

**PPL ELECTRIC**  
**POINT OF COMMON COUPLING (PCC) REQUIREMENTS FOR**  
**DISTRIBUTION VOLTAGE FACILITIES**

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2	09/01/2023	884154	Added PCC recloser requirement for secondary customers with generators >=500 kW and modified the requirement for primary 12.47kV customers with generators to >=500kW (from 1000KW) Changed POC (point of contact) to PCC (point of common coupling) to align with industry naming conventions.	NP	MK	KWG	JJB		
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			Interconnections and Tariff Rules						

SORTS

LOC CODES

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## **FOREWORD**

PPL Electric Utilities (PPL or PPL Electric) prepared the information contained in this document. This document is owned by PPL's Distribution Interconnection and Tariff Rules department with technical inputs from Distribution Protection, Planning, Standards, Customer Service, and others.

This information represents the minimum design requirements required to ensure the safe and reliable operation of facilities to protect PPL Electric's system and personnel. However, this shall not relieve the customer from sole and complete responsibility for all aspects of design, installation, and operation of facilities.

Neither PPL Electric nor any person acting on behalf of PPL Electric:

- (a) makes any warranty with respect to the use of information disclosed in this document or that such use may not infringe on privately owned rights; or
- (b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information disclosed in this document.

## **SECTION 1: OVERVIEW OF INTERCONNECTING UTILITY AND CUSTOMER FACILITIES**

### **1.1 INITIATING A REQUEST TO ADD OR MODIFY CUSTOMER CONNECTIONS**

- 1.1.1 All projects to add or modify an existing business customer's connection to the PPL Electric system should start with a call to the PPL Electric Business Accounts Department at telephone number 1-888-220-9991, menu option 4 to contact a Business Accounts Specialist, who will appropriately respond to your inquiry. Alternatively, you may initiate contact with the Business Accounts Department by emailing [businessaccounts@pplweb.com](mailto:businessaccounts@pplweb.com).

### **1.2 POINT OF COMMON COUPLING (PCC) – GENERAL**

- 1.2.1 This Section defines specific practices required for the interconnection of customer facilities to the utility system at 12.47 kV, as well as lower secondary voltages in certain scenarios. The point of interconnection for a customer facility will be defined by the term Point of Common Coupling (PCC), which defines the physical point where the customer's facilities connect to the PPL Electric system. These requirements also generally apply to customers served at 4 kV or 23 kV, however the specific requirements may vary. Due

to the infrequent nature of customer's connecting at these voltages, please contact the Business Accounts Department by calling 1-888-220-9991, menu option 4 or by emailing [businessaccounts@pplweb.com](mailto:businessaccounts@pplweb.com) for details.

Point of Common Coupling (PCC) protection is required to protect PPL Electric facilities, as well as other customers supplied from the same circuit, from faults within the customer's equipment. PCC protection is not intended or specified to provide protection for the customer's equipment or facilities. The customer must provide additional protection devices to adequately protect their equipment; any protection of the customer's equipment that is provided by the PCC protection is coincidental—it must not be relied upon for comprehensive protection of the customer's equipment. Similarly, the fuse choices and relay settings are specified to provide the best possible protection for the PPL system for faults in the customer's equipment; these settings may not coordinate with the customer's low side protective devices or provide complete protection of the customer's equipment.

1.2.2 Additional specifications for customer connections are covered by other PPL documents or procedures, as follows:

- A. Installation requirements for 12.47 kV supply and lower voltages are covered in REMSI at the PPL website: [REMSI \(Rules for Electric Metering and Service Installation\)](#).
- B. If a customer is planning to operate a DER in parallel with PPL such as Independent Power Producers (IPP) or Distributed Energy Resources (DER), additional inter-tie protection and metering may be required. The customer must comply with the requirements of parallel operation of customer's DER as covered by the "[Relay and Control Requirements for Parallel Operation of Distributed Energy Resources](#)" document and the "SCADA Requirements for Parallel Operation of Distributed Energy Resources" document, as applicable.

1.2.3 The various sections of the PCC Requirements document address customer facilities at 12.47 kV voltage with single or multiple utility lines of supply. The following configurations are covered by this document:

- A. Single Line Supplies are covered in [Section 3.1](#)
- B. Alternate Supplies are covered in [Section 3.2](#)

- C. PPL Electric can help the customer determine the best facility configuration based on economics and electric service reliability. Refer to [Section 2](#) for a list of the customer's responsibilities.
  - D. Secondary customers with parallel generators  $\geq 500\text{kW}$  have some have some requirements specifically called out in this document.
- 1.2.4 Installation and upgrade costs for the PCC protective device will be included in the Line Extension Guarantee for customers taking Basic Utility Supply Service (BUSS).
- A. A Line Extension Guarantee is not available for alternate services or DER customers.

### 1.3 METERING OF ELECTRIC SERVICE

- 1.3.1 For billing metering of electric service at 12.47 kV or lower voltages, please refer to the PPL document titled, [REMSI \(Rules for Electric Metering and Service Installation\)](#). PPL normally meters at 12.47 kV or below.
- 1.3.2 Distributed Energy Resource (DER) installations, such as solar, will require metering facilities discussed in REMSI. To obtain these requirements, please refer to [REMSI Distributed Energy Resources \(DER\) Sketch Table](#) or contact the Business Accounts Department by calling 1-888-220-9991, menu option 4 or by emailing [businessaccounts@pplweb.com](mailto:businessaccounts@pplweb.com).

### DEFINITIONS

- 1.3.3 PPL Electric uses the following defined terms for various utility and customer facilities' configurations:
- AMPERES INTERRUPTING CAPACITY (AIC) - The highest available symmetrical, Root Mean Squared (RMS), alternating current at which the protective device has been tested, and which it has interrupted safely under standardized test conditions. AIC is also known as fault clearing capacity.
  - ALTERNATE SERVICE - PPL Electric furnishes one source of service to a single point of service to a premise. When an alternate source of service is requested by the customer, PPL Electric will install the additional facilities required. The customer must however compensate PPL Electric for the cost of the additional

facilities installed to supply the alternate service and for the future costs of maintaining the alternate service.

- Alternate Service can be configured in the two following ways:
  - Backup Service – A standby source, which can be selected to service customer load when the normal source is not available.
  - Dual Service “main–tie-main” – An electrical facility that is supplied by two utility service lines which are not paralleled by the customer facility but allows for the transfer and restoration of customer load.
- BUS - An electrical conductor which serves as a common connection for two or more electrical circuits. A bus may be in the form of rigid bars, either circular or rectangular in cross section or in form of stranded-conductor overhead cables.
- BUSINESS ACCOUNTS SERVICES (BAS) – Handle all electric delivery inquiries for mid-size industrial and commercial customers (GS3 RATE SCHEDULE, Three-Phase General Service at Secondary Voltage, and LP-4 RATE SCHEDULE, Large General Service at 12.47 kV and above) ranging from billing/tariff and customer choice to service requests and energy efficiency rebates.
- COLD SEQUENCE - In a cold meter sequence a disconnecting device is located on the line side (before) of the metering equipment.
- COMPANY - Herein after PPL Electric Corporation is called "PPL Electric", "PPL", or "the Company".
- CONNECTED KVA – This is the total nameplate transformer capacity connected beyond the Point of Common Coupling (PCC).
- CURRENT TRANSFORMER (CT) – A current transformer is an instrument transformer designed for the measurement or control of current. Its primary winding, which may be a single turn or bus bar, is connected in series with the

load. It is normally used to reduce primary current by a known ratio to within the range of a connected measuring device.

- CUSTOMER - A customer is an individual, firm, organization or other electric utility which purchases electric service at one location under one rate classification, contract, or schedule.
  - Note 1 – If service is provided to a customer at one location through more than one meter and under several rate classifications or schedules but only for one class of service (for example, separate meters for residential regular and water heating service), such multiple rate services shall be counted as only one customer at the one location.
  - Note 2 – Where service is used for only part of a month, the bill will be prorated.
  - Note 3 – Those customers purchasing electricity for their own use and not for resale.
  
- CUSTOMER POLE – A pole provided and owned by a customer. The pole is generally used as part of the customers' service facilities.
  
- DEMAND – The rate at which electric energy is delivered to or by a system or equipment expressed in kilowatts. The primary source of "demand" is the power-consuming equipment of the customer.
  
- DISTRIBUTED ENERGY RESOURCE(S) (DER) - Small-scale electric energy supply or demand resources that are interconnected to the distribution system, typically under 3 MW of capacity. They can include generation resources such as solar, wind, combined heat and power (CHP), natural gas/diesel generators, microturbines and fuel cells as well as energy storage technologies. They can be “behind the meter” or utility-owned DER and can be used individually or in aggregate to provide value to the distribution system.
  
- DISTRIBUTION – The act or process of distributing electric energy from convenient points on the transmission or bulk power system to the consumers.

- DISTRIBUTION LINE – One or more circuits of a distribution system on the same line of poles, supporting structures or underground system operating at relatively low voltage as compared with transmission lines.
- DISTRIBUTION SYSTEM – The distribution system includes all lines energized at voltages less than the nominal 69,000 volts (69 kV).
- FAULT INTERRUPTING DEVICE (FID) – Any device capable of interrupting fault current (circuit breaker, fuse etc..).
- FEDERAL ENERGY REGULATORY COMMISSION (FERC) – An independent agency that regulates the interstate transmission of electricity, natural gas, and oil.
- FOREIGN ENERGY SOURCE – Customer owned energy sources, including, but not limited to, DER, back up/emergency generation, all renewable energy sources, fuel cells, energy storage etc.
- FOREIGN UTILITY POLE – A pole owned by another utility company with whom PPL Electric has an agreement or understanding for joint use of poles.
- FURNISHED BY PPL Electric, INSTALLED BY CUSTOMER – Materials as specified shall be provided by PPL Electric at no expense to the customer and will be installed by the customer at their expense.
- FURNISHED AND INSTALLED BY PPL Electric – Either PPL Electric or an authorizing agent acting on PPL Electric's behalf shall provide labor and material at the expense of PPL Electric for the items as specified.
- HOT SEQUENCE – In a hot meter sequence, there is no disconnecting device located on the line side (before) the meter.
- INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) – A non-profit organization that is the world's leading professional association for the advancement of technology. The IEEE promotes the engineering process of creating, developing, integrating, sharing, and applying knowledge about



electrical and information technologies and sciences for the benefit of humanity and the profession.

- INSTRUMENT TRANSFORMER – A transformer that reproduces in its secondary circuit, in a definite and known proportion, the voltage or current of its primary circuit, with the phase relation substantially preserved. Instrument transformers allow standard meters to measure high currents and voltages.
- INTERNATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS (IAEI) – The association that plays a cohesive role among testing agencies, standards, organizations, manufacturers, distributors, contractors, and inspectors in the electrical industry.
- INTERNATIONAL RESIDENTIAL CODE (IRC) – The provisions of the International Residential Code for One – and Two – Family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal, and demolition of detached one – and two – family dwellings and multiple single-family dwellings (townhouses) not more than three stories in height with a separate means of egress and their accessory structure. See Chapter 1 Section R101 of the IRC for One – and Two – Family Dwellings for more information.
- JUNCTION BOX – A junction box is an electrical box used to run multiple conductors in two or more directions. Metering and termination compartments (CT Cabinets) are not considered by PPL Electric, to be junction boxes, they are defined as Metering Equipment.
- LINE EXTENSION – Any construction beyond the normal service facilities (which includes the service extension to the customer, transformers, transformer devices, service drop and meter) to extend the distribution system along the normal route of development of the distribution system to the point where the extension departs from the normal route of development and is being installed as a service extension solely for the customer.
- LINE VOLTAGE – See Primary Voltage and Secondary Voltage.

- METER BASE – An enclosure used to terminate service conductors and to accommodate the installation of PPL Electric’s self-contained meter.
- METERING EQUIPMENT – Refers to self-contained meter bases, metering, and termination compartment (CT Cabinets), manufactured meter stacks, metering compartments in customer owned switchgear, Current Transformers (CTs), Voltage Transformers (VTs) aka, Potential Transformers (PTs) secondary metering panels, pad mounted metering and service termination cabinets, etc.
- METER PANEL – An enclosure used to terminate PPL Electric’s secondary metering conductors and to accommodate the installation of PPL Electric’s secondary meter.
- METER SEQUENCE – Refers to the position of the meter in the circuit. See Hot Sequence and Cold Sequence.
- NATIONAL ELECTRIC CODE (NEC) – The standard as recommended by the National Fire Protection Association and adopted by the American National Standards Institute in effect at any given time for electrical wiring and apparatus.
- NATIONAL ELECTRICAL SAFETY CODE (NESC) – The rules published by the Institute of Electrical and Electronics Engineers (IEEE) applying to grounding, installation, maintenance and operation of electric supply, communication, utilization equipment, lines and facilities which have been adopted as standard by the American National Standards Institute (ANSI).
- ON-PEAK – Energy provided during periods of relatively high system demands as specified by the suppliers.
- OFF-PEAK – Energy provided during periods of relatively low system demands as specified by the suppliers.
- THE PENNSYLVANIA PUBLIC UTILITY COMMISSION (PUC) – The Pennsylvania Public Utility Commission aims to ensure safe, reliable, and reasonably priced electric, natural gas, water, telephone and transportation service for Pennsylvania consumers, by regulating public utilities and by serving as responsible stewards of competition.

- PJM INTERCONNECTION (PJM) – The regional transmission organization that PPL Electric is a member of. PJM ensures reliability of the largest centrally dispatched control area in North America by coordinating the movement of electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.
- POINT OF CONTACT (POC) – A legacy term replaced by Point of Common Coupling (PCC).
- POINT OF COMMON COUPLING (PCC) – The interconnection of customer facilities to the utility system, generally at 12.47 kV. The point of interconnection for a customer facility will be defined as Point of Common Coupling (PCC). Associated with the PCC are the protective relay and control functions required by the utility to provide the necessary isolation of the customer facilities under fault conditions either within the customer facility or on the PPL Electric system.
- POINT OF INTERCONNECTION – The electrical connection point where PPL Electric’s service conductors meet the customers service conductors.
- POINT OF SERVICE – The point in or on a premises, where PPL Electric’s overhead service drop or underground service lateral connects to the customer’s service entrance conductors. The location is designated by PPL Electric.
- POTENTIAL OR VOLTAGE TRANSFORMER (PT or VT) – An instrument transformer intended for measurement or control purposes which is designed to have its primary winding connected in parallel with a circuit, the voltage of which is to be measured or controlled.
- POLYPHASE – Two phase or three-phase voltages.
- PREMISES – A building, group of buildings and/or contiguous parcels of land under the control of a single customer and used for a single purpose. Contiguous parcels of land separated by a public road are considered separate premises. Separate buildings and adjoining buildings in a group of buildings, which are directly accessible to the public and function independently from the others, are separate premises. A building is defined by the National Electrical Code (NEC) as a structure which stands alone, or which is cut off from adjoining structures by

fire walls with all openings therein protected by approved fire doors. Fire walls and fire doors are defined by local building code.

- PRIMARY VOLTAGE – Primary voltage is the voltage at which electricity is delivered from a substation to a distribution transformer. Primary voltage is greater than 600 volts.
- RENEWABLE ENERGY SOURCE – An energy source which comes from natural resources such as sunlight, wind, rain, tides, bio-digestion, geothermal heat, etc. which are renewable (naturally replenished).
- ROADWAY – A roadway is any public or private road and unless otherwise specified it also includes other locations subject to vehicular traffic including but not limited to alleyways, driveways, loading docks and parking lot areas, etc.
- RULES FOR ELECTRIC METER AND SERVICE INSTALLATION (REMSI) – These are the Rules for Electric Meter and Service Installations (REMSI) as referred to in [Rule 2](#) G. of the electric service tariff of PPL Electric on file with the Pennsylvania Public Utility Commission (PUC). Nothing in these rules shall in any way conflict with the requirements of the National Electric Code (NEC), the National Electric Safety Code (NESC) or with any national, state, or municipal ordinance applying to electrical installations. These rules are issued to advise the customer, architect, engineer, or electrical contractor of the general type of wiring and electrical apparatus and method of installation acceptable to PPL Electric. All sketches included in this document are for illustration only; PPL Electric will provide detailed construction drawings upon request from the customer.
- SECONDARY SERVICE – Service provided at less or equal to 600 Volts.
- SECONDARY VOLTAGE – Secondary voltage is the voltage at which electricity is delivered from the distribution transformer to the customer. Secondary voltage is less than or equal to 600 volts.
- SERVICE – As used herein refers to the supply of PPL Electric’s product “electric energy” to the customer.

- SERVICE DROP / SERVICE WIRES – That portion of an overhead service installation provided by PPL Electric between its pole or aerial support and the point of connection to the customer’s service entrance conductors.
- SERVICE ENTRANCE – The customer owned common point of termination for PPL Electric’s service lateral/service drop. A service drop refers to an overhead service and a service lateral refers to an underground service.
- SERVICE ENTRANCE CONDUCTORS – The portion of an overhead or underground service installation served by the customer between PPL Electric’s service drop or service lateral and the customer’s service equipment.
- SERVICE DISCONNECTING EQUIPMENT – The necessary equipment, usually consisting of circuit breaker(s) or switch and fuses and their accessories, located near the point of entrance of service conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the service.
- SERVICE INSTALLATION – The connection between PPL Electric’s distribution system and the customer’s service equipment is a service installation and is commonly referred to as “a service”. This generally consists of the Service Drop or Service Wires, Service Lateral, and Service Entrance Conductors.
- SERVICE LATERAL – The portion of an underground service installation served by PPL Electric between its overhead or underground distribution mains and the point of connection to the customer’s service equipment.
- SERVICE TERMINATION COMPARTMENT – The interconnection point where PPL Electric’s service conductors connect to the customers service entrance conductors.
- SERVICE VOLTAGE – Service Voltage is the voltage of PPL Electric’s service to a particular customer.
- SINGLE LINE SUPPLY – A customer facility which is supplied via a single Point of Common Coupling (PCC).

- STANDBY SERVICE – Service that is not normally used but which is available through a permanent connection in lieu of, or as a supplement to, the usual source of service.
- SUBSTATION – A substation is an assemblage of equipment for the purpose of switching and/or changing or regulating the voltage of electricity. Service equipment, line transformer installations, or minor distribution or transmission equipment are not classified as substations.
- SWITCHING DEVICE – Any device capable of making or breaking load. (Disconnects, breakers, fuses, etc.).
- SWITCHING STATION – An assemblage of equipment for the sole purpose of tying together two or more electric circuits through switches selectively arranged to permit a circuit to be disconnected, as in case of trouble, or to change the electric connections between the circuits, a type of substation.
- TARIFF – The schedules of rates or charges of PPL Electric and its associated rules and regulations as filed with the regulatory agency having jurisdiction over its operations.
- TRANSFORMER – An electromagnetic device for changing the voltage of alternating-current electricity.
- TRANSFORMER BANK – The installation of two or more transformers in a single location to serve customer(s).
- TRANSFORMER PAD MOUNT – A transformer sitting on a pad on the ground.
- TRANSFORMER VAULT – Enclosure for housing transformers located either above or below grade to serve customer(s).
- TRANSMISSION – The act or process of transporting electric energy in bulk from a source or sources of supply to other principal parts of the system or to other utility systems.

- TRANSMISSION LINES – Lines with nominal phase to phase voltages of 69,000 Volts (69 kV) or higher.
- UNIFORM CONSTRUCTION CODE (UCC) – The UCC was established to provide uniform standards for new construction and renovations around the state of Pennsylvania. Commercial buildings will comply with the International Building Code (IBC); residential builders will choose either the International Residential Code (IRC) or CABO (Council of American Building Officials) code. The code applies to almost all buildings, excluding manufactured and industrialized housing (which are covered by other laws), agricultural buildings and certain utility and miscellaneous buildings.
- U.S. DEPARTMENT OF LABOR OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA) – Their mission is to assure the safety and health of United States of America’s workers by setting and enforcing standards, providing training, outreach, and education, establishing partnerships, and encouraging continual improvements in workplace safety and health.
- VACUUM CIRCUIT RECLOSER (VCR) – A pole mounted or submersible microprocessor-controlled fault interrupting device (FID).
- VOLTAGE – The electric pressure measured in volts. It is generally a nominal rating based on the maximum normal effective difference of potential between any two conductors.

WORK REQUEST NUMBER – The unique number assigned by PPL Electric for the purpose of designing, tracking, constructing, and billing a project.

#### **1.4 POWER TRANSFORMER CONNECTIONS AND VECTOR DIAGRAMS**

- 1.4.1 PPL employs a “C-B-A” phase sequence at voltage levels of 138 kV and below. Most references cite an “A-B-C” or “1-2-3” sequence. For PPL, the equivalent would be “C-B-A” or “1-2-3.”
- 1.4.2 PPL connects the high side of delta-wye substation power transformers in the following manner in all regions except the Lancaster region:

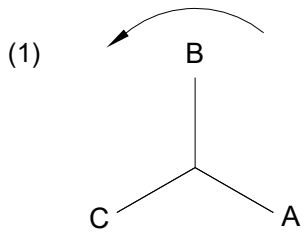
A phase – H1 Bushing  
B phase – H2 Bushing  
C phase – H3 Bushing

for the Lancaster Region:

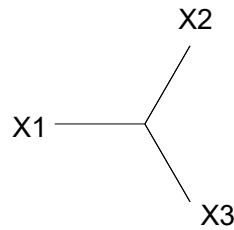
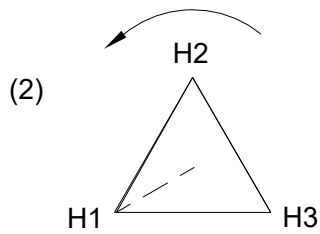
C phase – H1 Bushing  
B phase – H2 Bushing  
A phase – H3 Bushing

- 1.4.3 For all PPL Regions, except Lancaster, the transformer connections noted above and the standard phase relationships and transformer terminal designations for three-phase power transformers as outlined in IEEE Standard C57.12.00-2021 result in a non-standard phase displacement of the low side voltage leading the high side voltage by 30 degrees.
- 1.4.4 For Lancaster Region, the transformer connections noted above and the standard phase relationships and transformer terminal designations for three-phase power transformers as outlined in IEEE Standard C57.12.00-2021 result in the low side voltage lagging the high side voltage by 30 degrees.
- 1.4.5 The diagrams on the following page illustrate the transformer connections and angular displacements noted in the discussion above.

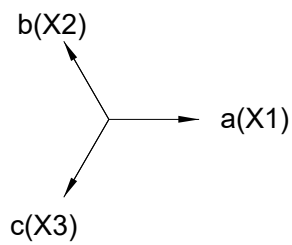
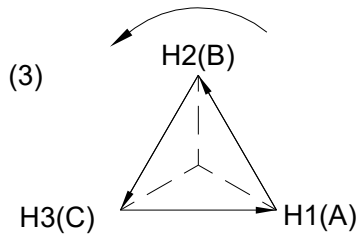




PPL 230 KV AND BELOW  
C-B-A ROTATION



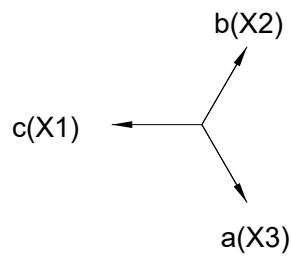
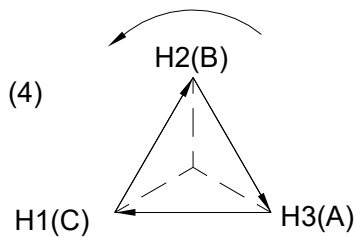
INDUSTRY STANDARD



LOW VOLTAGE LEADS  
HIGH VOLTAGE BY 30°  
(SYSTEM).

HIGH VOLTAGE

LOW VOLTAGE



LOW VOLTAGE LAGS  
HIGH VOLTAGE BY 30°  
(LANCASTER).

HIGH VOLTAGE

LOW VOLTAGE

## 1.5 BASIC INSULATION LEVELS (BIL) AND CLEARANCES

1.5.1 Minimum insulation levels for service voltage (higher levels are customer's option):

- A. 12.47 kV system = 110 kV BIL (open air)
- B. 12.47 kV system = 95 kV BIL (switchgear)

1.5.2 Electrical clearances (phase-to-phase, phase-to-ground, elevation above grade/road, etc.) of bus conductor and equipment in a substation shall, at a minimum, be designed to the National Electrical Code (NEC) and National Electrical Safety Code (NESC) requirements, latest code revisions, for the BIL chosen.

1.5.3 Minimum insulation levels for service voltage (higher levels are customer's option):

Nominal System Voltage (kV)	Basic Impulse Level (kV BIL)	Disconnecting Vertical Break (inch)
12.47	95	30

## 1.6 VOLTAGE LEVELS AND VARIATION

1.6.1 The primary voltage levels on the PPL system are as noted below:

	Nominal System Voltage (kV)	Typical Voltage Range at Point of Connection High – Low (kV)
All PPL Service Territory (except Hershey Area)	12.47	13.1 – 11.8
Hershey Area (Check with PPL)	13.2	13.8 – 12.5

1.6.2 The anticipated operating voltage at a given location can be obtained by contacting the PPL Electric representative.

## 1.7 INSTALLATIONS INVOLVING 15KV CLASS SWITCHGEAR

1.7.1 For Installations involving 15 kV class switchgear (12.47 kV supply) please refer to the REMSI instructions at website: [REMSI \(Rules for Electric Metering and Service Installation\)](#) and PPL Customer Reference Specification [\(CRS\) 6-09-199](#), titled "Installation Instructions for 12.47 kV 3-Phase Service Termination and Metering

Compartments in Customer-Owned Switchgear Cubicles, Underground Supply”, for requirements.

## 1.8 INSTALLATIONS INVOLVING A SINGLE LINE SUPPLY

1.8.1 For single line supply with less than or equal to 2,500 kVA connected transformer capacity, a customer-owned paralleled DER less than 500 kW and/or no backup DER with a break-before-make transfer switch operation (also known as “open transition”), the following conditions apply:

- A. The PCC fault interrupting device will be a PPL Electric-owned, installed and maintained fused disconnects. Refer to [Section 3.1](#) for additional information.
- B. The maximum fuse size will be a Kearny 80k fuse link or similar.
- C. At the request of the customer, a vacuum circuit recloser (VCR) may be substituted as the PCC fault interrupting device. The VCR would be installed, owned, and maintained by PPL Electric, and paid for by the customer under the Line Extension Guarantee, as mentioned in Section 1.2.4. (LEG) for load Customers taking Basic Utility Supply Service (BUSS).

1.8.2 For single line 12kV supply with connected transformer capacity greater than or equal to 2,500 kVA, a customer-owned with paralleled DER greater than or equal to 500 kW at 12 kV or below, or with a make-before-break transfer switch (also known as “closed transition”) operation, the following conditions apply:

- A. The PCC fault interrupting device required for customers taking Basic Utility Supply Service (BUSS) will be a PPL Electric owned, installed, maintained Vacuum Circuit Recloser (VCR) and paid for by the customer under the Line Extension Guarantee (LEG), as mentioned in Section 1.2.4.
- B. The PCC fault interrupting device required for Distributed Energy Resources (DER) or any paralleled DER will be a PPL Electric owned, installed and maintained Vacuum Circuit Recloser (VCR) paid for by the customer as an upfront payment. This applies to both customer-owned transformers serving primary (12.47 kV) customers and PPL Electric owned transformers serving secondary (below 12.47 kV) customers. Refer [Section 3.1](#) for additional information.

## 1.9 INSTALLATIONS INVOLVING ALTERNATE SERVICE

- 1.9.1 The PCC fault interrupting device will be a PPL Electric-owned, installed and maintained Vacuum Circuit Recloser (VCR). Refer to Section 3.2 and paid by the customer as upfront payment. [Section 3.2](#) for more information.

## SECTION 2: CUSTOMER RESPONSIBILITIES

### 2.1 CUSTOMER RESPONSIBILITIES CHECKLIST

- 2.1.1 The list of Customer Responsibilities covered in the following page provides the customer with a list of activities that must be completed before obtaining service or if an existing customer is planning to change their facilities, equipment, or load. Obtaining the information listed below in a timely manner will aid PPL greatly in our efforts to coordinate the installation of PCC protection equipment at the point of common coupling for high-voltage service.

<b><u>Description</u></b>	<b><u>Reference</u></b>
<input type="checkbox"/> Call PPL Business Accounts Department to initiate process	Telephone No. 1-888-220-9991, menu option 4
<input type="checkbox"/> Complete Application for Service	PPL Electric Application for Electric Service
<input type="checkbox"/> Submit site drawings showing desired location of electric service	
<input type="checkbox"/> Provide Letter of Intent (may be required)	
<input type="checkbox"/> Return signed Electric Service Contract (may be required)	
<input type="checkbox"/> Submit customer proposed one-line diagram	<a href="#">Section 4</a> of this document
<input type="checkbox"/> If emergency backup DER is installed, provide a one-line diagram showing connection of the PPL Electric service to the DER equipment. Provide the manufacturer and model number of the transfer switch.	<a href="#">REMSI Rules</a> (26) REMSI – Approved Metering and Equipment Tables Index
<input type="checkbox"/> Submit preliminary “shop” drawings for PPL review <b>prior</b> to ordering equipment	<a href="#">Section 4</a> of this document
<input type="checkbox"/> Submit final “as built” drawings incorporating required PPL changes for point-of-contact protection <b>prior</b> to ordering equipment	<a href="#">Section 4</a> of this document

### Description

### Reference

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li><input type="checkbox"/> For Underground Services:<br/>Submit switchgear drawings for approval – <b>must</b> comply with reference documents<ul style="list-style-type: none"><li>1. Termination cubicle</li><li>2. Metering cubicle</li></ul></li><li><input type="checkbox"/> For Overhead Services:<br/>Switch &amp; Meter poles <b>must</b> comply with reference documents</li><li><input type="checkbox"/> Install PPL billing metering CTs and VTs per PPL specifications</li><li><input type="checkbox"/> Complete inspection requirements—by an independent electrical inspection agency</li><li><input type="checkbox"/> Provide as-built drawings for PPL Electric file, including final one-line diagram</li></ul> <hr/> | <p><a href="#">REMSI Sketch</a> (31, 32, 39, 40, 90)<br/><a href="#">REMSI Rules</a> (3, 8, 18)<br/><a href="#">Customer Reference Spec</a> (6-09-192, 6-09-195, 6-09-199)</p> <p><a href="#">REMSI Sketch</a> (30, 31, 32, 33, 34, 90)<br/><a href="#">REMSI Rules</a> (3,7,18)<br/><a href="#">Customer Reference Spec</a> (6-09-192, 6-09-199)</p> <p><a href="#">REMSI Sketch</a> (33, 34, 40, 90)<br/><a href="#">REMSI Rules</a> (12, 18)<br/><a href="#">Customer Reference Spec</a> (6-09-196, 6-09-197, 6-09-199, 6-09-200)</p> |
|--|--|

## **SECTION 3: PROTECTION AND CONTROL REQUIREMENTS FOR SUPPLY**

### **3.1. SINGLE LINE SUPPLY– NO ALTERNATE SUPPLY,**

(See diagrams on pages 28-29)

#### 3.1.1. Configuration and Operating Philosophy

- A. Single line supply configuration provides service to the customer via a single line of supply. A set of fused disconnects or a three-phase electronically controlled Vacuum Circuit Recloser (VCR) will be installed, owned, and maintained by PPL Electric at the end of the PPL Electric owned 12.47 kV tap. The fuses or VCR will serve as the Point of Common Coupling (PCC) protection.
- B. All settings and programming of the VCR or fuse selection will be performed by PPL Electric.
- C. Fuses will be the default choice for the PCC protection device; however, a VCR will be installed for the following conditions:
  - 1) Total connected transformer capacity greater than 2,500 kVA
  - 2) Closed transition backup DER
  - 3) Any paralleled DER greater than or equal to 500 kW (connected at 12 kV or below)
  - 4) When mutually beneficial for the company and the customer
- D. If the above criteria are met, any existing PCC relays will be updated to require a VCR to be the PCC protection device as required by PPL's current protection standard.

#### 3.1.2. Function of a PCC Fuse

- A. PCC construction requirements for customers taking supply at 12.47 kV and lower voltage levels can be found in the REMSI document, at the following website: [REMSI \(Rules for Electric Metering and Service Installation\)](#).
- B. The intention of PCC fuse is to isolate the customer from the PPL system for the following conditions:

- 1) Faults between the PCC fuse and the first customer owned fault interrupting device.
  - 2) Faults not adequately cleared by the customer's fault interrupting devices.
- C. Fuse selection will be based on the customer's load on the PPL Electric system. Coordination with customer owned protection will be attempted but cannot be guaranteed.
- D. The PCC fuse is not intended to provide protection for customer owned equipment.

### 3.1.3. Function of a PCC VCR

- A. PCC construction requirements for customers taking supply at the 12.47 kV and lower voltage levels can be found in the REMSI document, at the following website: [REMSI \(Rules for Electric Metering and Service Installation\)](#).
- B. The intention of a PCC VCR is to isolate the customer from the PPL Electric system for the following conditions:
- 1) Faults between the PCC VCR and the first customer owned fault interrupting device.
  - 2) Power flow into the PPL Electric system from the customer bus. Power flow could be sourced by a customer owned DER.
  - 3) Faults not adequately cleared by the customer's fault interrupting devices.
- C. The PCC VCR is not intended to provide protection for customer owned equipment.
- D. Overcurrent based fault protection settings will be coordinated against the PPL Electric system regarding customer load. Coordination with customer owned protection will be attempted but cannot be guaranteed.
- E. Reverse power and reverse current protection settings will be utilized to detect current flowing from the customer bus into the PPL Electric system.
- 1) Reverse power will be used to detect load flow from the customer bus; the time delay for a reverse power condition will be typically set at 0.5 seconds.

- 2) Reverse current will be used to detect current flowing from the customer bus to a fault on the PPL Electric system; the time delay for a reverse current condition will be typically set at no more than 0.1 seconds.

#### 3.1.4. Normal Operation

- A. Under normal operating conditions, the PCC recloser is closed and carrying load.

#### 3.1.5. Customer Equipment Protection

- A. Protective relaying can be applied as required to protect additional customer equipment. These customer-specified relays can initiate a trip of the customer's equipment and are not considered as part of PPL Electric PCC protective relaying.
- B. PPL Electric may comment on additional customer relaying, but these relay settings will not be specified, nor will the settings be applied by the utility.

#### 3.1.6. Protection for Utility Supply Line Faults

- A. Supply line faults are cleared remotely by the utility. This action isolates the fault, and the customer load is interrupted when the utility Fault Interrupting Device (FID) opens. Any customer DER that may export fault current and/or voltage and/or frequency outside the prescribed operating range shall also trip the PCC recloser.

#### 3.1.7. PPL Billing Metering

- A. All Current Transformers (CTs) Potential Transformers (PTs) and meters for Billing Metering will be provided by PPL Electric for customer installation. All necessary information about metering requirements is also provided by PPL Electric.
- B. No relays or other meters are to be connected to the CTs and PTs used for Billing Metering. Similarly, no customer loads will be connected to Billing Metering CTs or PTs.
- C. The preferred location for the PPL Billing Metering CTs and PTs is on the customer's operating bus side of the customer's main switching device. If the customer adds a second supply line or installs emergency standby DER (or if the customer plans to add these facilities in the future), the customer may want to consider adding a disconnect switch between the billing metering CTs and PTs and the operating bus. This additional disconnect switch will allow the customer's

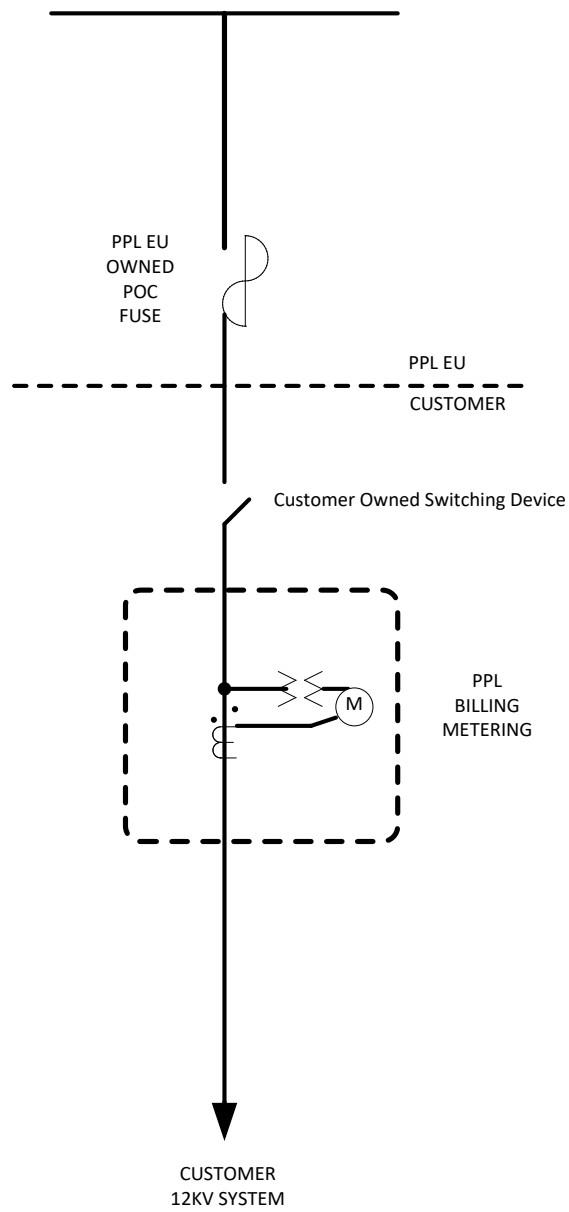


operating bus to remain energized via the alternate source (supply line or emergency standby DER) if the metering, metering CTs or metering PTs must be maintained or replaced. Refer to [Section 3.2](#) of this document for more information on Alternate Service.

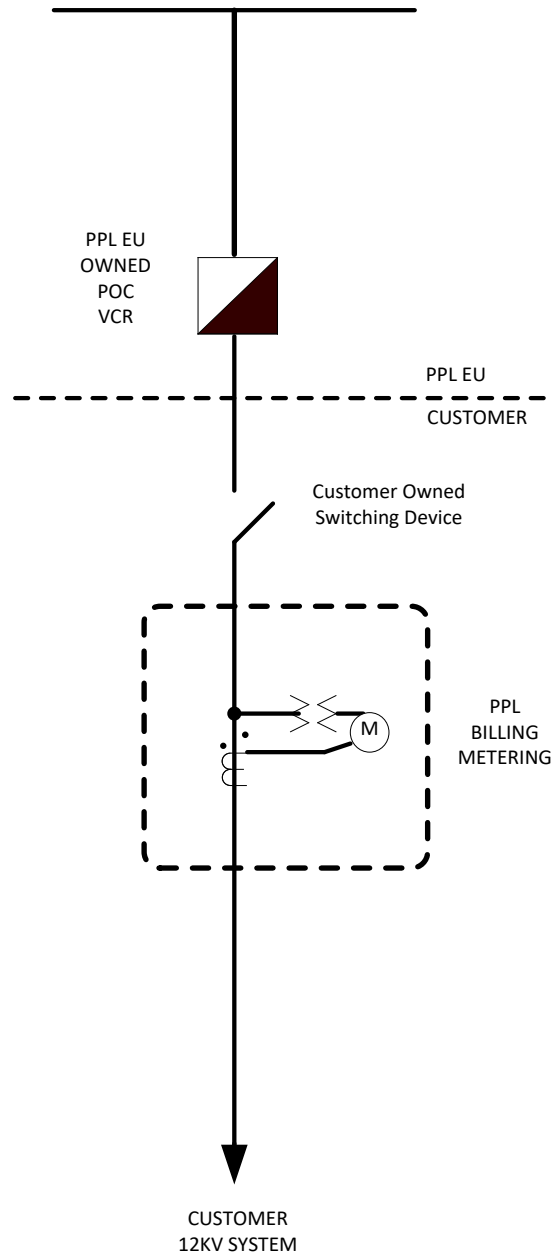
#### 3.1.8. Operating Transformers

- A. All substation load, such as battery chargers, lights, heaters, etc., will be supplied from operating transformers. These operating transformers must be connected such that the billing metering will record the usage of the load connected to them.

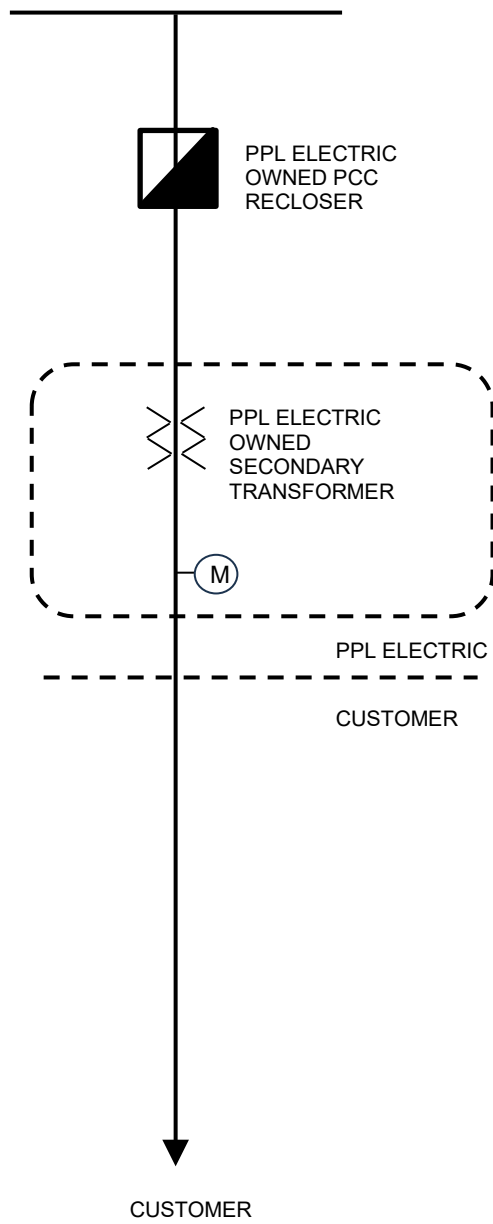
3.1.9. One-Line Diagram – Less Than or Equal to 2,500 kVA, a paralleled DER less than 500 kW and/or No Close Transition Transfer Switch



3.1.10. One-Line Diagram – Greater Than 2,500 kVA, paralleled DER greater than or equal to 500 kW or Closed Transition Transfer Switch



3.1.11 One-Line Diagram – Secondary with paralleled generation greater than or equal to 500 kW



### 3.2. ALTERNATE SUPPLY

(See diagrams on pages 36-39)

#### 3.2.1. Configuration and Operating Philosophy

- A. Alternate Service provides service to the customer via two lines of supply. During normal operation, the supply lines may not be paralleled via the customer operating bus or any other downstream customer facilities. A three-phase electronically controlled Vacuum Circuit Recloser (VCR) will be installed, owned, and maintained by PPL Electric at the end of both PPL Electric owned 12.47 kV taps. These two VCRs will serve as the PPL Electric-owned Point of Common Coupling (PCC) protection.
- B. The Customer pays for installation of the PCC VCR for the Alternate Service, as an upfront cost, according to [Tariff Rule 4 D. ALTERNATE SERVICE](#). All settings and programming for the VCRs will be performed by PPL.
- C. Alternate supplies may be operated in one of the following configurations:
  - 1) Dual Supply “Main/Tie/Main”
    - a) This configuration consists of a normally closed Main switching device for each 12.47 kV source and a normally open Bus Tie switching device. Each Main switching device feeds an independent customer owned bus; these two customer owned buses are tied together through the normally open Bus Tie switching device. Load transfers for this configuration may be automatic or manual and are discussed under section 3.2.6.
  - 2) Stand-By Supply
    - a) This configuration consists of a normally closed main switching device for one 12.47 kV source and a normally open main switching device for the other 12.47 kV source. Each main switching device feeds the same bus, however only one main switching device is to be closed at a time. Load transfers for this configuration may be automatic or manual and are discussed under section 3.2.6.

- D. For higher reliability two independent 12.47 kV lines of supply may be available. This type of supply must be investigated by PPL to determine if it is available and to determine what additional cost will be incurred by the customer.
- E. Any existing PCC relays must be upgraded to a PCC VCR.

### 3.2.2. Function of the PCC VCR

- A. The intention of the PCC VCR is to isolate the customer from the PPL Electric system for the following conditions:
  - 1) Faults between the PCC VCR and the first customer owned fault interrupting device.
  - 2) Power flow into the PPL Electric system from the customer bus. Power flow could be sourced by a parallel utility 12.47 kV supply line or by a customer owned DER.
  - 3) Faults not adequately cleared by the customer's fault interrupting devices.
- B. Overcurrent based fault protection settings will be coordinated against the PPL system regarding customer load. Coordination with customer owned protection will be attempted but cannot be guaranteed.
- C. Reverse power and reverse current protection will be utilized to detect current flowing from the customer bus into the PPL Electric system.
  - 1) Reverse power will be used to detect load flow from the customer bus; the time delay for a reverse power condition will be typically set at 0.5 seconds.
  - 2) Reverse current will be used to detect current flowing from the customer bus to a fault on the PPL system; the time delay for a reverse current condition will be set at no more than 0.1 seconds.
- D. The PCC VCR is not intended to provide protection for customer owned equipment.

### 3.2.3. Normal Operation

- A. Under normal operating conditions, the PCC recloser is closed and carrying load or ready to carry load.

#### 3.2.4. Customer Equipment Protection

- A. Additional protective devices can be applied as required to protect the customer's equipment. These customer-specified devices will initiate a trip of the customer's switching devices and are not considered as PCC protection. These additional customer devices are solely installed and applied at the discretion of the customer.
- B. PPL Electric may comment on this additional customer protection, but these protective settings are neither specified nor applied by the utility.

#### 3.2.5. Protection for Utility Supply Line Faults

- A. Since the supply lines are not paralleled through the customer's equipment, supply line faults are cleared remotely by the utility. This action isolates the fault, and the corresponding customer load is interrupted briefly until the customer owned transfer scheme operates to supply the interrupted customer load from the alternate line, or until the normal 12.47 kV supply is re-energized.

#### 3.2.6. Load Transfer Schemes

##### A. Automatic Closed Transition

##### 1) Automatic Transfer Upon Loss of a 12.47 kV Source

- a) Loss of the 12.47 kV source must be detected by under-voltage relays.
- b) Loss of potential on a single phase shall initiate automatic transfer.
- c) Potential check must be referenced line to ground.
- d) All transfers are normally initiated with a minimum 2.0 second time delay. This assures that the opposite source is energized before load transfer and that this transfer does not occur during transient system fault conditions.
- e) Appropriate interlocks must be included to ensure that the selected source switching device is tripped before the 12.47 kV bus sectionalizing switching device can be closed.

- f) For any close transition in the customer facility on the 12.47 kV side, an SEL-751 shall need to be installed which will monitor the status of normally closed and normally open switching devices and trip one of them if paralleling time exceeds 100 ms.
- 2) Automatic Return to Normal Operation Upon Return of Lost 12.47 kV Source
- a) Automatic return to normal operation is initiated only after a three-phase potential check of the restored line.
  - b) Over-voltage relays monitoring the utility 12.47 kV supply lines initiate the automatic return to normal operation.
  - c) Potential check must be referenced line to ground.
  - d) The return shall be initiated with a minimum 3-minute time delay.
  - e) For any close transition in the customer facility on 12.47 kV side, a SEL-751 shall be installed which will monitor the status of normally closed and normally open switching devices and trip one of them if paralleling time exceeds 100 ms.
  - f) Any transition which places PPL Electric sources in parallel must be completed within 0.5 seconds. Parallel operations lasting longer than 0.5 seconds may initiate tripping of one of the PCC VCRs.
  - g) Automatic Closed Transition Return to Normal Operation must be investigated and approved by PPL Electric to determine if it is acceptable.

#### B. Manual Closed Transition

- 1) Manual Transfer Upon Loss of a 12.47 kV Source
  - a) Appropriate interlocks must be included to ensure that the selected source switching device is tripped before the 12.47 kV bus sectionalizing switching device can be closed.



- 2) Manual Return to Normal Operation Upon Return of Lost 12.47 kV Source – Closed Transition
  - a) Manual return to normal operation may only be initiated after the customer verifies three-phase potential of the restored line.
    - Potential check can be confirmed by indicating lights or by voltmeter.
    - Potential check must be referenced line to ground.
  - b) Manually closing the normal source breaker must initiate a trip of the normally open breaker.
  - h) For any close transition in the customer facility on the 12.47 kV side, a SEL-751 shall be installed which will monitor the status of normally closed and normally open switching devices and trip one of them if paralleling time exceeds 100 ms.
  - c) Any transition which places PPL Electric sources in parallel must be completed within 0.5 seconds. Parallel operations lasting longer than 0.5 seconds may initiate tripping of one of the PCC VCRs.
  - d) Manual Closed Transition Return to Normal Operation must be investigated and approved by PPL Electric to determine if it is acceptable.

#### C. Automatic Open Transition

- 1) Automatic Transfer Upon Loss of a 12.47 kV Source
  - a) An interlock shall be provided to ensure that when an automatic transfer is initiated the lost source switching device is open before closing the normally open switching device.
  - b) Loss of the 12.47 kV line must be detected by under-voltage relays.
  - c) Loss of potential on a single phase shall initiate automatic transfer.
  - d) Potential check must be referenced line to ground.

- e) All transfers are normally initiated with a minimum 2.0 second time delay. This assures that the opposite source is energized before load transfer and that this transfer does not occur during transient system fault conditions.
- 2) Automatic Return to Normal Operation Upon Return of Lost 12.47 kV Source
- a) Automatic return to normal operation is initiated only after a three-phase potential check of the restored line.
  - b) Over-voltage relays monitoring the utility 12.47 kV supply lines initiate the automatic return to normal operation.
  - c) Potential check must be referenced line to ground.
  - d) An interlock must be provided to ensure that the normal open switching device is tripped before closing the restored source.
  - e) The return shall be initiated with a minimum 3-minute time delay. The normal closed switching device of the restored source is closed after the bus sectionalizing switching device is tripped.

#### D. Manual Open Transition

- 1) Manual Transfer Upon Loss of a 12.47 kV Source
  - a) The selected source switching device must be tripped before the customer bus sectionalizing switching device can be closed.
  - b) An interlock shall be provided to ensure that when a transfer is initiated, the lost source switching device is open before closing the normally open switching device.
- 2) Manual Return to Normal Operation Upon Return of Lost 12.47 kV Source
  - a) Manual return to normal operation may only be initiated after the customer verifies three-phase potential of the restored line.
    - Potential check can be confirmed by indicating lights or by voltmeter.

➤ Potential check must be referenced line to ground.

- b) An interlock must be provided to ensure that the normal open switching device is tripped before closing the restored source.

### 3.2.7. PPL Billing Metering

- A. All Current Transformers (CTs) Potential Transformers (PTs) and meters for Billing Metering will be provided by PPL Electric for customer installation. All necessary information about metering requirements is also provided by PPL Electric.
- B. The CTs and PTs are for PPL Billing Metering use ONLY. Similarly, no customer loads will be connected to Billing Metering CTs or PTs.
- C. The PPL Billing Metering CTs and PTs must be located on the customer's operating bus side of the switching device. If the customer adds a second supply line or installs emergency standby DER (or if the customer plans to add these facilities in the future), it is recommended that the customer install a disconnect switch between the billing metering CTs and PTs and the operating bus. This additional disconnect switch will allow the customer's operating bus to remain energized via the alternate source (supply line or emergency standby DER) if the metering, metering CTs or metering PTs must be maintained or replaced.

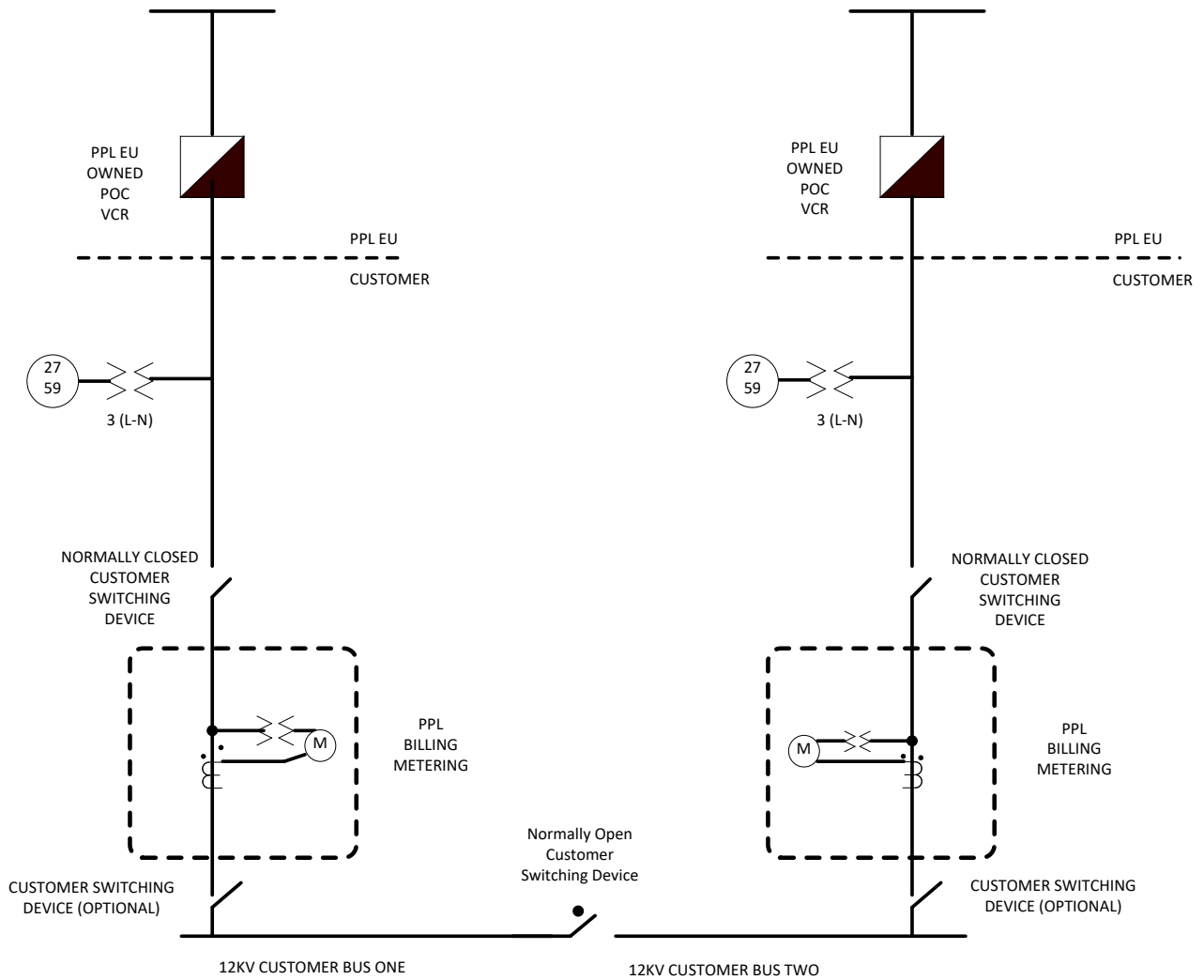
### 3.2.8. Operating Transformers

- A. All substation load, such as battery chargers, lights, heaters, etc., will be supplied from operating transformers. These operating transformers must be connected such that the billing metering will record the usage of the load connected to them.

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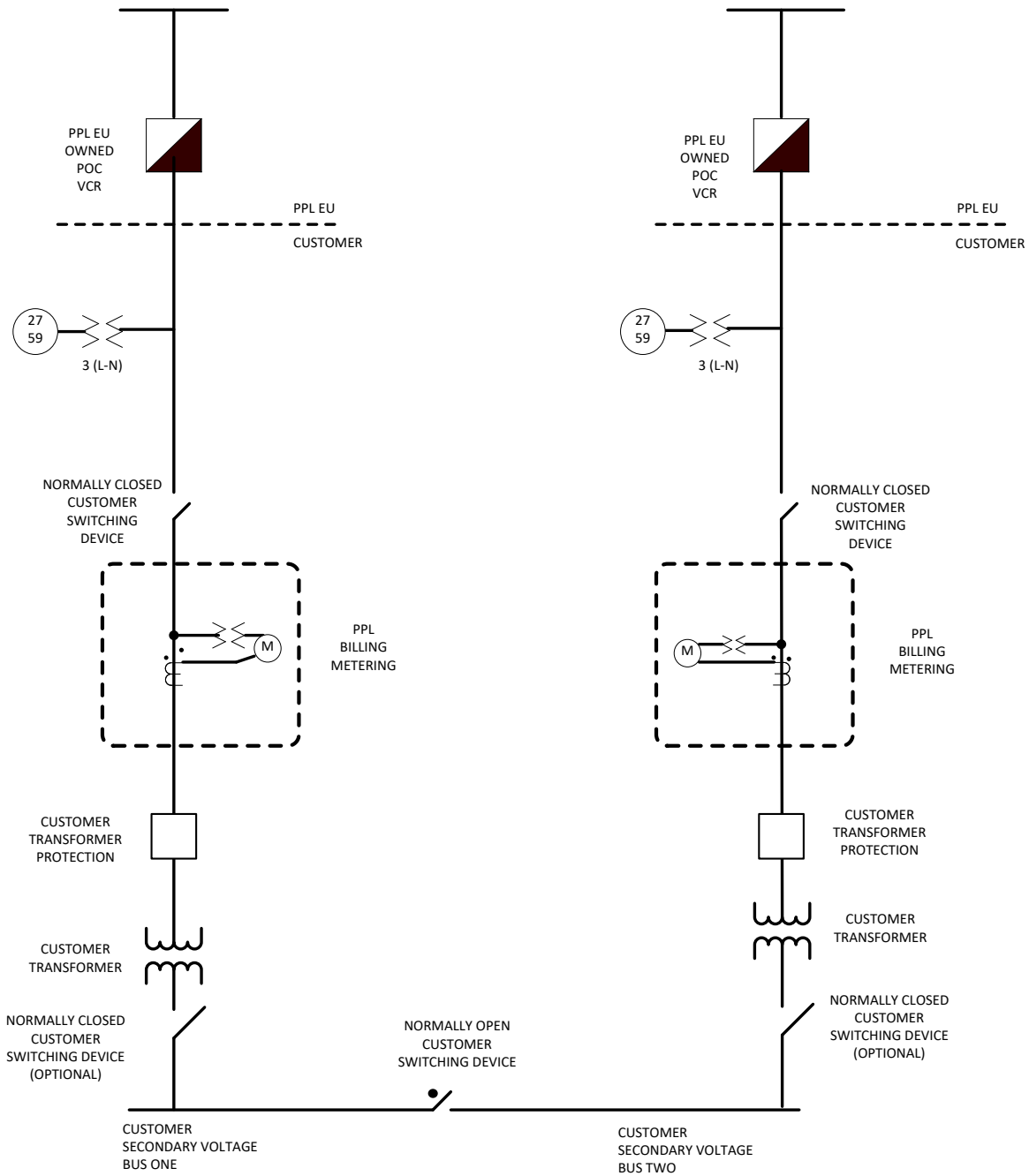
3.2.9. Alternate Supply – Dual Supply Configuration – Option One

**ALTERNATE SUPPLY**  
**DUAL SUPPLY CONFIGURATION**  
**“MAIN/TIE/MAIN”**  
**OPTION 1**



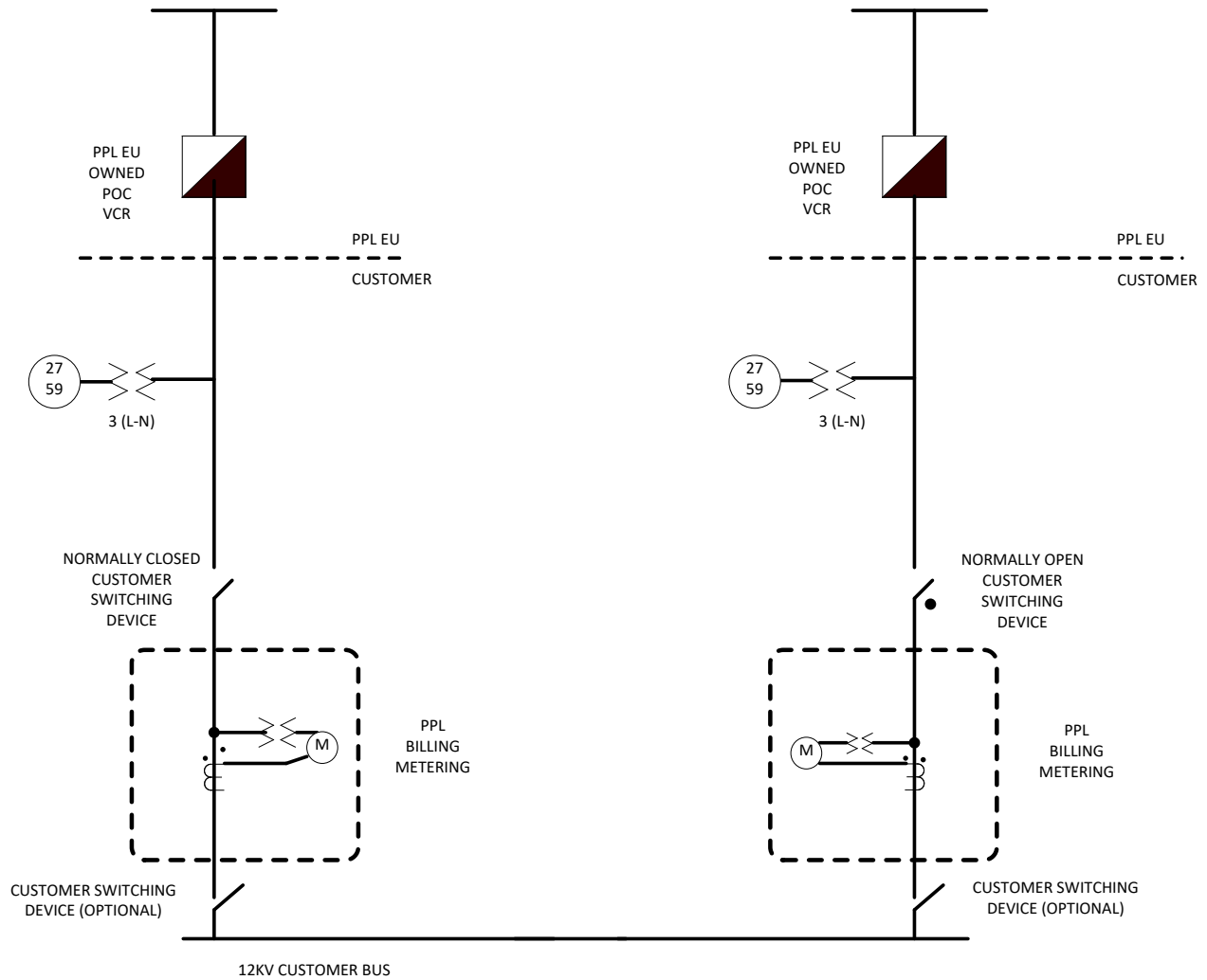
3.2.10. Alternate Supply – Dual Supply Configuration – Option Two

**ALTERNATE SUPPLY**  
**DUAL SUPPLY CONFIGURATION**  
**“MAIN/TIE/MAIN”**  
**OPTION 2**



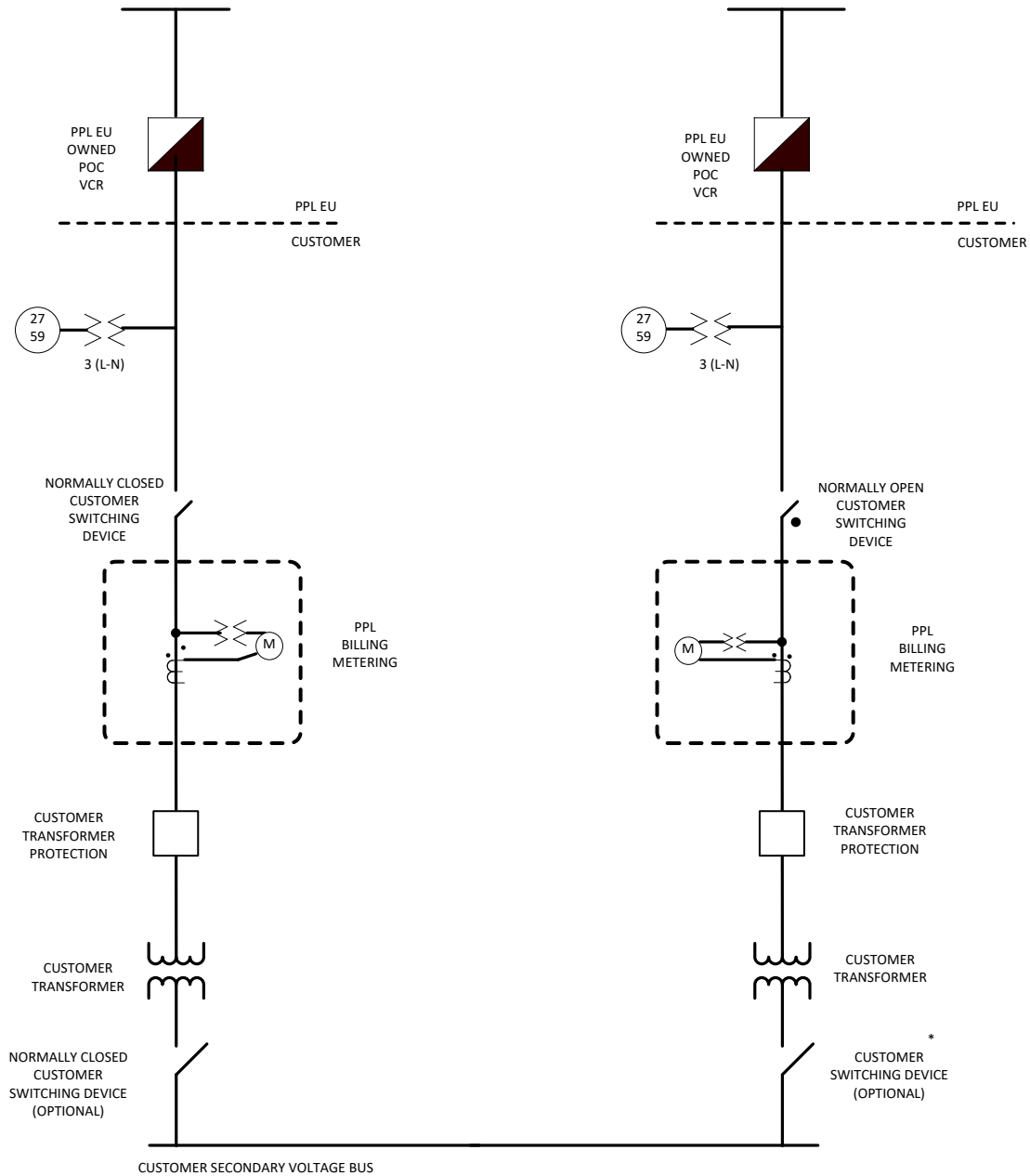
3.2.11. Alternate Supply – Backup Supply Configuration – Option One

**ALTERNATE SUPPLY**  
**BACK UP SUPPLY CONFIGURATION**  
**OPTION 1**



3.2.12. Alternate Supply – Backup Supply Configuration – Option Two

**ALTERNATE SUPPLY**  
**BACK UP SUPPLY CONFIGURATION**  
**OPTION 2**



\* The optional switching device may be substituted as the normal open device



## **SECTION 4: DRAWING REQUIREMENTS**

### **4.1. DRAWINGS AND INFORMATION FOR REVIEW**

4.1.1. PPL Electric will require the following drawings and information for review and acceptance:

A. All Installations:

- 1) One Line Diagram
- 2) Plan and Elevation Views (electrical arrangements only)

B. Additional Drawings Two Line Supply and Back Up Generation:

- 1) Bill of Material (major electrical equipment only, including switch, protective device, transformer, surge arresters, relays, etc.)
  - a. Three Line Diagram
- 2) Commissioning Procedure
- 3) Switch Interlock Schematic and Detail
- 4) Three Line Potential Elementary
- 5) Three Line Current Elementary
- 6) Control Elementary
- 7) Detailed worded descriptions of customer relay and control functions and description of operation
- 8) CT Test Reports

### **4.2. CONTENTS OF DRAWINGS**

4.2.1. One Line Relay Diagrams

A. This drawing shows the customer's substation functional arrangement. All the equipment shall be shown using single-line diagram and standard symbol notations (per latest ANSI/IEEE Standard 315; titled Graphic Symbols for Electrical and Electronic Diagrams). This drawing shall include:

- Power Transformers (PTs) - Nominal kVA, nominal primary/secondary and tertiary voltages, and vector diagram.
- Instrument Transformers - Voltage and current transformers (VTs) and (CTs) that supply the relays.
- Lightning Arresters/Spill Gaps/Surge Capacitors - Ratings.

- Air Switches - Indicate status Normally Open with a (N.O), Normally Closed with a (N.C.) and type of operation manual or motor.
- Safety Switch - Continuous ampere and interrupting ratings.
- FIDs - Interrupting rating, continuous rating, operating times.

#### 4.2.2. Current Elementary Diagrams

- A. Terminal designations of all devices - Relay coils and contacts, switches, transducers, etc.
- B. Relay Functional Designation - Per ANSI/IEEE standard C-37.2-2008.
- C. The same functional designation shall be used on all the drawings showing the relay.
- D. Complete relay type such as "SEL 321", etc., and the relay range.
- E. Range and settings of timing relays.
- F. Switch developments and escutcheons shall be shown on the drawing where the majority of contacts are used. Where contacts of a switch are used on a separate drawing, that drawing should be referenced adjacent to the contacts in the switch development. Any contacts not used should be referenced as spare.
- G. All switch contacts are to be shown in the open position with each labeled to indicate the positions in which the contacts will be closed.
- H. Switch contacts shall be referenced to the switch development if development is shown on a separate drawing.
- I. Isolating points (States sliding links, test switches, etc.).
- J. Grounding of Current Transformer (CT) cables.
- K. All other circuit elements and components with device designation, rating, and setting where applicable.
- L. Current Transformers (CTs) - Polarity marks, rating, tap, ratio, and connection.
- M. Auxiliary Current Transformer (CT) ratios, connections and polarity, winding current rating, and arrows to indicate assumed current flow.
- N. Phase designations and rotation of both PPL and customer.

O. Cable connection number or wire designation.

#### 4.2.3. Potential Elementary Diagrams

- A. Terminal designations of all devices – relay coils and contacts, switches, transducers. etc.
- B. Relay functional designation – per ANSI/IEEE standard C-37.2-2008.
- C. The same functional designation shall be used on all the drawings showing the relay.
- D. Complete relay type such as "SEL 321", etc., and the relay range.
- E. Relay contacts shall be referenced to the drawing when the coil is shown, provided the coil is shown on a separate drawing.
- F. Relay contacts should be shown with each reference to the drawing where they are used. Contacts not used should be referenced as spare.
- G. Range and settings of timing relays.
- H. Switch developments and escutcheons shall be shown on the drawing where the majority of contacts are used. Where contacts of a switch are used on a separate drawing, that drawing should be referenced adjacent to the contacts in the switch development. Any contacts not used should be referenced as spare.
- I. All switch contacts are to be shown in the open position with each labeled to indicate the positions in which the contacts will be closed.
- J. Switch contacts shall be referenced to the switch development if development is shown on a separate drawing.
- K. Isolating points (States links, test switches, etc.).
- L. Grounding of cables.
- M. All other circuit elements and components with device designation, rating, and setting where applicable.
- N. Coil voltage for all auxiliary relays.
- O. Potential transformer – nameplate ratio, polarity marks, rating, primary and secondary connections.
- P. Phase designations and rotation of both the utility and customer.

Q. Current ratings and designation of all fuses.

#### 4.2.4. Control Elementary Diagrams

Control elementaries are to be functionally complete schematics. They should be as simple and uncluttered as possible, and shall contain the following information:

- A. Terminal designations of all devices – relay coils and contacts, switches, transducers, etc.
- B. Relay functional designation – per ANSI/IEEE standard C-37.2-2008.
- C. The same functional designation shall be used on all the drawings showing the relay.
- D. Complete relay type such as "SEL 321", etc., and the relay range.
- E. Range and settings of timing relays.
- F. Switch developments and escutcheons shall be shown on the drawing where the majority of contacts are used. Where contacts of a switch are used on a separate drawing, that drawing should be referenced adjacent to the contacts in the switch development. Any contacts not used should be referenced as spare.
- G. All switch contacts are to be shown in the open position with each labeled to indicate the positions in which the contacts will be closed.
- H. Switch contacts shall be referenced to the switch development if development is shown on a separate drawing.
- I. Isolating points (States links, test switches, etc.)
- J. All other circuit elements and components with device designation, rating, and setting where applicable.
- K. Cable connection number or wire designation.
- L. Device auxiliary switches (Interrupting Device, contactors) should be referenced to the drawings where they are used.
- M. Any interlocks; electromechanical, key, etc.
- N. Coil target ratings, on dual ratings underline the appropriate tap setting.

- O. Complete internals for electromechanical protective relays. Solid-state relays may be shown as a "black box," with power supply and output connections, but manufacturer's instruction book number shall be referenced, and terminal designations shown.
- P. DC fuses protecting the point of common coupling relaying and Interrupting Device control circuits shall be monitored for blown fuse or open circuit with a yellow indicating light.
- Q. The trip coils of lockout relays should be monitored.
- R. The coils and contacts of all timers and lockout relays shall be wired through states links or equivalent terminal blocks to provide isolation for testing.

#### **4.3. DRAWING APPROVAL PROCEDURES**

- A. The customer must submit requested drawings for PPL Electric review and acceptance. These drawings must be submitted before the customer's equipment is ordered to ensure that it meets PPL requirements.
- B. All drawings submitted to PPL Electric for acceptance must contain complete information as outlined under "Contents of Drawings." PPL Electric will review the customer's drawings and provide comments within 30 working days from the day a complete set of drawings is submitted.
- C. Specific Grading Plan, Foundation Plan, Foundation Details, Conduit Plan, Structural Steel Assembly, and Structural Steel Fabrication Detail drawings do not require PPL Electric review.
- D. The responsibility of detail and correct design lies with the customer. Neither PPL Electric nor any person acting on behalf of PPL Electric:
  - 1) Assumes any responsibility for correctness of design, drawings, installation or operations.
  - 2) Assumes any liability with respect to the use of, or from damages resulting from the use of, any comments disclosed in this document or in any other PPL Electric correspondence with the customer.

#### **4.4. FINAL AS-BUILT DRAWINGS**

- A. The customer must provide an electronic copy of the final As-Built drawings.