

# Exelon Energy Delivery Interconnection Guidelines for Generators 2 MVA or less

Table of Contents:

INTRODUCTION and SCOPE ..... 3

DEFINITIONS ..... 3

QUALIFICATIONS FOR AN EXPEDITED REVIEW:..... 5

RESPONSIBILITIES OF THE GIC ..... 6

    Portable Generators:..... 7

    Back-up Generation: ..... 7

DESIGNS ..... 7

    Design A1: Generating Capacity Under 25 kVA ..... 8

    Design A2: Inverter Connected Generating Capacity Up to 50 kVA..... 8

    Design A3: Inverter connected Generation on Networks (Spot and Grid)..... 8

    Design A4: Small Generation Up to 2000 kVA not Covered in Designs A1-A3..... 9

APPENDIX 1- PRE-INTERCONNECT INSPECTION STANDARDS ..... 15

APPENDIX 2 - APPROVED RELAYS FOR USE ON THE EED SYSTEM..... 17

## INTRODUCTION and SCOPE

This guide is intended for use by customers wishing to connect small generators 2 MVA or less with the EED Distribution System. The guide provides the technical information and requirements for acceptable interconnection of small generators 2 MVA or less.

Interconnections less than 2 MVA can still require the more complex relaying as detailed in the greater than 2 MVA but less than or equal to 20 MVA interconnection guidelines, depending on the aggregate of generation connected to the line and the minimum loading of the line to which the GIC wishes to connect.

This guide only provides the technical requirements to interconnect a GIC. Small generator interconnection procedures and agreements are covered in separate documents.

## DEFINITIONS

**“EED “Distribution Line” or “Feeder”**” consists of the medium voltage conductors and equipment emanating from an EED substation that serves customers through distribution transformers. In most cases these feeders are radial (meaning they have a source at only one end), but may also be primary networked, where the line has two or more sources forming a primary network.

**“EED Distribution System”** consists of the primary and secondary wires and equipment up through 34kV owned and operated by EED.

**“EED Radial Distribution System”** consists of the primary and secondary wires and equipment, that is not networked, up through 34kV owned, controlled, or operated by Exelon Energy Delivery. Any line that is networked on either the primary or secondary is not considered radial. (See a further explanation of networks below.)

**“EED System”** as used in this document refers to facilities owned, controlled operated by the Exelon Energy Delivery.

**“Generation Interconnection Customer” (GIC)**”: An entity that submits an Interconnection Request to interconnect a new generation facility or to increase the capacity of any existing generation facility interconnected with the EED System.

**“IEEE 1547”** is the Institute of Electrical and Electronics Engineers “Standard” for the “Interconnecting of Distributed Resources with Electric Power Systems”.

**“Line/Feeder Section”** is a portion of a line or feeder bounded by automatic protective equipment (such as circuit breakers, reclosers, sectionalizers, and fuses) or the end of the line. This protective equipment effectively splits the feeder into smaller sections. If no additional protective equipment is installed between the generator and the substation, the line section could be the entire line. Minimum feeder loads will be based upon the smaller “line section” if this type of equipment exists on the feeder. For example, the minimum line load on a feeder is 2000 kVA, but a recloser has been installed at the load center of the feeder. If a customer installs a

generator on the 2<sup>nd</sup> half of the feeder behind the recloser the minimum “Line Section” load is 1000 kVA and this will be used to determine the protection plan required.

**“Momentary Parallel Generation”** refers to generation connected for short periods of time during a transition from the EED System to the customers local electric power system and on return to the EED System. Generation that is parallel connected to the EED System for 10 cycles or less is considered Momentary Parallel Generation. (See the section on Momentary Parallel Generation in this guide.)

### **Networks:**

**“Grid Network”** refers to a collection of secondary cables (sometimes called secondary mains or street ties) all interconnected together over a wide area covering many city blocks. Network transformers are located at various locations throughout the grid to supply power and support the grid voltage. Several primary feeders are used to feed the network transformers. The low voltage cables may have customer service cables connected in manholes between the network transformer vaults. A Grid Network may also be referred to as an area network, secondary network or street network. This includes the EED secondary grid network in Chicago, IL (in the loop and near north side), in downtown Evanston, IL and downtown Philadelphia, PA.

**“Spot Network”** refers to two or more network transformers connected by a common bus at a single location, such as in the basement of a building. Several spot networks may be located within a building or geographic area, but unlike grid networks no secondary cables interconnect between the spot network vaults. Spot networks may be located in shopping centers, high-rise buildings, airports, and other less defined locations on the EED system.

**“Parallel Generation”** refers to generation directly interconnected to the EED T&D System for periods in excess of those described in Momentary Parallel Generation above. Parallel generation will be required to install the appropriate EED relay protection described in this guide.

**“P.C.C.”** is the “Point of Common Coupling or the connection point between the customer and the EED Distribution System.

**“Reclosing Practices”** When a fault occurs on a line the substation protective device opens to isolate the fault. Since on overhead systems greater than 85% of the faults are temporary in nature, allowing the protective device to close back in automatically (Reclose) after a time delay can restore most overhead circuits and increase reliability. For this reason most utilities install reclosing on overhead feeders.

## **QUALIFICATIONS FOR AN EXPEDITED REVIEW:**

1. The GIC does not intend to sell wholesale power on the open market through PJM (Back-feed by qualifying facilities to EED lines is not considered wholesale marketing); and
2. The GIC must be connected to the EED Radial Distribution System. The aggregate of generators and the utility source cannot cause the fault current to exceed 85% of the protective equipments interrupting rating.; and
3. The GIC is not connected to facilities controlled or operated by PJM, to provide transmission service, either at the point of common coupling or through the transformer that serves the GIC. (NOTE: Some distribution lines may be under FERC jurisdiction, if there are existing exporters selling wholesale power on the open market connected to the line. In this case PJM may be involved and the expedited process does not apply.); and
4. Construction or modification of facilities by EED on EED's Distribution System is not required to accommodate the generator; and
5. The proposed Small Generator Facility, in aggregation with other generation on the line section, does not contribute more than 10 % to the line section's maximum fault current at the point on the primary voltage distribution line nearest the P.C.C, and
6. The aggregate of generation on the line section does not exceed the lesser of 15% of the annual peak load or 50% of the minimum load on a line section to a maximum of 2000kVA and there are no transient stability limitations; and.
7. The generator is tested and certified by a third party independent test laboratory to comply to IEEE1547.1; and
8. Proposed generator is not directly or through an on-site transformation connected to a transmission line; and
9. There is no EED owned primary voltage source-transfer equipment installed at the site.
10. In addition, if the GIC is to be interconnected on a shared single phase secondary line the aggregate of generation does not exceed 20kVA or if interconnected on the center tap neutral of a 240 volt service, its addition shall not create an imbalance between the two sides of the 240 volt service more than 20% of the nameplate rating of the service transformer.

When a GIC makes a request to connect to the EED System, the GIC will not know if they meet the conditions listed above. EED's screening process will verify that the generator or generators meet the conditions defined above. If the initial review indicates that the GIC does not meet the conditions mentioned above, the GIC will be notified that the expedited process does not apply and that further review is required by EED. Please note that an individual generator can meet all the screenings described above and still require additional review as the screens above all

stipulate that the maximum generation is based upon the aggregate of all generators on a line section.

Any generator or aggregate of generators with a kVA rating greater than 50% of the minimum line load of the line section to which they are connected will be required to install protection per EED's Design "B" or higher. Design "B" is detailed in the guide covering generation greater than 2 MVA but less than or equal to 20MVA.

## **RESPONSIBILITIES OF THE GIC**

The GIC is responsible for designing, installing, operating, and maintaining its own equipment in accordance with Good Utility Practice(s), IEEE 1547, the National Electrical Code, city or village building codes, the National Electrical Safety Code, North America Electric Reliability Council, any applicable independent system operator, EED planning criteria and guidelines, service requirements and all applicable laws and regulations. This includes installing, setting, and maintaining all protective devices necessary to protect the GIC's facilities. The requirements specified in this document are designed to protect EED facilities and to maintain system reliability, not to protect the GIC's facilities. It is important that the GIC's protective settings coordinate with the utility protective equipment. On larger installations EED will review the GIC's settings for proper coordination.

Also, on occasion, the GIC may not be allowed to operate in parallel with the EED T&D system or, in the case of a GIC with multiple interconnection points, maybe permitted to operate only in parallel with specific lines so EED can perform "Liveline Maintenance" on the facilities serving the GIC. The GIC, EED (and possibly PJM) will coordinate with these conditions and requests.

- During planned outages, or if the GIC is not permitted to operate the generator in parallel with a line while EED performs "Liveline Maintenance", EED may lockout the generator (or other breaker designated by the GIC) to prevent its closing into EED's line(s). A GIC must notify EED before bringing a generator on line. EED may require the GIC to delay synchronizing when EED is experiencing line trouble or system disturbances.
- A GIC must not energize supply lines interconnecting with EED's facilities or continue to maintain supply to EED lines after EED has deenergized its lines. EED may discontinue parallel operation during emergencies and under abnormal operating conditions. EED's Operation Center dispatcher will call the GIC asking to isolate the generator from the EED system. If no one can be reached, EED may take other measures on its T&D lines to isolate the generator.
- A GIC is responsible to evaluate the potential effect of EED's reclosing practices on the generator and to provide suitable protection.

## **NOTE: IMPORTANT EXCEPTION TO IEEE 1547 SETTINGS BY COMED**

ComEd's reclosing practice is to have a first reclose after the protective device has been open for 2 seconds and a second reclose after 30 seconds. IEEE1547 protective guidelines call for the first level of tripping to occur after 2 seconds. This means that the generator could still be connected when the ComEd line is reclosed. To avoid this harmful condition, the first trip level

of tripping must be reduced from 2 seconds to 1 second. PECO's reclose timing is different and this exception does not apply to PECO.

### **Portable Generators:**

Portable generators are NOT to be directly connected to the EED system. Many customers have purchased small generators for use during service interruptions. These generators, while assisting customers in having electricity during outages, can cause a significant hazard to EED personnel repairing the damaged facilities and to the public. If the customer is not careful when connecting the generator, it can back-feed the EED system through the distribution transformer creating high primary voltages on wires that may be laying on the ground. Whenever connecting portable generators, the customer's main circuit breaker or fuse is to be removed or the equipment, to which the generator is connected, is to be isolated from the rest of the electrical system on the premises.

### **Back-up Generation:**

Generators that operate in a break before make manner (on both separating from and returning to EED) must never parallel the EED system and do not need to follow this guide.

### **Momentary Parallel Generation:**

Generation that is connected to the EED System for 10 cycles or less is considered Momentary Parallel Generation. This type of parallel generation generally does not require the protection described in this guide. EED will determine if any unusual system conditions exist that would require the relaying described in this or the other generation guide books (i.e. The generator would cause excessive voltage flicker if the high speed transfer is performed). Note that it is the GIC's responsibility to design and protect these momentary connections to insure safe and reliable operation. Momentary generation transfer schemes are to be supervised by hard-wired timing relays or an equivalent interlocking scheme. The GIC will be required to field verify to EED that the transfer takes place in 10 cycles or less. If the installation fails the test or if the paralleling time period is intentionally over 10 cycles, relaying per this or the other guides will be required.

## **DESIGNS**

A1. Generators smaller than 25 kVA (Either one generator or an aggregate of multiple generators on a feeder).

A2. Small inverter based generation (photovoltaic, wind, microturbine, etc) up to 50 kVA (Either one generator or an aggregate of multiple generators on a feeder ).

A3. Any one generator or aggregate of multiple generators who's capacity is less than 5% of the peak load or less than 50% of the minimum load including any regeneration caused by elevators (whichever is less) on a spot network or a network grid to a maximum of 50 kVA can be connected provided the connection is through a certified non-islanding inverter. An aggregate of non-islanding inverter photovoltaic generation can be connected up to 50% of the minimum day time load or 50kVA, whichever is less.

A4. Any one generator or aggregate of multiple generators who's capacity is less than 15% of the peak line or line section load, or less than 50% of the minimum line or line section load on a feeder, up to 2000 kVA on a feeder (Whichever is less).

Note: Plan A4 in this guide may also be used for certain small generation less than 2000 kVA that does not meet the qualifications for an expedited plan because it does not meet one of the qualifications above.

#### **Design A1: Generating Capacity Under 25 kVA**

Special protective devices on the EED system are generally not required for parallel generator installations (either a single unit or an aggregate of multiple units on a line section) with a total generating capacity less than 25 kVA. Generators are to be tested and certified to the latest version of IEEE 1547. Protective trip points are to be set in accordance with the latest version of IEEE 1547 (Note ComEd reclosing exception above). These facilities must have suitable protection and provide a readily accessible disconnect switch that is lockable and has a visible break that EED can operate in order to isolate the generator from the EED system for maintenance, reliability, and safety concerns. Note that the total aggregate generation on an EED line section where the generation is to be installed could impact the need for additional protective equipment. An aggregate of more than 25 kVA of synchronous and induction machine type generation could result in the GIC having to install protective relaying per Design A4.

Witness testing by EED, will not be performed for these small generator units.

#### **Design A2: Inverter Connected Generating Capacity Up to 50 kVA**

Inverter based generators up to 50 kVA (either one generator or an aggregate of multiple generators, such as micro-turbines, wind, and photovoltaics (PV)), can be installed on a line section using the integral protection present on these units. The units must be installed in accordance with current IEEE 929 standards and be UL 1741-listed using utility interactive (non-islanding) inverters with non adjustable set-points. Set-points to conform to IEEE 1547 or manufacturers recommendation, whichever is more conservative (Note the ComEd reclosing exception to IEEE 1547).

The total aggregate generation on an EED line section where the generation is to be installed could impact the need for additional protective equipment. An aggregate of more than 50 kVA of inverter based generation could result in the GIC having to install protective relaying per Design A4.

Witness testing by EED, will not be performed for these small generator units.

#### **Design A3: Inverter connected Generation on Networks (Spot and Grid)**

Any one generator or aggregate of multiple generators who's capacity is less than 5% of the peak load or less than 50% of the minimum load including any regeneration caused by elevators (whichever is less) on a spot network or a network grid to a maximum of 50 kVA can be connected provided the connection is through a certified non-islanding inverter. An aggregate

of non-islanding inverter photovoltaic generation can be connected up to 50% of the minimum day time load or 50kVA, whichever is less.

Inverter generation in excess of the above amounts will NOT be connected to the networks. Synchronous and induction machines will NOT be allowed to connect to the networks (unless connected by the GIC in a break before make operation, no paralleling, or isolated by a certified non-islanding inverter, such as a micro-turbine).

NOTE: PECO's network is a 2 phase 5 wire system and is not a standard network that may be present in many other cities. Standard three phase inverters cannot be connected to this network, as proper phasing cannot be obtained. Any connection of inverters will have to conform to the phasing on this network.

For generation that qualifies under Design A3 the protection included with the inverter is all the EED relaying needed. The units must be installed in accordance with current IEEE 929 standards and be UL 1741-listed using utility interactive (non-islanding) inverters with non adjustable set-points. Set-points to conform to IEEE 1547 or manufacturers recommendation, whichever is more conservative.

Witness testing by EED, will be required for any inverter installation connected to the networks.

#### **Design A4: Small Generation Up to 2000 kVA not Covered in Designs A1-A3**

Any one generator or aggregate of multiple generators who's capacity is less than 15% of the peak load, less than 50% of the minimum load, or up to 2000 kW on a line or line section (whichever is less) can connect using Design A4.

Relatively small generators (less than 2000 kVA) operated in parallel with the EED distribution system usually require adding relatively simple protective systems unless the minimum total load on the EED supply line section is lower than twice the rating of the generator. In this case, Design B protection scheme, from the Exelon Energy Delivery Interconnection Guidelines for Generators greater than 2 MVA but less or equal to 20 MVA, is more appropriate. A Design B protection scheme also might be required when multiple generation installations are on the same EED supply line/line section.

#### **Highlighted Protective Relay Functions**

When a fault occurs on the system, EED quickly isolates the faulted line or equipment from the EED system. Because of the large imbalance between load and generation, voltage and frequency relays at the paralleled generator will detect these faults after the line protective equipment for the line has opened. Likewise, the voltage and frequency relays should detect and trip the unit for other islanding conditions where the generator becomes isolated with a system load that is at least twice the rating of the generator. Furthermore, to provide safe and proper closing of breakers when a generator is to be paralleled to the EED system, synchronizing relays may be required.

Witness testing by EED will be required for a Plan A4 installation.

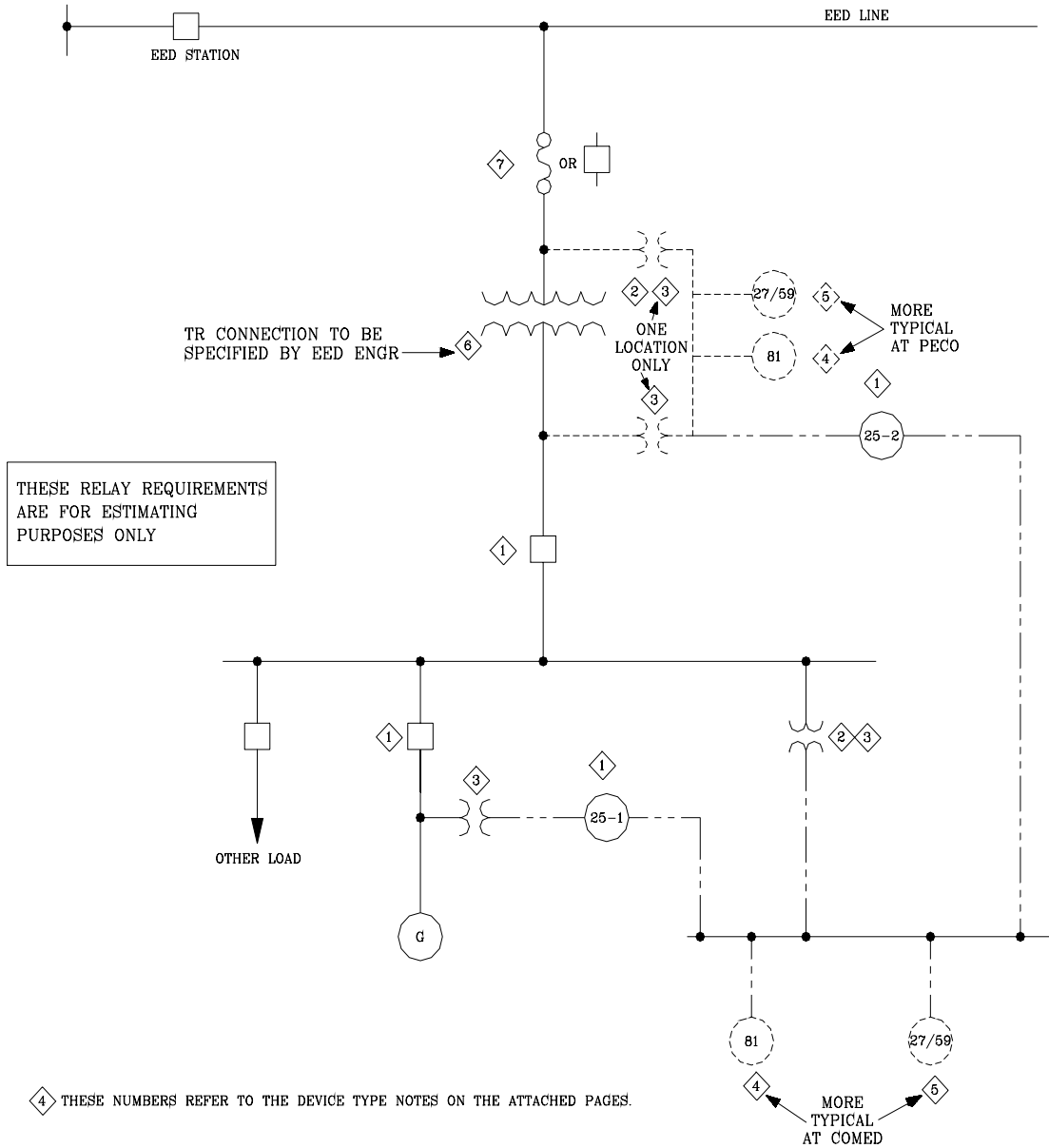
**Design A4: Requirements for Generating Capacity Up to 2000 kVA**

PRELIMINARY RELAY REQUIREMENTS  
 GIC OWNED GENERATION PARALLELED WITH EED.  
 FOR PRELIMINARY REPLY TO SERVICE ESTIMATE REQUEST

**DESIGN A4**

THIS DESIGN IS FOR GENERATION FACILITIES WITH THE FOLLOWING CHARACTERISTICS:

- A. TOTAL GENERATION IS LESS THAN 50% OF THE MINIMUM LINE SECTION LOAD.
- B. TOTAL GENERATION IS LESS THAN 15% OF PEAK LINE SECTION LOAD.
- AND-----
- C. TOTAL GENERATION IS LESS THAN 2000KVA



FILENAME: /2006/Design A4

DATE DRAWN: 9-25-06

**Plan A4 - Notes for Relay Functional Requirements Specification (RFRS) Form and Preliminary Relay Requirements Diagram**

---

This design is for Generation Facilities with the following characteristics:

- a. Total generation is less than 50% of the minimum line section load.  
---and---
- b. Total generation is less than 2000 kVA

Relay requirement/recommendation and installer are dependent upon EED/Customer property line location. Required relays are to be approved by EED.

- W: Protection required by EED due to GIC's parallel generation; to be installed by EED at GIC's expense.
- X: Protection required by EED due to GIC's parallel generation; to be installed by GIC at GIC's expense.
- Y: Protection recommended by EED due to GIC's parallel generation; to be installed by customer at customer's expense.
- Z: Protection recommended by EED due to GIC's parallel generation; to be installed by EED at GIC's expense.
- EX: Existing relay or equipment.
- N/A: Not applicable in this case.
- IN: Equipment to be installed.

**Protective Device Numbering**

The following requirements and examples, the nomenclature and numbering of protective devices will follow the standards set forth in ANSI C37.2. This standard numbering should also be used by the customer on information provided to EED showing customer equipment. All relays are to be utility grade relay and to be approved for use on the EED system or the integrated generator/relay scheme has been type tested and certified by a nationally recognized third party testing laboratory to conform to IEEE1547.1.

A few of the more commonly used devices are shown in the following list:

- 2 Timer
- 4 Master Contactor
- 21 Distance Relay
- 25 Synchronizing or Synchronism Check
- 27 Under-voltage
- 32 Power Direction
- 40 Loss of Field Detection
- 46 Current Balance
- 47 Voltage Phase Sequence
- 50FD Phase Instantaneous Over-current Fault Detector

51	Time Over-current
51G	Ground Time Over-current
51N	Neutral Time Over-current
51V	Voltage Restrained/Controlled Time Overcurrent
59	Overvoltage
59G	Overvoltage Type Ground Detector
67V	Voltage Restrained/Controlled Directional Time Overcurrent
79	Reclosing Relay
81O	Over-frequency
81U	Under-frequency
87	Current Differential

### ADDITIONAL NOTES PERTAINING TO EACH DEVICE TYPE

1. Device Type: Synchronizing Relay Device #: 25  
Number Required: as required by the number of generator and transformer breakers needing synchrochecking. Not needed for most induction type generators.  
Purpose: Provide for proper closing of breakers when customer generator(s) are to be paralleled to the EED system. Additional synchronizing relays or interlocks may be required at circuit breakers that could initiate paralleling of the generator to the EED system.
2. Device Type: Voltage Transformer  
Number Required: 3 connected grounded-wye/grounded-wye  
Purpose: Provide voltage for under/over voltage and under/over frequency relays. These voltage transformers to be connected on the primary or secondary side of power Transformer. One location only as specified by the EED Engineer.
3. Device Type: Voltage Transformer  
Number Required: as required for synchronizing  
Purpose: Provide voltage for synchronizing relays. May be one connected phase to phase or may be part of a 3 phase voltage transformer package.
4. Device Type: Under/over Frequency Relay Device #: 81U/O  
Number Required: 1  
Purpose: Provide tripping of customer breaker in the event the frequency fails to be maintained. This relay would be expected to operate if the GIC should become isolated on the EED line and not be able to maintain the load. The relay is to have a minimum of one over-frequency and two under-frequency elements with the capability of providing a trip time in the .1 second to 2 second range. A solid-state definite time type relay is recommended. The setting is to conform to IEEE 1547 section 4.2.4 (Note the Comed reclosing exception in this document.). Frequency relays are to be connected to VT's on the primary or secondary side of power Transformer. One location only as specified by the EED Engineer.
5. Device Type: Under/over voltage relay Device #: 27/59  
Number Required: depends on type  
Purpose: Provide tripping of customer breaker should the feeder or line voltage not be maintained within acceptable limits. This relay should be a definite-time

Exelon Energy Delivery Interconnection Guidelines for Generators 2 MVA or Less

type or an instantaneous type with a timer. The relay is to have a minimum of two over-voltage and two under-voltage elements with capabilities of providing a trip time in the .1 second to 2 second range. The setting is to conform to IEEE 1547 section 4.2.3 (Note the Comed reclosing exception in this document.).

Voltage relays are to be connected to VT's on the primary or secondary side of power Transformer. One location only as specified by the EED Engineer.

6. \_\_\_ Device Type: Power Transformer  
Number Required: As needed  
Winding configuration to be specified by EED Engr: \_\_\_\_\_.
  
7. \_\_\_ Device Type: Interrupting Device  
Number Required: As needed  
Purpose: May be a fuse or circuit breaker. Circuit breaker must not be dependent upon A.C. power for tripping.

## Exelon Energy Delivery Interconnection Guidelines for Generators 2 MVA or less

RELAY FUNCTIONAL REQUIREMENTS  
SPECIFICATIONS...DESIGN A4

GIC: \_\_\_\_\_ P.D.: \_\_\_\_\_ SER NO.: \_\_\_\_\_

LOCATION: \_\_\_\_\_ DATE: \_\_\_\_\_

CONNECTED TO: \_\_\_\_\_ FIRST ISSUED: \_\_\_\_\_

THE INFORMATION BELOW IS TO BE FURNISHED BY THE CUSTOMER AND RETURNED TO EED						NOTES REFER TO "PRELIMINARY" RELAY REQUIREMENTS FOR DESIGN A NOTE #	INITIATED BY RELAYS AT LEFT AS INDICATED				
DEVICE NO.	FUNCTION	TYPE*	CONN.	C.T. RATIO	P.T. RATIO		LBB	TRIP TRANS. C.B.	TRIP GEN C.B.	TRIP LINE C.B.	SUPV. CLOSE
25-1	SYNCHRONIZING					1					
25-2	SYNCHRONIZING					1					
27/59	UNDER/OVER VOLTAGE					5					
81	UNDER/OVER FREQ.					4					

\* RELAYS ARE TO BE APPROVED BY EED BEFORE GIC PURCHASE

RETURN TO: \_\_\_\_\_

ADDITIONAL NOTES: \_\_\_\_\_

(Engineer)

ADDRESS: EED  
Relay and Protection Services.  
2 Lincoln Centre  
Oakbrook Terrace, Illinois 60181-4260

RETURNED BY: \_\_\_\_\_  
GIC/CONSULTANT (Signature/Date)

## **APPENDIX 1- PRE-INTERCONNECT INSPECTION STANDARDS**

### **Witness Testing:**

Witness testing requires an EED testing representative to be on site during testing to verify that equipment operates properly. A “Witness Test List” will be provided with a specific list of tests required. Overall functional test such as through fault test and functional trip testing will be witness tested.

The Testing Work Management cycle requires scheduling 6 weeks in advance of the actual testing date. The GIC should contact Testing 10 days prior to any testing to confirm the test date. The EED testing department shall be given a minimum of one week to review any testing documentation upon receipt from the GIC’s testing representative. Testing documentation for a particular piece of equipment shall be received as a package.

Testing at the generator site follows review and approval of the GIC’s relay settings and protective relaying schematics. Testing will not commence until the Relay and Protection Services Department has reviewed and approved all required schematics, operational sequences, and settings and these items have been delivered to the testing department. The main items that required witness testing by EED are as follows (the Witness Test List” for a given site will contain specifics):

- Protective sensing circuit (CTs and PTs) and protective relay acceptance test
- Relay calibration test per approved settings
- Functional checks of relay sensing circuits per approved schematics
- Functional checks of relay tripping circuits including breaker tripping per approved schematics
- Functional test of any DC interlocking schemes (Hardwired or PLC) present at the site. Verification of all operational sequences for generator operation.
- Functional checks of relay alarm circuits per approved schematics
- Overall primary current through fault test of line, transformer, and bus differential circuits (if present) and a final trip check of these circuits
- Energization of GIC lines and transformers to follow directly after completion and acceptance of overall tests
- In-service current and voltage circuit test to occur upon initial loading of equipment
- Initial synchronization tests

Initial energization of high voltage circuits will not be allowed until satisfactory completion of all testing items including required through fault test have been witnessed and approve. Energizing equipment without these tests will result in disconnection from the EED system.

## **Inspection Standards for Generation Interconnected at 34.5kV and Lower**

### *Acceptance Tests*

The two types of acceptance tests are:

- \* Initial current and potential transformer acceptance tests
- \* Relay acceptance testing

### *Initial Current And Potential Transformer Acceptance Tests*

These tests verify that the current transformers (CTs) and potential transformers (PTs) have the correct ratio, polarity, and burden and can be expected to function as per manufacturers specifications. Before these tests, EED must have the latest revision of the vendor prints for the equipment in order to verify nameplate data and get information needed for testing.

**Current transformer (CT) tests.** These tests include the following:

- \* Ratio test with enough current through the CT to be able to verify that the ratio of the CT agrees with the ratio on the customer's prints
- \* Polarity test using a battery or some other suitable method in order to verify the CT polarity as installed agrees with the customer prints
- \* Saturation curves test to confirm the manufacturers data for the point at which the CTs will saturate
- \* Insulation resistance testing of secondary wiring to verify that no grounds in the CT secondary exist other than the one designated in the circuit
- \* Lamping (continuity) test to verify continuity and prove all connections agree with customer prints for all devices in each secondary current circuit
- \* Current tests to verify the phasing of the currents before energizing by the lamping method

**Potential transformer (PT) tests.** These tests include the following:

- \* Polarity test to verify polarity of each PT as installed agrees with customer print
- \* Ratio test to verify the specified ratio of the PT with the customer print
- \* Hi-potential test to verify that the PT will not "break-down" when full potential plus 10% is applied
- \* Lamping (continuity) test to verify the continuity of the potential to all of the relays and to verify only one ground in the circuit

## **APPENDIX 2 - APPROVED RELAYS FOR USE ON THE EED SYSTEM**

The following is a partial list of relays that EED has approved. The intention of this list is to avoid the customer's use of unapproved relays. However, using only approved relays does not take the place of submitting to EED for approval; the non-utility generation installation's proposed list of relays and application including settings. Even an approved relay can be misapplied. To avoid problems, the customer needs to seek the relay manufacturer's approval of the relay application before submitting the protection scheme to EED for approval. For relays EED has not tested, IEEE/ANSI C37.90 certified test reports by the manufacturer and independent laboratories should be submitted to EED along with the complete manufacturer instruction books and application guides for the relay model being used. Generally speaking, early and periodic exchange of information with EED is the best way to insure a successful project.

The appearance of a relay on the list is not a guarantee of the relay nor, does it constitute a recommendation of any relay application to protect the customer's equipment. Nor does appearance on the list address software, firmware or hardware revisions. Any questions regarding the acceptability of a relay should be directed to the Protection and Control Engineering Department.

An integrated generator/relay scheme that has been type tested and certified by a nationally recognized third party testing laboratory to conform to IEEE1547.1 is also acceptable. The GIC is to provide EED with certificate of conformance with IEEE1547.1 and any instruction manuals required to set the relays.

Exelon Energy Delivery Interconnection Guidelines for Generators 2 MVA or less

MANUFACTURER	MODEL
BASLER	BE1-25
	BE1-81 O/U
	BE1-27/59
	BE1-51C
	BE1-951
BECKWITH	M3410A
	M-3420
	M3425
	M-3430
	M-3520
SCHWEITZER	SEL-311 A, B, C, & L
	SEL-321-1
	SEL-279H-2
	SEL-251
	SEL-2PG10
	SEL-300G
	SEL-587
	SEL-501
	SEL551
	SEL-351A & S
SEL-547	
GE – Multilin	489
	750/760
	D60
	G60