

## **Table of Contents**

<b>1.0</b>	<b>DESIGN CONSIDERATIONS.....</b>	<b>1</b>
<b>2.0</b>	<b>PERIODIC MAINTENANCE PROGRAM ON ALL TRANSMISSION LINES.....</b>	<b>3</b>
<b>3.0</b>	<b>PERSONNEL SAFETY RULES.....</b>	<b>4</b>
<b>4.0</b>	<b>MAGNETIC FIELD MANAGEMENT PLAN.....</b>	<b>5</b>

### **List of Tables**

**Table 4-1:** 69 kV Vertical Clearance to Ground

**Table 4-2:** 138 kV Vertical Clearance to Ground

**Table 4-3:** 230 kV Vertical Clearance to Ground

**Table 4-4:** 500 kV Vertical Clearance to Ground

## **1.0 DESIGN CONSIDERATIONS**

PPL Electric’s new and rebuilt transmission lines will be designed according to, and generally exceed, all National Electric Safety Code (NESC) minimum standards. The NESC standards are developed to safeguard utility workers and the public during the installation, operation, and maintenance of electric power lines. Although not intended as a design specification, its provisions establish minimum design requirements. The NESC is a safety code that includes loading requirements and clearances for the design, construction, and operation of power lines. Loading requirements are the loads on the conductors and structures that are anticipated assuming certain ice and wind conditions. Loading requirements always contain "safety factors" to allow for unknown or unanticipated contingencies. The clearances and loading requirements contained in the NESC are designed to maintain public safety. PPL Electric’s transmission line design standards meet or surpass the NESC clearances and loading requirements.

For example, the NESC specifies strength and loading rules based on three different “grades of construction” for conductors and supporting structures:

- Grade B – This grade of construction provides the highest margin of safety and is required when the pole supports spans that cross limited access highways, railroads, and waterways.
- Grade C – This grade of construction is most common and provides a basic margin of safety. It is often utilized for the typical power and joint-use distribution pole.
- Grade N – This is the lowest grade of construction and is most often used for emergency and temporary construction.

PPL Electric designs all of its transmission lines for Grade B construction. The use of Grade B design and construction translates to higher levels of structural reliability and safety to withstand the environmental conditions of ice and/or wind loading.

Another example is the design parameters utilized during project engineering to account for ice and wind loadings on the wires and structures since structure dimensions and conductor sag and tension

are dependent on these loads. PPL Electric’s transmission lines are designed to exceed NESC requirements by accounting for additional ice and wind loading conditions not contemplated under the NESC. This means that PPL Electric’s lines are designed to operate safely and reliably during extreme inclement weather. In addition, where practicable, PPL Electric’s transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL Electric’s general conductor to ground design criteria and the NESC minimum ground clearances for lines of various voltages.

**TABLE 4-1: 69 kV Vertical Clearance to Ground**

Surface Underneath Conductors	NESC Standard Clearance	PPL Conductor Clearances
Roads, streets, alleys	19.2 Ft.	30 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	19.2 Ft.	30 Ft.
Spaces accessible to pedestrians only	15.2 Ft.	30 Ft.
Railroad tracks	27.2 Ft.	31.5 Ft.

**TABLE 4-2: 138 kV Vertical Clearance to Ground**

Surface Underneath Conductors	NESC Standard Clearance	PPL Conductor Clearances
Roads, streets, alleys	20.6 Ft.	31 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	20.6 Ft.	31 Ft.
Spaces accessible to pedestrians only	16.6 Ft.	31 Ft.
Railroad tracks	28.6 Ft.	35 Ft.

**TABLE 4-3: 230 kV Vertical Clearance to Ground**

Surface Underneath Conductors	NESC Standard Clearance	PPL Conductor Clearances
Roads, streets, alleys	22.4 Ft.	33 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	22.4 Ft.	33 Ft.
Spaces accessible to pedestrians only	18.4 Ft.	33 Ft.
Railroad tracks	30.4 Ft.	35 Ft.

**TABLE 4-4: 500 kV Vertical Clearance to Ground**

Surface Underneath Conductors	NESC Standard Clearance	PPL Conductor Clearances
Roads, streets, alleys	28.4 Ft.	40 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28.4 Ft.	40 Ft.
Spaces accessible to pedestrians only	24.4 Ft.	40 Ft.
Railroad tracks	36.4 Ft.	53 Ft.

PPL Electric also uses a relay protection system to protect the public safety, as well as the equipment on the transmission system. Relay protection is installed for all transmission lines and is designed to automatically de-energize a line in the unlikely event that the line or supporting structure fails and the line contacts the ground.

## **2.0 PERIODIC MAINTENANCE PROGRAM ON ALL TRANSMISSION LINES**

To ensure continued public safety and integrity of service, PPL Electric has implemented a periodic maintenance and inspection program for every transmission line. The program is administered using helicopter patrols, with supplemental foot patrols, as needed. Helicopter patrols are performed on all lines on a predetermined frequency, depending on voltage level. The two-man helicopter crew flies

parallel and above the line so that the observer can look for signs of line damage or deterioration and observe clearances between vegetation and conductors. The observations are included in a report that is forwarded to the appropriate department for corrective action.

### **3.0 PERSONNEL SAFETY RULES**

PPL Electric designs and constructs its projects with a high appreciation for the safety of the public and its employees and meets or exceeds all applicable codes and requirements. The following are examples of the PPL Electric safety rules that illustrate the Company's dedication to employee and contractor safety:

- Work procedures have been developed to facilitate the safe performance of work on energized facilities. Any time lines or equipment is removed from service for repair or maintenance, an Energy Control Process system is applied. This system requires that a red tag be physically placed on the control handle of all de-energized equipment.
- The red tag may be removed only after proper authorization to re-energize the equipment has been received.
- Various other tags are used for limited operations and informational purposes.
- Only authorized employees and contractors can apply or remove a tag or change the status of tagged equipment.
- Temporary safety grounds are used on de-energized facilities to promote employee safety during maintenance, construction, or reconstruction work. Safety grounds are wires that connect a de-energized facility to an electrical ground. If the facility should be unintentionally energized, the safety grounds will reduce the likelihood of personal injury but diverting the current directly to ground.
- Lines are tested to confirm de-energization before applying safety grounds using a voltage testing device to assure reliability.
- Poles and structures are inspected and examined for structural integrity before climbing. If there is any reason to believe that a pole is unsafe, it is stabilized before any work is

performed. Appropriate safety gear in the form of body belts, safety straps, hard hats, gloves, etc., is always worn by linemen during line work activity.

#### **4.0 MAGNETIC FIELD MANAGEMENT PLAN**

PPL Electric’s Magnetic Field Management Program is applied to new and reconstructed transmission line projects. The Company does not believe that current scientific evidence demonstrates that magnetic fields cause any adverse health effects or pose a health or safety danger to the public. Nevertheless, PPL Electric has determined, as a matter of policy, to design its new and rebuilt transmission lines to reduce magnetic fields when consistent with functional requirements. The program generally prescribes the use of a line design with ground clearance that exceeds NESC standards by a minimum of five feet and reverse phasing of new double-circuit lines where feasible and can be implemented at low or no additional cost.