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**PPL EU Requirements For Transmission Connected Facilities
To Be Owned And Operated By PPL EU: Attachment 4**

-2-086-

Revision: -01-

Effective Date: 9/1/2017

Sheet 1 of 16

**PPL EU REQUIREMENTS FOR TRANSMISSION CONNECTED
FACILITIES TO BE OWNED AND OPERATED BY PPL EU**

**Attachment 4
Sample Checklist of Responsibilities
500/230 kV Standards**

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Location Codes	S	0	6	0												Sorts				
Rev	Date	Sponsor	Reviewer	SUBSTATION CONSTRUCTION STANDARD PPL ELECTRIC UTILITIES CORPORATION																
0	9/19/14	NJM	SEH																	
1	9/1/17	NJM	GJ																	
				Approved _____ Yves Nembo Mgr. Standards																



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Record of All Issued Revisions

Revision	Page(s)	Section(s)	Description	Issue Date
0	All	All	Initial Issue	9/19/2014
1	All	All	General grammatical corrections, removal of fire extinguisher requirement, telephone requirement updates, DC system division of responsibilities	9/11/2017

Distribution:

1. RC 0880 – T&S Standards
2. RC 0883 – Substation Engineering
3. RC 0601 – T&S Asset Management
4. RC 0878 – T&S System Engineering



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The following list is a guideline for the general requirements with associated responsibilities for 3rd parties to build a facility which will be later turned over to PPL EU. It is imperative to adhere to these general guidelines to ensure a successful project will be completed.

1. General

- Description of 500/230 kV system – by PPL EU
- Phasing and phase rotation – by PPL EU
- Single line drawing – by IPP
- Electrical arrangement drawing – by IPP
- Reference drawings – by PPL EU
- Standard Bill of Material, approved vendors list – by PPL EU
- Assembly Details – by IPP
- Specifications for all equipment – by PPL EU
- Approved vendors for all equipment – by PPL EU
- Construction Specifications – by IPP
- Control cable philosophy – by PPL EU
- Low voltage and communication cable segregation philosophy – by PPL EU
- List of industry standards – by PPL EU
- Standard drawings – by PPL EU
- Major Equipment Specifications – by PPL EU
- Relay Settings – by PPL EU

2. Permits

- Wetlands Mitigation – by IPP
- Erosion and Sedimentation Control – by IPP

3. Environmental

- Acceptance of reports [reports by IPP, review by PPL EU]
- Archeological studies – by IPP
- Property lines – by IPP

4. Civil

4.1. Earthwork

- Soil conditions, core borings, etc. – by IPP
- Location and grading plan – by IPP

4.2. Control Cubicle

- Technical Requirements – by PPL EU
- Standard Layout/Arrangement drawing, door requirements – by PPL EU
- HVAC – by IPP
- Foundations – by IPP
- AC/DC panels – by IPP:
 - Number of panels – by IPP
 - Rating – by IPP
 - Separation of circuits – by IPP
- Smoke detectors – by IPP
- Lighting – by IPP
- Reinforcing (foundation) – by IPP
- Raised Floor – by IPP
- Battery installation details (reinforcing) – by IPP
- Extra bracing located in the control cubicle for mounting of equipment (not shown anywhere, usually worked out with the vendor, engineer and field personnel before construction) – by IPP
- Equipment mounted on walls – by IPP
- Cable tray system – by IPP

4.3. Equipment foundations

- Technical Requirements – by PPL EU
- Materials – by IPP
- Reinforcing – by IPP
- Anchor bolts – by IPP:
 - Specifications – by IPP
 - Ratings – by IPP

4.4. Structures

- Standard designs – by IPP



- Custom designs – by IPP
- Bill of materials – by IPP
- Design loads – by PPL EU (line dead-ends only)
- Welding – by IPP

4.5. Roadway

- Layout – by IPP
- Parking – by IPP
- Crossings – by IPP

4.6. Access road

- General specification – by PPL EU
- Final Route – by IPP
- Final Grade – by IPP
- Overall design – by IPP

4.7. Yard surfacing

- Specifications – by PPL EU

4.8. Fence

- Technical Requirements – by PPL EU
- Design – by IPP
- Gates – by IPP
- Grounding – by IPP
- Signs – by IPP

4.9. Drainage

- Technical Requirements – by PPL EU
- Collection system – by IPP
- Detention basin – by IPP
- Piping and drains – by IPP

4.10. Spill control

- Technical Requirements – by PPL EU

- Oil containment – by IPP

5. Electrical

5.1. Facility configuration

- General arrangement drawing – by IPP

5.2. Initial configuration and ultimate expansion – by PPL EU

5.3. Equipment Ratings – by PPL EU

- Interrupting – by PPL EU
- Continuous current – by PPL EU
- Fault duty – by PPL EU
- BIL – by PPL EU
- Thermal – by IPP
- Other ratings – by IPP

5.4. Station Insulation – by PPL EU

- Electrical clearances – by PPL EU
- BIL – by PPL EU
- Surge Arrestors – by IPP

5.5. Disconnect switches

- Technical Requirements – by PPL EU
- Manufacturer approval drawing review and concurrence – By PPL EU
- Manual – by IPP
- Gang operated – by IPP
- Motor operated – by IPP

5.6. Bus arrangement

- Technical Requirements – by PPL EU
- Strain bus design – by IPP
- Rigid bus design – by IPP:
 - Welding – by IPP
 - Support insulators – by IPP
- Rating – short circuit and continuous – by IPP
- Conductor – by IPP
- Design calculations – by IPP

5.7. High voltage conductors

- Technical Requirements – by PPL EU
- Connectors – by IPP
- Conductor ratings – by IPP
- Type – by IPP

5.8. Grounding

- Technical Requirements – by PPL EU
- Layout drawing – by IPP
- Design criteria – by PPL EU:
 - Connection methods – by IPP (in accordance with PPL EU design criteria)
 - Materials – by IPP
- Safety grounding – by IPP
- Fence – by IPP
- Equipment – by IPP
- Step and Touch – by IPP
- Control Cubicle – by IPP
- Direct lightning stroke protection – by IPP
- Shielding – by IPP
- Standard assemblies – by PPL EU:
 - Application of standard assemblies – by IPP

5.9. Fire protection

- Technical Requirements – by PPL EU
- Fire suppression – by IPP
- Fire walls – by IPP
- Extinguishers – not needed
- Other – by IPP

5.10. Cable routing

- Technical Requirements – by PPL EU
- Trough, Synertech – by IPP
- Conduit – by IPP
- Separation criteria – by IPP

5.11. Circuit Breakers

- Technical Requirements – by PPL EU
- Ratings, continuous, interrupting, operating time, BIL, etc. – by PPL EU
- Supply of breakers – by IPP
- Three pole or IPO – by PPL EU
- SF6 – by IPP
- CT requirements – by PPL EU



- Control circuit voltages – by PPL EU
- Manufacturers drawing approval review and concurrence – By PPL EU

5.12. CCVTs

- Technical Requirements – by PPL EU
- Standard units – by IPP
- Metering accuracy units – by IPP
- Power CCVT units – by IPP
- Manufacturers approval drawing review and concurrence – By PPL EU

5.13. PVTs (Power Voltage Transformers)

- Technical Requirements – by PPL EU
- Purchase Specification – by PPL EU
- Manufacturers approval drawing review and concurrence – By PPL EU
- Supply of units – by IPP

5.14. Column CTs

- Purchase Specification – by PPL EU
- Manufacturers approval drawing review and concurrence – By PPL EU
- Supply of units – by IPP

5.15. Surge Arresters

- Purchase specification – by PPL EU
- Manufacturers approval drawing review and concurrence – By PPL EU
- Supply of units – by IPP

5.16. Telephone System

- Technical Requirements – by PPL EU
- VOIP fiber connected phone – by IPP

5.17. Yard Lighting

- Technical Requirements – by PPL EU
- Location – by IPP
- Quantity – by IPP
- Switches – by IPP
- Automatic controls – by IPP

5.18. Auto Transfer Switch

- Technical Requirements – by PPL EU
- Alarms – by IPP
- Sizing – by IPP
- Manufacturers approval drawing review and concurrence – By PPL EU

5.19. Padmount Transformers

- Technical Requirements – by PPL EU
- Manufacturers approval drawing review and concurrence – By PPL EU
- Connections, 15kV, 133% insulated cable – by IPP
- Phase rolling requirements – by IPP
- Location – by IPP

6. Protection and Control

6.1. Elementaries and Wiring Drawings

- Technical Requirements – by PPL EU
- Nameplate lists – by IPP and PPL EU
- SCADA PAS – by PPL EU and IPP
- SCADA I/O – by PPL EU and IPP
- Alarm Management System PAS – by PPL EU and IPP
- Alarm Management I/O – by PPL EU and IPP
- Revenue Metering (if required) to be determined
- One Line diagram – by PPL EU:
 - Official PPL EU equipment names – by PPL EU
 - Equipment designations – by PPL EU and IPP
- Diesel generator and transfer switch (if required) – by IPP
- Smoke detector alarms – by IPP
- Battery alarms – by IPP
- Station service transfer switch – by IPP
- Panel front views – by IPP
- Panel wiring – by IPP
- Direct transfer trip (each line) – by IPP
- Primary line protection (each line) – by IPP
 - Settings – by PPL EU
- Backup line protection (each line) – by IPP
 - Settings – by PPL EU
- Breaker failure protection (each breaker) – by IPP
- Current elementary (each breaker, line, transformer, bus) – by IPP
- Potential elementary (each line or bus) – by IPP
- Control elementary (each breaker, MOD, transformer) – by IPP
- Communications diagram – by IPP
- Three line diagram – by IPP
- Fiber optic equipment – by PPL EU and IPP
- HMI programming – by PPL EU
- Control programming references – by IPP
- Fiber/EU Net – by PPL EU

6.2. Bills of Material

- Relay and Control Standard BOM (PDF) – by PPL EU
- Physical Electrical Standard BOM (PDF) – by PPL EU
- Custom Items – by IPP

6.3. Approved Devices – by PPL EU

- Fiber Optic communication – by IPP
- Primary protection – by IPP
- Backup protection – by IPP
- Breaker failure protection – by IPP
- Battery chargers – by IPP
- SCADA RTU – by IPP
- AMS equipment – by IPP
- HMI – by IPP

6.4. Block Diagrams

- Technical Requirements – by PPL EU
- Cable block diagram – by IPP
- Cable list – by IPP
- Separation criteria – by IPP
- Color coding – by IPP

6.5. DC System

- Technical Requirements – by PPL EU
- Battery voltage – by PPL EU
- Battery capacity – by IPP
- Number of batteries (primary /backup) – by PPL EU
- Number and arrangement of chargers (3 with one shared or 4 with no shared) – by IPP
- DC panels (2 required, primary and backup) – by IPP:
 - Tie connection – by IPP
 - Capacity – by IPP
- Alarms, midpoint protection – by IPP
- Battery arrangement, stacking, no 3 step high racks – by IPP

6.6. Panels

- Technical Requirements – by PPL EU
- Layout – by PPL EU
- Lighting – by IPP
- Grounding – by IPP
- Spacing – by IPP
- Wiring – by IPP
- Isolation facilities – by IPP

- Equipment Mounting – by IPP

6.7. Transient Suppression

- CT circuits – by IPP
- Potential circuits – by IPP
- DC controls – by IPP

6.8. Description of Relay and Control – by IPP

- Draft document – by PPL EU

7. Final Documentation/As Built Drawings

1. Complete set of ‘as built’ drawings within 90 days of energization of facility – by IPP
2. Complete set of manufacturer drawings – by IPP
3. Complete set of instruction manuals – by IPP
4. Complete set of all test reports – by IPP
5. Operating Instructions – by PPL EU and IPP
6. Maintenance Instructions – by PPL EU and IPP
7. Completed AOF – by IPP
8. Transfer of Easements – by IPP
9. Bill of Sale – by IPP
10. Close out of all required Permits – by IPP
11. Testing and commissioning documentation – by IPP
12. Geotechnical reports – by IPP
13. Engineering Calculations – by IPP
14. Any other documentation – by IPP

8. Other Items

1. Remote terminal work and coordination of this work – by PPL EU
2. Spare equipment/material not presently supported in PPL EU – by IPP

9. PPL Sample Drawing Packages, Studies, and Types

9.1. Civil Structural

- Site Design and Plot Plan

- Fence Plan
- Grading Plan
- Grading Sections
- Roadway design and Plan
- Foundation Plan
- Foundation Details
- Key Plan of Structures
- Structural Detail Fabrication Drawings
- Oil Containment
- Bill of Materials

9.2. Physical Electrical

- Station One-Line Diagram
- AC One-Line Diagrams
- DC One-Line Diagrams
- AC Wiring Diagrams
- DC Wiring Diagrams
- Three-Line Diagram
- Line Arrangement
- General Arrangement
- Electrical Sections
- Electrical Details
- Bus Cutting Schedule
- Conduit Plan
- Conduit Details
- Grounding Plan
- Grounding Details
- Lighting Design
- Control Cubicle Plan
- Control Cubicle Sections
- Cable Tray
- Cable List
- AC/DC Box Design Details
- Bill of Materials

9.3. Protection and Control

- Current Drawings
- Potential Drawings



- DC Control Schematics
- Metering Drawings
- Overall Panel Front View
- Individual Panel Front View
- Junction Box Front View
- Nameplates Schedules
- Network Drawings
- Communications Drawings
- Fiber Drawings
- Prism Front View
- Meter Cabinet Front Views
- Station bill of Materials
- Panel Bill of Materials
- Junction Box Bill of Materials
- AMS Point Assignment Sheets
- SCADA Point Assignment Sheets
- Logic Diagrams for Relays (info supplied by PPL)

9.4. Wiring Drawings

- Equipment Wiring Diagrams
- Panel Wiring Diagrams – for panel Manufacturer
- Final Panel wiring Diagrams
- Junction Box Wiring Diagram

9.5. Studies and Calculations

- Structural Calculation for all Structures
- Foundation Calculation for all Foundations
- Rigid bus Design Calculations (short circuit, wind, load, strength, deflection expansion, etc.)
- Strain Bus Calculations (short circuit, wind, load, deflection, etc.)
- Grounding Calculations/Studies
- Lighting Calculations/Studies
- Battery Sizing
- Battery Charger Sizing
- Cable Pulling Calculations as required

9.6. Specifications

- Auto transfer Switch Supplemental Specification
- Main AC Panel Supplemental Specification
- Lighting AC Panel Supplemental Specification
- Main DC Panel Supplemental Specification



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- Station Battery Supplemental Specification
- Battery Charger Supplemental Specification
- Building Specification
- Final Project Scope
- Description of Relay Control