DER Technical Interconnection Requirements

Effective Date:

November 1, 2024

Table of Contents

I. PURPOSE

The purpose of this guideline is to outline the technical requirements for safe and effective interconnection of Distributed Energy Resources (DER), also called Distributed Generation (DG), either interconnected to the Alliant Energy Corporation (Company) electric distribution system or connected to the electric facilities of Company's electric customer. This guideline is intended for intentional islanding only and does not cover *unintentional* islanding.

Distributed Generation Facility (DG Facility) includes electric generators that are ultimately connected in parallel for more than 100 milliseconds, or more than six cycles, to the Company's electric distribution system. The Company's electric distribution system is located in Iowa and Wisconsin. It is operated at a nominal voltage of 35 kV or less. The manner in which the distributed generation is connected to and disconnected from the Company's electric distribution system can vary.

II. INTERCONNECTION POLICY

The Company's Interconnection Policy permits an Interconnection Customer to operate generating equipment in parallel with the Company's electric distribution system, providing it can be done safely. The Company strives to provide a safe and reliable interconnection and to carry out the interconnection process in a timely manner.

- All services must meet all applicable requirements of the Company's two manuals, *Electric Service Equipment Manual* and *Electric Service Rule Book*, which can be found at the following location: http://www.alliantenergy.com/SellMyPower

- All DG Facilities will require an application and an Interconnection Agreement which can be found or linked to at the following location:
  http://www.alliantenergy.com/SellMyPower

- For the purpose of this guide DG also includes energy storage.

- All DG Facilities must receive services and compensation under applicable tariffs, or enter into a Power Purchase Agreement (PPA).

- Single-phase and three-phase customer-owned generation may be connected in parallel with the Company's electric distribution system providing these facilities meet the requirements outlined in this guideline. The Company's approval process shall be followed when an Interconnection Customer is interested in paralleling with the Company's electric distribution system. The Company's employees shall report findings of any unapproved parallel operation to Company's System Protection and Distribution Engineering Departments. A management team will review the facilities and take any necessary action to ensure safe operation. The Company will reserve the right to open the inter-tie to any DG Facility who violates the requirements outlined in this guideline.

- The Company shall not assume any responsibility for the protection of the DG Facility, or any other customer's equipment. The Interconnection Customer shall be completely responsible for protecting their system from any abnormalities.

- The Company requires that certain protective devices, as outlined in this document, shall be installed at the Point of Common Coupling (PCC), also the Point of Interconnection (POI), and is where an Interconnection Customer desires to operate their distributed generation in parallel with the Company's electric distribution system. The purpose of the protective devices is to separate a parallel-operated DG Facility from the Company's electric distribution system during abnormal operating conditions and when the Company's personnel are performing maintenance on its electric distribution system. This is done to protect the general public and Company personnel from injury and to prevent damage to the Company's equipment and the DG Facility.

- The Company will study the generator's nameplate capacity impact on local distribution system and retain the right to limit the size of DG based on the size of the local substation equipment. Unintentional backflow onto the transmission system may occur during low load periods throughout the year.
    - The Company will not allow the DG Facility to interconnect if the generation is to be sold to the MISO market without adhering to the MISO interconnection study process.

- The Company will approve additions based upon the correctly completed application submittal date for determining who is first for use of hosting capacity, curtailment or sizing limitations.

- The Company shall retain the right, but not the obligation, to immediately sever or disconnect with the DG Facility if, in the sole judgment of Company personnel, such action is necessary to protect the Company's facilities, employees, or the general public, and shall not be liable for any damage which may result from the disconnection.

- The Interconnection Customer does not need an interconnection agreement if the generator does not provide the capability to operate in parallel with the Company's electric distribution system for more than 100 milliseconds. In this instance there shall be no means, either deliberate or accidental, by which parallel operation in excess of 100 milliseconds may be achieved.

III. REGULATORY COMPLIANCE

To interconnect with the Company's electric distribution system, the following are requirements:

- Safety of personnel and equipment has highest priority.
- Depending upon the size and location of the DG, either a review or an interconnection study is required in accordance with the state's administrative codes. The type of review or interconnection

study ("review/study") is described within the specific state administrative code.

- Iowa Administrative Code (IAC) Utilities 199 Chapter 45, *Electric Interconnection of Distributed Generation Facilities* https://www.legis.iowa.gov/docs/ACO/chapter/04-01-2015.199.45.pdf
- Wisconsin Administrative Code (WAC) Chapter Public Service Commission [PSC 119], *Rules for Interconnecting Distributed Generation Facilities* http://docs.legis.wisconsin.gov/code/admin_code/psc/119

- The Interconnection Customer is cognizant of and shall comply with all applicable federal, state and local codes, safety rules, regulations and practices applicable to the personnel and equipment that will be utilized in the performance of its obligations under the Standard Interconnection Agreement. For example, Iowa Administrative Code (IAC), Wisconsin Administrative Code (WAC), National Electric Code (NEC), National Electric Safety Code (NESC), and all applicable building codes.
- The Interconnection Customer is responsible for specifying appropriate equipment so that the parallel generation is compatible with the electric distribution system and meets the applicable standards within IEEE Standard 1547, *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

IV. INTERCONNECTION PROCESS

A. IOWA

The Iowa Administrative Code (IAC) – Utilities 199 Chapter 45, *Electric Interconnection of Distributed Generation Facilities,* depicts the level of review for the DG Facility on the basis of the aggregate nameplate capacity of 10 MVA or less.

- **Level 1** – Lab-certified inverter-based generator with a nameplate capacity rating of 20 kVA or less
- **Level 2** – Lab-certified interconnection equipment with an aggregate electric nameplate capacity rating in the range of less than 500 kVA to 4 MVA, depending on line voltage, and interconnects to radial distribution or limited to serving one customer
- **Level 3** – The nameplate capacity rating is 50 kVA or less on an area network, or the total aggregated nameplate of generators located on a radial distribution circuit would be 10 MVA or less, the generator does not export power, and is not served by a shared transformer
- **Level 4** – The nameplate capacity rating of generator is less than or equal to 10 MVA and has not qualified for a Level 1, 2, or 3 review

B. WISCONSIN

The DG Facility with a capacity of 15 MW or less in accordance with the Wisconsin Administrative Code (WAC) – Public Service Commission, Chapter PSC 119, *Rules for Interconnecting Distributed Generation Facilities,* are reviewed depending upon their category:

- **“Category 1”** means a DG facility with an export capacity of 20 kW or less. A DG facility comprised of a resource no larger than 20 kW with a non−exporting energy storage system no larger than 20 kW shall be considered a Category 1 system.

- **“Category 2”** means a DG facility with an export capacity of greater than 20 kW and not more than 200 kW. The nameplate rating shall be used instead of the export capacity for this definition if the non−exporting energy storage system is larger than 20 kW.

- **“Category 3”** means a DG facility with an export capacity of greater than 200 kW and not more than 1 MW. The nameplate rating shall be used instead of the export capacity for this definition if the non−exporting energy storage system is larger than 200 KW.

- **“Category 4”** means a DG facility with an export capacity of greater than 1 MW and not more than 15 MW.

V. ELECTRICAL DISTRIBUTION SYSTEM DESIGN AND OPERATING REQUIREMENTS

The Company will operate, maintain, and own all components that are an integral (networked) part of the Company’s electric distribution system including all buses, circuit breakers, relays, and switches on the distribution side of the generator’s isolating switch.

The following operating requirements apply to all interconnected generating equipment. The Company shall be the source side and the customer’s system shall be the load side in the following requirements.

The Company monitors and/or controls the electric distribution system at the following dispatch centers:

- Distribution System Operations (DSO) – located in Cedar Rapids, IA and Janesville, WI
- Generation Dispatch Center (GDC) – located in Madison, WI

A. VOLTAGE REGULATION AND CLEARING TIMES

The Interconnection Customer shall operate their generator(s) to maintain the same voltage level as the Company's electric distribution system at the PCC/POI and voltage regulation is required to be in service whenever the generator is synchronized to the system. Undervoltage and overvoltage functions are applied to prevent unintended islanding operation. The Interconnection Customer must provide an automatic method of disconnecting their generator(s) from the Company's electric distribution system if the voltage cannot be maintained within the Company's limits as stated in the following table.

IEEE 1547-2018 Tables 11 and 12: Voltage Disturbance Delay & Trip Times

Range		**Clearing Time [2]**	
Percentage	Voltage [1]	Seconds	Cycles
< 50%	< 60	0.16	9.6
50% - 88%	60 - 105.6	2.0	120
88% - 110%	105.6 - 132	Normal Operating Range	
110% - 120%	132 - 144	1.0	60
> 120%	> 144	0.16	9.6

[1] Voltage based on 120V nominal.
[2] Total Clearing Time includes breaker & relay time.

B. VOLTAGE FLICKER

The starting of motors and generators may cause inrush currents in excess of normal steady-state operating current. These inrush currents will cause voltage sag (flicker), which can adversely impact the operation of some electrical equipment. The DG is not allowed to produce excessive flicker to adjacent electric customers. Therefore, they shall not cause voltage fluctuations (flicker) in excess of 2% on the Company's electric distribution system at the PCC/POI.

C. FREQUENCY

The frequency of the Company's electric distribution system shall be 60 Hz nominal and shall be maintained within the limits of 59.3 - 60.5 Hz under normal steady-state operation. Under frequency and over frequency functions are applied to prevent unintended islanding operation. The Interconnection Customer shall provide an automatic disconnecting means from the Company's electric distribution system when generation falls outside the values prescribed in the following table.

IEEE 1547-2018 Table 18: Frequency Disturbance Delay & Trip Times

Frequency	**Clearing Time [1]**	
Hz	Seconds	Cycles
62.0	0.16	9.6
61.2	300	18000
58.5	300	18000
56.5	0.16	9.6

[1] Total Clearing Time includes breaker and relay time.

D. POWER FACTOR

All Category 1 and 2 DG facilities shall be operated at a power factor greater than 0.9.

All Category 3 and 4 DG facilities shall be operated at unity power factor or as mutually agreed between the public utility and applicant.

E. HARMONICS

The DG Facility shall not introduce excessive distortion to the sinusoidal voltage or current waveforms that exceed the guideline values for total harmonic distortion published in the latest issue of IEEE Standard 1547, *IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems,* drawn directly from IEEE Standard 519, *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.*

The Interconnection Customer shall cooperate with the Company during the analysis of harmonic disturbances and when necessary, provide the Company's personnel access to generation system equipment for testing and to obtain information relating to the causes and magnitude of the disturbances. The Company will not be responsible for any DG Facility costs associated with the harmonic analysis.

The Interconnection Customer shall comply with all Company recommendations for the installation and operation of corrective equipment required to mitigate any harmonic disturbances generated by the DG Facility. The Interconnection Customer is responsible for the cost to install and operate this equipment.

The Interconnection Customer will be required to properly maintain all harmonic correction equipment installed. If the generation produces unacceptable harmonics during parallel operation, or if this equipment fails or no longer provides the level of harmonic correction as designed per IEEE Standard 1547 the Company shall disconnect and lock-out generator from the Company's electric distribution system until the harmonic correction equipment is repaired and operational.

IEEE 1547-2018 Table 26: Maximum Odd Harmonic Current Distortion in Percent of Rated Current (I_{rated})[1]

Individual Odd Harmonic Order, h	h < 11	11 ≤ h < 17	17 ≤ h < 23	23 ≤ h < 35	35 ≤ h < 50	Total Rated Current Distortion (TRD)
Percent (%)	4.0	2.0	1.5	0.6	0.3	5.0

[1] I_{rated} = the DG unit rated current capacity (transformed to the Reference Points of Applicability (RPA) when a transformer exists between the DG unit and the RPA).

IEEE 1547-2018 Table 27: Maximum Even Harmonic Current Distortion in Percent of Rated Current (I_{rated}) [1]

Individual Even Harmonic Order, h	h = 2	h = 4	h = 6	8 ≤ h < 50
Percent (%)	1.0	2.0	3.0	Associated range specified in Table 26

[1] I_{rated} = the DG unit rated current capacity (transformed to the Reference Points of Applicability (RPA) when a transformer exists between the DG unit and the RPA).

The total rated current distortion (TRD) in Table 26, which includes the harmonic distortion and inter-harmonic distortion, can be calculated using the following Equation:

$$\%TRD = \frac{\sqrt{I_{rms}^2 - I_1^2}}{I_{rated}} x\ 100\%$$

where

I_1 is the fundamental current as measured at the RPA

I_{rated} is the DG rated current capacity (transformed to the RPA when a transformer exists between the DG unit and the RPA)

I_{rms} is the root-mean-square of the DG current, inclusive of all frequency components, as measured at the RPA

F. SYNCHRONIZING

- The DG Facility shall not be manually synchronized unless authorized by the Company. Automatic synchronization shall be supervised by a synch check relay, IEEE Device 25.
- The Company will have the right to review and inspect the method of synchronization. Automatic synchronizing settings will not be changed following installation unless mutually agreed to by both parties. The Interconnection Customer must install proper sensing devices to sense a de-energized circuit to assure that a de-energized circuit of the Company is not energized.
- The Interconnection Customer shall be solely responsible for synchronizing their generator(s) with the Company's system. Table 5 shows the parameter limits for synchronization to the Company's electrical distribution system.

IEEE 1547 Table 5: Synchronization Parameter Limits for Synchronous Interconnection

Aggregate Rating of DG Facility[1] (kVA)	Frequency Difference (Δf, Hz)	Voltage Difference (Δ V, %)	Phase Angle Difference ($\Delta\Phi$, °)
0 – 500	0.3	10	20
> 500 – 1,500	0.2	5	15
> 1,500 – 10,000	0.1	3	10

[1] Total amount of generation at PCC/POI being synchronized to the Company's electrical distribution system.

G. UNINTENTIONAL ISLANDING

Under certain conditions with extended parallel operation, it would be possible for a part of the electrical power system to be disconnected from the rest of the Company's electrical grid and have the generation system continue to operate and provide power to a portion of the electrical power system. This condition is called "unintentional islanding".

- It is not possible to successfully reconnect the isolated circuit to the rest of the Company's system since there are no synchronizing controls associated with all of the possible locations of disconnection. Therefore, it is a requirement that the DG Facility be automatically disconnected from the system immediately by protective relays for any condition that would cause the system to be islanded. In the case of inverters, they will need to cease to energize and trip within 2 seconds of the formation of the island.
- The DG Facility must either isolate with the Interconnection Customer's load and/or be blocked from closing back into the electrical power system until the electrical power system is energized for five minutes from the Company's normal source. Depending upon the size and type of the DG Facility

and the electrical power system loads, it may be necessary to install Direct Transfer Trip (DTT) equipment from the Company's source to remotely trip the generation system to prevent islanding.

H. RECLOSING

Automatic reclosing of protective equipment exists on the Company's distribution circuits or transmission circuits. Upon request, these reclosing times for the Company's source breakers and/or the transmission reclosing times will be provided to the Interconnection Customer. It is the Interconnection Customer's responsibility to design and maintain their system to properly isolate parallel generation upon loss of the Company's supply and/or transmission before any reclosing operation.

VI. INTERCONNECTION EQUIPMENT REQUIREMENTS

A. TYPE OF GENERATOR

The Company recognizes three types of generators and an inverter interfaced generator. Refer to Company-approved protection scheme one-line drawings per the table below.

Table: Company-Approved Protection Scheme One-line Drawings

Generator Type	One-line Drawing
Single-Phase Induction Generator	Appendix A1.1
Small Three-Phase Generator	Appendix A1.1 – A1.2
Large Three-Phase Generator	Appendix A1.3
Inverter	Appendix B1.1 – B1.8

If the Generating Facility's generator type differs from the following, the next level of study is required per the interconnection process and the protection scheme would require approval from the Company.

1. SINGLE-PHASE INDUCTION GENERATOR

Induction based generators with an inverter as the last device between the DG Facility and the Company's electric distribution system, or generators with inverters that are NRTL certified may be exempt from the protective relay requirements. The single-phase induction generator's relatively simple protection scheme consists of voltage and frequency relays at the generator that will detect a fault on the distribution line and isolate the generation.

Drawing A1.1 contains the Company-approved one-line protection scheme for generators meeting these requirements:

- Does not contribute significant fault current as determined by the System Impact Study / Distribution System Study, and
- Nameplate capacity is less than 33% of the minimum aggregate load of the circuit as determined by the System Impact Study / Distribution System Study.

2. SMALL THREE-PHASE GENERATOR

Small three-phase generators, normally less than 1 MW, can supply greater amounts of energy to a fault on the Company's electric distribution system; therefore, additional protection is required.

Drawing A1.1 contains the Company-approved one-line protection scheme for generators meeting these requirements:

- Does not contribute significant fault current as determined by the System Impact Study / Distribution System Study, and
- Nameplate capacity is less than 33% of the minimum aggregate load of the circuit as determined by the System Impact Study / Distribution System Study.

Drawing A1.2 contains the Company-approved one-line protection scheme for generators meeting these requirements:

- Contributes significant fault current as determined by the System Impact Study / Distribution System Study, and
- Nameplate capacity is less than 33% of the minimum aggregate load of the circuit as determined by the System Impact Study / Distribution System Study.

3. LARGE THREE-PHASE GENERATOR

Large generators, normally 1 MW or greater, can deliver a significant amount of energy to a fault on the Company's electric distribution system. The level of protection for this class of generation is greater in order to provide high-speed separation of the generation during system disturbances.

Drawing A1.3 contains the Company-approved one-line protection scheme for generators meeting these requirements:

- Contributes significant fault current as determined by the System Impact Study / Distribution System Study, and/or
- Nameplate capacity is larger than 33% of the minimum aggregate load of the circuit as determined by the System Impact Study / Distribution System Study.

4. INVERTER

Drawings B1.1–B1.8 contain the Company-approved one-line protection schemes for inverter-based generation.

All inverter-based DG facilities shall be UL 1741 published September 28, 2021 listed.

All DG facilities shall meet the requirements of IEEE Std 1547-2018 and be tested in accordance with IEEE Std 1547.1.

a. NRTL Certified

The Interconnection Customer shall confirm that the power inverter used is classified as a non-islanding (grid-tie/utility interactive) inverter conforming to:

- IEEE 1547, *Standard for Interconnecting Distributed Resources with Electric Power Systems*, or listed as certified according to a Nationally Recognized Testing Laboratory (NRTL) that uses procedures similar to Underwriters Standard, UL 1741, *Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems*.

Any equipment that is not listed as NRTL certified will require the installation of additional interconnection protection equipment.

b. Fault Detection

Additional protection equipment will be required for smart inverters with Short Circuit Contribution Ratio (SCCR) greater than 0.1 or smart inverters than cannot cease operations within 2 seconds of the formation of an Unintended Island. The additional protection equipment will be required to detect any Distribution and Transmission system faults and cease operation within two seconds of the initiation of the fault. This additional protection equipment may be Direct Transfer Trip (DTT) or relays as required by the Company.

c. Inverter Settings

Technical reviews or study results that identify unique settings supersede those identified in this document. Such settings will be shared with results and included in the Interconnection Agreement.

IOWA ONLY: Inverters should have the Voltage-Reactive Power mode activated with the standard settings (identified in the table below) implemented.

Table: Standard Voltage-Reactive Power Inverter Settings (IOWA)

Voltage-reactive power parameters	Settings
V1	0.95 P.U.
V2	0.98 P.U.
V3	1.03 P.U.
V4	1.05 P.U.
Q1	44% of nameplate apparent power rating, injection
Q2	0%
Q3	0%
Q4	44% of nameplate apparent power rating, absorption
Open loop response time	5s

B. EQUIPMENT RATINGS

Electrical equipment provided by the Interconnection Customer shall meet the applicable ANSI and IEEE standards, local codes and state codes.

If a DER Impact Analysis is required, further system upgrades may be identified and deemed necessary.

C. INTERTIE TRANSFORMER

The Company may require, at the Interconnection Customer's expense, a dedicated transformer or transformers to serve the DG Facility. Since transformer connections and configuration can significantly impact the Company's electric distribution system operation, the Company allows grounded wye to grounded wye transformer connection configuration.

The Interconnection Customer may request another transformer configuration provided the following concerns shall be successfully mitigated through design and/or a comprehensive DER Impact Analysis. The Company will make the final decision whether or not an alternative transformer configuration adequately addresses the concerns listed below:

- Ground Fault Overvoltage (GFOV)
- Load Rejection Overvoltage (LROV)
- Open Phase – The design shall prevent voltage unbalance and voltage regeneration on unfaulted phases.
- Backfeed onto utility during utility line-to-ground fault – The design shall prevent voltage regeneration on unfaulted phases.

- Ferroresonance
- Effective grounding
- Inverter shall be able to detect line-ground faults on the Company's distribution system.
- Utility's substation feeder protection shall remain appropriately coordinated.
- SEL-700GT intertie relay shall be able to detect ground faults at inverter.
- Arresters shall be appropriately sized.
- System Grounding shall comply with NEC Article 250.20(B)(2), NESC 215(B)(2), NESC 97(D)(2), PSCW 119.20(5); and any clarifications established by Public Service Commission of Wisconsin (PSCW), Department of Safety and Professional Services (DSPS), Institute of Electrical and Electronics Engineers (IEEE), and Court.

D. GROUNDING AND SAFETY ISSUES

All electrical equipment shall be grounded in accordance with local, state, and federal electrical and safety codes and applicable standards.

- Grounding shall be of sufficient size to handle the maximum available ground fault current and shall be designed and installed to limit step and touch potentials to safe levels as set forth in *IEEE Guide for Safety in AC Substation Grounding*, ANSI/IEEE Standard 80.
- The grounding scheme of the DG Facility shall not cause over-voltages that exceed the rating of the equipment connected to the Company's distribution system and shall not disrupt the coordination of the ground fault protection on the Company's distribution system.
- The Interconnection Customer is responsible to provide the required grounding for the Generation System. A good standard for this is the IEEE Std. 142-1991, *Grounding of Industrial and Commercial Power Systems.* Ground resistance data collected before the DG Facility is interconnected to the distribution system and after the DG is operating in parallel to the Company's distribution system are required to show ground resistance value is consistent with the neutral-earth or stray voltage requirement.
- The expected ohmic resistance is 1 ohm or less. A test report shall be provided to the Company.
- Additional grounding resistance and/or studies may be required to avoid adverse impact to neighboring customers, such as dairy farms and hog farms.

E. INTERRUPTING DEVICE

To properly isolate parallel generation from the Company's system, the Interconnection Customer shall provide an interrupting device with appropriate protective relays and/or other protective equipment capable of interrupting the maximum available fault current at that location. The interrupting device shall be located within the DG Facility in accordance with applicable codes.

Three-phase devices shall interrupt all three phases simultaneously and shall have a separate tripping control independent of the AC source, i.e., a DC battery and charger. This requirement may be waived for generation with a UL 1741 inverter. For inverter-based generation AC tripping is allowed via UPS backup.

F. INTERCONNECTION DISCONNECT SWITCH

A disconnecting device shall be installed to electrically isolate the Company's electric distribution system from the DG Facility. Depending on system configuration and application, the Company may require that the disconnecting device have load break capability.

Refer to *Electric Service Rulebook* Chapter 511 Interconnection Disconnect Switch Requirements.

G. RELAYS AND TEST SWITCHES

Protection, control, and monitoring for the DG Facility shall be provided as an integrated microprocessor-based relay package. The microprocessor-based relay package must be provided with unshared, ANSI relay accuracy instrument transformer signals for independent AC current and voltage measurements. The microprocessor-based relay package must have adequate protective function logic, inputs and outputs required to perform the protection required in Section VII Protection Requirements.

The relaying package shall have a reliable source of power independent from the AC system (AC UPS, or DC battery and charger) to assure reliable operation of the protection. Relay trip output contact(s) shall directly energize the trip coil of the DG Facility's breaker or an intermediate auxiliary tripping relay that directly energizes the breaker trip coil.

All equipment providing relaying functions shall be utility grade devices that meet or exceed ANSI/IEEE Standards for protective relays, i.e., IEEE C37.90, and IEEE C37.90.1.

All relays shall be equipped with setting limit ranges at least as wide as specified in IEEE 1547. Setting limit ranges are not to be confused with the actual relay settings required for the proper operation of the installation. At a minimum, all protective systems shall meet the requirements established in IEEE 1547.

The DG Facility's system protective equipment shall be located within the DG Facility whenever possible. The DG Facility's equipment will not be allowed on the Company's property. The relays shall be grouped in dedicated panels or cabinets accessible to Company personnel. A heater is required if the relays or battery systems are in an outdoor enclosure.

All relays that are not "draw-out" cased relays shall have appropriate test switches (ABB type FT-1 preferred) to allow testing the operation of the relay without unwiring or disassembling the equipment. The test switch configuration and terminal designation may be reviewed by the Company's System Protection group upon the Company's request.

VII. METERING REQUIREMENTS

The Interconnection Customer shall agree to allow the Company to install on their premises the equipment necessary to measure loads and other required data.

The Interconnection Customer may be financially responsible for the installation of Company-owned metering equipment.

- The Company shall furnish electric revenue meters and instrument transformers including secondary wiring.
- The Interconnection Customer shall furnish and install at their expense meter sockets, associated cabinets and enclosures for meter equipment, and all conduits and piping between the instrument transformers and meter sockets and provide a suitable metering mounting location.
- Metering is to be installed according to the Company's applicable tariff(s), Electric Service Rule Book provisions, and/or contracts.

VIII. PROTECTION REQUIREMENTS

The Interconnection Customer is responsible for providing electrical protection for the Company's facilities for conditions that arise during parallel-operated generation. The Interconnection Customer is also responsible for providing adequate electrical protection to their facility under any Company operating condition whether or not the parallel generation is in operation. Conditions may include, but are not limited to:

- Open phasing,
- System faults,
- Equipment failures,
- Abnormal voltage or frequency,
- Lightning and switching surges,
- Ground Fault Overvoltage (GFO)
- Load Rejection Overvoltage (LROV)
- Excessive harmonic voltages,
- Excessive negative sequence currents and voltages,
- Separation from the Company's supply (islanding).

For a DG Facility that cannot detect Distribution or Transmission System faults (both line-to-line and line-to-ground) or the formation of an Unintended Island, and cease to energize Company's Distribution or

Transmission System within two seconds, Company may require a Direct Transfer Trip (DTT) system or an equivalent Protective Function. If DTT is required, the Interconnection Customer shall agree to allow the Company to install on their premises the equipment necessary for the Company to provide the DTT functionality. The Interconnection Customer shall agree to provide a reliable power source for the Company DTT equipment and the circuit to tie the Company DTT equipment to the Interconnect Customer breaker trip coil.

Refer to Appendices A & B for one-line diagrams of Company-approved protection schemes.

A. PROTECTION COORDINATION

The customer-owned DG Facility which is interconnected to the Company's electric distribution system shall have protection systems designed such that they operate correctly for faults in the generator, generator step-up (GSU) transformer, circuit breakers, bus, bus connections, or any other DG Facility equipment and will not cause interruption of the Company's distribution service to other customers or circuits.

The Interconnection Customer shall submit all protection schemes applied to the Interconnection Customer's facilities to Company for review. The Company shall have a final review on all protection schemes applied to the Interconnection Customer's facilities. Any aspects of the DG Facility's protection schemes that are found to be unsatisfactory by the Company shall be redesigned, changed, or otherwise reworked, then resubmitted to the Company for additional review. Subsequent to final review by the Company of the DG protection schemes, the Interconnection Customer is responsible for providing said protection devices that will protect against faults and disturbances on the Company's distribution system as well as the DG Facility.

DG Facility's protective devices must coordinate with the Company's under frequency load shed (UFLS) program. The DG Facility's under frequency relays shall be set according to Table 2. The Company's engineers will evaluate the UF settings on a case-by-case basis and may provide additional requirements.

The Interconnection Customer shall submit all relay settings to the Company for review prior to initial commissioning and prior to any relay setting changes post commissioning. The Company reserves the right to have final review on all DG Facility's relay settings. Any relay settings need to be based on any studies performed. Any aspects of the DG Facility's relay settings that are found to be unsatisfactory by the Company shall be redesigned, changed, or otherwise reworked, then resubmitted to the Company for additional review. The Customer shall provide 10 business days prior to relay testing on site: all relay settings in RDB file format, relay coordination report with graphs and calculations, CT/PT test reports, and transformer test reports.

B. EVENT ANALYSIS

The Interconnection Customer shall cooperate with the Company in the analysis of disturbances to either the DG Facility or the Company's electric distribution system by gathering and providing access to any information relating to disturbances, including information from oscillographs, protective relay targets and reports, breaker operations, power quality monitors, and sequence of events recorders. Any actions, events, or eyewitness accounts of information relating to a disturbance shall also be made readily available within 72 hours of the Company's request for the records.

IX. COMMUNICATON PATH

A communications channel shall be installed as part of the relay protection and metering scheme based on the size of the load connected with the local electric distribution system, the aggregate capacity of the DG, and inverter type.

The communication path type and mode will be identified in the System Impact/Distribution System Study. To ensure cohesion, this communication circuit and associated communication equipment at both the DG Facility and the Company's facilities shall be purchased and installed by Company personnel at the Interconnection Customer's expense.

The Interconnection Customer may be required to install, at their expense, a communications service from the generator to a location determined by the Company. The Interconnection Customer will be responsible for the local Telecommunications Data Equipment that will support DNP over IP transport to the Company's dispatch centers. The customer may be responsible for the cost of monthly fees associated with the communications service.

Customer shall list the Company as an authorized agent on the communications service to be able to provide maintenance for the telecommunications equipment and troubleshoot all communications issues.

X. TELEMETERING

The Company shall require the continuous telemetry of power quantities, breaker statuses and alarms for all aggregate generation for the following criteria:

- The aggregate generation output capability is greater than 1 MW and less than or equal to 10 MW (Iowa) or 15 MW (Wisconsin) connected to the Company's electric distribution system at a voltage 35 kV or less.
- Any customer-owned generation involved in wholesale power transactions.

The Interconnection Customer shall furnish and install, at their expense, the necessary communication equipment, channel(s) and the necessary Company-approved telemetering equipment and devices. The Company will determine the most appropriate technology.

A. BASIS FOR CONTINUOUS TELEMETRY

The basis for requiring continuous telemetry for power quantities, breaker statuses and alarms are:

- Determination and monitoring of real-time limit thresholds and/or violations.
- Historical tracking of limit thresholds and/or violations.
- Monitoring of the Real Power Flows – Real-time and historical.
- Monitoring of Reactance Power Flows - Real-time and historical.
- Monitoring of Generator On or Off Line Status.
- De-coupling of Generation and Load for Network Applications such as State Estimation and Security Analysis.
- Monitoring equipment health and functionality.

XI. COMMISSIONING, TESTING AND MAINTENANCE REQUIREMENTS

In preparation of synchronizing the DG Facility with the Company's distribution system, the Interconnection Customer is responsible for adhering to the Company's commissioning, testing and maintenance requirements and IEEE 1547.

A. COMMISSIONING REQUIREMENTS

The intent of the commissioning process shall be as extensive and complete as specified to provide positive assurance of correct installation and operation of all equipment. The requirements are governed by:

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- InterNational Electrical Testing Association (NETA)
- National Electrical Manufacturers Association (NEMA) and Insulated Cable Engineers Association (ICEA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)

The Interconnection Customer is responsible for all costs, associated with relay testing.

The Company shall not be responsible for verifying any control or signal wiring related to the interconnection relay. The Company may witness the operational testing of the interconnection relay system or inverter to verify system performs as intended.

B. TESTING REQUIREMENTS

All DG protective relays must be tested and calibrated per manufacturer recommendations and industry standards. The Company reserves the right to trip the intertie interrupting device to verify on demand the calibration of all protective equipment including relays, interrupting devices, etc., at the PCC/POI.

- For installations where the relays and intertie interrupting device(s) are not installed within a Company facility, the Interconnection Customer shall be responsible for maintenance and testing of this equipment. Provisions shall be made for the Company to have access to this equipment for inspection, testing, and control. The Interconnection Customer shall furnish the maintenance documentation and test reports to the Company upon request.

- For installations where the relays and intertie interrupting device(s) are installed within a Company facility, the Company shall maintain this equipment and bill the Interconnection Customer for maintenance costs.

1. TESTING PARAMETERS

a. The following data will be collected for **certified** equipment:
   - Device ratings (kW, kV, Volts, amps, etc.);
   - Maximum available fault current in amps;
   - In-rush current in amps;
   - Trip points, if factory set (trip value and timing);
   - Trip point and timing ranges for adjustable settings;
   - Nominal power factor or range if adjustable; and
   - If the equipment is certified as Non-Exporting and the method used (reverse power or under power);

b. The following data will be collected for **non-certified** equipment:
   - The manufacturer or a laboratory acceptable to Company may perform tests;
   - Test results for non-certified equipment must be submitted to Company for supplemental review;
   - Approval by Company for equipment used in a particular DG Facility does not guarantee Company approval for use in other DG Facilities.

2. COMMISSIONING TESTS

The Company and/or the Interconnection Customer shall notify the other in advance of performing tests of its Interconnection Facilities and shall notify each other of any modifications to its facilities that are found to be necessary as a result of such testing.

Commissioning tests shall include visual inspections of the interconnection equipment and protective settings to confirm compliance with the interconnection requirements. Company personnel have the right to witness the following commissioning tests which may include, but are not limited to:

- Equipment Commissioning Tests (Conducted prior to energizing the system)
    - Instrument Transformer Tests – Verify proper wiring, polarity, CT/PT ratios, and proper operation of the protection and measuring circuits. CTs shall be visually inspected to ensure that all grounding and shorting connections have been removed where required.
    - Verifying Final Protective Relay Function Settings and Testing – Confirm and document all devices are set to the final review settings. All protective relays shall be calibrated and tested to ensure the correct operation of the protective element. Documentation of all relay calibration tests and settings shall be furnished to the Company.
    - Trip Test/Checks – Protective relay control circuits shall be tested to ensure they correctly activate associated interrupting device(s).
- Direct Transfer Trip / Anti-Islanding Function (if applicable)
- Open Phase
- Inability to Energize Dead Line
- Time Delay on Restart After Company Source is Stable
- Company System Fault Detection (if used)
- Synchronizing Controls (if applicable)
- Grounding shall be verified to ensure that it complies with this guideline, the NESC and the NEC.
- Auxiliary Equipment Energization (600 V and below).
- Control System Tests – Remote control, SCADA and remote monitoring tests.
- Verification of Inverter Settings – Verify standard settings or alternative inverter settings are correct as identified in this guide or the Interconnection Agreement (if applicable)
- Initial Energization – Verify correct CT/PT secondary values and inputs to protective devices and metering, phase tests, and synchronizing test.
- Post Energization Tests – On-line commissioning test including an anti-islanding test will proceed once the Interconnection Customer has completed pre-testing and the results have been reviewed by the Company.

3. FINAL SYSTEM SIGN OFF

The Interconnection Customer must submit the commissioning test results to the Company for review before any DG Facility is energized from the Company electric distribution system.

C. MAINTENANCE REQUIREMENTS

The Company performs routine maintenance and inspections of its distribution and substation facilities during normal working hours. Maintenance coordination of these facilities takes into account numerous factors, including but not limited to, the capability to serve load, safety, DG requirements, and economics.

- The Company will use Reasonable Efforts to schedule planned inspection and maintenance.
- The Interconnection Customer may request that this maintenance occur outside of normal working hours or meet an expedited schedule. The Interconnection Customer will reimburse the Company for any incremental costs for meeting special schedule requirements.

The Interconnection Customer has sole responsibility for the routine maintenance of their generating and interconnection protective equipment. Maintenance testing will be completed on a cyclical basis per the Company's standards.

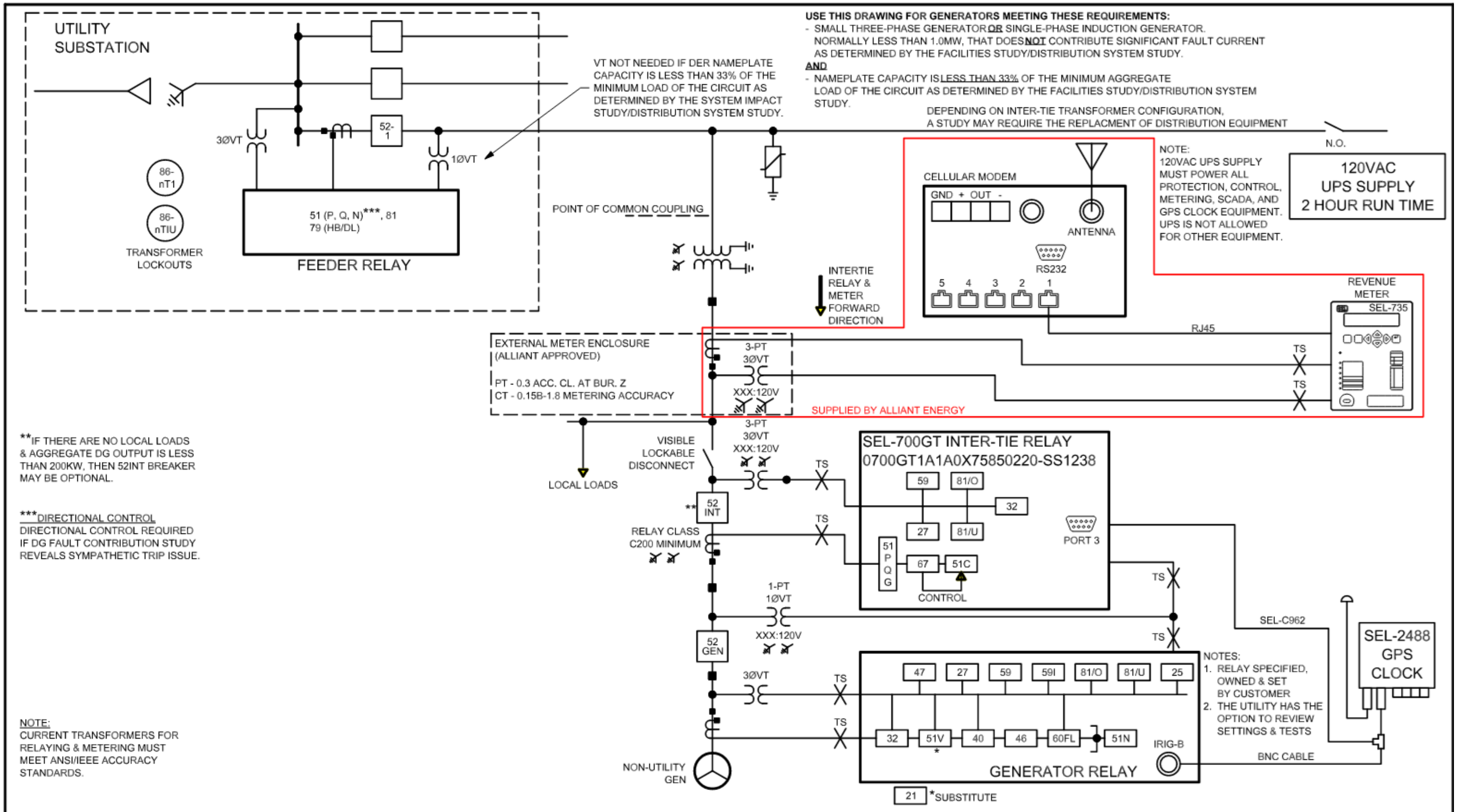
- The Interconnection Customer is encouraged to contact the Company for recommendations regarding maintenance practices and testing intervals of their protective equipment.
- The intertie relay, open phase relay, and intertie breaker shall be tested on a regular schedule not to exceed five calendar years by the Interconnection Customer.
- The Interconnection Customer must provide all test reports to the Company documenting the existing settings as well as the "as found" and "as left" test results. Any relays found to be performing out of manufacturers recommended limits must be recalibrated, repaired, or replaced before being placed back in service. Operating out of manufacturer recommended limits constitutes a failure of the protective device. The Company shall be notified immediately upon detection of protection systems or components that are found to have failed and/or the status or condition renders them otherwise inoperable. The DG Facility may be curtailed or disconnected until such failure, status, or condition is remedied in a fashion that is acceptable to the Company.
- Complete maintenance records shall be maintained by the Interconnection Customer and be made available upon request for the Company's review. Failure of the Interconnection Customer to provide proper routine maintenance may result in the DG Facility being required to cease parallel operation.

XII. REFERENCES

The following standards shall be used in conjunction with this guideline. When the stated version of the following standards is superseded by an approved revision then that revision shall apply:

- Alliant Energy, *Electric Service Equipment Manual*
- Alliant Energy, *Electric Service Rule Book*
- Alliant Energy, *Interconnection Agreement*
- Alliant Energy, *Power Purchase Agreement*
- ANSI C84.1-1995, *Electric distribution systems and Equipment – Voltage Ratings (60 Hertz)*
- ANSI/IEEE 446-1995, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*
- ANSI/IEEE Standard 142-2007, *IEEE Recommended Practice for Grounding of Industrial a Commercial Power System – Green Book*
- IEEE Std. C37.90.1-1989 (1995), *IEEE Standard Surge Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers*
- IEEE Std. C62.41.2-2002, *IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and Less) AC Power Circuits*
- IEEE Std. C62.42-1992 (2002), *IEEE Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000V and less) AC Power Circuits*
- IEEE Std. 100-2000, *IEEE Standard Dictionary of Electrical and Electronic Terms*
- IEEE Std. 1547, *IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems*
- IEEE Std. 519-2014, *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*
- Iowa Administrative Code Utilities 199 Chapter 45, *Electric Interconnection of Distributed Generation Facilities*
- NEC – *National Electrical Code,* National Fire Protection Association (NFPA), NFPA-70-2014
- NESC – *National Electric Safety Code,* ANSI C2-2012, Published by the Institute of Electrical and Electronic Engineers, Inc.
- UL Std. 1741 *Inverters, Converters, and Controllers for use in Independent Power Systems*
- Wisconsin Administrative Code Chapter Public Service Commission (PSC) 119, *Rules for Interconnecting Distributed Generation Facilities*

APPENDIX A. ONE-LINES: INDUCTION / SYNCHRONOUS GENERATOR



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL	QY	QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

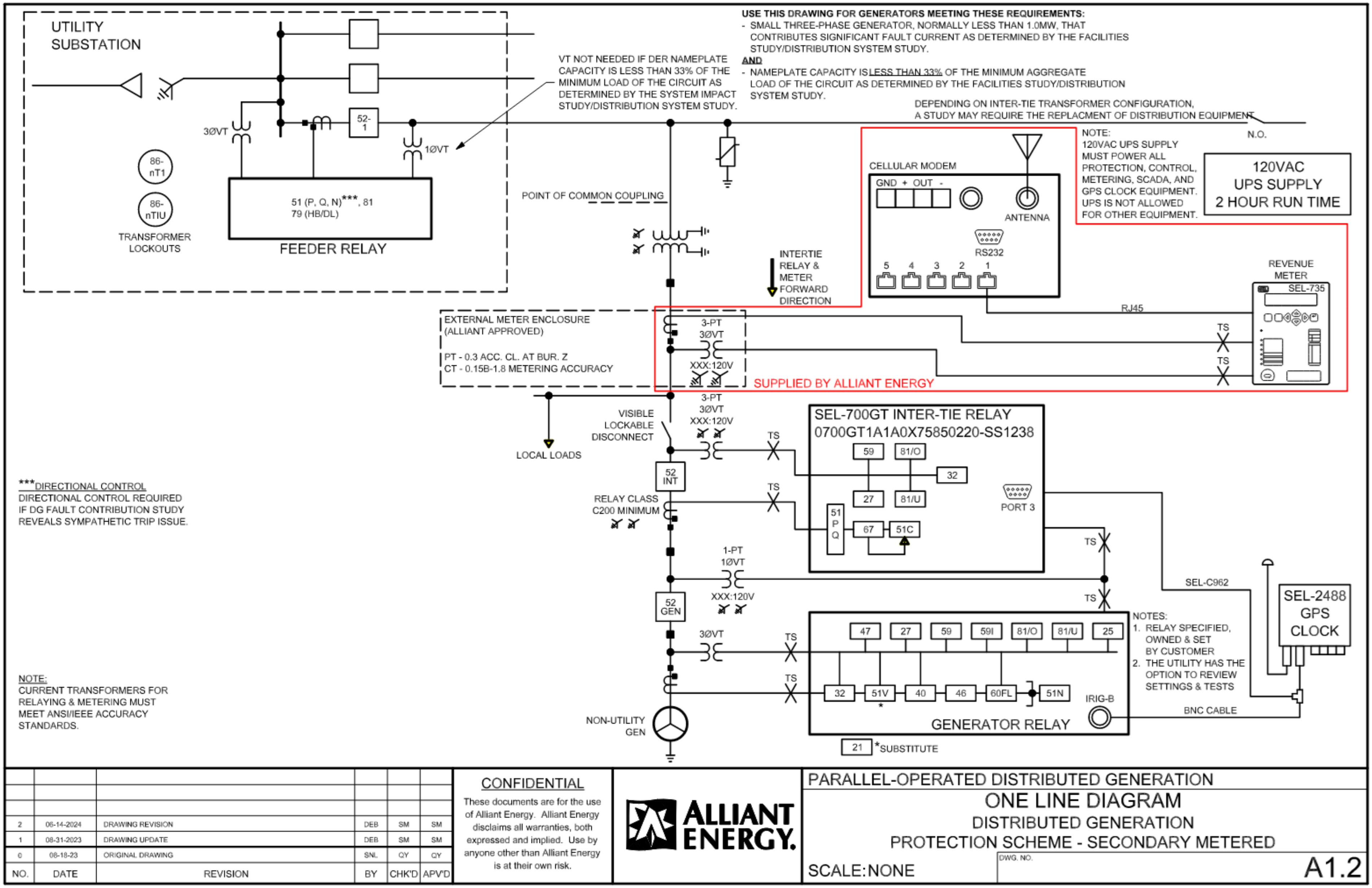
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

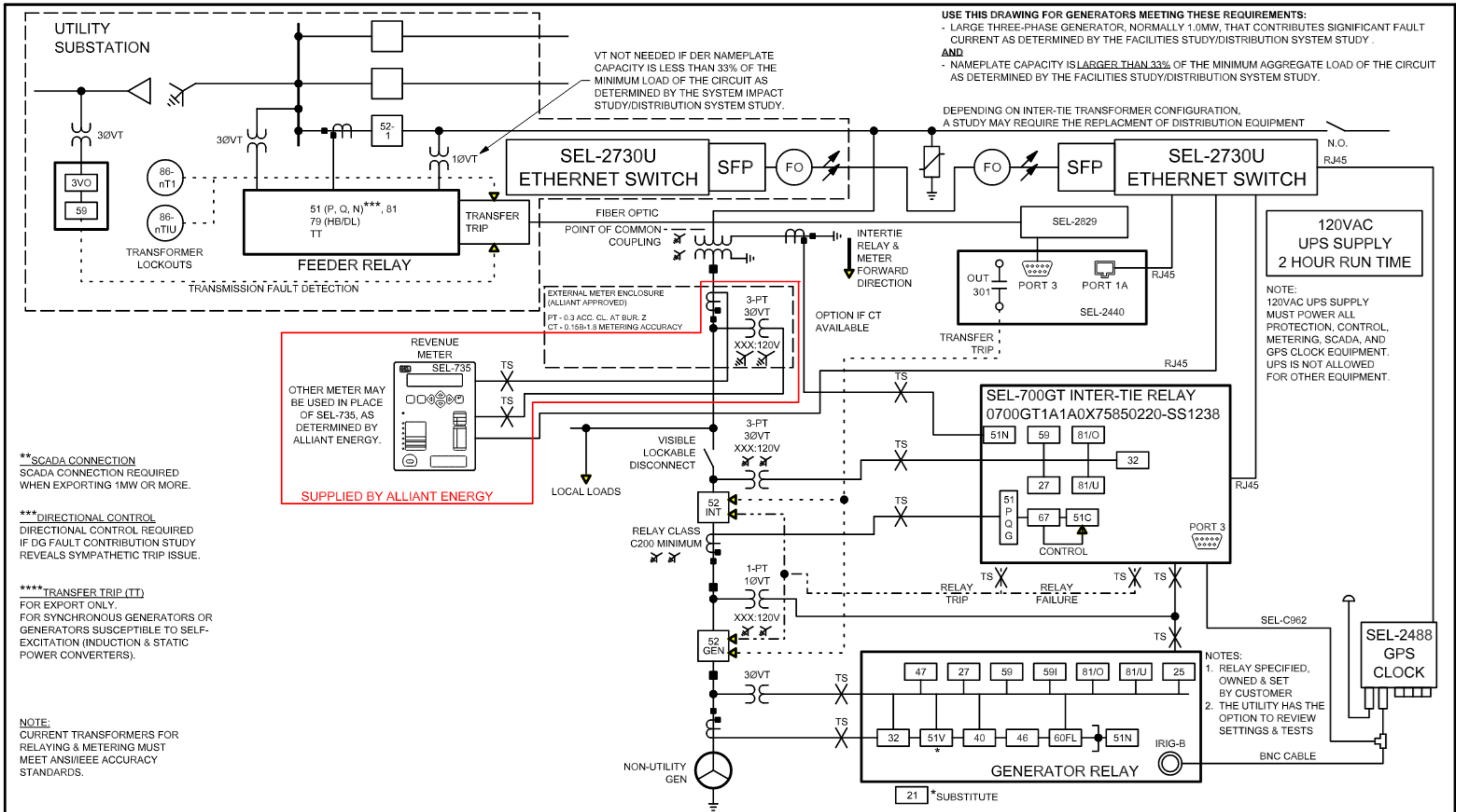
PROTECTION SCHEME - SECONDARY METERED

SCALE: NONE

DWG. NO. A1.1



USE THIS DRAWING FOR GENERATORS MEETING THESE REQUIREMENTS:
- SMALL THREE-PHASE GENERATOR, NORMALLY LESS THAN 1.0MW, THAT CONTRIBUTES SIGNIFICANT FAULT CURRENT AS DETERMINED BY THE FACILITIES STUDY/DISTRIBUTION SYSTEM STUDY.
AND
- NAMEPLATE CAPACITY IS LESS THAN 33% OF THE MINIMUM AGGREGATE LOAD OF THE CIRCUIT AS DETERMINED BY THE FACILITIES STUDY/DISTRIBUTION SYSTEM STUDY.
UTILITY SUBSTATION
3ØVT
52-1
1ØVT
86-nT1
86-nTIU
TRANSFORMER LOCKOUTS
51 (P, Q, N)***, 81
79 (HB/DL)
FEEDER RELAY
VT NOT NEEDED IF DER NAMEPLATE CAPACITY IS LESS THAN 33% OF THE MINIMUM LOAD OF THE CIRCUIT AS DETERMINED BY THE SYSTEM IMPACT STUDY/DISTRIBUTION SYSTEM STUDY.
DEPENDING ON INTER-TIE TRANSFORMER CONFIGURATION, A STUDY MAY REQUIRE THE REPLACMENT OF DISTRIBUTION EQUIPMENT
N.O.
POINT OF COMMON COUPLING
INTERTIE RELAY & METER FORWARD DIRECTION
CELLULAR MODEM
GND + OUT -
ANTENNA
RS232
5 4 3 2 1
NOTE:
120VAC UPS SUPPLY MUST POWER ALL PROTECTION, CONTROL, METERING, SCADA, AND GPS CLOCK EQUIPMENT. UPS IS NOT ALLOWED FOR OTHER EQUIPMENT.
120VAC UPS SUPPLY 2 HOUR RUN TIME
REVENUE METER
SEL-735
RJ45
TS
EXTERNAL METER ENCLOSURE (ALLIANT APPROVED)
PT - 0.3 ACC. CL. AT BUR. Z
CT - 0.15B-1.8 METERING ACCURACY
3-PT 3ØVT XXX:120V
SUPPLIED BY ALLIANT ENERGY
LOCAL LOADS
VISIBLE LOCKABLE DISCONNECT
52 INT
RELAY CLASS C200 MINIMUM
1-PT 1ØVT XXX:120V
52 GEN
3ØVT
NON-UTILITY GEN
SEL-700GT INTER-TIE RELAY
0700GT1A1A0X75850220-SS1238
59 81/O 32 27 81/U 51 P Q 67 51C
PORT 3
SEL-C962
SEL-2488 GPS CLOCK
47 27 59 59I 81/O 81/U 25
32 51V * 40 46 60FL 51N
IRIG-B
BNC CABLE
GENERATOR RELAY
21 *SUBSTITUTE
NOTES:
1. RELAY SPECIFIED, OWNED & SET BY CUSTOMER
2. THE UTILITY HAS THE OPTION TO REVIEW SETTINGS & TESTS
***DIRECTIONAL CONTROL
DIRECTIONAL CONTROL REQUIRED IF DG FAULT CONTRIBUTION STUDY REVEALS SYMPATHETIC TRIP ISSUE.
NOTE:
CURRENT TRANSFORMERS FOR RELAYING & METERING MUST MEET ANSI/IEEE ACCURACY STANDARDS.
2 08-14-2024 DRAWING REVISION DEB SM SM
1 08-31-2023 DRAWING UPDATE DEB SM SM
0 08-18-23 ORIGINAL DRAWING SNL QY QY
NO. DATE REVISION BY CHK'D APV'D
CONFIDENTIAL
These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.
ALLIANT ENERGY
PARALLEL-OPERATED DISTRIBUTED GENERATION
ONE LINE DIAGRAM
DISTRIBUTED GENERATION
PROTECTION SCHEME - SECONDARY METERED
SCALE: NONE
DWG. NO.
A1.2



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISION	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL	QY	QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

ONE LINE DIAGRAM

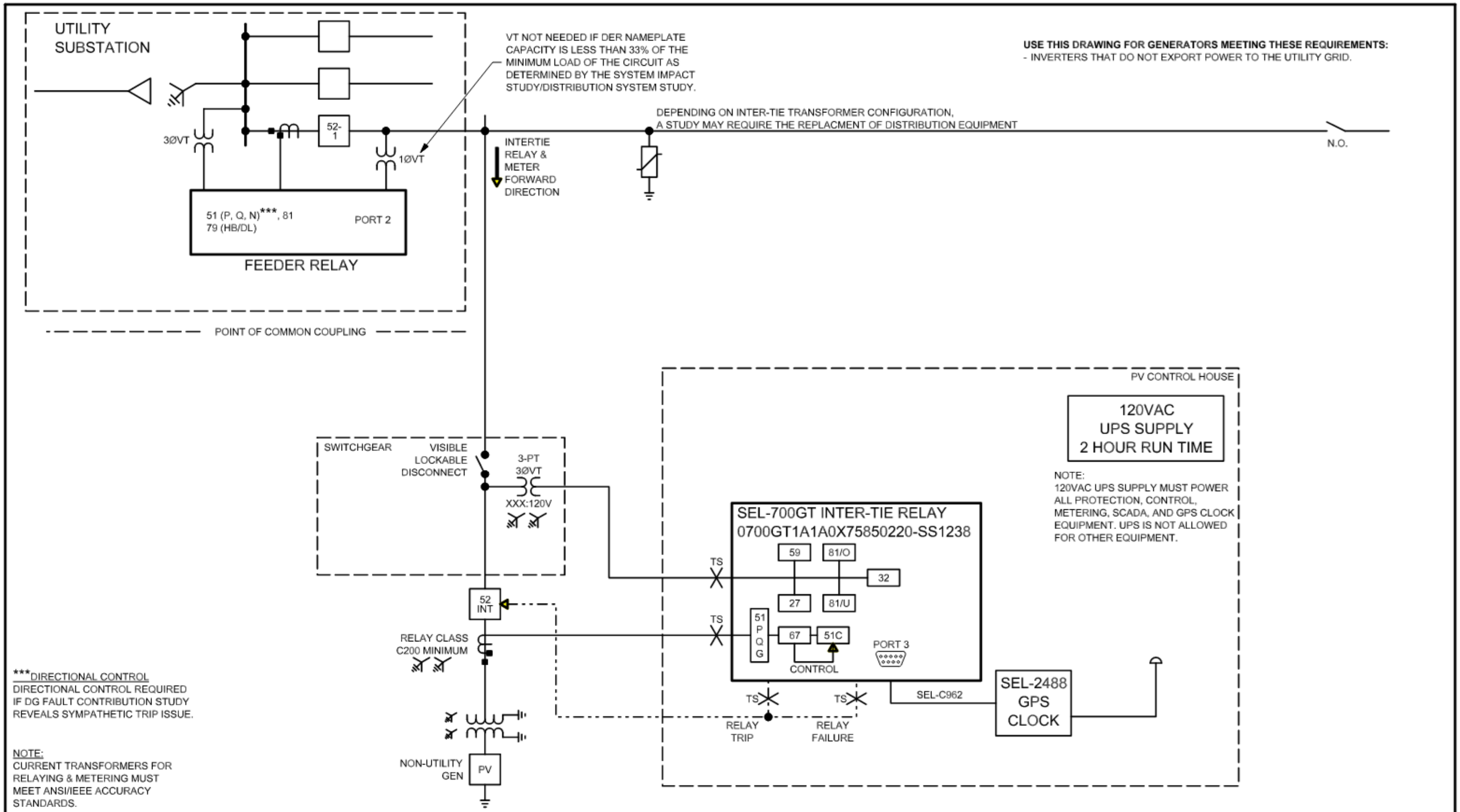
DISTRIBUTED GENERATION

PROTECTION SCHEME - SECONDARY METERED

SCALE: NONE

DWG. NO. A1.3

APPENDIX B. ONE-LINES: INVERTER



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	UPDATED DRAWING	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

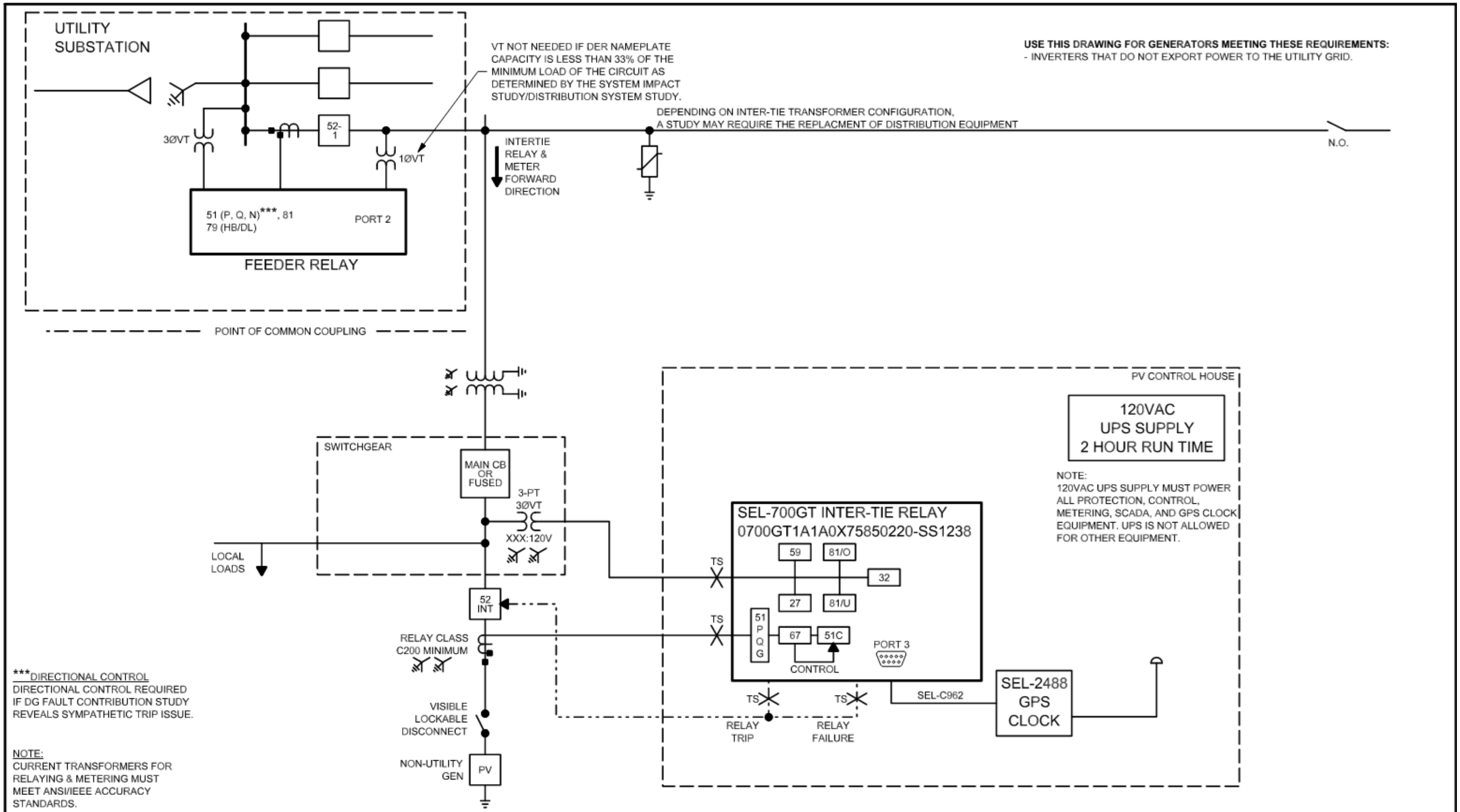
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

PROTECTION SCHEME - PRIMARY NO BIDIRECTIONAL METER

SCALE: NONE

DWG. NO. B1.1



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

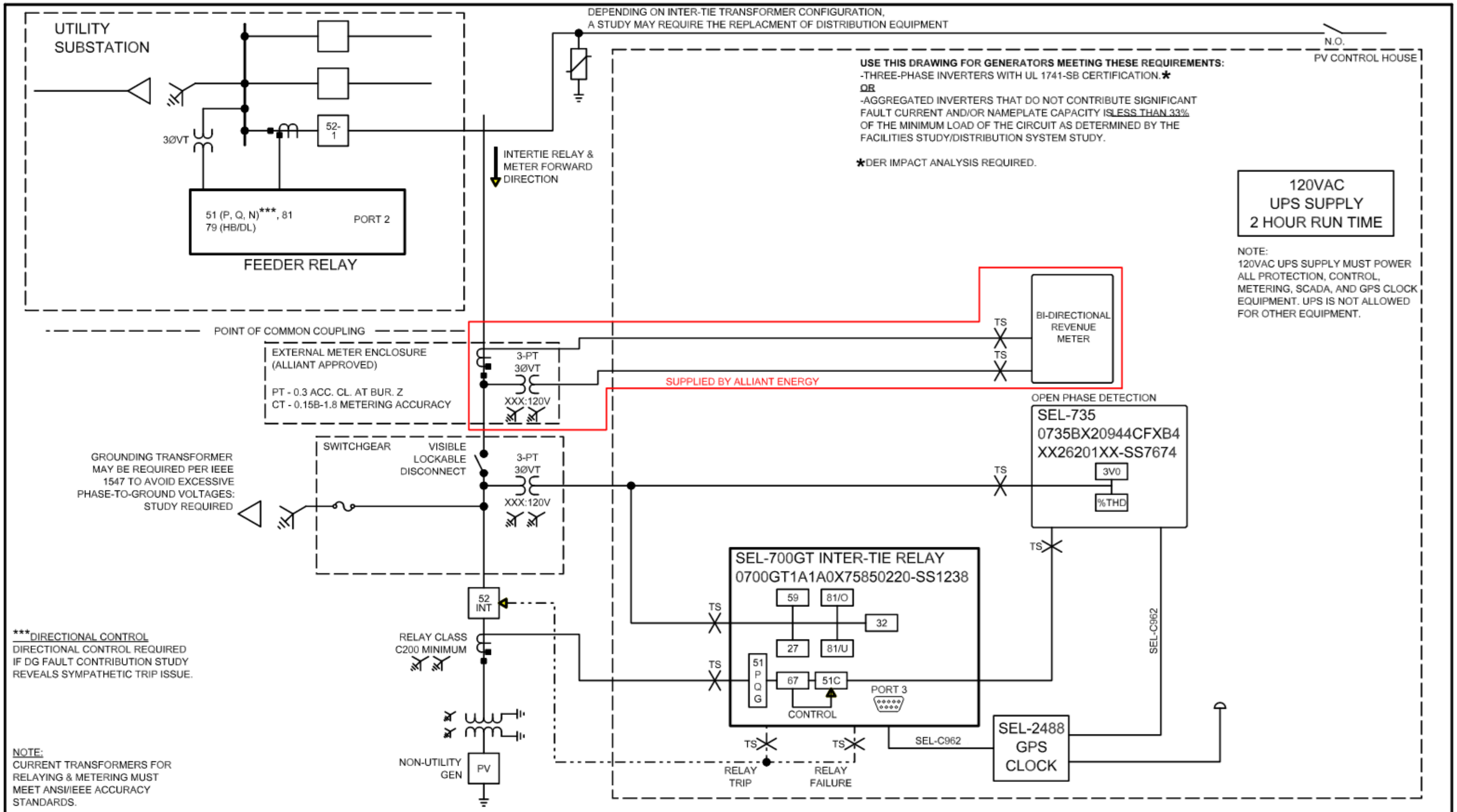
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

PROTECTION SCHEME - SECONDARY NO BIDIRECTIONAL METER

SCALE: NONE

DWG. NO. B1.2



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

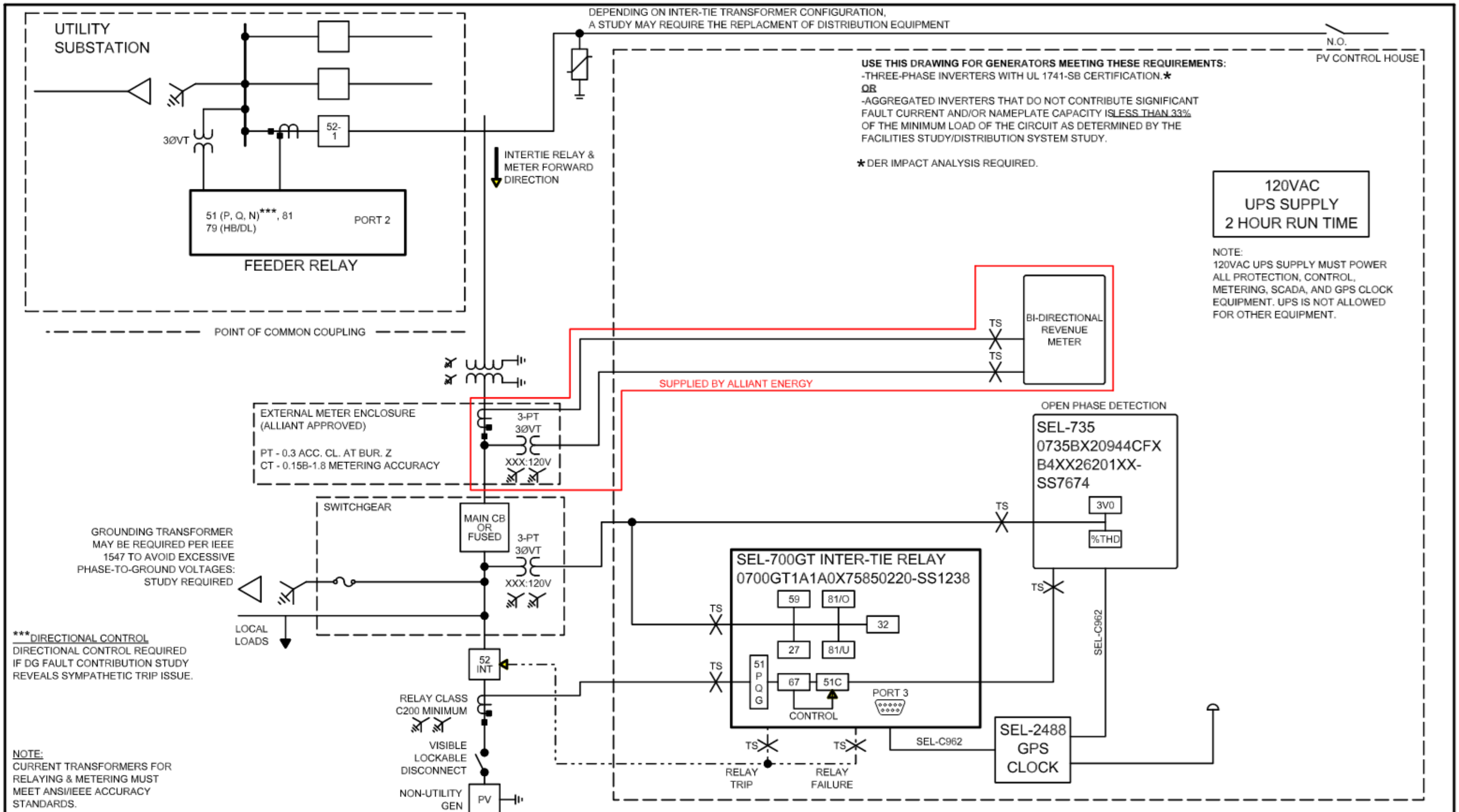
ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

ONE LINE DIAGRAM
DISTRIBUTED GENERATION
PROTECTION SCHEME - PRIMARY BI-DIRECTIONAL METER

SCALE: NONE

DWG. NO. B1.3



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

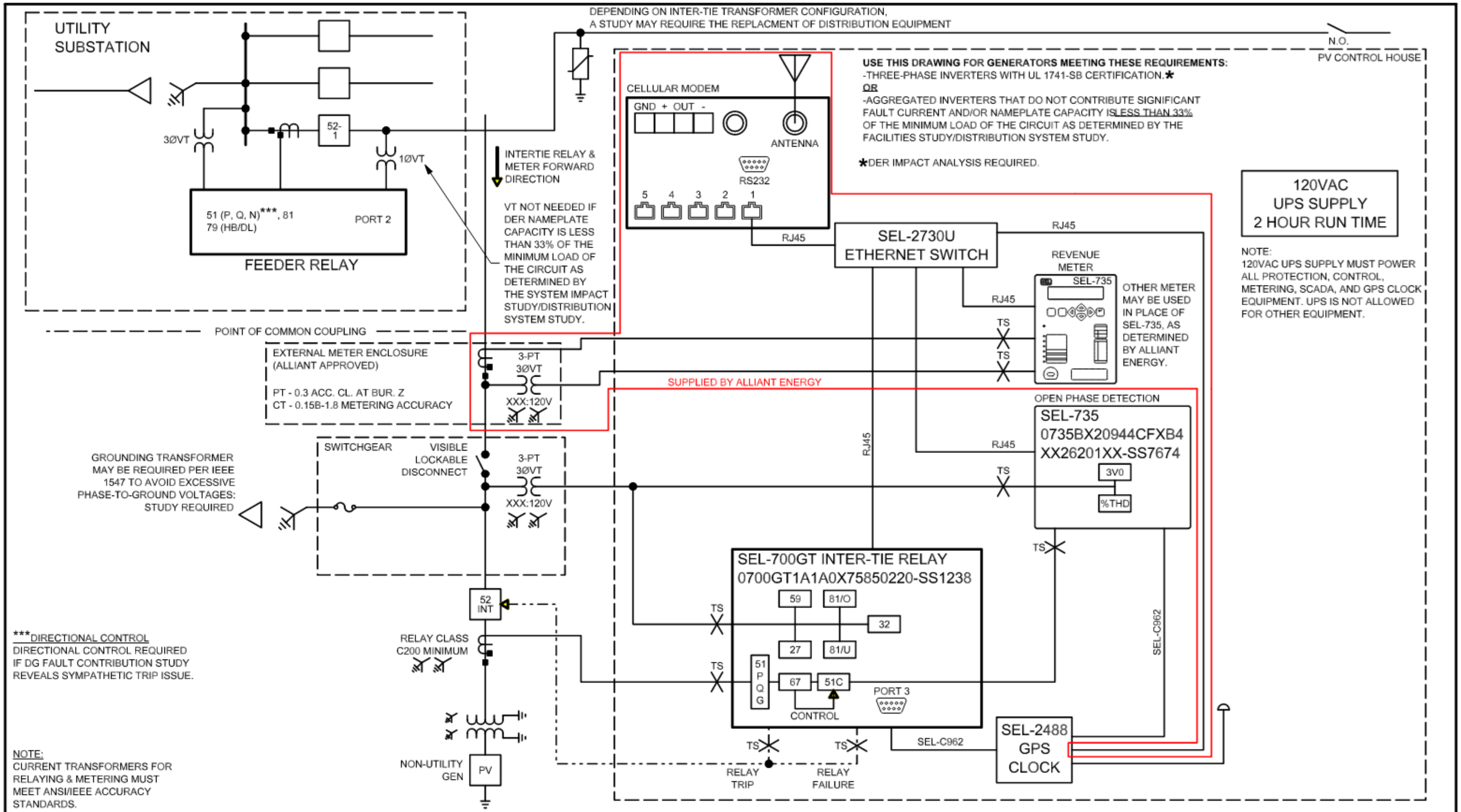
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

PROTECTION SCHEME - SECONDARY BI-DIRECTIONAL METER

SCALE: NONE

DWG. NO. B1.4



NO.	DATE	REVISION	BY	CHK'D	APV'D
2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		QY

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

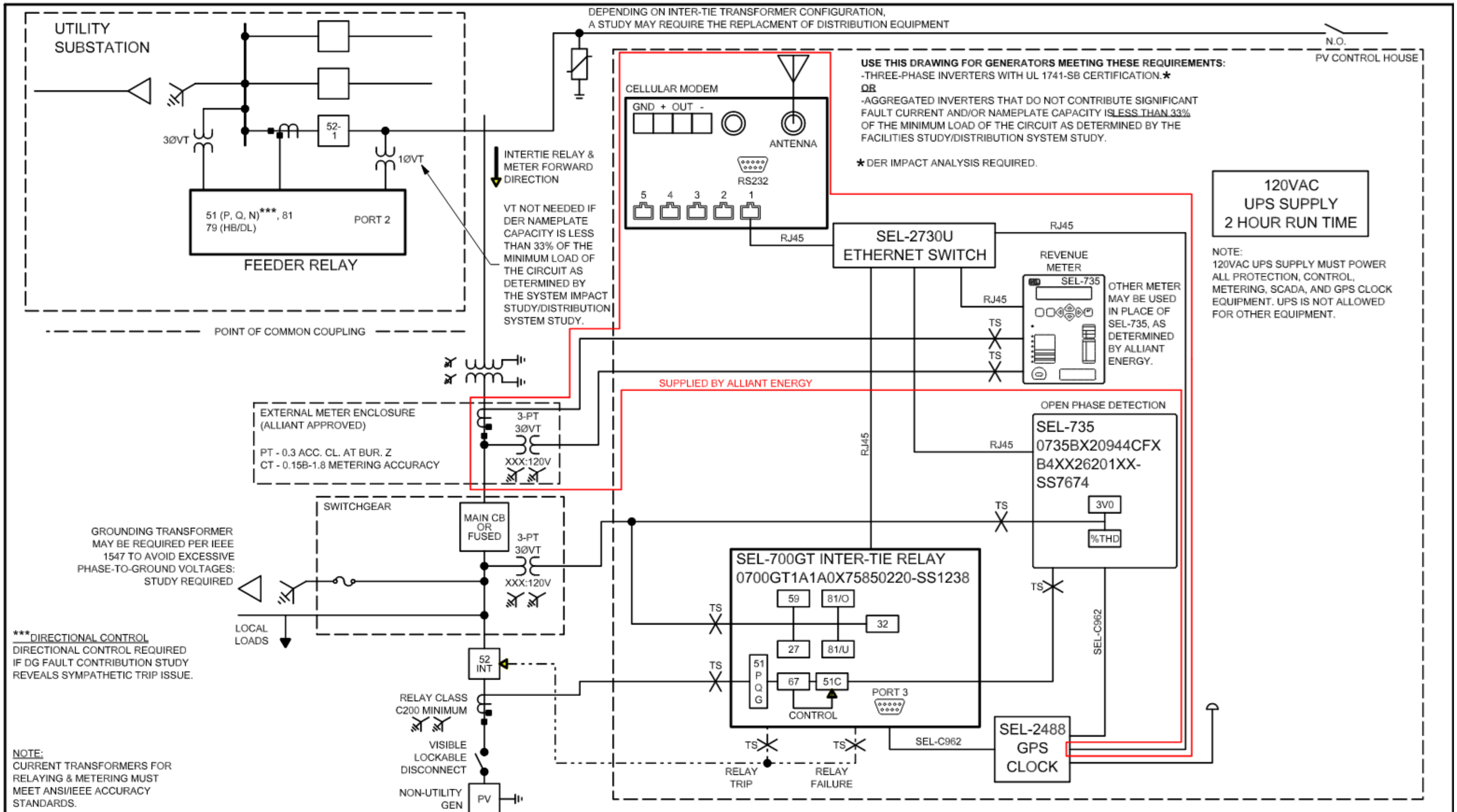
PARALLEL-OPERATED DISTRIBUTED GENERATION

ONE LINE DIAGRAM

DISTRIBUTED GENERATION PROTECTION SCHEME - PRIMARY METERED

SCALE: NONE

DWG. NO. B1.5



2	06-14-2024	DRAWING REVISIONS	DEB	SM	SM
1	08-31-2023	DRAWING UPDATE	DEB	SM	SM
0	08-18-23	ORIGINAL DRAWING	SNL		OY
NO.	DATE	REVISION	BY	CHK'D	APV'D

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

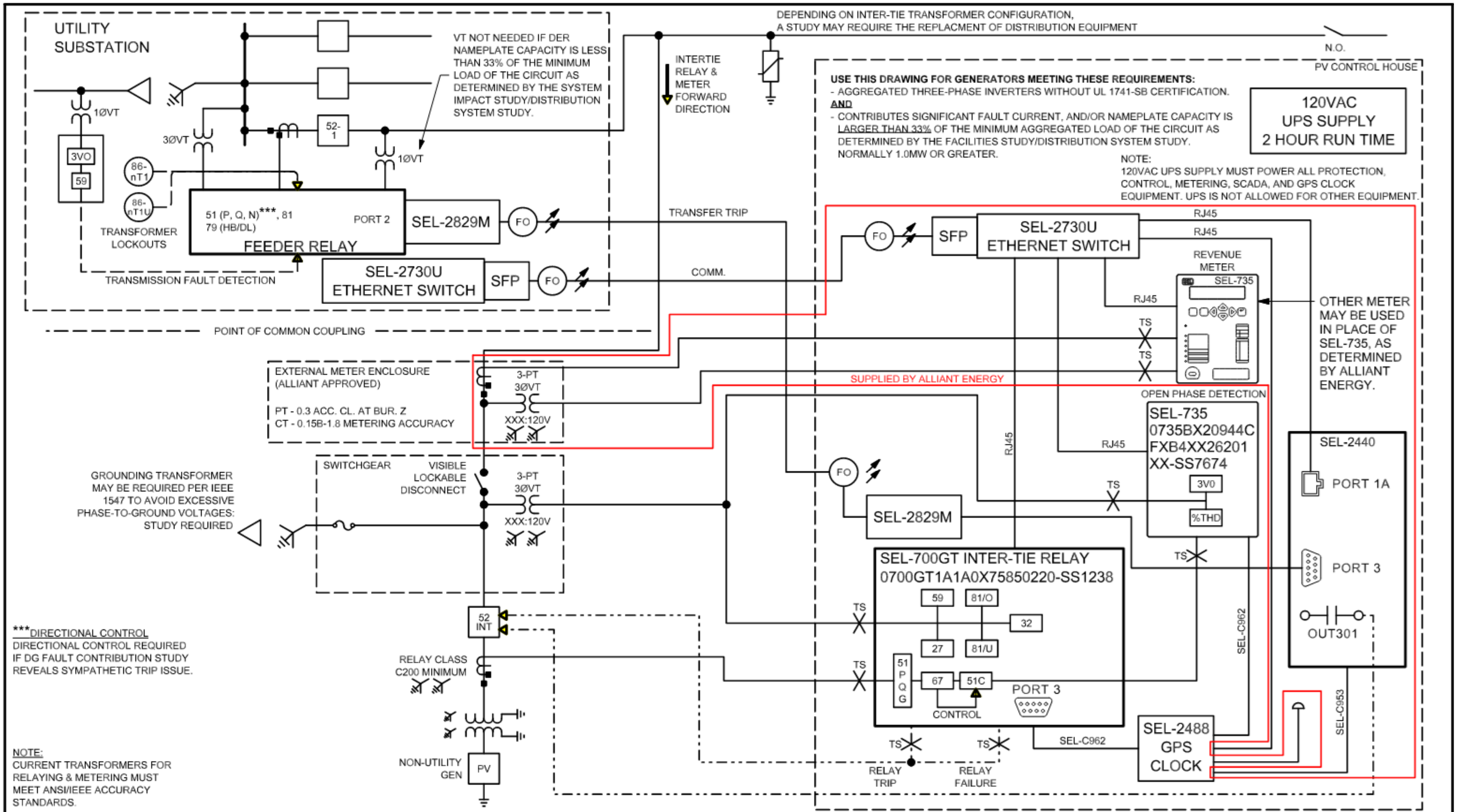
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

PROTECTION SCHEME - SECONDARY METERED

SCALE: NONE

DWG. NO. B1.6



NO.	DATE	REVISION	BY	CHK'D	APV'D
0	06-14-2024	ORIGINAL DRAWING	DEB	SM	SM

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

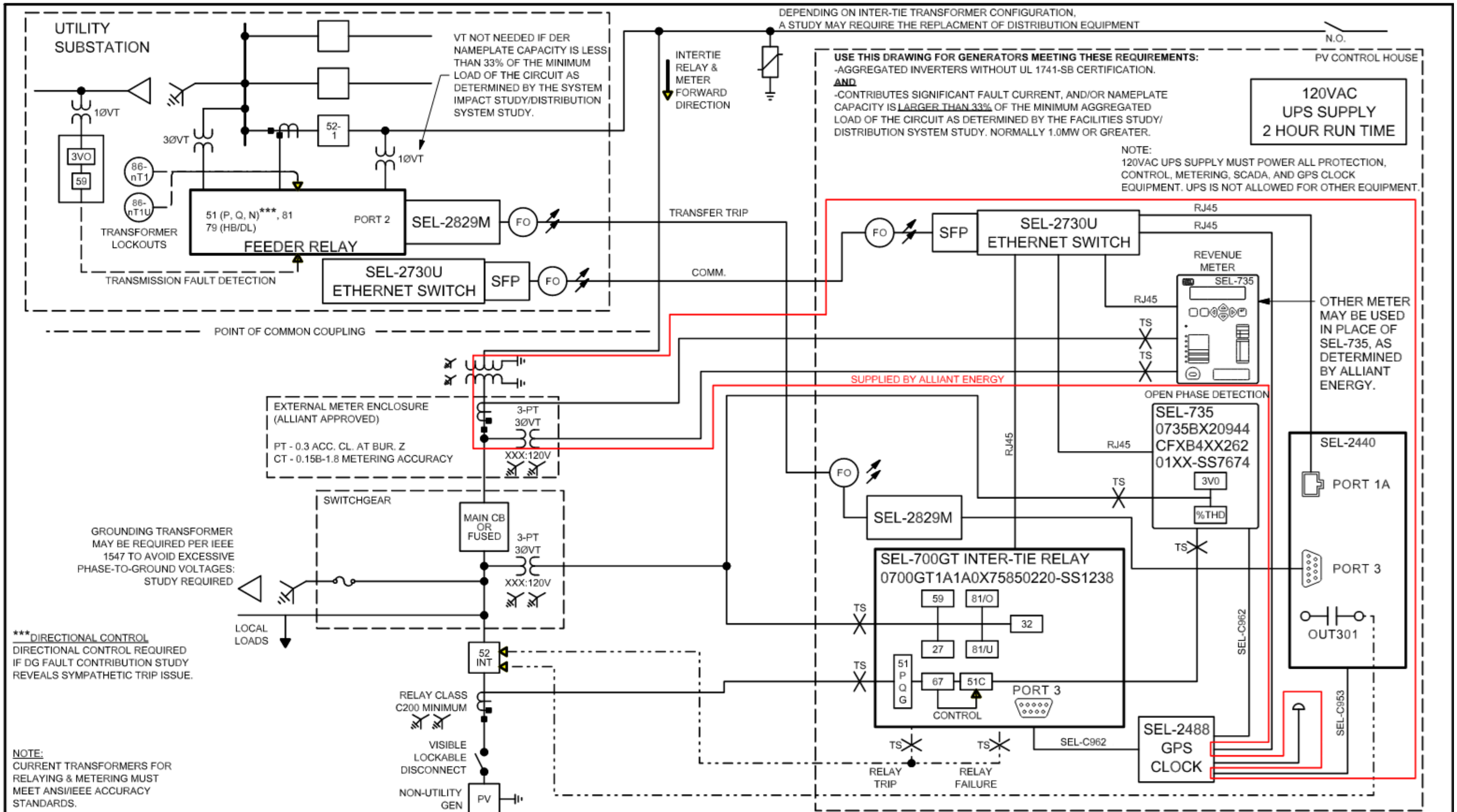
ONE LINE DIAGRAM

DISTRIBUTED GENERATION

PROTECTION SCHEME - PRIMARY METERED

SCALE: NONE

DWG. NO. B1.7



NO.	DATE	REVISION	BY	CHK'D	APV'D
1	06-14-2024	ORIGINAL DRAWING	DEB	SM	SM

CONFIDENTIAL

These documents are for the use of Alliant Energy. Alliant Energy disclaims all warranties, both expressed and implied. Use by anyone other than Alliant Energy is at their own risk.

ALLIANT ENERGY.

PARALLEL-OPERATED DISTRIBUTED GENERATION

ONE LINE DIAGRAM

DISTRIBUTED GENERATION

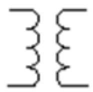
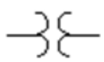
PROTECTION SCHEME - SECONDARY METERED

SCALE: NONE

DWG. NO. B1.8

APPENDIX C. SYMBOLS AND RELAY ELEMENT DEFINITIONS

Symbol Chart

	Distribution Transformer: A transformer used to change the voltage from a distribution voltage level (2400V-34kV) to a level for use by the customer (typically 277/480V, 120/208V, or 120/240V).
	Fuse: A short piece of conducting material of low melting point, which is inserted in a circuit for the purpose of opening the circuit when the current reaches a certain value.
	Disconnect: A device used to isolate a piece of equipment. A disconnect may be gang operated (all poles switched simultaneously) or individually operated.
	Circuit Breaker: A device for interrupting a circuit between separable contacts under normal or fault conditions.
	Potential Transformer (PT): A transformer intended for metering, protective or control purposes, which is designed to change the voltage from a distribution or utilization voltage level to a level for metering or protection purposes (typically 24V or 48V).
	Current Transformer (CT): A transformer intended for metering, protective or control purposes, which is designed to have its primary winding connected in series with a circuit carrying the current to be measured or controlled. A current transformer normally steps down current values to safer levels. A CT secondary circuit must never be open circuited while energized.
	Relay: A device that is operative by a variation in the condition of one electric circuit to affect the operation of another device in the same or in another electric circuit. The number corresponds to a specific relay type. The relay types are shown in the Table on page 6 of this Appendix 1.
	Meter: A device used to measure the flow of electricity (in kWh) between Alliant Energy and the customer. The meter may measure flow in one or both directions.
	Generator: Any device producing electrical energy, i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, etc.; or any other electric producing device, including energy storage technologies.
	Ground: A term used in electrical work in referring to the earth as a conductor or as the zero of potential. For safety purposes, circuits are grounded while any work is being done on or near a circuit or piece of equipment in the circuit; this is usually called protective or safety grounding.

Relay Element Definitions

Relay Device	Description, Purpose and Setting Parameters
21-2	**Impedance Relay** (time-delayed). Provide tripping of the customer breaker for faults on transmission or distribution line.
25	**Synchronizing or Synchronism-Check Device**. Provide voltage and phase angle supervision of generator breaker closure.
27	**Undervoltage Relay**. Provide tripping of the customer breaker should the Company line voltage not be maintained within an acceptable lower limit. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
27N	**Neutral Undervoltage Relay**. Provide tripping of the customer breaker for ground faults on the Company system. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
32	**Directional Power Relay.** For Non-Export or Export Limited only. Must sense Real and Reactive Power.
46	**Negative Sequence Relay**. Detects unbalanced conditions on feeders. Protects the interconnection transformer from overloads associated with unbalanced feeder loading.
50/51	**AC Instantaneous/Time Overcurrent Relay**. Provide tripping of the customer breaker in the event of a phase fault on the customer system.
50/51N	**AC Instantaneous/Time Ground Overcurrent Relay**. Provide tripping of the customer breaker in the event of a ground fault on the customer system and for close-in solid ground faults on the Company's feeder.
51C	**Voltage-Controlled Phase Timed Overcurrent Relay**
51 (P, Q, G)	**Timed Overcurrent Relay.** Torque-controlled for direction**.**
51G	**Time Neutral Overcurrent**. Provide tripping of the customer breaker for excessive distribution line unbalances or presence of a phase-to-ground fault.
51V	**Torque-Controlled Time Overcurrent**. Provide tripping of the customer breaker for faults on the Company's distribution line.
52	**AC Circuit Breaker**

Relay Device	Description, Purpose and Setting Parameters
59I	**Instantaneous Overvoltage Relay**. Provide tripping of the customer breaker should the Company line voltage not be maintained within an extreme acceptable upper limit. Actual voltage setting will be determined on a case-by-case basis.
59N	**Neutral Overvoltage Relay**. Provide tripping of the customer breaker for ground faults on the Company's distribution system. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
59T	**Time Overvoltage Relay**. Provide tripping of the customer breaker should the Company line voltage not be maintained within an acceptable upper limit. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
67 (P, Q, G)	**AC Directional Instantaneous Overcurrent Relay**
79 (HB/DL)	**AC Reclosing Relay.** Reclose supervised by Hot Bus/Dead Line
81 O/U	**Over/Under Frequency Relay**. Provide tripping of the customer breaker should system frequency not be maintained. This relay would be expected to operate if the customer should become isolated from the Company system (islanding condition). The relay should be capable of providing a trip time in the ½ to 2-second range. Actual frequency and time delay settings will be determined on a case-by-case basis.
RQM	**Revenue Quality Meter**
TS	**Test Switch**

END