to determine how many remote terminals are served by the circuits that will be hardened.

Conclusion

AT&T Florida's input is limited by the scope of the information provided and the timeframe in which AT&T Florida had to respond. AT&T Florida looks forward to continuing a dialogue with FPL regarding its hardening efforts so that the most accurate cost information and feedback can be provided to the Florida Public Service Commission prior to its review of the Hardening Plan.

LAWYERS

Davis Wright Tremaine LLP

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April 23, 2007

Via Electronic and First Class Mail

Bob Valdez
Florida Power & Light Company
Regulatory Affairs Room No. 6047
9250 West Flagler Street
Miami, Florida 33174

Re: FPL 2007-2009 Storm Hardening Plans

Dear Mr. Valdez:

I am writing on behalf of the Florida Cable Telecommunications Association (FCTA) concerning the Florida Power and Light Company Electric Infrastructure Storm Hardening Plan ("Plan") dated March 22, 2007. Florida Administrative Code, Rule 25-6.0342(6) requires pole owning utilities, such as FPL, to 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. In your cover letter accompanying the Plan, you asked that FCTA member cable operators provide input concerning the Plan by no later than today, April 23, 2007. In an email dated April 9, 2007, FCTA asked for additional information as well as additional time to review the data and compile cost data for input, but FPL responded that it unable to grant FCTA's request due to the deadline imposed by the Public Service Commission (PSC) of May 7, 2007 for submission of plans to the PSC.

As a preliminary matter, FCTA appreciates the substantial responsibility that FPL has as a pole owner and respects the management decisions FPL has reached in its Plan. The information presented by FPL in the Plan and in additional materials sent via compact disc on April 16, 2007 address substantial portions of FPL's plant to which cable operators are attached and cover a large geographic area. As you know, Comcast is the largest cable operator in FPL's service territory. Comcast has distributed the information to its field representatives in numerous geographic areas for their analysis and review. These representatives have initiated a review of the proposed plans and the impact that such Plan will have on its attachments. However, given the volume of information presented, it will be some time before Comcast will have a true sense of the impact that FPL's Plan will have on its attachments and related activities.

Moreover, while a significant amount of information was included in the plans, additional information was not included that would greatly aid Comcast in providing constructive information to FPL about the costs and benefits of such plans, including the effect on reducing storm restoration costs and customer outages. For example, FPL: provided information only for some example communities not all, only included information about its own attachments to the poles and not those of third party attachers, fails to explain the precise work that will be necessary for third party attachers (i.e., it may state that the pole needs to be replaced but does not further indicate whether the attachments will be transferred to the new pole or re-routed, does not indicate why a particular action is being taken (i.e., whether the pole is being replaced because it is overloaded or rotten), does not indicate the extent to which its storm hardening efforts will delay construction of new third party attachments, and does not give an estimate of the costs for the proposed work or what costs it expects to shift to attaching entities.

We realize that the Plan cannot be extremely detailed as illustrated by the wide ranging estimate of $40 million to $70 million in anticipatory hardening related costs that FPL projects for 2007 alone. FPL has stated that it does not yet know what portion of these costs will be billed to cable operators or other third party attachers. We agree that many of the details of costs and benefits of storm hardening must be resolved after the May 7, 2007 filing deadline. However, without this type of information, third party attachers cannot discern the possible cost to them associated with the Plan.

Moreover, as discussed at the meeting held April 13, 2007, third party attachers initially were not consulted in determining what would constitute critical infrastructure and targeted poles. As a result, it does not appear that poles carrying main line cable operator feeders were included. Cable operators now provide life-line services to Florida residents, including valuable communications infrastructure that is relied upon in storm restoration and 911 services. Accordingly, it is possible that certain poles carrying cable facilities should be added to the list of critical infrastructure and targeted poles. FPL stated that it was willing to consider recommendations from cable operators and other third party attachers concerning proposed additions to FPL's list of critical infrastructure and targeted poles. Again, this issue will likely be resolved after the May 7, 2007 filing deadline.

Comcast understands that it may have been difficult for FPL, in the timeframes established by the PSC, to have anticipated and provided all of the detail necessary for third party attachers to give meaningful input. However, given the broad scope of information addressed in the Plan and the limited amount of cost-related detail provided, it would be counter-productive to limit third party input to a one-time response. Instead, FCTA suggests that this plan be only the starting point for discussion between pole owners and third party attachers. FCTA members believe it would be extremely beneficial to all parties to the proceeding and to Florida consumers to hold regularly scheduled workshops to ensure that as specific plans are implemented, third party attachers have an opportunity to participate in the decision making process. Such workshops would also allow third party attachers an opportunity to propose some additional facilities that they believe should be included as critical infrastructure and/or targeted poles. These workshops have worked well in the past to promote good working relationships and good project results, and should be beneficial in working through the storm hardening issues.

While FCTA was not able to provide precise costing data in response to FPL's Plan for the reasons set forth above, FCTA nevertheless has the following comments on the general features of the Plan, which FCTA believes should be treated as initial comments in an ongoing dialogue between cable attachers and FPL.

Electric Infrastructure Storm Hardening Plan

- Page 7, Hardening Existing Facilities. This section explains the process of capturing detailed information at each pole location of a storm hardening project. If the detailed information can be shared with cable operator personnel for the purpose of designing cable operator work associated with the project, much duplication of field work can be eliminated and good results can be expedited.
- Page 7, Examples of Hardening Options: Storm Guying. FCTA agrees that storm guying where practical is a very cost effective means of strengthening poles up to and including extreme wind standards. We also believe that more emphasis on identifying lines or portions of lines which should be strengthened by storm guying will be a good addition to the FPL plan. In addition, the storm guying effects of crossing power and communications lines should be left in the wind loading calculations for poles being hardened. Both crossing lines and lateral pull-off lines whose pull is balanced by down guy wires serve the same purpose as storm guys on existing poles. Ignoring the effects of such lines on wind loading substantially increases the cost of individual projects.
- Some areas of proposed storm hardening of critical infrastructure circuits are shielded to a great extent by tall trees above the height of the distribution lines while others are shielded by tall buildings. The shielding effects of trees and buildings have not been considered by FPL. Clearly, if the trees or buildings do not blow down they shield the line from high winds. If they do blow down they take the storm hardened poles with them. Trees and buildings should be considered, at least in some circumstances. Inclusion of this additional information in the Plan would be helpful.
- It would be very helpful if FPL could provide the number of poles it proposes to change out and the proposed type of replacement pole (i.e., wood, concrete, steel) for each of the categories identified by FPL – i.e., Critical Infrastructure, Community Project, Critical Poles. Gulf Power recently provided this level of detail in its third draft of its Plan at page 10, which is attached hereto for your convenience.

- It would be helpful to include in the Plan additional information concerning storm restoration coordination.

FPL Attachment Standards and Procedures Addendum

Section I: Safety

- Page 4. To the extent that FPL adopts requirements they should be reasonable implementations of applicable codes.
- Also on page 4 in the 5th paragraph please explain what is meant by "At no time may the CATV worker encroach upon the electric supply space." It would be best to state that communications workers must at all times comply with applicable NESC and OSHA work rules.
- Also on page 4 in the 6th paragraph concerning RF emitting devices, please provide for at least 48 hours advance notice to the device owner before disconnecting power except in emergencies. Moreover, most wireless (RF emitting) devices attached by cable operators are line powered through the existing cable system and do not require FPL meters. Would this still require a termination switch?

Section II: Standards

- Overlashing a fiber optic cable to an existing cable should not require a permit, notification of FPL only. It is our understanding based upon conversations with FPL that in fact FPL only intends to require approval for overlashing where diameter size of existing facility will be increased. The Plan should so state.
- Page 8, Clearances of communications cables to FPL. At dimension letter B, add an asterisk and refer to NESC Rule 238D Exception which allows reduction of the 12" clearance to 3" if the loop is covered.
- Page 10, Clarification of installation of poles in private easements. If FPL places pole in private easement do third party attachers require a separate easement or is the language of the FPL easement agreement include cable operator?
- At dimension letter F the new requirement in the 2007 NESC is 40". See NESC Rule 239G1. (The change was to Exception 1). The FPL 3" requirement should be referenced for grandfathering of facilities installed prior to 2007.
- At dimension letter K, the 12" separation between cable messengers became effective in NESC 2002 with a requirement for 4" separation between cables in the span under the specified conditions. Please reference NESC Rule 235H l. and 2.
- At dimension letter L, the recognition of the NESC exception allowing 30" separation is good. Please add reference to NESC Rule 235.2.b.(1)(a). Exception 1. This rule reduces

the required clearance between the neutral and cable to 12 inches in the span, not 30." The rule also applies to separation between fiber optic cable (supply) and communications cables in the communication space.

- Section II.C. Windload Criteria and Calculations. It would be helpful if this section explained criteria for determining which party is responsible for pole overloading, and how costs for any necessary work to bring pole into compliance will be allocated.
- Section III.B. Procedures for Third Parties (CATV and Telecommunication Carriers). It would be informative if the Addendum included timeframes for the pole makeready process including but not limited to the permit process and completion of work specified by Make Ready engineering approval, so that attachers would have a sense of whether storm hardening activities will impact speed to market.

In addition, there are certain provisions included in the Plan that do not appear to be related to storm hardening but instead appear to be standard terms and conditions of attachment. For example, Section III.B. provides that when overlashing to existing attachments or increasing wire diameter, third parties (CATV and non-ILEC telecommunications carriers) must obtain a permit.[1] Similarly, the same section implies that power supplies, amplifiers and similar equipment will be subject to separate permitting requirements, and thus additional rent. However, permitting is required for rental rate purposes and the rates, terms and conditions of attachment are not before the PSC in this proceeding. Florida Administrative Code, Rule 25-6.0342(8). Accordingly, FCTA believes that these provisions should not be included in the Plan.

FCTA commends FPL on its reliance on the NESC requirements to a great degree for the engineering guidelines for separation between electric and communications attachments. FCTA believes that the suggested changes are consistent with FPL's intentions when these standards were established before recent revisions of the NESC and that most, if not all, the suggestions will be acceptable to FPL. Moreover, FCTA members do see a significant benefit from several of the ten initiatives being deployed by FPL including its three year cycle for vegetation management and eight year inspection plan. Ensuring that wires are not endangered by tree limbs and that poles are not rotten or overloaded, should significantly assist in efforts to prevent storm outages and in storm restoration. Rotten poles in particular are a serious problem in high wind situations because they can cause a cascading effect.

FCTA members would like to work with FPL to ensure that distribution pole infrastructure is hardened to withstand stronger winds and to improve storm restoration. To that end, FCTA members strongly believe that continued open lines of communication and workshops in details of storm hardening plans are provided and input from third parties is solicited extending over the course of the Plan's implementation would significantly contribute

[1] In a subsequent conversation it was explained that in fact permits would only be required where the diameter of wire is increased, as is currently the case.

to state's efforts to ensure the availability of power and communications services in extreme weather situations.

Please feel free to contact me if you have any questions or comments related to these initial responsive comments. We look forward to an ongoing dialogue and working together to hardening FPL's infrastructure in a manner that is beneficial to all involved.

Sincerely,

Maria T. Browne

Maria T. Browne

ATTACHMENT

pumping/treatment plants and major sewage treatment plants. The planned projects are shown in the table below.

2007 - 2008	District	Critical Load	Total Main Miles	Estimated Number of Pole Changeouts
	Western	Fuel Depot	1.38	46
	Central	Fuel Depot	2.83	100
	Eastern	I-10 Crossings	N.A.	16
TOTAL ALL				162

2008 - 2009	District	Critical Load	Total Main Miles	Estimated Number of Pole Changeouts
	Western	Hospital	3.56	125
	Central	I-10 Crossings	N.A.	14
TOTAL ALL				139

2009 - 2010	District	Critical Load	Total Main Miles	Estimated Number of Pole Changeouts
	Central	Hospital	2.14	75
	Central	Hospital	1.08	38
	Western	I-10 Crossings	N.A.	56
TOTAL ALL				169
Three Year Plan Totals	Company			470

The estimated poles which may be subject to replacement based on the above and possible impact from Joint-Use Assessments are as follows:

Year	Extreme Wind Loading	Joint-Use Assessments	Total Estimated Poles Impacted
2007-2008	162	500	662
2008-2009	139	500	639
2009-2010	169	500	669

9.1.2 Transmission

Gulf Power transmission utilizes overload and strength factors greater than or equal to those required in Section 26 of the National Electric Safety Code. Gulf's loading criteria for new line design is derived from Section 25 of the National Electric Safety Code. These design criteria are used on all new installation and complete rebuild projects throughout the Gulf Power service territory.

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May 2, 2007

Mr. Bill Walker
Florida Power & Light Company
215 South Monroe Street, Suite 810
Tallahassee, FL 32301-1859

In RE: Florida Power & Light Storm Hardening Plan

Dear Mr. Valdez:

Embarq has reviewed the Florida Power & Light Electric Infrastructure Storm Hardening Plan dated March 22, 2007 for the years 2007 through 2009 and which was discussed in the April 23, 2007 meeting in Miami. While the plan provided some specifics, e.g. the intent to harden the facilities serving Naples Community Hospital and Lee Memorial Hospital in 2007, most of the plan is non-specific. Therefore, in order to respond regarding the impact of this plan on Embarq, certain assumptions have been made. If additional details are provided regarding the plan, Embarq will review this response and provide a more targeted estimation of the costs and benefits.

Based on the assumption from the plan that FP&L will harden approximately 20% of their poles in the first three years of this plan, Embarq applied that 20% factor times the number of FP&L poles with Embarq attachments in order to arrive at an estimate of the direct and immediate costs to Embarq. Using the formula in the current Joint Use Agreement between FP&L and Embarq and the costs of transferring attachments as well as the costs of existing and new joint use poles, the estimated cost to Embarq is $13,967,200.00 in years 2007 through 2009 of the plan. If 50% of FP&L's poles are hardened within ten years, the cost to Embarq would be almost $35,000,000.00 for the ten years (2007 - 2016). Another potential cost which may not be as immediate nor as direct would be increases in pole attachment fees charged by FP&L.

FP&L's Hardening Plan may benefit Embarq by reducing the amount of damage to our facilities, thereby reducing the number of customer outages and reducing the time to restore service. The extent of these benefits will not be known until the next storm and they cannot be readily quantified in dollar savings; however, Embarq does not believe that it is likely these benefits will outweigh the costs.

Sincerely,

Sandra A. Khazraee

Sandra A. Khazraee

cc: Mr. Bob Valdez, FP&L
Mr. Henry Bowlin, Embarq
Mr. Bill Radel, Embarq

Sandra A. Khazraee
REGULATORY MANAGER
LAW AND EXTERNAL AFFAIRS
Voice: (850) 847-0173
Fax: (850) 878-0777

Bob Valdez

05/02/2007 06:13 PM

To: "Dave Bromley" <Dave_Bromley@fpl.com>
cc:
Subject: Fw: Fwd: 2007 Hardening projects

----- Original Message -----
From: "Denise Yoezle" [DYOEZLE@hollywoodfl.org]
Sent: 05/02/2007 04:33 PM
To: Bob Valdez
Subject: Fwd: 2007 Hardening projects

Hi Bob,
Is there another person I can contact for this information?

Denise Yoezle
Operations Manager
Streets & Highways
City of Hollywood
954-967-4526

>>> Denise Yoezle 4/30/2007 9:37 AM >>>
Hi Bob,
I see on your March 22, 2007 correspondence that Memorial Regional Hospital is on the list of 28 Critical Facilities to be hardened. Do you have a schedule for completion of the work at this facility?

Also, of the 34 Community Projects, 11 are located in Broward County. Are any of these located in the City of Hollywood?

We have reviewed the criteria and have no comments, other than to welcome all such efforts for a speedy and effective post-storm recovery.

Regards,

Denise Yoezle
Operations Manager
Streets & Highways

City of Hollywood
954-967-4526

Tony Newbold

04/18/2007 11:27 AM

To: Bob Valdez/RAD/FPL@FPL
cc:
Subject: Fw: Hardening Plans

"Paul W. Milelli" <pmilelli@psd.co.palm-beach.fl.us>

04/11/2007 12:01 PM

To bob_valdex@fpl.com
cc Greg_Cope@fpl.com, Tony_Newbold@fpl.com, "Charles Tear" <ctear@psd.co.palm-beach.fl.us>
Subject Hardening Plans

Mr. Valdez:

After reviewing the plans provided to Palm Beach County, we offer the following comments:

1. The 2007 Deployment Plan identified four "Acute Care Facilities" in Palm Beach County for "EWL" activities. While we support any activities that will harden the electical grid leading to all of our facilities, we question how the hospitals were selected, in particular, Good Samaritan Hospital and the Veteran's Administration Hospital.

Good Samaritan Hospital is within the County's Hurricane Vulnerability and Surge Zones and must evacuate in the event of a landfalling hurricane. St. Mary's Hospital (it's sister facility) rests on higher elevation, is one of our County's Trauma Centers, lies outside of the evacuation zones, and is the reciepient of Good Samaritan's patients. We would believe that our hospitals outside of the surge and vulnerability zones would take priority over those within the hurricane zones.

The V.A. Hospital, while outside of the surge and vulnerability zones, does not accept patients from the general public. Similarly, we would believe that hospitals serving the general public would take priority.

2. The 2007 Deployment Plan identified ten (10) "Community Projects" for "EWL" activities. While we support any actitivities that will harden the electrical grid leading to all of our critical infrastructure, we question how FPL selected the listed Feeder's. Of the over 400 Feeders within Palm Beach County serving critical infrastructure, we have identified the top 20% of the feeders for priority restoration immediately following a hurricane. None of the ten feeders identified in the 2007 Deployment Plan is within our top 20%. We have worked with our account executives from FPL to create the list (please see attached) and we would suggest that the Deployment Plan recognize this list as a generator of FPL's Community Project hardening.

The 2007 Deployment Plan speaks to the 2008 and 2009 deployment plans and the critical facilities and community projects selected for upgrading during those years. We would suggest that FPL partner with our County Emergency Management Division staff to review, and possibly modify the "Targeted Facilities" lists for 2008 and 2009.

Again, we support FPL's aggressive hardening plans. We strongly suggest and encourage FPL's consideration of partnering with the County in selecting future feeders and facilities for the electrical grid hardening.

Should you have any questions, please feel free to contact me.

Paul W. Milelli, Director
Department of Public Safety
Palm Beach County
20 South Military Trail
West Palm Beach, FL 33415

561-712-6470 (Office)
561-712-6490 (Fax)

PBTop20PercentFdrs04022007.xls

Barbara Gilbreath

04/30/2007 09:22 AM

To: Bob Valdez/RAD/FPL@FPL
cc: timothy young
Subject: FiberNet Cost Estimates

Bob,

Attached is a summary of costs associated with the hardening of the circuits supplied on the CD. The total cost to FN is estimated at $15,584.00.

Should you require additional information, please advise.

Barbara Gilbreath
Manager-OSP Engineering and Construction
305-552-2879

FN Cost Summary.x

FPL FiberNet Cost - 2007 FPL Network Hardening

FPL Circuit Number	FPL FN Cost
404032	$2,381
803835	$1,800
804535	$1,200
101539	$3,303
501137	$6,900
	$15,584

THIRD PARTY ATTACHERS LIST

EXHIBIT II

- Mr. Henry Bowlin
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- Ms. Maria Browne Esquire
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- Mr. Cody Harrison
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  Four Times Square
  New York, New York 10036

- Mr. Douglas C. Nelson
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- Pat Fernandez
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  Orlando, Fl 32810

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  Tulsa, OK 74117

- Mr. Joe Faber
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  Palo Alto, CA 94301

- Mr. Gary Hunt
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  UT H27.19
  Littleton, Colorado 80120

- Mr. Ken Kirkland
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  Macclenny, Fl 32063

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  202 Titus Av
  Warrington, PA 19876

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  Miami, Fl 33187

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  Fort Myers, Florida 33901

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  11111 Sunset Hills Road
  Reston, VA 20190

- City of Cocoa Beach
  Mr. Thiel, I.T. Director
  2 South Orlando Avenue
  Cocoa Beach, Fl 32931

- City of Stuart
  Attn: City Clerk
  121 S.W. Flagler Avenue
  Stuart, Fl 34944

- City of Miami Beach
  Attn: City Clerk
  1700 Convention Center Drive
  Miami Beach, Florida 33139

- Mr. Jack Yaghdjian
  WLRN
  172 N.E. 15 Street
  Miami, Fl 33132

- City of South Daytona
  Attn: City Clerk
  1672 S. Ridgewood ave.
  South Daytona, Fl 32119

- Collier County
  Attn: Board of Commissioners
  3301 E. Tamiami Trail
  Naples, Fl 34112

- Myakka River State Park
  13207 S.R. 72
  Sarasota, Fl 34241

- Sarasota County
  Chairman of Board of Commissioners
  1001 Sarasota Center Blvd.
  Sarasota, Fl 34240

- City of Palm Beach Gardens
  Attn: City Clerk
  10500 North Military Trail
  Palm Beach Gardens, Fl 33410

- Town of Juno beach
  Attn: City Clerk
  340 Ocean Drive
  Juno Beach, Fl 33408

- Village of Wellington
  Attn: City Clerk
  14000 Greenbriar Blvd.
  Wellington, Fl 33414

- Seminole County
  Attn: Board of Commissioners
  1101 East First Street Sanford, Fl 32771

- City of Hollywood
  Attn: City Clerk
  26000 Hollywood Boulevard
  Hollywood, Florida 33020-4807

- City of Vero Beach
  Attn: City Clerk
  1053 20th Place
  Vero Beach, Fl 32960

- Volusia County
  Attn: Board of Commissioners
  123 W. Indiana Ave.
  Deland, Fl 327320

- Broward County
  Attn: Board of Commissioners
  2300 West Commercial Boulevard
  Fort Lauderdale, Florida 33309

- West Palm Beach
  Attn: Board of Commissioners
  200 2nd Street, Fifth Floor
  West Palm Beach, Fl 33401

- City of Boca Raton
  Attn: City Clerk
  201 W. Palmetto Park Rd.
  Boca Raton, Fl 33432

- Brevard County
  Attn: Board of Commissioners
  2725 Judge Fran Jamieson Way
  Suite A-204
  Viera, Fl 32940

- City of Cape Canaveral
  Attn: Cit Clerk
  105 Polk Avenue
  Cape Canaveral, Fl 32930

- Charlotte County
  Attn: Board of Commissioners
  18500 Murdock Circle
  Port Charlotte, Fl 33948

- Indian River County
  Attn: Board of Commissioners
  1028 20th Place
  Vero Beach, Fl 32960

- Manatee County
  Attn: Board of Commissioners
  1112 Manatee Avenue West
  Bradenton, Fl 34205

- Martin County
  Attn: Board of Commissioners
  2401 SE Monterey Road
  Stuart, Fl 34996-3322

- City of Melbourne
  Attn: City Clerk
  900 E. Strawbridge Ave.
  Melbourne, Fl 32901

- Palm Beach County
  Attn: Board of Commissioners
  301 N. Olive Avenue
  West Palm Beach, Fl 33401

- City of Port St. Lucie
  City Clerk's Office
  121 SW Port St. Lucie Blvd.
  1st Floor, Building "A", Room 187
  Port St. Lucie, Fl 34984-5099

- City of Rockledge
  Attn: City Clerk
  1600 Huntington Lane
  Rockledge, Fl 32955-2660

- St. Lucie County
  Attn: Board of Commissioners
  2300 Virginia Avenue
  Fort Pierce, Fl 34982

- State of Florid, Department of Transportation
  Ms. Ruth Yanks
  FDOT Utility Section
  3400 W Commercial Blvd
  Fort Lauderdale, Fl 33309

- Town of Lake Park
  Attn: City Clerk
  535 Park Avenue
  Lake Park, Fl 33403

- Hendry County
  Attn: Board of Commissioners
  25 E. Hickpoochee Ave.
  Labelle, Florida 33935

- City of Deltona
  Attn: City Clerk
  2345 Providence Boulevard
  Deltona, Fl 32725

- City of Fort Myers
  City Clerk's Office
  2200 Second Street
  Fort Myers, Florida 33902

- City of Lauderdale Lakes
  Attn: City Clerk
  4300 NW 36th Street
  Lauderdale Lakes, Fl 33319

- City of Coral Springs
  Attn: City Attorney
  9551 W. Sample Road
  Coral Springs, Fl 33065

- City of Boynton Beach
  City Clerk's Office
  100 E. Boynton Beach Blvd.
  Boynton Beach, Fl 33435-3838

- City of Delray Beach
  Assistant City Manager
  100 NW 1st Ave.
  Delray Beach, Fl 33444

- City of West Melbourne
  City Attorney
  2285 Minton Road
  West Melbourne, Fl 32904-4928

- Town of Indialantic by the Sea
  Attn: City Clerk
  100 N Andres Avenue
  Fort Lauderdale, Fl 33301

- City of Fort Lauderdale
  Attn: City Clerk
  100 N Andrews Avenue
  Fort Lauderdale, Fl 33301

- Columbia County
  Attn: Board of Commissioners
  607 NW Quinten St.
  Lake City, Fl 32055

- City of Miami
  Attn: City Clerk
  3500 Pan American Drive
  Miami, Fl 33133

- City of Riviera Beach
  Attn: City Clerk
  600 West Blue Heron Blvd.
  Rivera Beach, Fl 33404

- City of Pompano Beach
  Attn: City Clerk
  100 West Atlantic, Boulevard
  Pompano Beach, Florida 33060

- Mr. Rick Scheller
  Advanced Cable Communications
  12409 NW 35 Street
  Coral Springs, Fl 33065

- Mr. Dave Floberg
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  1681 Kennedy Causeway
  North Bay Village, Fl 33141

- Mr. Darrell Larid
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  High Springs, Fl 32643

- Mr. Gary English
  Florida Cable
  23505 SR 40
  Astor, Fl 32102

- Nextel South Corp.
  Attn: Legal Services
  851 Trafalgar Court suite 300E
  Maitland, Florida 32751

- Mr. Tim Thompson, Regional Vice President
  Nextel South Corp.
  Field Engineering and Operations
  6575 the Corners Parkway
  Norcross, GA 30092

- Nextel South Corp.
  Attn: Contracts Manager
  2001 Edmund Halley Dr.
  Reston, VA 20191-3436

- NEXT G NETWORKS, INC.
  Attn: Contracts Administrator
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  San Jose, CA 95131

- Ms. Rosanne Gervasi Esquire
  Office of the General Counsel
  Florida Public Service Commission
  2540 Shumard Oak Boulevard
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