Duquesne Light Company
Distribution System Generation Interconnection Requirements

Revision 1

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Duquesne Light Company
Distribution System Generation
Interconnection Requirements

1. INTRODUCTION

Duquesne Light Company (DLC) is a regulated electric utility operating an 817-square-mile area in southwestern Pennsylvania that includes the majority of Beaver and Allegheny Counties. Duquesne Light provides electric transmission and distribution services to approximately 605,000 customers within DLC's service territory. Duquesne Light's distribution system is operated at three operating voltages, 23 kV (i.e., 23,000 V), 11.5 kV and 4 kV[1]. The DLC distribution system is comprised of 23 kV sub-transmission circuits, 23 kV and 4 kV radial distribution circuits, and 23 kV and 11.5 kV secondary network distribution circuits.

This document describes the processes and technical requirements for new or modified generation interconnections operating in parallel to the DLC distribution system. For more details on generation interconnects to the DLC transmission system, please refer to the *Duquesne Light Company Transmission Facility Interconnection Requirements* document available on the Duquesne Light website as well as the PJM website.

The DLC service territory is governed by the reliability standards established by the North American Electric Reliability Corporation (NERC), ReliabilityFirst Corporation (RF), and PJM Interconnections, LLC (PJM) organizations and the laws of the state of Pennsylvania. As a member Transmission Owner (TO) of PJM, DLC adheres to the wholesale generator interconnection process established by the PJM Tariff and documented within the PJM Manual 14 series. Additionally, as a regulated electric utility within Pennsylvania, DLC adheres to all applicable laws of the state of Pennsylvania for the interconnection of net metered generation.

1.1. Document Overview

This document has been prepared to communicate DLC's requirements for customers wishing to interconnect new generators in parallel to the DLC distribution system or modify existing generators already connected in parallel to the DLC distribution system. This document is applicable to both Wholesale Generators (i.e., generators participating within the PJM wholesale market) and Net Metered

[1] Unless otherwise stated, all voltage values specified in this document shall be considered nominal values.

Generators (i.e., generators that are installed to off-set energy consumption, also known as Customer-Generators).

Section 2 of this document describes the process DLC follows to ensure all new generator interconnections and all modifications of existing generator interconnections are reviewed or studied.

Section 3 of this document covers project details that the Generation Customers (GCs) should consider when requesting to interconnect to DLC's distribution system.

Sections 4 through 17 of this document contain technical requirements that may affect the design, operation, and/or maintenance of Interconnecting Facilities (IF). Note, the technical requirements contained within this document are general and may not cover specific details for every case. The technical requirements normally applied may be altered by DLC to cover unanticipated technical problems that may occur despite the fact that the proposed installation is similar to a previously accepted installation. Since the technical requirements specified in this document are minimum DLC requirements, they must also meet national, state and local codes and regulations including all applicable NERC, RF, and PJM standards.

1.2. Definitions

Table 1-1 defines terms that are used throughout this document.

Table 1-1: Definitions

Term	Definition
Attachment Facilities	As defined in the PJM Open Access Transmission Tariff as amended and supplemented.
Direct Connection Network Upgrades	As defined in the PJM Open Access Transmission Tariff as amended and supplemented.
Generation Customer (GC)	Any entity with interconnected generation or interconnecting generation to the DLC distribution system.
Interconnection Facilities (IF)	Any facilities required for an entity to interconnect generation to the DLC distribution system.
Larger-Scale Generator	A generator with a maximum apparent power (AC) output of 500 kVA or generation that DLC determines to pose elevated risk to the DLC system.
Net Metered Generators	Generators that are installed to off-set energy consumption.
New Service Request Process	PJM's process for interconnecting new generators or upgrading existing generators to the PJM system.
Point of Common Coupling (PCC)	The point where a Generation Customer's equipment interconnects to the DLC system.

Term	Definition
Small-Scale Generator	A generator with a maximum apparent power AC output less than 500 kVA that poses reduced risk to the DLC system.
Wholesale Generators	Generators participating within the PJM wholesale market.

1.3. Small-Scale Generation/Larger-Scale Generation Determination

Various requirements in this document are based off the Small-Scale Generator/Larger-Scale Generator determination. DLC is solely responsible for determining if a generator shall be categorized as a Small-Scale Generator or a Larger-Scale Generator. Load to generation ratio and circuit configuration are two key factors DLC considers when making this determination, amongst others.

2. INTERCONNECTION REQUEST AND STUDY PROCEDURES

Duquesne Light reserves the right to perform technical studies to evaluate the impact of new generation interconnections and modifications to existing generation interconnections to DLC's distribution system. GC's seeking to interconnect new generation or to modify existing generation must follow the interconnection processes as discussed in Section 2.1 of this document. DLC will perform hosting studies as described in Section 2.2 of this document and, as necessary, additional studies as described in Section 2.3.

2.1. Interconnection Request Process

The process GCs follow when requesting new generation or modifications to existing generation varies for wholesale generators and net metered generators. Section 2.1.1 describes the processes for GCs that are seeking to install new or modifying existing Wholesale Generators and Section 2.1.2 describes the processes for GCs that are seeking to install new or modifying existing Net Metered Generators.

2.1.1 Wholesale Market Participants

GCs wishing to participate in the PJM wholesale market must submit all interconnection requests for generation facilities to PJM via the New Services Requests process. *PJM Manual 14A: New Service Request Process* describes the New Services Requests process for the interconnection of generating facilities (including increases to the capacity of an existing generating unit or decommissioning of a generating unit) within the PJM RTO. Additionally, PJM Manual 14A guides GCs through the application, study, and agreement process. DLC coordinates with PJM on all PJM-required interconnection studies pursuant to the process in PJM Manual 14A. The result of these studies document any upgrades to DLC's transmission system required to facilitate the request. After all applicable interconnection studies have been completed, PJM will draft the appropriate Wholesale Market Participation Agreement (WMPA) to be executed by all applicable parties.

Generators that are interconnecting to DLC's distribution system that want to participate in the wholesale market are also subject to a hosting study performed by DLC. Information about this

hosting study can be found in the Section 2.2 of this document. After the hosting study has been completed, DLC will draft an Interconnection Agreement (IA) to be executed by DLC and the GC.

Existing GCs should also consult their WMPA or Interconnection Agreement when seeking to modify existing interconnections.

2.1.2 Net Metered Generators

Duquesne Light Company processes interconnection requests for Net Metered Generators based on the guidelines set out in Chapter 75 of the Pennsylvania Alternative Energy Portfolio Standards.

Current regulations in the state of Pennsylvania generally allow zero load net metered generators to participate in net metering e.g., a 3MW generator with no existing load and no future load, other than station service.[2]

Chapter 75 of the Pennsylvania Alternative Energy Portfolio Standards defines four levels of net metered generator interconnections. DLC's Net Meter Generator interconnection request process consists of a two-part application along with an application fee. The levels defined in Chapter 75 of the Pennsylvania Alternative Energy Portfolio Standards and the associated application fees are described Table 2-1.

Table 2-1: Application Levels and Fees

Application Description[3]	Fee
Level 1 - Certified inverter-based installations with aggregate rating 10 kW or less	$100
Level 2 - Certified inverter-based installations with aggregate rating 10 kW to 2,000 kW	$250 plus $1.00 per kW
Level 3 - Non-Certified equipment 5,000 kW or less that will export power to Duquesne Light Company	$350 plus $2.00 per kW
Level 4 - Non-Certified equipment 5,000 kW or less that will not export power to Duquesne Light Company	$350 plus $2.00 per kW

There are two different applications for Net Meter Generators based on the interconnecting generator's level: a Level 1 application and a Level 2, 3, or 4 application. Level 1 generators must complete a Level 1 application. Level 2, Level 3, and Level 4 generators must complete a Level 2, 3, or 4 application. Each application consists of two parts.

[2] This information is current as of the publication of this document. This document may be updated via a revision based on regulation changes at the state level.
[3] All kW values in this table refer to AC output.

DLC requires all GCs that are altering the capabilities of an installed generator to resubmit an application for DLC to review. A non-exhaustive list of examples of alterations that would require a new application are as follows:

- An increase or decrease in the output of a generator,
- A change in inverter make or model,
- A change to the Utility Accessible Disconnect,
- Any modification to the system that would impact the previously submitted one-line diagram.

Section 2.1.2.1 of this document describes the material that the GC must provide during Part 1 of the application. Once DLC has reviewed and approved Part 1 of an application, construction of the generating facilities may commence.

Section 2.1.2.2 of this document describes the material that the GC must provide during Part 2 of the application. Once DLC has reviewed and approved Part 2 of an application, DLC will perform the actions described in Section 2.1.2.3 of this document.

2.1.2.1. Part 1

Part 1 is an application requesting permission to install generation. The following must be provided as part of the Part 1 application submission.

- A completed part 1 application, signed and dated
- One-Line Diagram
- Site Plan
- Inverter/Equipment Datasheet(s)
- Satellite image of Interconnection Location
- Application Fee

After the GC provides the items listed above, DLC will provide the GC with an application ID, a work order number (six digits), and a service point ID (ten digits). Note the GC will need to provide this information to the GC's electrical inspector for documenting the receipt of the approved wiring inspection and completed installation.

Part 1 Level 1 applications are reviewed within 25 business days. Part 1 Level 2, Level 3, and Level 4 applications are reviewed within 30 business days.

Upon receipt of Duquesne Light Company's Part 1 approval, construction of the generating facilities may commence.

2.1.2.2. Part 2

Part 2 is an application requesting permission to operate generation. The following must be completed for application approval after construction is complete.

- A completed part 2 application, signed and dated including the electrical inspector signature.
- Installation photos showing the meter, utility accessible disconnect (as required per Section 4.4 of this document), and inverters. The meter must be in site line view of the UAD. If not, a placard indicating the location of the disconnect in relation to the meter placed near the meter, and photo of the placard is required.
- Ensure the electrician or electrical contractor contacts an approved electrical inspection agency for your area with the Duquesne Light Work Order Number and Service Point ID received in Part 1 to conduct electrical inspection.
- Have the electrical inspector contact DLC's New Business Group to submit documentation of the wiring inspection. The New Business Group's phone number can be found on the Duquesne Light website.
- Return Part 2 Application to DLC for approval through the online portal.

2.1.2.3. Post Application

Upon receiving a signed copy of the Application Agreement Part 2 and a copy of the electrical inspector's approved inspection card, DLC may schedule a date to observe testing of the system to ensure the system is operating in accordance with DLC's requirements. DLC's requirements for this testing is described within Section 16 of this document.

Upon observation of a satisfactory performance, or DLC's waiving of test requirements, DLC will schedule a meter change. Generally, a new meter will be set around 7-10 business days following the observation of testing, and the billing account will be updated to reflect Rider 21-net metering service. DLC will notify the installer in writing once the meter has been changed that the system is now allowed to operate.

For existing services, the GC will be billed and will receive credits in accordance with their legacy rate class. For new or modified services that see a change in demand, a rate class that aligns with the new estimated demand will be assigned. Zero load net metered generators are by default assigned to Rate GS - General Service Small. DLC reviews accounts annually and if the average monthly usage or GC's average monthly billing demand changes, the GC will be

assigned to a new rate class in accordance with DLC's retail tariff, effective with their next billing cycle.

2.2. Hosting Studies

Hosting studies are performed to determine the feasibility and upgrade requirements for new generation interconnecting to the DLC distribution system. Any facility upgrades or direct connection costs associated with connecting a generator to the DLC distribution system are the responsibility of the GC. DLC drafts cost estimates at various stages of the project life cycle, provides these cost estimate to GCs, and subsequently invoices GCs as required. At the end of each project there is a true-up that takes place, and each dollar spent by DLC is required to be paid by the GC.

2.2.1 Screening Process: Small-Scale Generators

For applications for Small-Scale Generators, both field and analytical reviews are conducted to ensure that the generator will not negatively impact the DLC distribution system. GCs are informed of any system upgrades needed to accommodate the proposed generator. Costs associated with system upgrades to accommodate generators are the responsibility of the GC. Some examples of upgrades needed for Small-Scale Generators are transformer upgrades and/or secondary wiring reconfigurations.

2.2.2 Detailed Studies: Larger-Scale Generators

For applications for Larger-Scale Generators, the review process can take up to 90 business days.

GC applications first go through a 10-business day administrative review. After this review, DLC performs a brief feasibility analysis to determine a high-level cost of necessary upgrades/line extensions. DLC hosts a kickoff meeting with the GC and provides an order of magnitude cost estimate based on the high-level feasibility assessment. The GC has 30 business days after the kickoff meeting to determine if they want to move forward with the study. Failure to move forward after 30 days will result in removal from the queue.

Once the study fee is received, DLC will perform an engineering study. These studies take approximately 60 business days. Once the engineering study has been completed, a full study report is provided to the GC including study results and a non-binding good faith cost estimate for the facility upgrades and direct connection costs. The GC is responsible for all costs associated with the project, not limited to the good faith cost estimate. The GC can then determine if they would like to move forward with upgrade payments.

The GC has 30 business days after the study is provided to the GC to determine if they want to move forward with the project. Failure to move forward after 30 days will result in removal from the queue.

Average projects of this size take 12-18 months to energize from the time of application.

2.3. Additional Reliability Studies

In order to ensure the reliability of the DLC system, DLC may perform Electromagnetic Transient (EMT) studies for GCs interconnecting inverter-based resources. To facilitate these studies, GCs interconnecting more than 3 MW of inverter-based resources must provide EMT modeling information to DLC consistent with NERC Reliability Guideline Electromagnetic Transient Modeling for BPS Connected Inverter-Based Resources. DLC reserves the right to identify and require the GC to install and/or employ as applicable, equipment and/or operational procedures to mitigate any issues identified by these studies.

3. GENERAL CONSIDERATIONS

GCs and prospective GCs should read, understand, and consider the topics discussed within Sections 3.1 through 3.6 when requesting an interconnection to DLC's distribution system.

3.1. Equipment Configurations

This section describes various configurations that are utilized to connect various generators to the DLC distribution system.

3.1.1 Small-Scale Generators

As of the effective date of this document, there are no special considerations for Small-Scale Generators. Small-Scale Generators can choose whether they add battery energy storage. It is the responsibility of the GC installing Small-Scale Generators at an existing service, to ensure the generation is compatible with the existing service type provided by DLC. Generators of this size do not require an intelligent recloser on the utility side of the installation, except for when the utility deems an exception is required.

3.1.2 Larger-Scale Generators

Larger-Scale Generators require intelligent recloser on the utility side of the installation. The equipment DLC is required to install to facilitate a generator interconnection will vary depending upon various aspects associated with the generator and the requested PCC.

3.1.2.1. Interconnecting Circuit Type

DLC can generally accommodate generators interconnecting to sub-transmission or distribution circuits. There is little difference in the equipment required to interconnect to these two different types of circuits.

Currently, there are limitations that prevent DLC from interconnecting Larger-Scale Generators on DLC's downtown secondary network circuits. Any generators wishing to interconnect on a network circuit require special consideration and analyses. These interconnections may not be feasible.

3.1.2.2. Primary Metering/Secondary Metering

GCs can choose whether they accept primary or secondary service from DLC. When secondary service is chosen, DLC will provide a transformer for services up to 3000 kVA at a standard service voltage. In these instances, the transformer will be owned and maintained by DLC. Appendix Figure 20-1 shows a typical one-line diagram for a secondary-metered GC with a Small-Scale Generator and Appendix Figure 20-2 shows a typical one-line diagram for a secondary-metered GC with a Larger-Scale Generator.

When primary service is chosen, the GC will purchase, own, and maintain their own transformer. The transformer's high-side voltage must match a DLC standard service voltage. Inverter-based generators selecting primary service shall utilize step-up transformers with a high-side grounded-wye/low-side grounded-wye winding configuration with all inverters grounded. Other generators selecting primary service at 69 kV or higher shall utilize step-up transformers with a high-side grounded-wye/low-side delta winding configuration. Other generators selecting primary service at 23 kV or lower shall utilize step-up transformers with a high-side delta /low-side grounded-wye winding configuration. Appendix Figure 20-3 shows a typical one-line diagram for a primary-metered GC with a Larger-Scale Generator.

GCs selecting primary service are responsible for purchasing a primary metering cabinet. DLC will provide metering cabinet specifications as part of the interconnection process.

3.1.2.3. Overhead/Underground

Larger-Scale Generators require a protection device to isolate the GC from the DLC system at the PCC. For interconnections fed by overhead service, the standard installation is a pole-mounted recloser. For underground service, the standard installation is typically a pad-mounted recloser.

3.2. Generation Certification Requirements

DLC requires all generation connecting to DLC's distribution system to be tested and certified to the latest version of UL1741 and IEEE 1547. All generation shall operate in a grid-following mode when connected in parallel with the DLC distribution system.

3.3. Energy Storage Systems

The same technical requirements for generators also apply to energy storage systems operating in parallel with DLC's distribution grid. For generation plus energy storage systems with independent inverters, the summed total AC output will be utilized to determine the applicable requirements for the energy storage system (i.e. Small-Scale vs. Larger-Scale Generation). A DC coupled storage source is required to be noted in the application process for DLC's records.

On a case-by-case basis, battery charge and discharge limits will be provided by DLC. These charge and discharge limits will be determined during the hosting study and documented within the IA between DLC and the GC. All net metered energy storage systems shall be configured for zero-net export, to

prevent exporting power from the energy storage onto the grid when operating in parallel with the DLC distribution system.

3.4. Microgrids

Microgrids designed to operate both in parallel with DLC's distribution system and asynchronously in an islanded mode are permissible on DLC's system however they are subjected to increased review. Additional technical requirements beyond what is described in this document may apply.

3.5. Option to Build

The PJM Open Access Transmission Tariff (OATT) allows for GCs participating in the wholesale market and going through the New Service Request Process to have the option, under certain circumstances, to assume the responsibility for the design, procurement and construction of Transmission Owner Attachment Facilities and Direct Connection Network Upgrades. *PJM Manual 14A: New Service Request Process* and *PJM Manual 14C: Generation & Transmission Interconnection Facility Construction* provide more details on this "Option to Build."

If exercising the Option to Build, the GC must select contractors to perform such work from DLC's "List of Approved Contractors and Vendors". Similarly, all equipment installed by the GC while exercising the Option to Build must be from the vendors/manufacturers on DLC's "List of Approved Contractors and Vendors". DLC's "List of Approved Contractors and Vendors" is available on PJM's website. If a contractor or vendor/manufacturer desired to be used by the GC is not on the "List of Approved Contractors or Vendors," the GC must request DLC to evaluate the contractor or vendor/manufacturer for acceptability by emailing DLC at Standards@duqlight.com.

3.6. Indemnification

The GC shall indemnify and hold DLC harmless for all damages, injuries and fatalities to DLC or others arising out of the GC's use, ownership, or operation of its facilities, and caused in whole or in part by the GC's equipment failure or negligence. The GC is solely responsible for providing adequate protection for its facilities operating in parallel with DLC's system and shall release DLC from any liability for damages or injury to its facilities arising out of such parallel operation, unless caused solely by DLC's negligence.

4. SAFETY REQUIREMENTS

All work performed by the GC shall be in accordance with all applicable safety practices and OSHA requirements. Furthermore, all facilities interconnecting to DLC's system must comply with the applicable codes and standards found in Section 4.1 of this document and must be constructed in accordance with the requirements of Sections 4.2 through 4.5. Failure to meet these requirements may result in serious harm to the public and/or DLC personnel. DLC reserves the right to assert location-specific requirements on a case-by-case basis.

4.1. Codes and Standards

All interconnecting facilities must comply with the requirements of the current National Electrical Code (NFPA-70/ANSI, as amended and supplemented), National Electrical Safety Code (ANSI C2, as amended and supplemented), all other applicable national, state, and local codes and ordinances, and the DLC *Electric Service Installation Rules* available on DLC's website.

All net metering projects are subject to the standards outlined in the Pennsylvania Alternative Energy Portfolio Standards of Chapter 75.

4.2. Grounding

The GC is responsible for the design and installation of the complete and integrated protective grounding system of the GC's site/equipment. The grounding system shall be designed in accordance with the current National Electrical Safety Code, National Electrical Code, DLC's *Electric Service Installation Rules*, and, as applicable, IEEE Std 80 "IEEE Guide for Safety in AC Substation Grounding," as amended and supplemented, to establish safe step and touch potentials. At its discretion, DLC will design the grounding system and, as necessary, perform soil resistivity testing for the portion of the GC's premises that will contain DLC-owned equipment.

4.3. Site Conditions and Access

The GC shall designate a location on its site for facilities necessary to serve the GC. DLC has the sole discretion to determine whether such site is suitable for construction of its facilities and reserves the right to require the GC to remediate issues with its designated site or identify a suitable alternative site.

Sites must be accessible via permanent stairs or access points unless the utility deems an exception is acceptable.

DLC reserves the right to install measures to secure its equipment (i.e., card readers, security cameras, fencing) as necessary.

DLC representatives, who are properly identified, shall have access to the GC's premises pursuant to DLC's *Electric Service Installation Rules* as amended and supplemented.

4.4. Isolation Devices

All systems must be capable of being isolated from the DLC grid by means of a Utility Accessible Disconnect, UAD, a lockable, visible break, isolation device that is accessible by DLC at all times. The isolation device must be installed, owned, and maintained by the GC. The isolation device shall be located at the PCC and shall be accessible without notice by DLC personnel, where applicable. It shall be mechanically interlocked in a manner that ensures continuous current has been interrupted allowing the visible break device to be operated. One visible disconnect point, clearly identified for utility access, for each PCC shall be installed and be located between the generation system and the PCC.

The GC may elect to provide DLC access to an isolation device that is contained in a building or area that may be unoccupied and locked or not otherwise readily accessible to DLC, by installing a lockbox provided by DLC that must provide ready access to the isolation device. The GC must install the lockbox in a location that is readily accessible by DLC, and the GC must permit DLC to affix a placard in a location of its choosing that provides clear instruction to DLC operating personnel on access to the isolation device. The isolation device must meet the following criteria:

- Lowest point can be no lower than 36” from level ground.
- Highest point can be no higher than 60” from level ground.
- Must be capable of isolating all sources of generation from the DLC system.

4.5. Mechanical Keyed Interlocks

For GCs that are interconnecting to the DLC distribution system at a primary voltage (i.e. 23 kV) via a circuit breaker, the circuit breaker shall have a mechanical key interlock for DLC use. DLC shall specify the manufacturer and model of the key release unit installed in the breaker during the design phase of the project.

5. SYSTEM PROTECTION AND COORDINATION

The GC must install protection capable of detecting and isolating faults downstream of the PCC. When required, protective relaying is used to isolate the generator and/or any ground source (if present) from the DLC distribution system for faults on the DLC distribution system or whenever continued operation would be detrimental to DLC or DLC customers. The generator shall not energize a de-energized DLC electric system. GC must provide and maintain, at GC owner’s expense, protection to prevent inadvertent energization of the DLC system. Standalone multi-function microprocessor relays shall be used when protective relaying is required.

5.1. General Requirements

The protective functions and settings detailed in this section are required for all generation types, regardless of size.

5.1.1 Over/Under voltage (59/27) and Frequency (81) protection elements

The required over/under voltage (59/27) and frequency (81) protection elements required for all generation types, regardless of size, are provided in Table 5-1 and Table 5-2 respectively.

Table 5-1: Required voltage protection functions from PJM Guideline for Ride Through Performance of Distribution-Connected Generators document.

Voltage Protection Function	Pickup (p. u. of nominal voltage)	Clearing time (s)
59-2	1.2	0.16
59-1	1.1	2
27-1	0.88	2
27-2	0.5	0.32

Table 5-2: Required frequency protection functions from PJM Guideline for Ride Through Performance of Distribution-Connected Generators document.

Frequency Protection Function	Pickup (Hz)	Clearing time (s)
81O-2	62	0.16
81O-1	61.2	300
81U-1	58.5	300
81U-2	56.5	0.16

5.1.2 Automatic Restoration

If the GC's fault interrupting device or inverter integral protection operates due to anti-islanding protection, voltage protection elements or frequency protection elements, automatic restoration is permitted. The GC equipment shall not connect or return to service until detecting 5 minutes of health utility voltage and frequency. Detection and return to service function shall be performed by utility grade relay. Return to service parameters are provided in Table 5-3.

Table 5-3: Return to Service Parameters

Utility Voltage Parameter	Required Value
Minimum Return to Service Voltage:	0.88 per unit of nominal voltage
Maximum Return to Service Voltage:	1.10 per unit of nominal voltage
Minimum Return to Service Frequency:	58.5 Hz
Maximum Return to Service Frequency:	61.2 Hz
Default return to service Ramp time (Enter service period)	300 s

5.2. Small-Scale Generators

For synchronous generation, protection will be required to meet IEEE 1547 requirements. At a minimum this will include utilizing over/under voltage (59/27), over/under frequency (81), directional power (32) and synchromism check functions (25) within the generator's protection. The required settings for the voltage and frequency protection elements are provided in Table 5-1 and Table 5-2 respectively. Parameters associated with the synchronism check function are provided in Section 9 of this document.

Inverter based generation will require protection to meet IEEE 1547 requirements. At a minimum this will require utilizing over/under voltage (59/27), over/under frequency (81), and synchromism check functions (25) within the generator's protection. The required settings for the voltage and frequency protection elements are provided in Table 5-1 and Table 5-2 respectively. Parameters associated with the synchronism check function are provided in Section 9 of this document. A. The GC shall enable active anti-islanding protection for inverter-based generation.

For Small-Scale Generators, a fused disconnect switch is an acceptable means for isolating faults downstream of the PCC as shown in Appendix Figure 20-1.

5.3. Larger-Scale Generators

The GC is solely responsible for the protection of their generator and the premise equipment, including any GC equipment required by DLC to interconnect to the DLC distribution system. The GC protection system shall use utility grade relaying (unless a fuse is approved for use as the main fault interrupting device). The GC is required to provide electrical equipment and relays with ranges and rating that will allow proper generation and premise relay system coordination with DLC protection systems. Coordination margins and parameters will be specified by DLC.

Requirements provided in Sections 5.3.1 through 5.3.8 apply to all generation types where Larger-Scale generation requirements apply. Additional requirements for inverter-based generation are provided in Section 5.3.9 and its subsections. Similarly, additional requirements for synchronous and induction generation are provided in Section 5.3.10. As-left settings for inverters and applicable protective devices shall be provided to DLC for review and approval prior to initial energization.

5.3.1 DLC Owned and Operated Recloser at PCC

Larger-Scale Generators require, at GC expense, a recloser to be installed at the PCC. The recloser will be owned and operated by DLC and will contain microprocessor-based protection and control relay.

DLC's recloser will contain the following functions:

- Phase and ground time overcurrent
- Frequency protection
- Voltage protection

- Automatic reclosing/restoration – only for voltage and frequency trips. One of the two conditions must be satisfied for automatic reclosing of DLC's recloser to occur:
    - De-energized GC equipment and energized DLC distribution system
    - "Synchronism check"

When the GC has protective relays, the GC's protective relays shall be set to achieve a 0.2 second coordination time interval with respect to DLC protective relays. The GC's proposed protective relay settings (time dial and pickup) may require adjustments to achieve the desired 0.2 second coordination time interval. Electric system faults within the GC facility shall be cleared by the GC fault interrupting first with adequate margin.

If the GC is utilizing a fuse as the main fault interrupting device, DLC will set its reclosers and relays to ensure the GC's fuse operates first for electric system faults within the GC facility.

5.3.2 Instrument Transformers for Protective Relays

Current Transformers (CTs) used for detecting faults that affect the DLC distribution system should be connected on the high-side of the GC's equipment. Current Transformer (CT) ratios and accuracy class shall be chosen that the secondary current is less than 5 amperes under normal operation, 100 amperes under maximum fault condition.

Voltage sensing is required on all three phases of on the DLC side of the GC interrupting device. Potential Transformers shall be connected wye-grounded (Yg-Yg). Voltage measurements shall have no more than 2% error under expected ambient temperature ranges and no more than 4% error under all operating temperatures.

5.3.3 Protective Relay and Trip Circuit Hard-Wire Requirements

GC protective relays shall be hardwired directly to the device they are tripping. Interposing computer-based or programmable logic controllers, auxiliary modules or the like are prohibited.

Interposing relays, such as a lockout relay, may be used. Interposing relays if used, shall be utility grade and the tripping scheme shall be fail-safe.

The GC protective relays shall be programmed to display a trip target for each required protection function.

5.3.4 GC Overcurrent Protection (50/51)

The GC is required to install overcurrent protection to detect faults on the DLC distribution system as well as faults on the GC's system that cause overcurrent conditions on the DLC distribution system. Overcurrent elements are required for phase and ground faults. DLC must review and accept all GC's protective relay settings prior to initial energization. This shall

include all GC's relays that trip the protective device, and all protection features integrated into the GC's Facility's generation.

As explained in Section 5.3.1, the GC's overcurrent relays shall be set with a 0.2 second coordination time interval with respect to DLC's overcurrent relays to ensure that electric system faults in the GC facility are cleared by the GC's fault interrupting device first.

5.3.5 GC Over/Under Voltage (59/27) and Over/Under Frequency Protection (81)

The GC must install voltage and frequency protection to detect islanding conditions and open its protective device at the GC Facility. The frequency and voltage protective element settings shall be set per Table 5-1 and Table 5-2.

The GC's Facility's protective equipment settings shall comply with the Distribution DLC's automatic load-shed program. DLC shall review the protective equipment settings to confirm compliance with the automatic load-shed program.

5.3.6 Automatic Reclosing (79)

The GC's fault interrupting device shall trip and lockout following an overcurrent fault condition. In other words, automatic reclosing of the GC equipment after an overcurrent element operates is prohibited.

5.3.7 Synchronism Check (25)

Parameters associated with the synchronism check function are provided in Section 9 of this document.

5.3.8 Required Documentation

The GC must supply, as applicable, to the DLC, at a minimum, a detailed AC single line diagram and detailed DC control schematics including the following information:

- Detailed relay information including manufacturer, model and style numbers, and range of operation.
- Complete power transformer specifications, including winding configuration, MVA rating, voltage rating, impedance values, and tap changer ranges with the no-load fixed tap position.
- Complete generator specifications, include type, voltage rating, zero sequence impedance, and the synchronous, transient, and subtransient reactance values.
    - Instrument transformer to relay connection details, including proper polarity marks.

DLC shall review and accept all applicable documentation prior to initial energization.

5.3.9 Additional Requirements for Inverter-Based Generation

Inverter-based Larger-Scale Generators shall also be configured with the following settings:

- Momentary Cessation: Disabled
- Maximum Recovery Frequency: 61.2 Hz
- Minimum Recovery Frequency: 58.5 Hz
- Active Anti-Islanding: Enabled
- Passive Anti-Islanding: Enabled

The need for direct transfer trip (DTT) is evaluated on a case-by-case basis during the hosting study. Inverters certified to the latest versions of IEEE 1547 and UL 1741 operating with active and passive anti-islanding protection enabled typically prevent the need for DTT between DLC's substation and DLC's recloser. The need for DTT from the DLC recloser to the GC's switchgear is evaluated on a case-by-case basis and can also be accommodated upon request at the GC's expense.

5.3.10 Additional Requirements for Synchronous and Induction Generation

Synchronous and induction Larger-Scale Generators require the installation of DTT at the GC's expense. DTT is required to prevent unintentional islanding, to prevent load-rejection over voltages and to clear DLC electric system faults that may not be detectable by the GC protection scheme.

DTT is typically transmitted to the DLC recloser at the PCC using cellar communications. Some installations may require direct fiber to be installed for DTT. The results of the hosting study will determine which medium for DTT is appropriate for each project.

6. VOLTAGE, REACTIVE POWER, AND POWER FACTOR CONTROL

The generation interconnection shall not result in any voltage conditions that violate DLC reliability criteria. DLC's distribution system is typically operated within a voltage range of 0.95 p.u. and 1.05 p.u. A more restrictive operating range is at times required.

6.1. Inverter-Based Generation

The generation facility shall have the capability of injecting (lagging) or absorbing (leading) reactive power when active power output levels are above 5% of rated active power output. The generation facility shall have reactive power capability as defined by Table 6-1.

Table 6-1: Reactive Power Capability

Active Power Output ($\%P_{active}$) (% of Rated kW)	Minimum Reactive Power Capability (% of Rated kVA)	
	Injection	Absorption
< 5%	0%	0%
5-20%	$44\% \; x \; \frac{\%P_{active}}{20\%}$	$44\% \; x \; \frac{\%P_{active}}{20\%}$
> 20%	44%	44%

The generator owner shall operate its generator facility to meet the voltage schedule specified by DLC. The voltage will be measured at the PCC between the Duquesne Light system and the generating facility. If the generating facility does not maintain its scheduled voltage, one of the following conditions must be met:

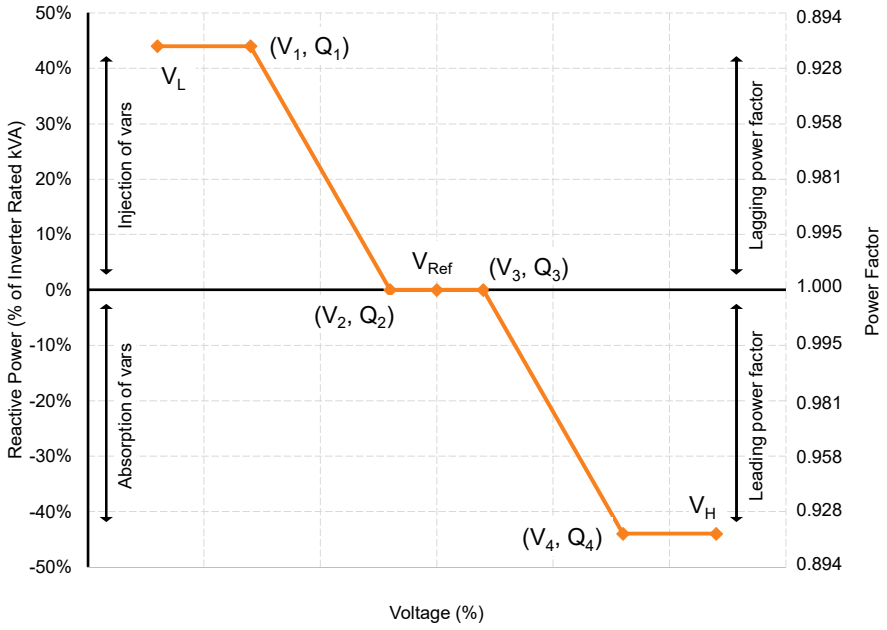
- While the maintained voltage was below the required scheduled voltage the generating facility maintained reactive requirement production capability and maximized its injecting (lagging) reactive power supply during this time.
- While the maintained voltage was above the required scheduled voltage the generating facility maintained reactive requirement production capability and maximized its absorbing (leading) reactive power absorption during this time.

Table 6-2 and Figure 6-1 define the typical voltage-VAR characteristics to be utilized by the generation facility. Note that for values between V1, Q1 and V2, Q2 and for values between V3, Q3 and V4, Q4, the reactive power shall adhere to the figure shown below. DLC reserves the right to modify these voltage thresholds for these reactive power requirements upon written notice to the GC.

Table 6-2: Voltage-VAR Characteristics

Parameter	Voltage, V (p.u. on 23 kV Base)	Reactive Power, Q (% of Nameplate kVA Rating)
V_1, Q_1	0.92	44% (Injection)
V_2, Q_2	0.98	0%
V_3, Q_3	1.02	0%
V_4, Q_4	1.10	-44% (Absorption)
V_{Ref}	1.00	0%

Figure 6-1: Voltage-VAR Characteristics



6.2. Synchronous Generation

The GC shall operate its generating facility to meet the voltage schedule specified by DLC. The voltage will be measured at the PCC. If the generating facility does not maintain its scheduled voltage, one of the following conditions must be met:

- While the maintained voltage was below the required scheduled voltage the generating facility maintained reactive requirement production capability and maximized its injecting (lagging) reactive power supply during this time.
- While the maintained voltage was above the required scheduled voltage the generating facility maintained reactive requirement production capability and maximized its absorbing (leading) reactive power absorption during this time.

An example of a DLC specified voltage schedule as measured at the PCC is shown in Table 6-3:

Table 6-3: Voltage Schedule

Generator Voltage Schedule (kV)	Generator Voltage Schedule (Vp.u.)	Generator Voltage Schedule Bandwidth (kV)	Generator Voltage Schedule Bandwidth (Vp.u.)	Reactive Power Schedule	DLC System Connection Voltage (kV)
23.23	1.01	+/- 0.23	+/- 0.01	No	23

7. RIDE THROUGH SETTINGS

The GC's facility shall provide low-voltage ride through (LVRT), high-voltage ride through (HVRT), under frequency ride through (UFRT), and over frequency ride through (OFRT) grid support functionality. At the PCC the GC shall adhere to the ride through settings as specified by DLC in Figure 7-1 and Figure 7-2.

The GC's facility shall maintain output and may not enter momentary cessation during the shall ride through period shown in Figure 7-1 and Figure 7-2. Where possible, DLC prefers that the GC's facility maintain output and not enter momentary cessation up to the shall trip region, which is displayed in Figure 7-1 and Figure 7-2 and also corresponds to the required voltage and frequency protection setpoints in Table 5-1 and Table 5-2.

DLC's specific ride through requirements are designed in accordance with the frequency and voltage ride through characteristics defined in the "PJM Guideline for Ride Through Performance of Distribution-Connected Generators" for Category II DER. DLC reserves the right to require GCs to utilize alternate ride through settings. Should the GC not be able to meet the specified ride through requirements (e.g., due to limitations associated with the generation type), DLC may provide acceptance of the noncompliance in writing following a detailed review.

Figure 7-1: HVRT and LVRT Requirements

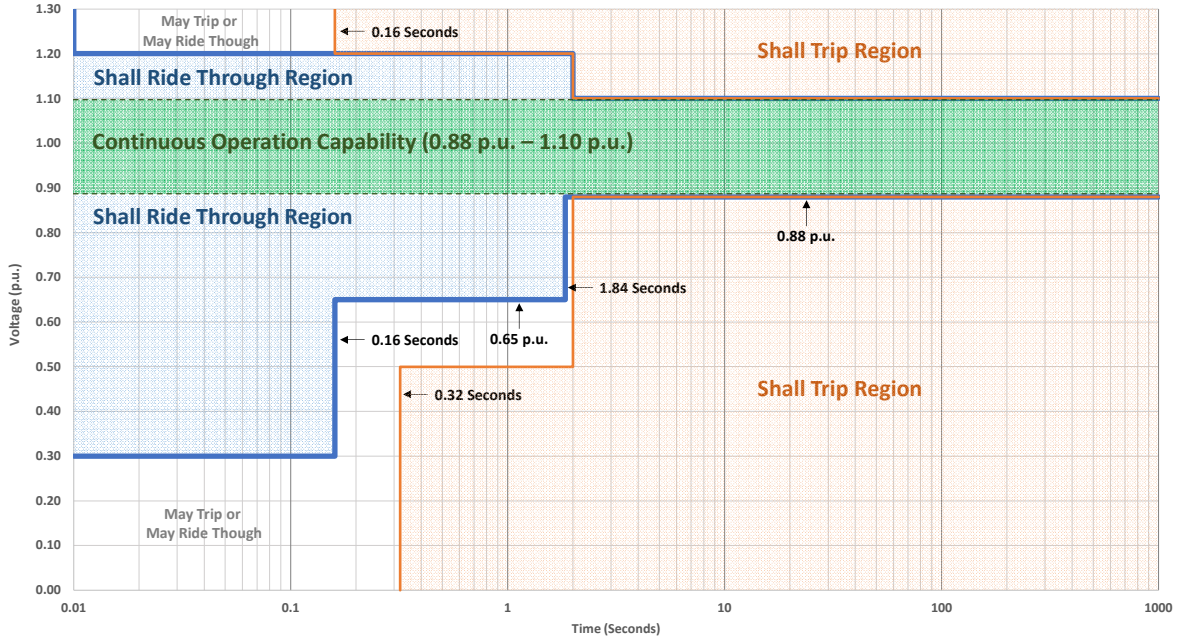
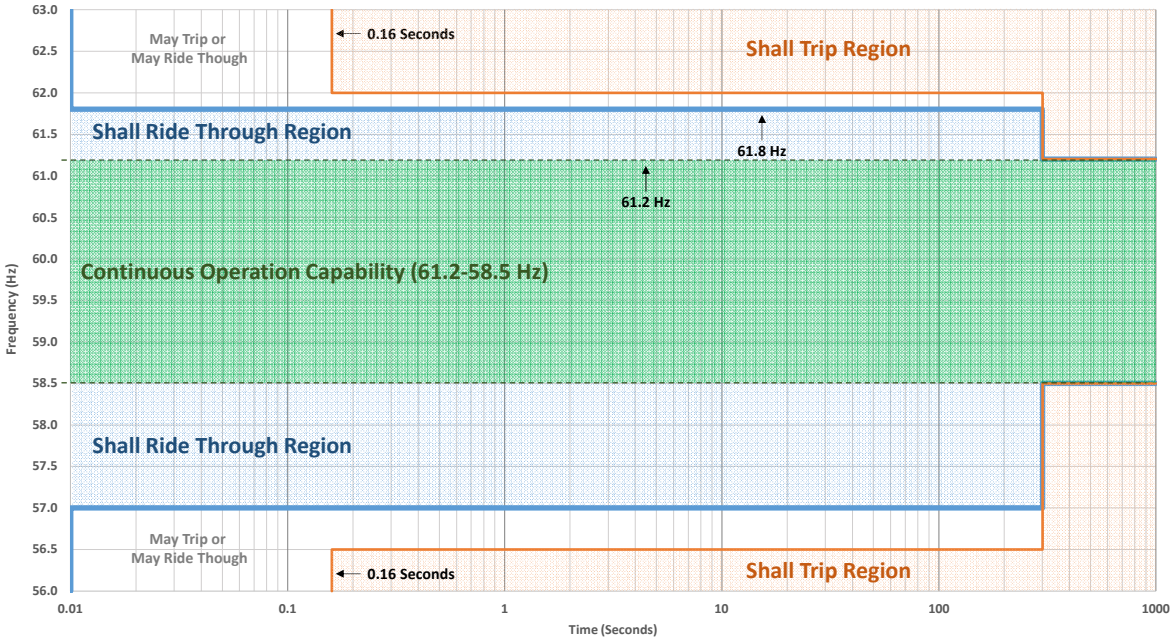


Figure 7-2: OFRT and UFRT Requirements



Any instance in which DLC does not strictly enforce any applicable ride through requirement does not constitute or imply a waiver of such requirement. At all times, DLC reserves all rights to strictly enforce ride through requirements.

8. POWER QUALITY IMPACTS

The interconnection of any generator to the DLC system shall not negatively impact the power quality of other DLC customers. DLC sets maximum limits on allowable voltage and current distortion at user facilities.

8.1. Power Quality Meter (PQM) Requirements

DLC requires all Larger-Scale Generators to have a DLC-owned Power Quality Meter (PQM) installed at the PCC. At DLC's discretion, this requirement may be applied to Small-Scale Generators on a case-by-case basis. The PQM and any other required equipment for its installation shall be purchased and installed by the GC. See Appendix Figure 20-5: Typical Building-Mounted PQM Installation with External Power Supply for a diagram of a typical building installation with an external power supply. The PQM measures harmonics and flicker at the PCC in real-time and identifies instances in which the GC does not conform to DLC's requirements in Sections 8.2 and 8.3 of this document.

8.2. Harmonics

Harmonic distortion levels at the PCC shall meet the applicable limits contained within or referenced by the latest revision of IEEE Std 1547 and IEEE Std. 519.

8.3. Flicker

DLC sets voltage flicker limitations for GCs in accordance with recommendations from IEEE Std 1547. Table 8-1 sets individual flicker emission value limits for users.

Table 8-1: Flicker Requirements

Flicker Emission Value	95th Percentile Flicker Limit $P_{95\%}$
P_{st}	0.35
P_{lt}	0.25

8.4. No Waiver

Any instance in which DLC does not strictly enforce any applicable power quality requirement does not constitute or imply a waiver of such requirement. At all times, DLC reserves all rights to strictly enforce power quality requirements.

9. SYNCHRONIZING OF FACILITIES

The GC shall assume all responsibility for properly synchronizing its generation with the DLC system. Reclosing of generation facilities is discussed in Section 5 of this document.

All generators paralleling to the DLC must meet the synchronization requirement of IEEE 1547. IEEE 1547 requires generators to parallel with the DLC system without causing step changes in the RMS voltage at the PCC exceeding 3% of nominal when the PCC is at 4kV or 23 kV, or exceeding 5% of nominal when the PCC is at a lower voltage.

9.1. Synchronous Generators, Induction Generators, and Grid Forming Inverters

Synchronous generators, induction generators, grid forming inverters, and other generators that produce a fundamental voltage before connecting to the DLC system shall not be synchronized outside of the tolerances specified in Table 9-1. The synchronization limits stated in this table may be waived by DLC if paralleling does not exceed the limitation of voltage fluctuations specified in IEEE 1547.

Table 9-1: Synchronization Requirements

Aggregate Rating of Generation (kVA)	Frequency Difference (Δf, Hz)	Voltage Difference (ΔV, %)	Phase Angle Difference ($\Delta\Phi$, °)
0 – 500	0.3	10	20
> 500 – 1,500	0.2	5	15
> 1,500	0.1	3	10

10. METERING

Metering requirements are different for Net Metered Generators and Wholesale Generators. Net Metered Generators will, at the end of their project, receive a net meter in replacement for a standard meter. The net meter measures the sum or "net" difference of the energy consumed at a property and the energy produced by a generator at a property. Wholesale market participants will not receive a Duquesne Light net meter.

10.1. General Considerations

All revenue metering equipment, including net meters, shall be installed at the discretion of DLC and in accordance with DLC's *Electrical Equipment Installation Rules*. For all customers, non-GC and GC, Duquesne Light will reference 'line side' and 'load side' from the perspective that power is flowing from the utility distribution (line side) to the customer (load side).

10.2. Net Metering

Net metering customers will go through the standard process of a Part 1 and part 2 application. Once all requirements of the part 2 application have been met, DLC will schedule a net meter to be installed at the property. Once the net meter is installed, the GC will begin billing as a net metered customer on the next utility bill cycle.

10.2.1 Standard vs. Dual Metered

Net Metered Generators are typically equipped with a single bidirectional meter that can measure and record the flow of electricity in both directions at the same rate. At the GC's cost and subject to DLC's approval, a dual meter arrangement may be substituted for a single bidirectional meter.

10.2.2 Transformer Rated Single Phase

For services greater than 200A, instrument transformers will be required. Please refer to DLC's *Electrical Service Installation Rules* for specific details on instrument transformers. Contact Duquesne Light field metering at 412-393-8713 to arrange delivery/pickup of material.

10.2.3 Primary Service

If the GC is choosing to accept primary service from the utility and subsequently procure, own, and maintain the transformer used for the generator, most often a primary metering cabinet will also need to be purchased. Exceptions when applicable. Please refer to DLC's *Electrical Service Installation Rules* for specific details regarding primary service. In all cases, DLC Metering Engineering will need to be involved in planning primary metering.

10.3. Wholesale Generation

Any Generation Facility connected to DLC's distribution system and participating in the PJM wholesale market shall install, own, operate, test, and maintain the necessary metering equipment to

provide revenue metering (MWh, MVAR) and real time data telemetry (MW, MVAR) for the Generating Facility that comply with the requirements set forth in PJM Manuals M-01 and M-14D.

For non-fleeting generators, DLC will supply and own revenue metering for all station service loads. In most typical installations DLC will provide any necessary revenue meters, instrumentation transformers, and wiring and the GC will provide metering sockets, instrumentation transformer enclosures, conduits, pedestals, concrete pads, etc. and perform all necessary civil work.

All power generated by the Generation Facility and fed into DLC's distribution system shall be reported by the GC directly to PJM via Power Meter. Additionally, each GC shall sign a retail service agreement with DLC and will be billed as appropriate for the anticipated station service load(s). GCs shall call the DLC business concierge at 412-393-7300 to set up billing by providing the address and requesting to set up the account. Based on this arrangement when the Generation facility is consuming power from DLC's distribution system, a zero MWh value should be reported to by the Generation Facility directly to PJM via Power Meter.

11. TELECOMMUNICATIONS

11.1. Small-Scale Generators

Projects of this size generally do not require installation of communication equipment, but communication equipment may be required at the discretion of DLC.

11.2. Larger-Scale Generators

At DLC's discretion, the GC may be required to install and maintain a dedicated communications link and devices, compatible with DLC's equipment, to provide telemetry (i.e. SCADA) to DLC's Operation Center. If requested by DLC, the required telemetry is as follows: circuit breaker status, voltage, amperage, MW, MVAR, MWH, and frequency. The preferred communications protocol for SCADA communications is DNP 3.0 over TCP/IP. All SCADA equipment installations shall comply with the current NERC Cyber Security standards, where appropriate.

Telecommunications circuits, which must also be reliable and secure, should be tested regularly and monitored online, with special attention given to emergency channels. Installation of communications facilities and services (internet service, leased telephone circuits, fiber optics, etc.), communications facility operation and maintenance, and other ongoing costs are the responsibility of the GC.

11.2.1 Wholesale Generation

If electing to participate in the PJM wholesale electricity market, the GC shall additionally follow the telecommunications requirements outlined in PJM Manuals.

12. SPACING, MINIMUM CLEARANCE, AND INSULATION COORDINATION

The GC shall ensure that new buildings, structures, additions, modifications and any other construction projects keep the minimum clearances required from existing DLC supply lines. These minimum clearances

are specified in the National Electrical Code, the National Electrical Safety Code and some local building codes. For more information refer to DLC's *Electric Service Installation Rules*.

Where applicable, Table 12-1 lists the DLC standard BIL for substation equipment. Electrical clearances of the substation equipment shall, at a minimum, be designed to the National Electrical Safety Code (NESC) and National Electrical Code (NEC) requirements based on the equipment BIL.

Table 12-1: DLC Standard BIL for Substation Equipment

Equipment	Basic Lightning Impulse Insulation Level (BIL)	
	4 kV	23 kV
Bus insulators	60	200
Disconnect switches	60	200
Circuit Breakers	60	150/200
Power transformer Bushing	60	200
Current transformers	60	200
Potential transformers	60	200
Reclosers	110	125

13. EQUIPMENT RATINGS

Service equipment (circuit breaker or switch and fuse) must have a rating adequate to withstand and interrupt the maximum short-circuit current to which it may be subjected and must be capable of being coordinated with DLC's protective equipment. The amount of such short-circuit current may be obtained from DLC after the service voltage and type of connection to the DLC system have been determined. For more information refer to DLC's *Electric Service Installation Rules*.

Substation equipment shall have interrupting, peak current, and continuous ratings no less than those in Table 13-1.

Table 13-1: DLC Substation Equipment Ratings

System Voltage (kV)	Rated Maximum Voltage (kV)	Rated Continuous Current (A)	Rated Short-Circuit and Short-Time Current (kA)	Rated Interrupting Time (ms)	Maximum Permissible Tripping Time Delay (s)	Rated Closing and Latching Current (kA)
4	4.76	1200	20	83	2	52
23	25.8/38	1200/2000	25/40	83	2	65/104

14. CIRCUIT BREAKER DUTY AND SURGE PROTECTION

The following subsections of this document provide requirements for short-circuit current ratings and surge protection.

14.1. System Short Circuit Duty

As necessary, DLC will provide the maximum three-phase and line-to-ground fault currents (magnitude and X/R) at the proposed interconnection location.

The minimum interrupting rating of all substation equipment at DLC substations is listed in Table 14-1:

Table 14-1: DLC Substation Interrupting Ratings

System Voltage (kV)	Rated Short-Circuit (Symmetrical) Interrupting Current (kA)	Rated Short-Time (Symmetrical) Withstand Current (kA)	Rated Short-Time Withstand Current Duration (s)
4	20	20	2
23	25/40	25/40	2

14.2. Surge Protection

For more information on surge protection for GC equipment refer to DLC's *Electric Service Installation Rules*. Table 14-2 lists the DLC standard for surge arresters used in substations:

Table 14-2: DLC Substation Surge Protection Requirements

Arrester Type	System Voltage	Duty Cycle Voltage	TOV (Note 1)	MCOV	Maximum discharge voltage at 10kA for 8/20µs waveshape:	Minimum Energy Capability	Minimum pressure relief current rating	Mounting Bolt Circle*	Fault Current Withstand	Leakage Distance
Intermediate	4 kV	3 kV	3.6 kV	2.55 kV	9 kV max	2.2 kJ/kV	20 kA or greater	8.75 in	20 kA	15" min
Intermediate	23 kV	21 kV	25.2 kV	17.7 kV	61.5 kV max	3.4 kJ/kV	40 kA or greater	10 in	40 kA	24" min

1) Temporary over voltage (TOV) capability shall be equal to or greater than 1.2 per unit arrester duty cycle rating for a time equal to or greater than 1.0 seconds at no prior energy.
2) Arresters shall be of adequate rigidity to withstand forces imposed by winds of up to 76 mph without damage and ice up to one (1) inch thick.
3) Each arrester shall be sealed to permanently prevent the entrance of moisture.
4) The base and top shall have three (3) holes at 120 degrees mounting for 1/2 inch minimum bolts on a ___ inch bolt circle.*
5) Arrester line terminal pads shall have four 9/16 inch holes drilled on 1-3/4 inch centers in accordance with NEMA LA-1 standard. The ground terminal pads shall have two 9/16 inch holes drilled on 1-3/4 inch centers.
6) Maximum discharge voltage based on the higher of published values in present supplier documentation or typical characteristics based on Table 1 in IEEE Std C62.22-2009.

15. FACILITY MAINTENANCE AND COORDINATION

All modifications made to generator facilities must be reported to DLC. Depending on the circumstances, additional documentation and upgrades may be required. This includes increases or decreases in capacity output, storage additions for the system, replacement of protection equipment, etc. If a change is being made to the generator, please alert interconnection@duqlight.com promptly.

The GC is responsible for the maintenance of its facilities in a safe and reliable manner in accordance with all applicable standards, rules, procedures, protocols, all applicable laws and regulations, and good utility practice. In addition to the electrical system maintenance, the GC is responsible for maintaining their generating property. This maintenance includes, but is not limited to fencing, foundations, grounding, underground conduit, structural steel, control house, control house HVAC, lighting, yard rock covering, access roadway(s) to the generating property and vegetation management within and adjacent to the generating facility.

For each generating facility, the GC shall provide DLC personnel access to areas under the GC's control as reasonably necessary to permit DLC to perform its obligations such as operation and maintenance.

The GC should review applicable interconnection agreements for specifics on the coordination of maintenance activities.

Unless otherwise agreed upon by DLC and the GC, the GC shall be responsible for the maintenance, replacement, and eventual removal of any equipment owned by the GC. Any new equipment installed by

the GC shall meet the applicable requirements of the then-effective Duquesne Light Company Distribution System Generation Interconnection Requirements. Whenever a generating facility is replaced, the GC shall conform all of its facilities to the applicable requirements of the then-effective Duquesne Light Company Distribution System Generation Interconnection Requirements.

16. INSPECTION REQUIREMENTS

16.1. Prior to Energization

All interconnected systems must be constructed, wired, and installed per the applicable NEC code(s), and all applicable state and local requirements. As part of the interconnection application process, the GC will be required to produce a wiring approval from a qualified electrical inspector verifying that the system(s) to be interconnected conform to all applicable electrical requirements.

DLC requires all generators operating in parallel to the DLC distribution system to conform to the requirements of IEEE Standard 1547. DLC reserves the right to require GCs to demonstrate their adherence to IEEE Standard 1547 by performing the tests specified within IEEE Standard 1547.1. DLC reserves the right to have a DLC employee observe these tests if deemed necessary by DLC. All testing of GC-owned equipment must be conducted by the GC or a designated contractor of the GC. DLC employees are not allowed to operate GC-owned equipment.

DLC's testing procedure is designed in accordance with IEEE 1547.1 and shall be followed with no exceptions.

16.2. Post Energization

Each GC shall perform routine inspection and testing of each of its facilities and equipment as may be necessary to ensure the continued interconnection of its facility with the DLC distribution system in a safe and reliable manner.

All modifications made to generator systems must be reported to DLC. Depending on the circumstances, additional documentation and upgrades may be required. This includes increases, decreases, and/or storage additions for the system. This applies to residential, commercial, and industrial generators. If a change is being made to the generator, please alert interconnection@duqlight.com promptly.

17. OPERATING ISSUES AND COMMUNICATIONS PROCEDURES

The GC shall maintain satisfactory operating communications with DLC. Requirements vary based on the size of the generation as detailed in the following sections:

17.1. Small-Scale Generators

The primary point of communications between the interconnected generation facility operator and DLC shall be through DLC's Customer Service team. In the event of an Emergency please call 888-393-7000. For general questions and support please contact 888-393-7100 (residential customers) or 412-

393-7300 (business customers). The generator operator shall provide DLC with phone numbers of critical operations personnel, such as the homeowner or the facility's electrical maintenance staff as part of the facility interconnection agreement.

17.2. Larger-Scale Generators

The primary point of communications between the interconnected generation facility operator and DLC shall be through DLC's Operation Center. The facility operator shall provide DLC's Operation Center the phone numbers of critical operations personnel, such as Operating Engineers and Shift Supervisors. These are the personnel that must quickly and accurately respond to operations directives transmitted by DLC. A list of all responsible operations and engineering personnel and their 24-hour access phone numbers shall also be provided and updated as soon as organizational changes are made. The DLC Operations Center 24-hour access phone numbers and email addresses shall be provided as part of the facility interconnection agreement.

For generation facilities participating in the PJM wholesale market, all communications and procedures during normal operations and emergency operating conditions shall follow the requirements outlined in:

- *PJM Manual 01: Control Center and Data Exchange Requirements*
- *PJM Manual 03: Transmission Operations*
- *PJM Manual 12: Balancing Operations*
- *PJM Manual 13: Emergency Operations*

To maintain situational awareness of the distribution system, the generating facility operator must directly notify the DLC Operations Center of any operating status change (i.e., offline to online or vice versa) of the generation facility. For general questions and support please contact DLC's Customer Service team at 1-412-393-7300.

18. REFERENCES

The following items referenced in this document are publicly available:

- Duquesne Light Company Electric Service Installation Rules
- Duquesne Light Company Approved Transmission Contractors and Vendors
- NERC Glossary of Terms
- PJM Open Access Transmission Tariff
- PJM Manuals

- PA Chapter 75: Alternative Energy Portfolio Standards

The following items referenced in this document either need to be purchased or require a subscription to access:

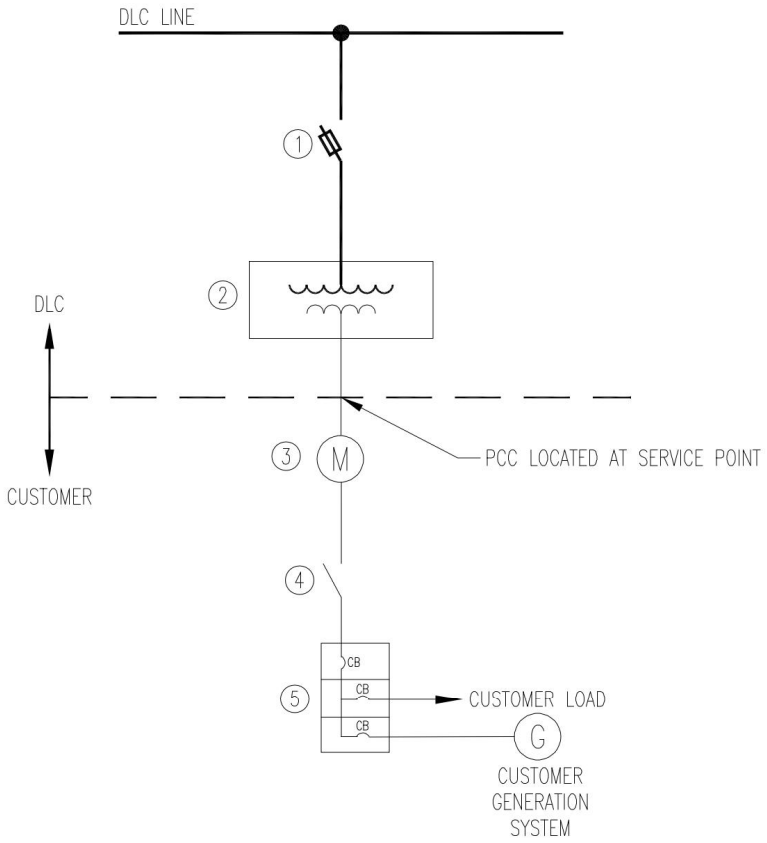
- National Electrical Code
- National Electrical Safety Code
- Various IEEE Standards

19. REVISION HISTORY

Version	Prepared By	Summary of Changes	Date
0	J. Hitt	Initial creation of the document.	09/09/2024
1	N. Glotzbach	Added additional clarification of transformer winding configuration based on voltage class.	09/30/2025

20. APPENDIX

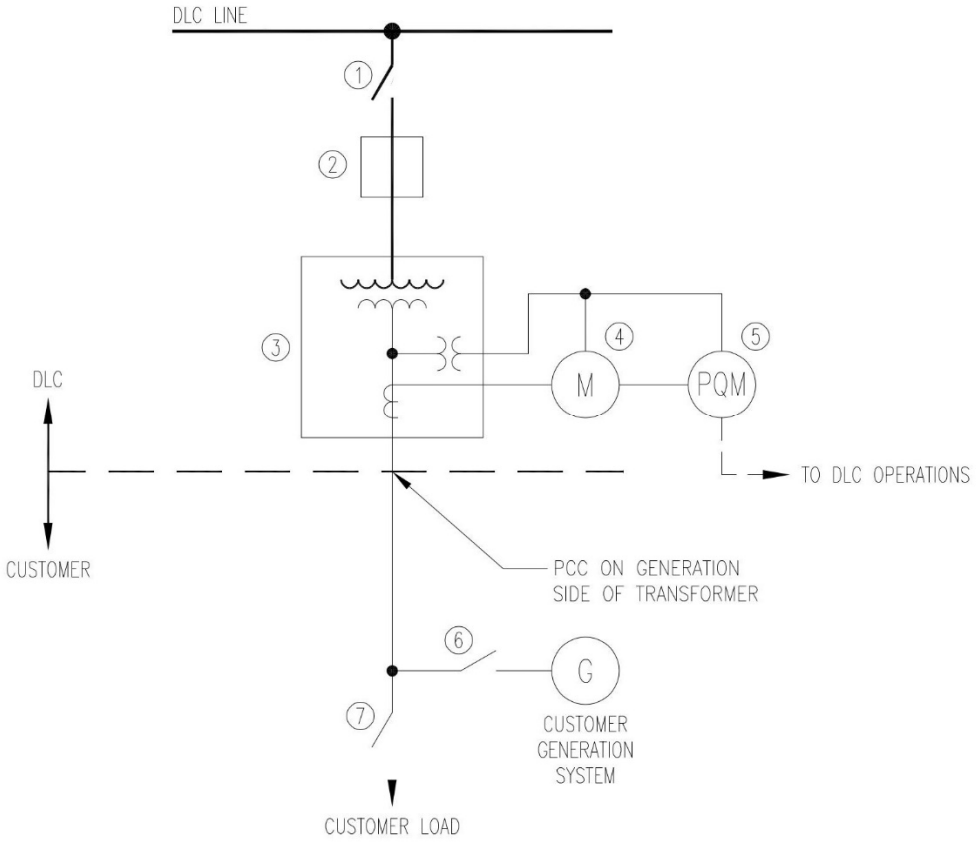
Figure 20-1: Standard One-Line Diagram for Net-Metered Secondary Service, Small-Scale Generators



MATERIAL LIST	
ITEM	DESCRIPTION
1	FUSED DISCONNECT
2	TRANSFORMER
3	METER, BI-DIRECTIONAL
4	DISCONNECT, UTILITY-ACCESSIBLE
5	CUSTOMER SWITCHGEAR

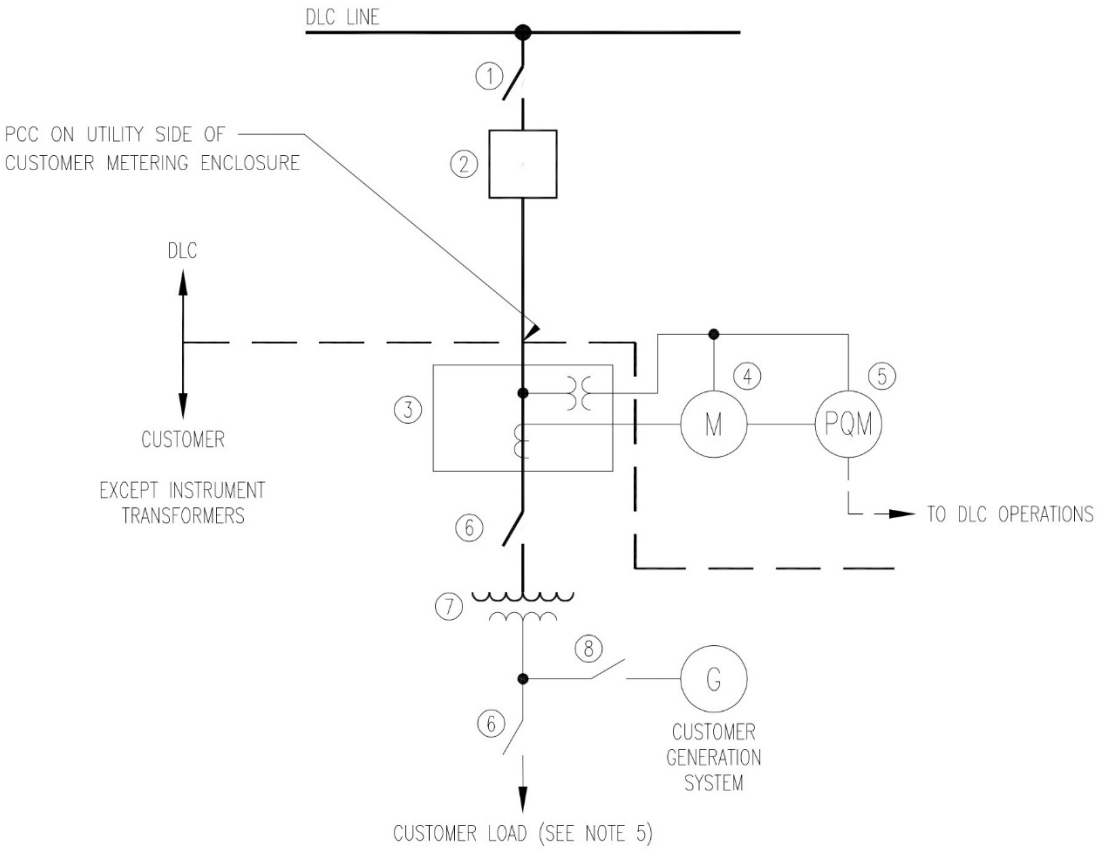
NOTES:
1. THE TYPE OF EQUIPMENT AND CONFIGURATION MAY VARY BASED ON PROJECT REQUIREMENTS. .
2. CUSTOMER-OWNED EQUIPMENT SHALL ADHERE TO DLC ELECTRIC SERVICE INSTALLATION RULES AND IS SUBJECT TO DLC REVIEW AND APPROVAL. CUSTOMER SERVICE EQUIPMENT FOR LOAD AND GENERATION CIRCUITS MUST PROVIDE FAULT INTERRUPTION AND LOAD-BREAK CAPABILITY (E.G. CIRCUIT BREAKERS OR FUSIBLE LOAD-BREAK SWITCHES).

Figure 20-2: Standard One-Line Diagram for Net-Metered Secondary Service, Larger-Scale Generators



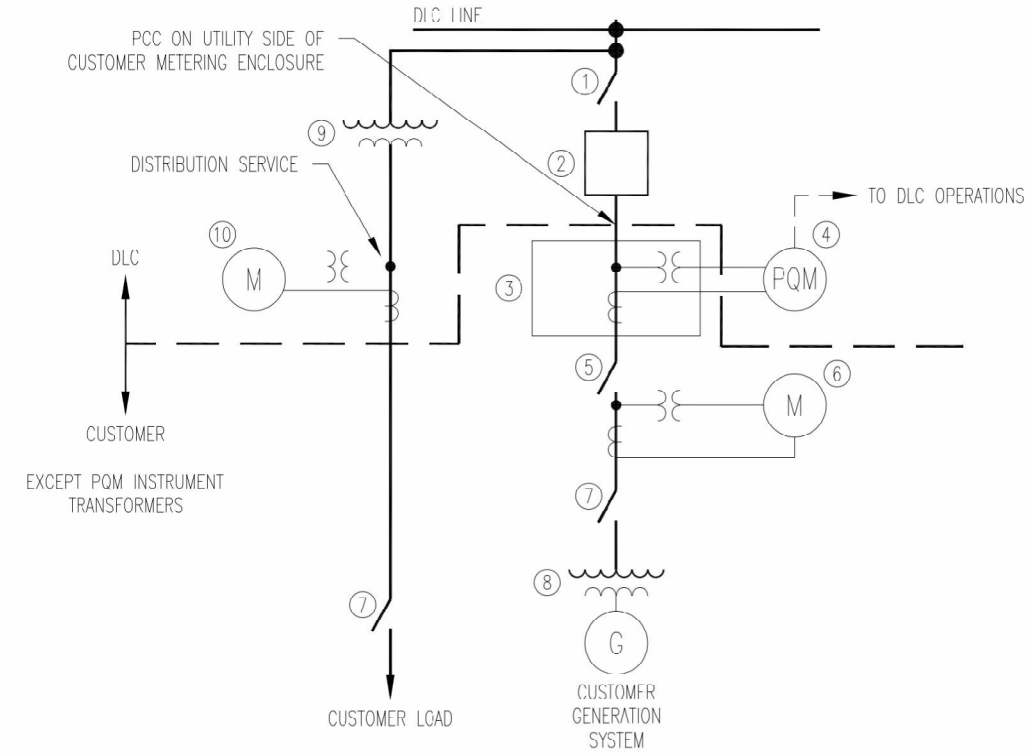
MATERIAL LIST	
ITEM	DESCRIPTION
1	DISCONNECT, VISIBLE BREAK, UNDERARM
2	PROTECTIVE RECLOSER/INTERRUPTER
3	TRANSFORMER, PAD-MOUNTED
4	METER, BI-DIRECTIONAL
5	POWER QUALITY MONITOR (SEL-735)
6	DISCONNECT, LOAD-BREAK, FAULT-INTERRUPTING, LOCKABLE, UTILITY-ACCESSIBLE, VISIBLE BREAK
7	DISCONNECT, SPECIFIED ACCORDING TO DLC INSTALLATION RULES

Figure 20-3: Standard One-Line Diagram for Net-Metered Primary Service, Larger-Scale Generators



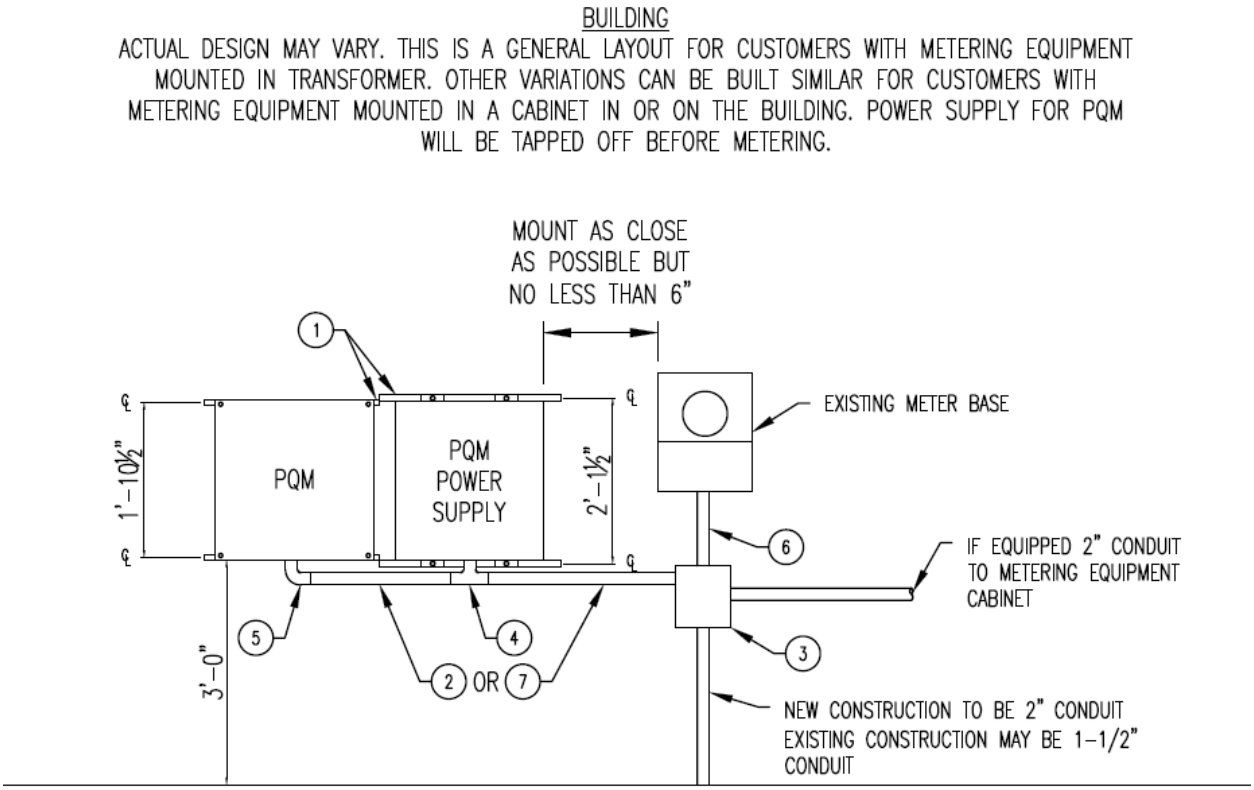
MATERIAL LIST	
ITEM	DESCRIPTION
1	DISCONNECT, VISIBLE BREAK, UNDERARM
2	PROTECTIVE RECLOSER/INTERRUPTER
3	METERING ENCLOSURE, PAD-MOUNTED, SPECIFIED BY DLC
4	METER, BI-DIRECTIONAL
5	POWER QUALITY MONITOR (SEL-735)
6	DISCONNECTS, SPECIFIED ACCORDING TO DLC INSTALLATION RULES
7	TRANSFORMER, PAD-MOUNTED, SPECIFIED BY DLC
8	DISCONNECT, LOAD-BREAK, FAULT-INTERRUPTING, LOCKABLE, UTILITY-ACCESSIBLE, VISIBLE BREAK

Figure 20-4: Standard One-Line Diagram for Wholesale Generation



MATERIAL LIST	
ITEM	DESCRIPTION
1	DISCONNECT, VISIBLE BREAK, UNDERARM
2	PROTECTIVE RECLOSER/INTERRUPTER
3	METERING ENCLOSURE, PAD-MOUNTED, CUSTOMER-OWNED EXCEPT FOR INSTRUMENT TRANSFORMERS
4	POWER QUALITY MONITOR (SEL-735)
5	DISCONNECT, LOAD-BREAK, FAULT-INTERRUPTING, LOCKABLE, UTILITY-ACCESSIBLE, VISIBLE BREAK
6	GENERATION METERING EQUIPMENT, CUSTOMER-OWNED, SUBJECT TO PJM ACCURACY AND TELEMETRY REQUIREMENTS
7	DISCONNECT, SPECIFIED ACCORDING TO DLC INSTALLATION RULES
8	TRANSFORMER, CUSTOMER-OWNED, SPECIFIED BY DLC
9	TRANSFORMER, DISTRIBUTION SERVICE
10	METER, DISTRIBUTION SERVICE

Figure 20-5: Typical Building-Mounted PQM Installation with External Power Supply



MATERIAL LIST	
ITEM	DESCRIPTION
1	UNISTRUT (VARIOUS LENGTH)
2	2" LIQUIDTIGHT FLEX CONDUIT
3	ENCLOSURE, PAD LOCKING, 8"X8"X6"
4	2" PVC CONDUIT BODY "T"
5	2" PVC CONDUIT BODY 90 DEGREE ELBOW
6	2" PVC MALE ADAPTER & LOCKING NUT
7	2" PVC SCHEDULE 80