



# VERSANT POWER

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## ***Guidelines for Generator Interconnection***

***Approvals:***

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**Attachment 1 - Vocabulary**

**Attachment 2 - Typical Interconnection One-Line Diagrams**

**Attachment 3 – Screening Criteria**

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**Attachment 5 - Codes and Standards**

**Attachment 6 – Applications and Agreements**

**Attachment 7 – Inverter Source Requirement Document of ISO New England (ISO-NE)**

**Attachment 8 – Interconnection Checklist**

## **I. Introduction**

It is Versant Power's policy to provide support for renewable resource generation and to permit operation of customer-owned generators in parallel with the Versant Power system whenever this can be done without impacting the quality of service to other customers or the safety of the employees and equipment of Versant Power.

In order to carry out their responsibilities to all Customers, the Company must assure that any interconnections to the Electric Power System are done according to certain protocols. Those protocols and procedures are described in this Guidelines document.

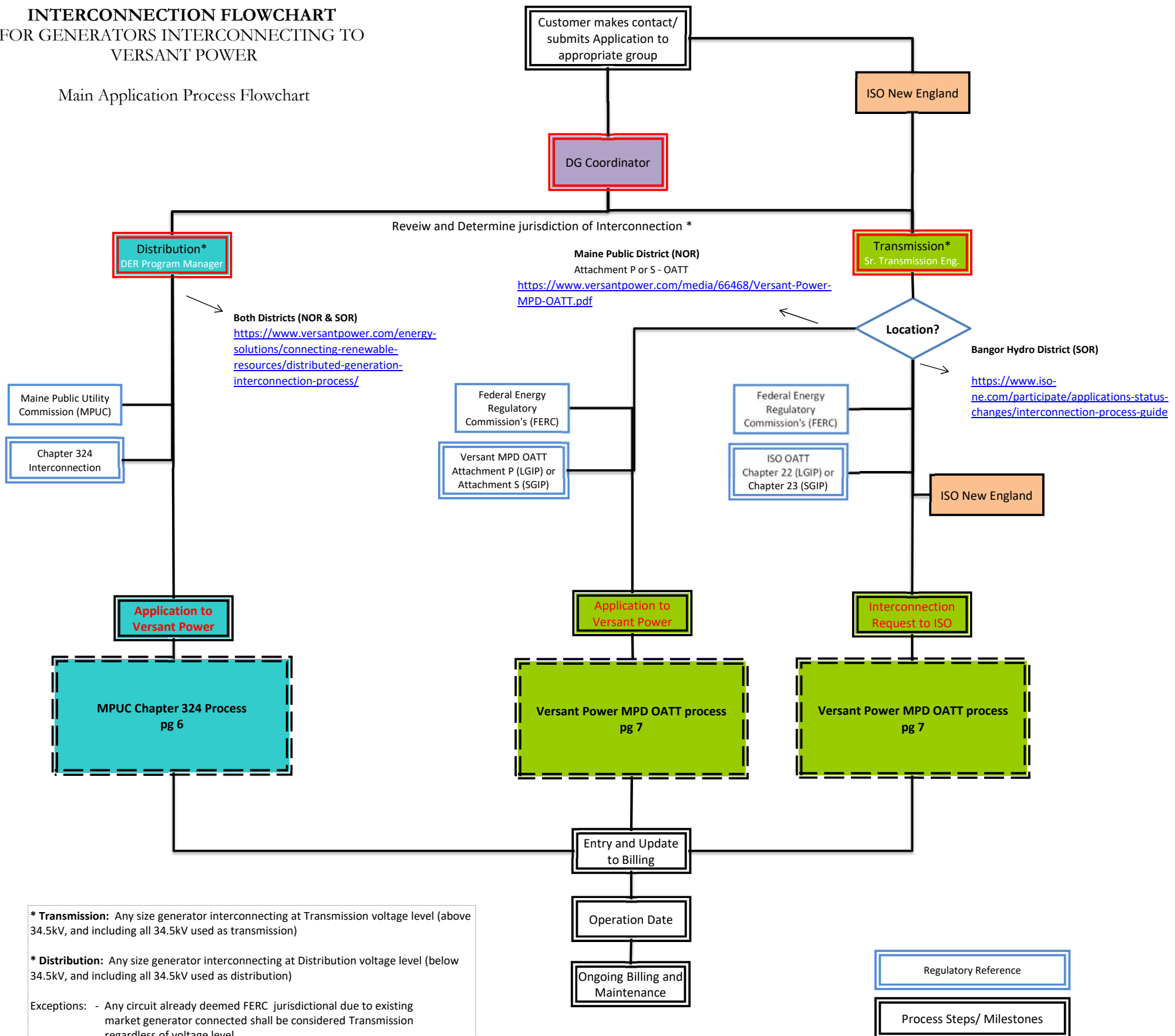
We look forward to working with you to facilitate a safe, reliable and successful interconnection! The Company DG Interconnection Program Lead will serve as the primary point of contact for any interconnection of Generating Facilities to the Electric Power System. Copies of these Guidelines, information and forms can be obtained from our website at <https://www.versantpower.com/energy-solutions/connecting-renewable-resources/distributed-generation-interconnection-process/>.

The Company DG Interconnection Program Lead for Versant Power can be contacted via email **[dginterconnections@versantpower.com](mailto:dginterconnections@versantpower.com)**, and by mail at:

**Versant Power**  
**Attn: DG Interconnections**  
**PO Box 932**  
**Bangor, Maine 04402-0932**

# INTERCONNECTION FLOWCHART FOR GENERATORS INTERCONNECTING TO VERSANT POWER

## Main Application Process Flowchart

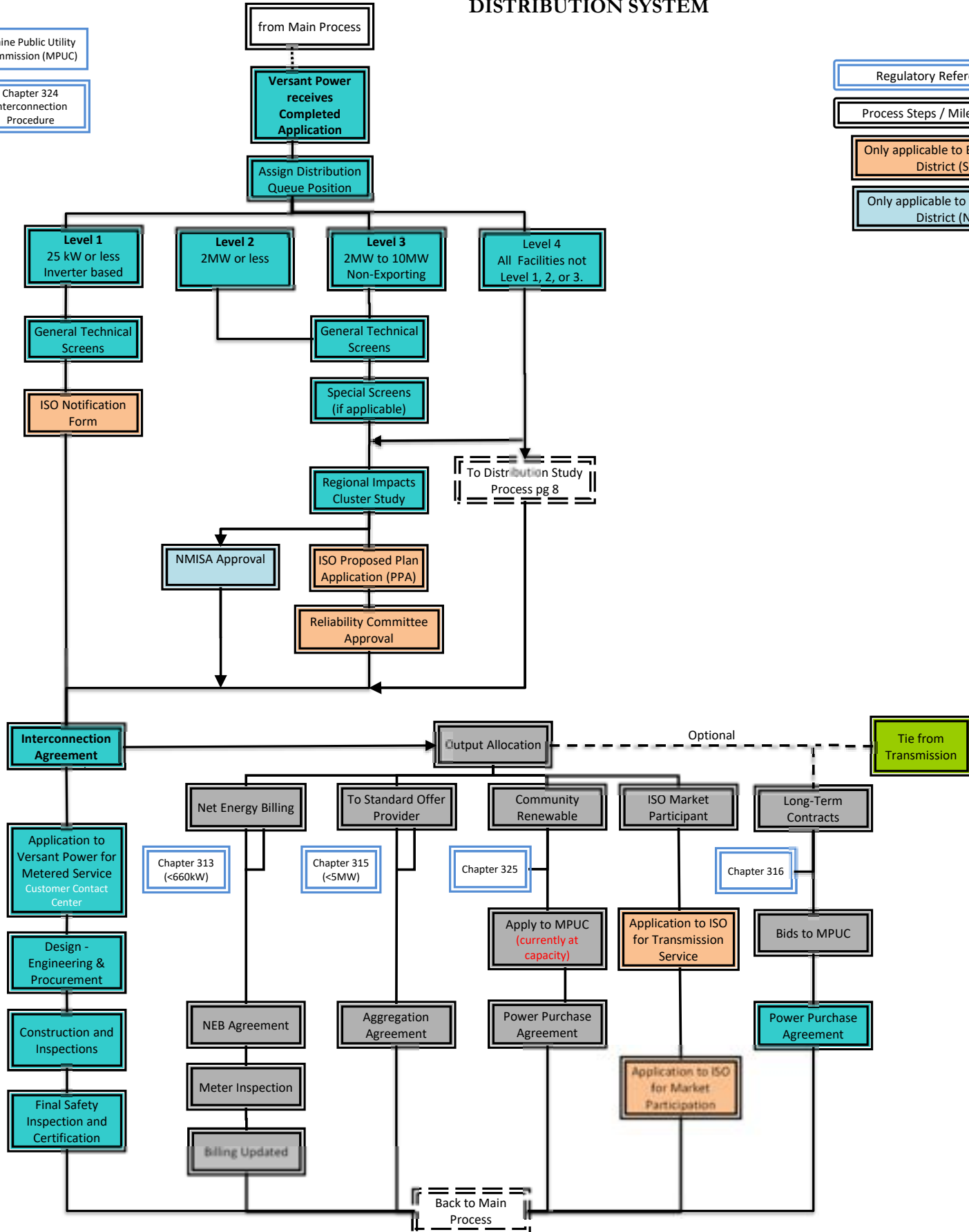


# INTERCONNECTION FLOWCHART FOR GENERATORS INTERCONNECTING TO

## VERSANT POWER'S DISTRIBUTION SYSTEM

Maine Public Utility Commission (MPUC)  
Chapter 324 Interconnection Procedure

Regulatory Reference  
Process Steps / Milestones  
Only applicable to Bangor Hydro District (SOR)  
Only applicable to Maine Public District (NOR)



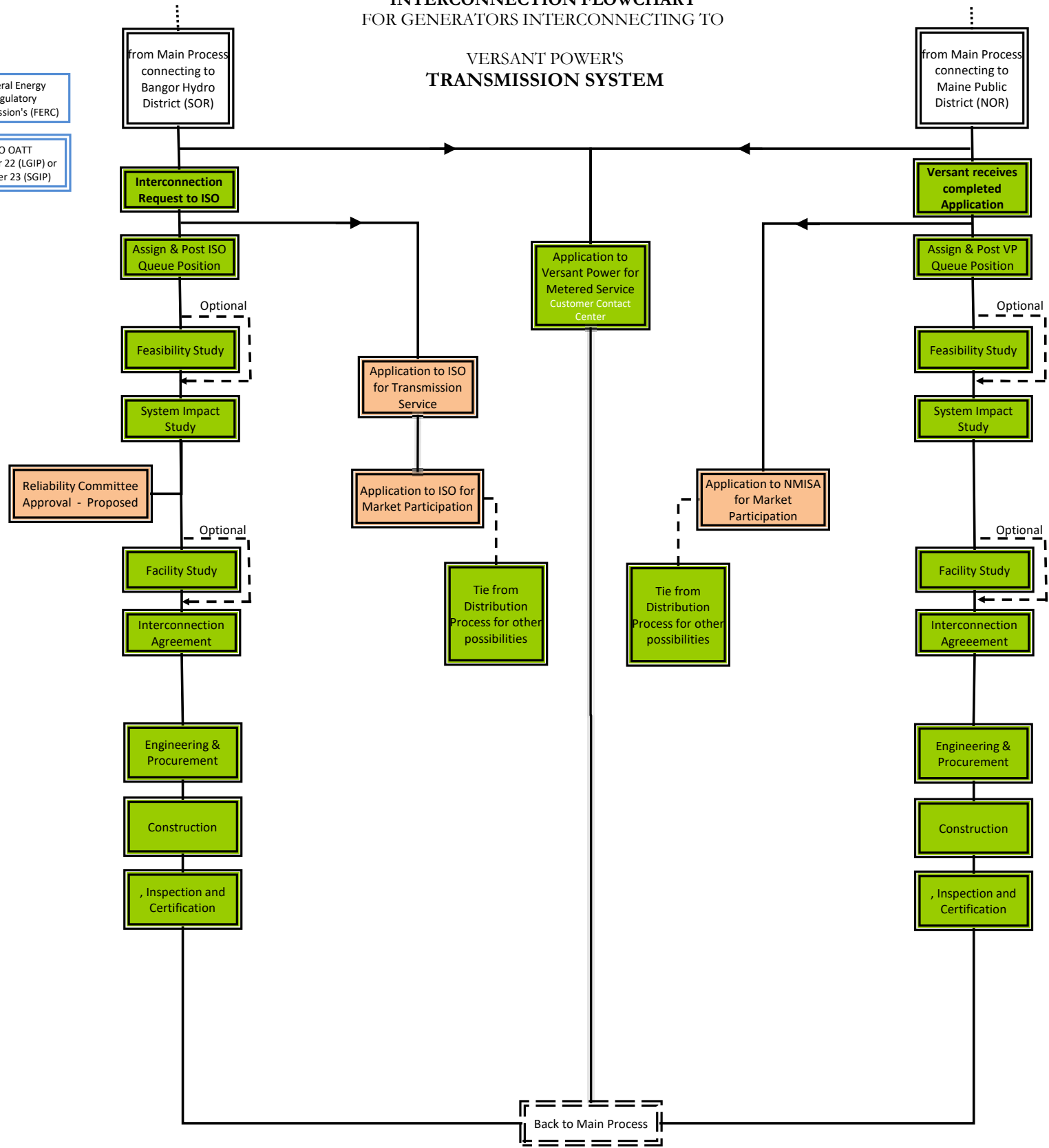
**INTERCONNECTION FLOWCHART  
FOR GENERATORS INTERCONNECTING TO  
VERSANT POWER'S  
TRANSMISSION SYSTEM**

Federal Energy  
Regulatory  
Commission's (FERC)

ISO OATT  
Chapter 22 (LGIP) or  
Chapter 23 (SGIP)

Federal Energy  
Regulatory  
Commission's (FERC)

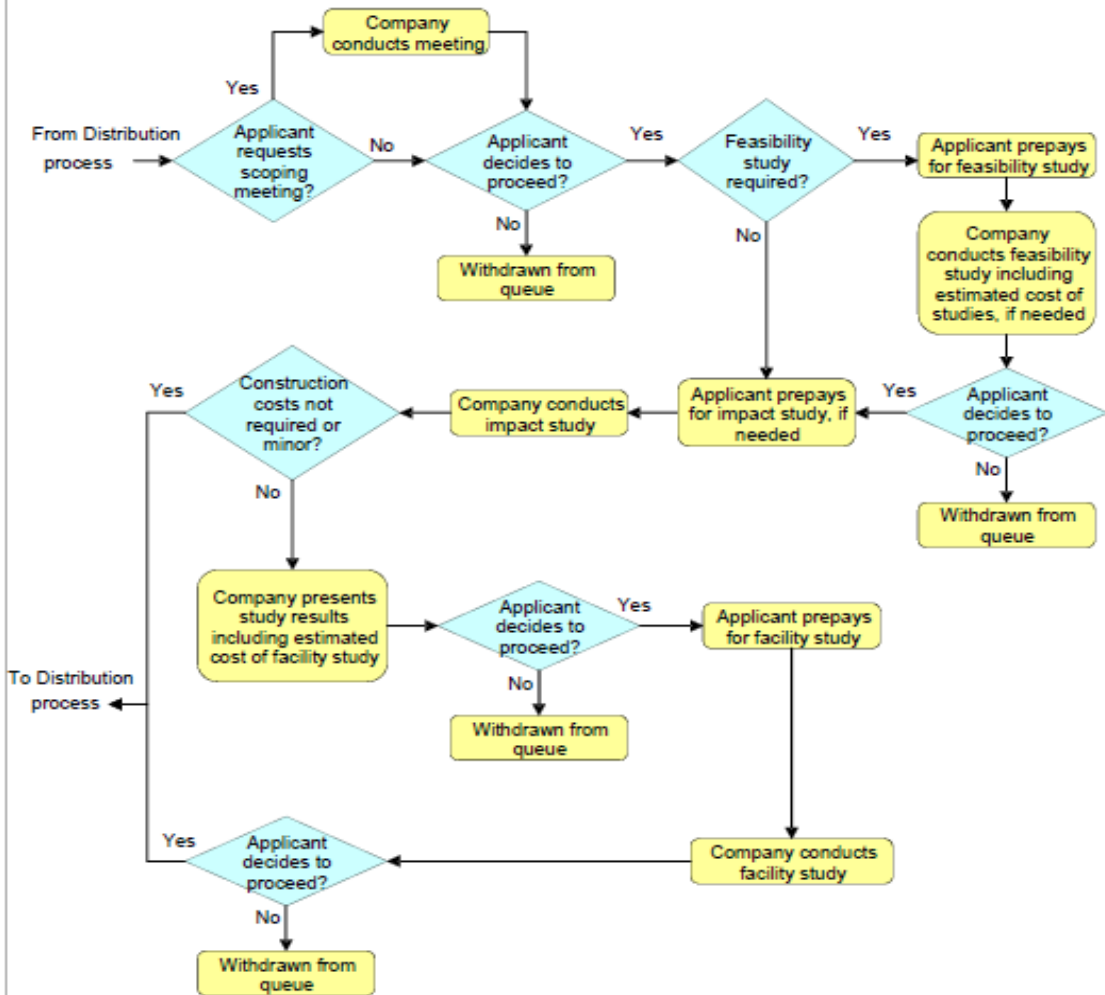
MPS OATT  
Attachment P (LGIP)  
Attachment S (SGIP)



Regulatory Reference

Process Steps / Milestones

## Impact and Facility Study Process





## II. Application Process for Distribution Interconnections

### a. Definition of Generating Facility Size Categories

The following Generating Facility size categories are used in determining minimum protective requirements, commercial requirements and time frames for Facilities. Size categories are listed according to nameplate ratings for each connection to the EPS. Generators must satisfy the general requirements and the minimum protective function requirements provided in this document for each Generating Facility category, as follows:

<b>Table 1: Distribution Interconnection <u>Levels</u></b>		
<b>Level*</b>	<b>Use Application Package</b>	<b>Processing Times (maximum)</b>
<b><u>Level 1</u></b>  Inverter-Based Generators Not Greater than 25 kW & Meeting Screens for Level 1	Attachment 6, Level 1 Standard Interconnection Application	See Attachment 3
<b><u>Level 2</u></b>  Generators Not Greater than 2 MW & Meeting Screens for Level 2	Attachment 6, Level 2,3,& 4 Standard Interconnection Application	See Attachment 3
<b><u>Level 3</u></b>  Non-Exporting Generators Not Greater than 10 MW & Meeting Screens for Level 3	Attachment 6, Level 2,3,& 4 Standard Interconnection Application	See Attachment 3
<b><u>Level 4</u></b>  All Generators Not Meeting Levels 1, 2, or 3 and Not Subject to FERC Jurisdiction	Attachment 6, Level 2,3,& 4 Standard Interconnection Application	See Attachment 3

\*All Levels are based on aggregate generation at the site.

The Transmission level interconnections, which are administered by ISO New England in our Bangor Hydro District (BHD), are broken into two size levels to determine the interconnection process. Generators less than 20 MW will follow the Small Generator Interconnection Process (SGIP) and generators 20 MW and larger will follow the Large Generator Interconnection Process (LGIP). These processes can be found at the links shown on the Interconnection Flowchart on page 5. All Transmission level interconnections in our Maine Public District (MPD) are administered by Versant Power under its filed OATT as found in the VP website <https://www.versantpower.com/> under ATTACHMENT L (LGIP) and ATTACHMENT S (SGIP).

### b. Additional Application Process Requirements

:  
Level 2, 3 & 4 Interconnection applications in the Bangor Hydro District also must notify ISO NE and follow their requirements in Planning Procedure PP5-1: Procedure for Review of Governance Participant's Proposed Plans. Requirements for new generation or changes in output are summarized in the table in Section 2.1 at:

[https://www.iso-ne.com/static-assets/documents/rules\\_proceeds/isone\\_plan/pp05\\_1/pp5\\_1.pdf](https://www.iso-ne.com/static-assets/documents/rules_proceeds/isone_plan/pp05_1/pp5_1.pdf)

Level 2, 3 & 4 applications in both districts must participate in a regional Cluster study to show no adverse impacts to the transmission grid.

## c. Application Process for Interconnecting Levels 1-4 Generating Facilities

### Pre-Application Report Request

An optional Pre-Application Report can be requested by potential applicants developing projects 500 kW in size and greater. The report provides applicants information about system conditions at a proposed Point of Common Coupling.

A Pre-Application Report request form, found in Attachment 6 must be sent along with a non-refundable processing fee defined in Table 2. Within fifteen (15) Business Days of receipt of a request Versant Power shall provide a Pre-Application Report.

### Step 1 Generator Submits Application

1. The process begins with the submission of a **completed\*** application to the Company. The following is required, with the full checklist detailed in Attachment 6:
  - A **completed** standard interconnection application based on the level of the Generating Facility (see Table 1 above).
  - A oneline electrical schematic drawing(s) depicting the complete proposed system design. The drawing(s) must show all electrical components and protective relaying proposed for the installation. The impedance values of all AC components must be listed.
  - General site plan of the proposed installation.
  - Demonstration of owner permission for proposed installation site.
  - Proposed schedule for the in-service date.
  - Payment of the non-refundable application fee set forth in Table 2.
  - Technical specifications for each piece of major equipment utilized in the installation.

**\*Note that any changes to any information provided by the Generating Facility described in the application, including any design changes and capacity increases, may result in starting the process over with a new application.** Applicants must obtain Company approval in writing of any modifications to the generating facility described in the application.

2. The application should be submitted to the Company Facilitator along with applicable application fees set forth by the MPUC.
3. The proposed POI must be an existing, or currently planned distribution circuit. For three phase interconnections there must be three phases existing at the source of the circuit. The generator will be connected to the distribution and/or substation serving the area where the POI is located.
4. The Company will work with the Applicant to attempt to promptly resolve all disputes arising during the application process. If informal efforts do not result in a resolution of the dispute, the more formal dispute resolution procedures set forth in the interconnection agreements are available.

### Step 2 Company Conducts Application Review

1. The Company reviews the application materials to verify that the application is complete. If any application information is missing, the Company Facilitator will notify the Applicant within five (5) business days. The Company Facilitator will work with the Applicant to identify what is needed to complete the package and will put the application "on hold" pending the receipt of the required information.

The Company will review the application material and may comment on various technical aspects, but the Company is not responsible for the correctness of the interconnection design, the drawings, or the technical specifications.

2. If the Applicant requests, following the receipt of a complete application and at a mutually agreed upon date, the Company will hold a scoping meeting with the Applicant.
3. Company conducts screening process per Attachment 3.
4. For all applications for which System Impact and Facility Studies of the proposed Generating Facility are not required and the Applicant decides to proceed, the Applicant may skip to Step 8 of this application process.
5. If an Interconnection Feasibility Study is requested, the Company will provide an Interconnection Feasibility Study Agreement including an outline of the study and a non-binding good faith estimate of the cost to perform the study. The Applicant then provides the completed agreement along with the appropriate associated payment (see Table 2) to the appropriate Company Facilitator.
6. If the Applicant asks that the Interconnection Feasibility Study evaluate multiple potential points of interconnection, additional evaluations may need to be performed. The Applicant is responsible for the costs of these additional evaluations.

### **Step 3 Company Conducts Feasibility Study**

1. Once the application package is complete, the Company Facilitator will add the application to the queue and will notify the Applicant. An Interconnection Feasibility Study will include the following analyses for the purpose of identifying a potential adverse system impact to the EPS that would result from the interconnection:
  - a. initial identification of any short circuit capability limits exceeded as a result of the interconnection;
  - b. initial identification of any thermal overload or voltage limit violations resulting from the interconnection;
  - c. initial review of grounding requirements and system protection;
  - d. description and a non-binding estimate of the cost of facilities required to interconnect the Generating Facility to the EPS a safe and reliable manner;
  - e. other items deemed necessary on a case-by-case basis.
2. For all applications where System Impact and Facility Studies are required, the following information will be provided to the Applicant by the Company Facilitator:
  - a. Scope of the System Impact and Facility Study required;
  - b. Estimated cost of the System Impact and Facility Study;
  - c. Estimated start date and duration of the Study;
  - d. Other necessary information required to allow completion of the Studies;
  - e. Study Authorization Agreements;
  - f. Company comments on the schedule provided.
3. Where required EPS modifications are minor, the Feasibility Study will identify those modifications.

### **Step 4 Applicant Authorizes System Impact Study**

1. If a System Impact Study is required and the Applicant decides to proceed, the Applicant needs to provide to the Company Facilitator:
  - Payment required by the Company for the System Impact Study (see Table 2);
  - Signed Study Authorization Agreement; and
  - Additional study data, if required.
2. Upon receipt of the payment, study data, including a valid PSCAD model which reflects the actual inverter functional and operational characteristics, and the signed Study Authorization Agreement, the Company will begin the System Impact Study.

3. If the Company does not receive a signed Study Authorization Agreement, payment and study data within two months, the Company will put the application on hold for up to six months, after which the application will be withdrawn from the queue.

#### **Step 5 Company Performs System Impact Study**

1. The Company performs a System Impact Study to determine the acceptability of the design of the proposed Generating Facility.
2. Upon completion of the System Impact Study, the Company Facilitator will provide the Applicant with the following:
  - The results of the System Impact Study.
  - Metering requirements for the proposed Generating Facility.
  - Cost estimate (plus or minus 25%) for the required additions and upgrades to the EPS.  
*Depending on Versant Power availability, any and all work associated with your interconnection may need to be contracted at a possible higher cost.*
3. The Generator shall modify the interconnection design based upon the Company's study or propose an alternative acceptable to the Company.
4. If the System Impact Study determines that EPS modifications are not required and/or may be minor, a Facility Study will not be required and the applicant may skip to step 8.

#### **Step 6 The Applicant Authorizes Electric Power System Facility Study**

1. Once an acceptable interconnection design has been settled on, the Company Facilitator will provide to the Applicant:
  - Scope of the Facilities Study required.
  - Estimated cost of the Facilities Study.
  - Estimated start date and duration of the Study.
  - Other necessary information as required to allow completion of the Study.
  - Study Authorization Agreement.
2. The Applicant needs to authorize the Company to perform the Electric Power System Facility Study by signing the Study Authorization Agreement and by submitting payment to cover the cost of the study and provide required study data.
3. If the Company does not receive authorization, required study data and payment within two months, the Company will place the application on hold for up to six months, after which the application will be withdrawn from the queue.

#### **Step 7 The Company Performs the Electric Power System Facility Study**

1. Upon receipt of the payment and the signed Study Authorization Agreement, the Company will begin the Electric Power System Facility Study.
2. Upon completion of the Facility Study, the Company Facilitator will provide the Applicant with the construction cost estimate and anticipated completion date for the required modifications to the EPS.

*Depending on Versant Power availability, any and all work associated with your interconnection may need to be contracted at a possible higher cost.*

### **Step 8 Applicant Executes Interconnection Agreement, Authorizes Work and Defrays Costs**

1. In this step, an agreement is developed for the construction of and any required Electric Power System modifications.
2. The Applicant executes and returns to the Company Facilitator a Standard Interconnection Agreement, and the construction agreement, thereby authorizing the Company to perform the work and pays for the costs associated with the work.

### **Step 9 Project Construction**

The Applicant and the Company construct the required interconnection facilities and Electric Power System modifications, in accordance with the design and engineering drawings, documents and the construction agreement.

### **Step 10 The Applicant Completes Commissioning, Pre-Parallel Testing**

1. Before operating in parallel with the Electric Power System, the Generating Facilities and associated interconnection equipment must be tested to assure proper operation.
2. The Applicant should notify the Company of a proposed date for commissioning testing, including a test procedure, at least ten business days in advance of the proposed test date.
3. If significant problems arise preventing the conclusion of testing, the Company and the Applicant will schedule a mutually acceptable retest date.

The Company will charge the Applicant for the Company's personnel with expertise in this specialized area to witness the commissioning testing as prescribed in the "Protection System Testing and Maintenance" section. Charges will be made for the first and any subsequent Company visits that are required for the commissioning testing. The Applicant will be charged only for company personnel required to witness the test.

There will be no charge for Company personnel to witness the commissioning testing of Level 1 inverter-based Generating Facilities, provided that the testing is completed in one visit. If the Applicant is not ready for the testing to occur on the first Company visit, or if the testing cannot be completed or must be repeated because of a problem on the first visit, then the Company will charge the Applicant for Company personnel to witness commissioning testing on subsequent visits.

### **Step 11 Final Acceptance, Cost Reconciliation, Authorization to Interconnect**

1. If the interconnection is not approved, the Applicant will need to take corrective action in order to obtain authorization to interconnect to the Electric Power System.
2. Prior to formal authorization of the interconnection, the Applicant will provide the Company with updated drawings and prints showing the Generating Facility as approved for normal operation. The one line drawings must be "as built" quality and include all changes that were made during construction and testing. The Applicant will provide the Company a commissioning test report (if requested) and must obtain release of municipal electrical inspector or the authority having jurisdiction.
3. When the interconnection is approved, the Company will provide notification stating that the Generating Facility is allowed to commence parallel operation to the Electric Power System.
4. The Company will provide a bill for any balance due or a reimbursement for overpayment of any deposit.

### III General Requirements

#### 1.0 Responsibility for Costs of Interconnecting a Generating Facility

##### a. Fees

During the conduct of the Feasibility Study, the Company determines the need for a System Impact Study and Facility Study. The Company will provide an estimate of the cost of any required Feasibility Study, System Impact Study or Facility Study. Table 2 lists the Application, Feasibility Study, System Impact Study, and Facility Study fees.

<b>Level</b>	<b>Nameplate Rating*</b>	<b>Application</b>	<b>Each Study Fee</b>
Pre-Application (opt.)	Greater than 500 kW	\$300	
Level 1	Inverter-Based Generators Not Greater than 25kW	\$100	
Level 2	Generators Not Greater than 2MW	\$100plus \$2.00/kW	Actual Time Based
Level 3	Non-Exporting Generators Not Greater than 10MW	\$100 plus \$3/kW	Actual Time Based
Level 4	All Generators Not Subject to FERC Jurisdiction	\$3,000	Actual Time Based

\* All Nameplate Ratings are based on aggregate generation at the site

##### b. Interconnection Equipment Costs

The Applicant is responsible for the actual construction cost of the Interconnection Facilities. They will be responsible for expenses, including overheads, associated with owning, operating, maintaining, repairing and replacing the Interconnection Facilities.

##### c. System Modification and Costs

The Applicant is responsible for all associated costs incurred by the Company in designing and constructing modifications to the Electric Power System that are required to accommodate the interconnection. Any costs associated with protection upgrades or modifications deemed necessary based on Good Utility Practice in order to accommodate the output from the Generator shall be the responsibility of the Applicant. Payment of the estimated cost of the modification is required before work will commence. Any incremental expenses incurred to operate and maintain the required upgrades, beyond what would be required without the interconnection, will be the responsibility of the Applicant. These O&M charges will be based on a calculation using the additional equipment's cost and will be billed monthly.

#### **d. Applicant Challenge to Costs**

If an Applicant believes that the Company has charged the Applicant for costs that are not reasonable for the work performed, or costs that are not related to the Applicant's interconnection or are not related to the Company's costs of analysis, design and system work to accommodate the interconnection, then the Applicant may challenge such costs, provided that: (1) the Applicant has paid the Company all billed costs, including the disputed costs, in a timely manner; and (2) the Applicant provides written notice to the Company within 10 business days of the receipt of an invoice for disputed costs, specifying the disputed costs and the reasons that the Applicant believes it should not be required to pay such costs. The dispute resolution procedures under these guidelines (see the Maine Public Utility Commission's Standard Generator Interconnection Rules) shall then be applicable to resolve the amount, if any, of the disputed costs that the Company shall return to the Applicant.

#### **2.0 Agreements**

An Applicant seeking to establish an electrical interconnection with the Company must have all necessary agreements executed before parallel operation will be authorized.

The agreements an Applicant may need to complete (depending upon the size of the proposed Generating Facility) include:

1. *Study Authorization Agreement(s)* (Feasibility Study, System Impact Study, and/or Facility Study).
2. *Construction Agreement*.
3. *Standard Interconnection Agreement* signed by the Applicant and the Company before parallel operation can commence (required for all Generating Facilities).

For generators utilizing renewable resources primarily for internal use, facilities 660 kW or less qualify for net metering. In this case a *Net Energy Billing Agreement* should be completed in addition to the Standard Interconnection Agreement.

4. *Aggregation Agreement* must be completed if the facility would like the Standard Offer Provider to purchase the output of their facility. All facilities with less than 5MW output qualify for this arrangement as set forth in Section 21 the Company's Terms & Conditions on file with the MPUC.

Generators who qualify for the net metering option may choose the Aggregation option instead of net metering (or make use of any other applicable selling option) but may only change between options a maximum of once per year.

If an extension to a Company owned line is required in order to accommodate the interconnection, the Company will obtain suitable easements or rights of way for the extension and the Applicant will be responsible for all costs incurred.

#### **3.0 Disconnection**

##### **Temporary Disconnection**

- a. **Emergency Conditions.** The Interconnection Agreement contemplates that the Company and the Generator will cooperate to minimize disruptions in service. The Interconnection Agreement provides that the Company will have the right to immediately and temporarily

disconnect the Generating Facility, without prior notification, in emergencies and in the cases of forced outages.

- b. **Routine Maintenance, Construction and Repair.** The Interconnection Agreement allows for the disconnection of the Generating Facility from the Electric Power System when necessary for routine maintenance, construction and repairs.
- c. **Forced Outages.** The Interconnection Agreement provides that during any forced outage, the Company shall have the right to suspend interconnection service to effect immediate repairs on the Company EPS. The Company will use reasonable efforts to provide the Generator with prior notice. Where circumstances do not permit such prior notice to the Generator, the Interconnection Agreement provides that the Company may interrupt interconnection service and disconnect the Generating Facility from the Company EPS without such notice.
- d. **Non-Emergency Adverse Operating Effects.** The Interconnection Agreement provides that the Company may disconnect the Generating Facility if the Generating Facility is having an adverse operating effect on the Electric Power System or on the Company's other customers.
- e. **Modifications of the Generating Facility.** The Interconnection Agreement provides that the Company may immediately suspend Interconnection service in cases where the Generator has implemented modifications to the Generating Facility without prior written authorization from the Company.
- f. **Non-Compliance.** If a Customer-Generator interconnects to Versant Power's distribution system without having received approval for the interconnection through the process described in MPUC Chapter 324, Versant Power may require disconnection of the Customer-Generator's facility and the costs of the inspection by Versant Power shall be borne by the Customer.
- g. **Re-connection.** Any curtailment, reduction or disconnection shall continue only for as long as is reasonably necessary. The Generator and the Company will cooperate to restore the Generating Facility and the Electric Power System to their normal operating states as soon as reasonably practicable following the cessation or remedy of the event or condition that led to the temporary disconnection.

#### **Permanent Disconnection**

- The Interconnection Agreement provides that the Generator may permanently disconnect at any time with 30 calendar days written notice to the Company.
- The Interconnection Agreement provides that the Company may permanently disconnect the Generating Facility upon termination of the Interconnection Agreement.
- The Interconnection Agreement provides that the Company may permanently disconnect the Generating Facility if the Generator is unable, after notice, to correct negative impacts on the Company's other customers or the Electric Power System caused by the Generating Facility.

#### **4.0 Insurance Requirements**

##### **a. General Liability – Projects Meeting Versant's Standard Interconnection Requirements**

The Generator may be required based on MPUC Chapter 324 §14(F) to provide general liability insurance coverage as part of this Agreement. No insurance is required for non-inverter based



Generating Facilities less than or equal to 50 kW or for inverter based Generating Facilities less than or equal to 1 MW. Requirements for other sizes are shown in Table 3.

All required insurance policies shall be maintained with an insurance company that is authorized to do business in the State of Maine.

**b. Effect**

Any inability of the Company to require the Generator to provide general liability insurance coverage for operation of the new generation resource is not a waiver of any rights the Company may have to pursue remedies at law against the Generator to recover damages.

<b>Table 3: Insurance Required</b>		
<b>Generation Capacity</b>	<b>Non-Inverter Based</b>	<b>Inverter Based</b>
> 5 MW	\$3,000,000	\$2,000,000
> 2 MW, <= 5 MW	\$2,000,000	\$1,000,000
> 500 kW, <= 2 MW	\$1,000,000	-
> 50 kW, <= 500 kW	\$500,000	-

**IV Technical Requirements**

**1.0 General Operating Requirements**

The Generator shall operate and maintain the Generating Facility in accordance with Good Utility Practice and comply with all aspects of the Company’s Guidelines for Generator Interconnection and tariffs. The Generator shall continue to comply with all applicable laws and requirements after the interconnection has commenced. In the event that the Company has reason to believe that the Generating Facility may be a source of problems on the Company EPS, the Company has the right to install monitoring equipment at a mutually agreed upon location to determine the source of the problems. If the Generator’s equipment interferes with the Company’s equipment and/or operations or other customers’ equipment, the Generator must immediately take corrective action to resolve the problem. If the Generator fails to take immediate action then the Company can disconnect the Generating Facility per these Guidelines. The cost of the monitoring equipment will be borne by the Company unless the problem or problems are demonstrated to be caused by the Generating Facility or if the test was performed at the request of the Generator.

### **a. No Adverse Effects; Non-interference**

The Company shall notify the Generator if there is evidence that the operation of the Generating Facility could cause disruption or deterioration of service to other customers served from the same Company EPS or if operation of the Generating Facility could cause damage to the Company's EPS or affected systems. The deterioration of service could be, but is not limited to, harmonic injection in excess of IEEE STD 519, as well as voltage flicker and/or rapid voltage changes in excess of IEEE 1453, caused by large step changes at the Generating Facility. Voltage changes, including the impact of any anticipated intermittent output values, will be evaluated using Table 3 in IEEE 1453. The immediate voltage change due to the tripping of the entire facility must be less than 3% on nominal voltages 46kV and above; and less than 5% on nominal voltages less than 46kV. Each party will notify the other in a timely manner of any emergency or hazardous condition or occurrence with its equipment or facilities which could affect safe operation of the other party's equipment or facilities. Each party shall use reasonable efforts to provide the other party with advance notice of such conditions. The Generator shall take immediate action to correct interference with the Company's EPS.

The Company will operate the EPS in such a manner so as to not unreasonably interfere with the operation of the Generating Facility. The Generating Facility will protect itself from normal disturbances propagating through the Company EPS, and such normal disturbances shall not constitute unreasonable interference. Examples of such disturbances could be single-phasing events, voltage sags from faults on the Company EPS, and outages on the Company's EPS.

Islanding, on any part of the Company EPS, is not allowed as it may result in unsafe and unreliable conditions on the Company EPS. The intent of the interconnection protection requirements is to prevent an unsafe and unreliable condition.

### **b. Safe Operations and Maintenance**

Each party shall be responsible for the maintenance, repair and condition of the lines and appurtenances on its side of the PCC. The Company and the Generator shall each provide equipment on its respective side of the PCC that adequately protects the Company's EPS, personnel, and other persons from damage and injury.

## **2.0 Access**

The Company shall have both truck and utility worker access to the disconnect switch of the Generating Facility at all times.

### **a. Company and Generator Representatives**

Each party shall provide and update as necessary the telephone number and other applicable contact information that can be used at all times to allow the other party to report an emergency.

### **b. Company Right to Access Company-Owned Facilities and Equipment**

If necessary for the purposes of these Guidelines and in the manner it describes, the Generator shall allow the Company access to Company equipment and the Company facilities located on the Generating Facility's premises. To the extent that the Generator does not own the property on which the Company is required to locate its equipment or facilities to serve the Generating Facility, the Generator shall secure and provide to the Company the necessary rights for access to such equipment or facilities, including easements.

### **3.0 Metering, Monitoring, and Communication**

#### **Metering and Related Equipment**

Metering of the output from the Generating Facility shall be by meters and metering devices provided, installed, owned, and maintained by the Company. The Company will make a one-time charge for the equipment, plus ongoing communication fees for reading the meter. Bi-directional energy flow must be metered for any Generator facility connected in parallel with the Company's EPS.

Additional meters may be necessary in order for the Company to record gross energy output as required by the MPUC Chapter 313 Customer Net Energy Billing rules for those Generating Facilities that wish to participate in the Net Energy Billing program.

All meters used to determine the billing hereunder shall be sealed and the seals shall be broken only by the Company and upon occasions when the meters are to be inspected, tested or adjusted. The Generator shall provide access for a representative of the Company to the billing meters at all reasonable times for the purpose of meter reading. The Company shall make periodic tests of the aforesaid metering equipment. Upon request of the Generator, the Company will make additional tests. However, if the Generator requests a test to be made within twelve months of a previous test, such test shall be at the expense of the Generator if the meter proves to be accurate within 4%.

In the event errors greater than 4% are discovered, the cost of the test shall be at the expense of the Company. Retroactive billing adjustments for errors found as a result of any test shall be made for a period equal to one-half of the time elapsed since the previous tests, but not to exceed six months.

Each party shall give reasonable notice to the other party of the time when any inspection or test shall take place, and that party may have representatives present at the test or inspection. The Generator shall be notified prior to all metering tests and shall have the right to observe the test and perform its own test. If the meter is found to be inaccurate or defective, it shall be adjusted, repaired or replaced, at the Company's expense, in order to provide accurate metering.

#### **Supervisory Control and Data**

The Company employs a Supervisory Control and Data Acquisition (SCADA) system to control and monitor the status of its power system. This SCADA system provides real time status of the power system and its components by gathering information at each installation via a Remote Terminal Unit (RTU) or equivalent device interconnected to a Master Control Computer.

Generation facilities interconnecting in the Southern Operating Region with 500kW or more of net generation must have an RTU or similar equipment, as approved by the Company, to provide the necessary information and control for monitoring the stability and maintaining the integrity of the EPS. Additional monitoring may be required for ISO-NE as described in ISO-NE's Operating Procedure #18 (OP18).

Generators interconnecting in the Northern Operating Region and under the jurisdiction of the Northern Maine Independent System Administrator (NMISA) will require an RTU if net generation is larger than 500kW.

The method used for SCADA communications will be radio or cellular if feasible. Otherwise, fiber may be required.

The Generator's RTU design and procurement must be reviewed with the Company to ensure compatibility with the Company's SCADA Master

## **Additional Monitoring and Communication requirements**

Generation facilities with 500kW or more of net generation require communications to the meter. As the amount of distributed generation on the Company EPS grows significantly, the MPUC, ISO New England, the Company or other jurisdiction may require additional monitoring and communication.

## **4.0 Protection Requirements for New or Modified Generating Facility Interconnections**

### **4.1 General Considerations**

1. Any Generator desiring to interconnect with Company's EPS or to modify an existing Interconnection must meet specifications as set out in the following standards and other requirements specified by the Company, where applicable:
  - Current version of IEEE 1547, ISO-NE "Default New England Bulk System Area Settings Requirement", IEEE Std 929 and UL(Underwriters Laboratories) Std 1741-SB, as listed in Attachment 5.
2. The specifications and requirements listed herein are intended solely to mitigate possible adverse impacts caused by the Generating Facility to the Company's equipment and to protect the safety of the Company's personnel and other customers of the Company. They are not intended to address protection of the Generating Facility itself or its internal load. It is the responsibility of the Generator to comply with the requirements of all appropriate standards, codes, statutes and authorities to protect itself and its loads.
3. If requested by the Generator, the Company will provide system protection information for the line terminal(s) directly related to the interconnection. This protection information is provided exclusively for use by the Generator to evaluate protection of its Generating Facility during parallel operation.
4. The Generator shall not operate a Generating Facility that superimposes a voltage or current upon the Company system that interferes with the Company operations, service to other customers or communication facilities. If such interference occurs, the generator must take immediate corrective action, within 8 hours of being notified by the Company or first learning of the interference. If the interference cannot be corrected within 8 hours, the Company may require the Generator to cease parallel operation with the EPS. If the generator does not correct the interference or cease parallel operation when directed to do so by the Company, the Company may without liability, disconnect the Generating Facilities from Company's system.
5. Automatic reclosing of the Company's circuits will usually occur following tripping operations and the reclosing operation should not be limited by the Generating Facility's interconnection. The Generator must take reclosing into consideration when designing the Generating Facility, to avoid equipment damage that may result from the Company's circuit reclosing. Reclose-blocking relay schemes and directional overcurrent protection may be required to be added to Company breakers and/ or line reclosers at the Generator's expense.
6. Generating Facility connections on the load side of a secondary grid network system (i.e., 208Y/120 volt secondary network system) are currently under consideration by IEEE

1547. Until industry standards are approved for this type of connection, none are allowed.

7. When connecting to a distribution circuit, a maximum output of the aggregate of all generation interconnected to the distribution low voltage side of the substation transformer may be imposed if it is determined that there are transient stability limitations to generating units located in the general electrical vicinity
8. For interconnection of a proposed single-phase Generating Facility where the primary distribution system is three phase, four-wire, the Generating Facility will be connected line-to-neutral. For interconnection of a proposed single phase Generating Facility where the primary distribution system is three-phase, three-wire, the Generating Facility will be connected line-to-line.
9. For the interconnection of a proposed Generating Facility to any distribution secondary spot network, the Generating Facility must utilize a protective scheme that will ensure its current flow will not affect the network protective devices including reverse power flow relays or a comparable function. Synchronous Generating Facilities cannot be interconnected to a distribution secondary spot network, either for momentary or continuous operation.
10. When measured at the secondary side (low voltage) of a shared distribution transformer, the short circuit contribution of the Generating Facility must be less than or equal to 2.5% of the interrupting rating of the Company's service equipment.
11. When the proposed interconnection may result in reverse load flow through the Company's load tap changing transformer(s) or line voltage regulator(s), the Company may make control modifications to these devices to mitigate the effects. These modifications would be at the Generator's expense. Otherwise the Generating Facility may be required to limit its output so reverse load flow cannot occur or provide reverse power relaying that trips the Generating Facility.
12. Disconnect Switch. The Generator shall provide an external disconnect switch at the Point of Interconnection or at Point of Common Coupling that can be opened for isolation. The switch shall be in a location easily accessible to the Company personnel at all times. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum Generator output and be capable of being locked open by Company personnel. The Company shall have the right to open the disconnect switch as required.

## **4.2 Intertie Requirements**

### **4.2.1 General Requirements**

All Generating Facilities must meet performance requirements set forth in relevant sections of the current version of IEEE Std1547-standard and additional requirements set forth by the Company. Interconnections under ISO-NE jurisdiction shall be handled via ISO-NE Generator Interconnection application requirements and procedures.

High generation-to-load ratios and low stiffness factors may be cause for concern. A system impact study, including a time domain impact study, will determine adverse impacts to the distribution circuit when screenings aren't met. The Company will also consider impacts to its subtransmission voltage and thermal limitations which may require additional mitigation at the generator's expense. The New England Independent System Operator (ISO-NE) may also require an analysis of the Generator's impact to the regional transmission network to ensure no

adverse impacts. Submission of PSSE and PSCAD models for the specific equipment, including inverter model and firmware if applicable, may be required.

Additional Company requirements are listed below.

### **1) Voltage Regulation and Flicker**

Additional Requirement: The Generator shall not cause the Company EPS service voltage or other Company EPS customer's voltage to exceed plus five percent (+ 5%) from the standard voltage for any period longer than five seconds. Meeting this requirement may require modifications to the EPS, at the expense of the generator.

To limit voltage flicker, the generator shall not cause a step change in voltage exceeding 2% upon a change in output from 100% to 25%. To limit excessive tap changes for the Company's voltage regulating equipment, a step change in generator output from 100% to 25% shall not cause a tap change of more than one position.

### **2) Non Export Power**

Generating Facilities which do not intend to export power to the Company EPS but which may export power incidentally, must include, if applicable, a reverse power relay with a setting of 10% (export) of the aggregate generation, with a maximum 2.0 seconds time delay, unless an under power protection function is utilized to ensure a minimum import of power at the PCC. This would not apply to equipment that includes a certified non-islanding function. Other methods that might mitigate for this issue include transfer trip, protective functions to detect phase and ground faults on the EPS, reclose blocking of the EPS equipment, or other Company acceptable means.

### **3) Transfer Tripping**

A direct transfer tripping system, if one is required by either the Generator or by the Company, shall use equipment generally accepted for use by the Company and shall, at the option of the Company, use dual channels. Fiber is the accepted method of communications for transfer tripping.

### **4) Communications Channels**

The Company will procure any necessary communications channels between the Generating Facility and the Company's stations and will provide protection from transients and over voltages at all ends of these communication channels. The Generator is responsible for bearing these installation costs as well as the ongoing cost to lease these communication channels. Examples include, but are not limited to, connection to a line using high-speed protection, transfer tripping, (i.e., facilities located in areas with low fault currents, or back up for Generating Facility breaker failure).

### **5) Interconnection Transformers**

In order to provide maximum operating flexibility for the Generating Facility and to minimize possible adverse effects on other Company customer's facilities, a power transformer may be required between the customer's generator and the Company-owned equipment. The Company reserves the right to require connection to its EPS through a dedicated transformer, and to specify the winding connections. This transformer is usually connected in such a manner as to isolate the zero sequence circuit of the customer from the zero sequence circuit of the Company's system. The Interconnection System Impact Study will determine the transformer connection and grounding configuration required. Delta connections on the Company's side windings are typically not allowed. Replacement, at the customer's expense, of the Company transformer to increase insulation levels, change winding connections and lightning arrester ratings to a higher voltage may be required due to the addition of customer generation. In addition to requiring an isolation transformer, the

Company may require current limiting reactors, shunt connected or in series to limit short circuit current levels.

#### **6) Reactive Compensation**

In the instance when the Generator would need to absorb reactive power in order to maintain the voltage within limits, a compensating source of reactive power will be required to be purchased by the Generator for installation on the Company's system at the location the Company has determined to be appropriate. A Volt/VAR operational study may be necessary to determine impacts of reactive power flows on the Company's tap changing and reactive capacity equipment

#### **7) Effective Grounding**

The Company's distribution circuit will remain effectively grounded in any generator configuration to limit unfaulted phase voltages to less than or equal to 125% of nominal phase voltage during unbalanced fault conditions. Generators shall meet the effective grounding criteria of  $X0/X1 < 3$  and  $0 < R0/X1 < 1$ . The Company may specify the specifications and installation of a grounding transformer if the proposed design does not meet the effective grounding criteria.

#### **8) Fault Current**

The Generator shall limit fault duty increases at the PCC to less than 10%. Otherwise, changes to the Company's protection and fuse savings schemes or equipment may be required at the generator's expense.

#### **9) Anti-Islanding Protection**

The Generator shall pass the Company's Risk of Islanding (ROI) screening criteria or prove their anti-islanding protection is reliable through a Time Domain analysis. Otherwise a transfer trip scheme will be required at the generator's expense.

#### **10. Underfrequency Load Shedding**

Existing underfrequency load shedding relay schemes on the Company distribution circuits will be reviewed by the Company to determine whether or not the scheme will operate properly with the Generating Facility installation. Changes required to the load-shedding scheme to provide proper operation will be at the Generator's expense.

#### **11. Automatic Load Transfer (ALT) Schemes**

Existing ALT schemes on the Company distribution and subtransmission circuits will be reviewed by the Company to determine whether or not the scheme will operate properly with the Generating Facility installation. Changes required to the ALT scheme to provide proper operation will be at the Generator's expense.

#### **11. Conservation Voltage Reduction (CVR) Schemes**

Existing CVR schemes on the Company distribution circuits will be reviewed by the Company to determine whether or not the scheme will operate properly with the Generating Facility installation. Changes required to the CVR scheme to provide proper operation will be at the Generator's expense.

## **4.2.2 Synchronous and Induction Facilities**

The following requirements apply to all synchronous and induction generators.

### **1. Interconnection Interrupting Device**

An interconnection interrupting device such as a circuit breaker or contactor shall be installed to isolate the Generating Facility from the Company's EPS. If there is more than one interrupting device, this requirement applies to each one individually. The interconnection interrupting device must be capable of interrupting the current produced when the Generating Facility is connected out of phase.

### **2. Synchronizing Devices**

The Generator shall designate one or more synchronizing devices such as motorized breakers, contactor/breaker combinations, or a fused contactor (if mutually agreeable) to be used to connect the Generating Facility to the Company's system. This synchronizing device could be a device other than the interconnection-interrupting device. The synchronizing device must be capable of interrupting the current produced when the Generating Facility is connected out of phase with the Company's system consistent with IEEE 1547.

All synchronizing will be done by the Generator at the Generating Facility. The Generating Facility shall not be used to energize a de-energized Company circuit.

In-line breakers without synchronizing devices require mechanical interlocks to prevent out-of-phase closing with the Company's EPS.

Synch-check relays are not acceptable synchronizing devices.

### **3. Transformers**

The Company reserves the right to specify the winding connections for the transformer between their voltage and the Generating Facility's voltage ("Step Up Transformer") as well as whether it is to be grounded or ungrounded at the Company's voltage. The use of grounded wye connections, on the Company's side of the interconnection, will not be allowed if the Company source is ungrounded at the PCC. In the event that the transformer winding connection is grounded-wye/ grounded-wye, the Company reserves the right to specify whether the Generator stator is to be grounded or not grounded. All grounded- wye/grounded -wye transformers must be of the five legged core design to prevent overheating and may require separate neutrals. The Generator shall be responsible for procuring equipment with a level of insulation and faults withstand capability compatible with the specified grounding method.

### **4. Ungrounded Transformers**

If the Generating Facility's step up transformer winding connection is ungrounded, on the Company side of the interconnection, the Generating Facility shall be equipped with a zero sequence overvoltage relay fed from the open delta of the three phase VT specified in the Voltage Transformers and Connections section. See "Voltage Transformers and Connections" section.

The requirement for a wye grounded primary connection may necessitate the use of a three-phase interrupting device (breaker) at the primary voltage level. Depending on the system parameters, a current limiting impedance may be required in the neutral of the wye winding, along with an overcurrent ground relay.

### **5. Voltage relays**

Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70Hz.



In addition, voltage relays that are Utility Grade or certified and can be connected directly to the primary voltage without a VT are acceptable to the Company.

#### **6. Protective Relay Hard-Wire Requirement**

Unless otherwise approved by the Company, the Company requires that protective relays be hardwired to the device they are tripping. Further, interposing computer or programmable logic controllers or the like are not permitted in the trip chain between the relay and the device being tripped. Test switches are allowed in the tripping circuit and should be installed to accommodate witness testing..

#### **7. Protective Relay Supply**

Where protective relays are required by this protection policy, their control circuits shall be DC powered from a battery/charger system or a UPS. Solid-state relays shall be self-powered, or DC powered from a battery/charger system or a UPS. If the Generator uses a non-latching interconnection contactor accepted by the Company, AC powered relaying shall be allowed provided the relay and its method of application is fail safe. This means that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay or a separate fail-safe power monitoring relay acceptable to the Company will immediately trip the Generating Facility by opening the coil circuit of the interconnection contactor.

#### **8. Current Transformers (CT)**

CT ratios and accuracy classes shall be chosen such that secondary current is less than 100 amperes and transformation errors are consistent with Company practices.

#### **9. Voltage Transformers and Connections**

The Generating Facility may be required to be equipped with a direct voltage connection or a voltage transformer (VT), connected to the Company side of the interrupting device. For three phase applications, a VT for each phase is required. All three phases must be sensed either by three individual relays or by one relay that contains three elements. If the voltage on any of the three phases is outside the bounds accepted by the Company, the unit shall be tripped. If the Generating Facility's step up transformer is ungrounded at the Company voltage, this VT shall be a single three-phase device or three single-phase devices connected from each phase to ground on the Company's side of the Generating Facility's step up transformer, rated for phase-to-phase voltage. The secondary winding shall be connected in open delta, have a loading resistor to prevent ferroresonance. On one side of the relay/resistor, the connection should be grounded to enhance worker safety.

Utility-grade or certified relays, approved by the Company, which are capable of calculating zero-sequence voltages, and which may be directly connected at the utilization voltage, may be utilized in lieu of grounded-wye to open delta VT's

**The following additional requirements apply to all synchronous generators:**

#### **1. Relay Functions**

Over and under voltage, over and under frequency, phase over current with voltage control, and either zero-sequence over voltage or neutral over current and synchronizing relay functions are required. Additional relay functions may be specified by the Company. Settings will be as specified by the Company after review.

The Generator is required to provide relaying functions to clear both phase and ground short circuit faults on the Company's distribution circuit. The operating characteristics shall be reviewed and approved by Company.

**2. High-Speed Protection**

The Generating Facility may be required to use high-speed protection if time-delayed protection would result in degradation in the existing sensitivity or speed of the protection systems on the Company's lines.

**3. Breaker Failure Protection**

The Generating Facility may be required to be equipped to provide local breaker failure protection which may include direct transfer tripping to the Company's line terminal(s) in order to detect and clear faults within the Generating Facility that cannot be detected by the Company's back-up protection.

**4. Power Factor**

The Generator is required to operate the Generating Facility at a relatively constant power factor during on-and off-peak hours. A power factor control capacity must be provided for each generator and it shall be capable of operating at the interconnection at unity power factor unless the System Impact Study specifies a specific power factor to maintain the EPS voltage at an acceptable level. For units 1 MW and larger and exporting power to the EPS, generators shall be capable of operating at 0.85 (either leading or lagging) power factor. If the Company requests that the Generator operate in a revised power factor range during a system emergency, the Company will compensate the Generator for any additional expense of such revised operation.

**5. Regulators**

The Generator must provide automatic voltage regulators for Facilities larger than 100 kW that are rated to operate at both maximum and minimum voltage levels as prescribed by the MPUC. The Generator must also consider that the EPS may reduce its voltage level an additional 5%, during times of system capacity emergency or during designated test periods.

**The following additional requirements apply to all induction generators:**

**1. Relay Functions**

Over and under voltage and over and under frequency relay functions are required. Over and under frequency relay functions are required for aggregate generators greater than 100 kW. If the Company determines that self-excitation may occur, these relay functions would also be required for generators 100 kW and below. Settings will be as specified by the Company, after review.

**2. Starting**

The induction generator may be connected and brought up to speed as an induction motor if it can be demonstrated that the initial voltage drop (visible flicker) is acceptable and within limits as defined by IEEE 519. When flicker occurs, outside of the IEEE 519 limits, soft starting will be required, such as speed matching to within 1% of synchronous speed or other techniques.

**3. VAR Support**

The VAR requirement for induction generators may be supplied from the Company's EPS. For aggregate generation of up to and including 100 kW, there will be no charge to

the Generator. For aggregate generation greater than 100 kW, the Generator will be charged a one-time “capacitor charge” to cover cost of supplying the reactive current to the Generator plus any ongoing O&M charge for that equipment.

The capacitor charge shall be based on 0.5 kVAR of capacitors per KW of generator nameplate capacity. The cost per kVAR of capacitors shall be Company’s most recent average installed cost per kVAR.

Alternatively, the Company may require the generator to install capacitors to limit the adverse effects of drawing reactive power from the Company’s EPS for excitation of the generator.

#### **4.2.3 Inverter Facilities**

The Company recognizes UL 1741-SB (including IEEE C62.41) for certifying the electrical protective functionality of independent power systems. UL 1741 compliance is established by UL and other Accredited, Nationally Recognized Testing Laboratories. All inverter-based interconnections must also follow the requirements in the “Default New England Bulk System Area Settings Requirement (ISO-NE)” attached as Attachment 7.

It is the Generator's responsibility to submit documentation that the proposed Generating Facility has been certified. Generators should contact the Generating Facility's supplier to determine if it has been listed.

Generating Facilities utilizing photovoltaic technology, the system must be in compliance with IEEE 929 specifications and requirements

Non-certified inverters must have either non-islanding or anti-islanding protection as defined by IEEE 929 and conform to the maximum harmonic limits prescribed in IEEE 519. Non-certified inverters must be protected by certified or utility-grade relays, using settings approved by the Company.

Unless otherwise approved by the Company, protective relays required by these Guidelines must be either certified to UL1741-SB and IEEE C62.41 or be utility-grade.

The Generator must submit to the Company settings for all relay functions or adjustable inverters or controllers protective functions for all the Generating Facilities protective devices/functions that affect the interconnection with the Company at least four weeks prior to the scheduled date for setting the relays/inverters/controllers for review and acceptance by the Company to assure adequate protection for the Company.

#### **Level 1 Facilities**

##### **a. Pre-certified Facilities**

Generating Facilities using qualified (certified to UL 1741-SB and in compliance with IEEE 929) inverter-based facilities or induction machine-based facilities with power ratings of 25 kW or less requesting an interconnection on radial systems where the aggregate Generating Facility capacity on the circuit is less than 15% of circuit annual peak load, qualify for Level 1 interconnection.

##### **b. Non-Pre-certified Facilities**

If Level 1 Generating Facilities are not using qualified inverters, the application shall be reviewed as a Level 2 Generating Facility.

### 4.3 Protection System Testing and Maintenance

The Company shall have the right to witness the commissioning testing (pre-parallel testing) as defined in the IEEE 1547. The Company must be notified ten (10) business days in advance of the testing so that it may, as its option, have company personnel observe the testing, or inspect the installation. The Generator should provide a copy of the test procedure and as-built electrical one line and relay diagram (if applicable) in advance of the test day. An individual qualified in testing protective equipment (professional engineer, factory-certified technician, or licensed electrician with experience in testing protective equipment) must perform commissioning testing in accordance with the manufacturer's recommended test procedure to prove the settings and requirements of this guideline document. At the completion of the test, the Company must receive a copy of the test report data.

Testing typically includes, but is not limited to:

- CT and CT circuit polarity, ratio, insulation, excitation, continuity and burden tests,
- VT and VT circuit polarity, ratio, insulation and continuity tests,
- Relay pick-up and time delay tests,
- Functional breaker trip tests from protective relays,
- Relay in-service test to check for proper phase rotation and magnitudes of applied currents and voltages,
- Breaker closing interlock tests, and
- Paralleling and disconnection operation.
- Anti islanding function, if applicable.
- Non-export function, if applicable.
- Synchronizing Controls, if applicable.
- Proof of inability to energize dead lines.
- Relay, communications and DC failure trip

Prior to final approval by the Company or anytime thereafter, the Company reserves the right to test the Generator relaying and control related to the protection of the Company's system.

The Generator has the full responsibility for the proper periodic maintenance of its Generating Facility equipment and its associated control, protective equipment and interrupting devices.

The Generator is responsible for the periodic maintenance of those relays, interrupting devices, control schemes, and batteries that involve the protection of the Company's system. The test cycle for protective relaying must not be less frequent than once every 60 calendar months, or manufacturer's recommendation, whichever is less. The Generator must provide copies of these test records to the Company. The Company shall have the right to monitor the periodic maintenance performed.

The Company reserves the right to install special test equipment as may be required to monitor the operation of the Generating Facility and its control or for evaluating the quality of power produced by the Generating Facility at a mutually agreed upon location.

Each routine check shall include both a calibration check and an actual trip of the circuit breaker or contactor from the device being tested. Visually setting a calibration dial, index or tap is not considered an adequate calibration check.

Inverters with field adjustable settings for their internal protective elements shall be periodically tested if those internal elements are being used by the Generator to satisfy the requirements of this protection policy.

#### **4.4 Momentary Paralleling of Standby Facilities Requirements**

A closed transition scheme is not allowed on the Company's low voltage network systems or on "spot" network systems.

The closed transition scheme and transition equipment used by the Generator must be reviewed and approved by the Company, prior to operation of the generator. The closed transition scheme must provide voltage, frequency and phase angle matching as appropriate to provide a smooth transition. It must also provide maximum paralleling time protection. Once a generator starts and the generator switch/breaker closes, paralleling the generator and the Company EPS, the line switch/breaker must open within 0.5 seconds (maximum). After the utility power is restored, the scheme must open the generator switch/breaker within 0.5 seconds after the line switch is closed paralleling the generator with the Company EPS.

Protection relays to isolate the Generating Facility for faults in the Company's system are not required if the paralleling operation is automatic and takes place for less than one-half of a second. The maximum paralleling time protection must be provided by a separate device from the equipment used for control and paralleling of the generator and operation of the transfer switch. A discrete timer (60 cycles) is required, powered by the generator battery, to trip an interrupting device, which may be the generator breaker. This requirement will provide fail-safe operation should the control equipment miss-operate.

If the paralleling operation takes place at one half-second or greater, the full complement of relays required for a synchronous generator may be required by the Company.

The Generator, as a minimum, must perform the following functional tests after the transfer equipment has been energized, but before the closed-transition transfer is allowed on the Company's EPS as a normal operation:

- Voltage, frequency, and phase rotation.
- Transfer test (maximum paralleling time must not exceed 0.5 seconds)
- Excessive parallel time test (when the Company source switch fails open, the generator must be shut off and vice versa).
- The Company must be notified ten (10) working days in advance of the testing so that it may, as its option, have its personnel observe the testing, and/or inspect the installation.

Before the approval of closed-transition transfer is granted by the Company, the Generator must provide to the Company a report attesting to the successful completion of the above testing. Upon receipt of the approved test and inspection reports, and verification of the local Electrical Inspector's approval, the Company will issue a written notice of approval of closed-transition transfer to the Generator.

#### **4.5 Protection System Changes**

The Generator must provide the Company with reasonable advance notice of any proposed changes to be made to the protective relay system, relay settings, operating procedures, inverter model or firmware version or equipment that affect the interconnection. The Company will determine if such proposed changes require re-acceptance of the interconnection per the requirements of this protection policy.

In the future, should the Company implement changes to the system to which the Generating Facility is interconnected; the Generator will be responsible at its own expense for identifying and incorporating any necessary changes to its protection system. These changes to the Facilities' protection system are subject to review and approval by the Company.

## ***Attachment 1: VOCABULARY***

In this Guidelines document, the following terms may be used:

**Accredited, Nationally Recognized Testing Laboratory:** A laboratory approved to perform the certification testing required for Generating Facilities.

**ANSI:** American National Standards Institute.

**Applicant:** The person or organization applying to interconnect a Generating Facility to the Electric Power System.

**Application Review:** A review by the Company of the completed Interconnection Application Form to determine if a Feasibility, System Impact and Facility Studies are needed.

**Business Day:** Shall mean Monday through Friday, excluding Federal and State Holidays.

**Calendar Day:** Shall mean any day including Saturday, Sunday, Federal and State Holidays.

**VERSANT POWER:** Versant Power Electric Company.

**Company:** VERSANT POWER.

**Company Facilitator:** The Company's designated single point of contact for customer inquiries related to Facilities. Interested parties can obtain a copy of the Guidelines, interconnection applications and any forms that are needed to request an interconnection from the Company Facilitator.

**Contract Path:** A specific contiguous electrical path from a point of receipt to a point of delivery for which Electric Power System rights have been contracted.

**Delivery Service:** The services the Company may provide to deliver capacity or energy produced by the Generator to a buyer to a delivery point(s), including related ancillary services.

**Disconnect:** To isolate a circuit or equipment from a source of power.

**Disconnect Switch:** A mechanical device used for isolating a circuit or equipment from a source of power.

**Electric Power System (EPS):** All electrical wires, equipment, and other facilities owned or provided by the Company that are normally operated at voltages below 115kV to provide distribution service to customers.

**Facility Study:** The study conducted by the Company for Category 3, 4 & 5 Generating Facilities to determine the scope and costs of the required modifications and upgrades to the Company EPS and/or the Generating Facility to provide the requested interconnection service.

**Fault:** An equipment failure, short circuit, or other condition resulting from abnormally high amounts of current from the power source.

**Feasibility Study:** Shall mean a preliminary evaluation of the system impact and cost of interconnecting the Generating Facility to the Company's Electric Power System.

**FERC:** Federal Energy Regulatory Commission.

**Generator:** The owner/operator of the Generating Facility.

**Generating Facility:** Any device producing electrical energy, i.e. rotating generators, wind, steam turbines, internal combustion engines, hydraulic turbines, solar, fuel cells, etc., including energy storage technologies. A system for the Generation of electricity that is located near the point where the electricity will be used or is in a location that will support the functioning of the electric power distribution grid.

**Good Utility Practice:** Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region.

**Guidelines:** The document prepared by VERSANT POWER to describe the protocols and procedures for interconnecting to the Electric Power System, "Guidelines for Generator Interconnection".

**IEEE:** Institute of Electrical and Electronics Engineers.

**System Impact Study:** An engineering study that evaluates the impact of the proposed interconnection on the safety and reliability of the Company EPS. The study shall identify and detail the system impacts that would result if the Generating Facility were interconnected without project modifications or system modifications, focusing on the Adverse System Impacts identified in the Interconnection Feasibility Study, or to study potential impacts, including but not limited to those identified in the Scoping Meeting.

**Independent System Operator (ISO):** An entity supervising the collective transmission facilities of a power region; the ISO is charged with nondiscriminatory coordination of market transactions, system-wide transmission planning, and network reliability.

**Induction Generator:** An induction machine, when driven above synchronous speed by an external source of mechanical power, used to convert mechanical power to electric power.

**In-Service Date:** The date on which the Generating Facility and system modification (if applicable) are complete and ready for service, even if the Generating Facility is not placed in service on or by that date

**Interconnection:** The physical connection of a Generating Facility to the Electric Power System so that parallel operation can occur.

**Interconnection Agreement (IA):** A written agreement between a Generator and a Company setting forth the mutual undertaking for an interconnection. An interconnection agreement is required to be signed by the Generator and Company before parallel operation of the Generating Facility can commence. Note: the Interconnection Agreement forms are attached to these Guidelines.

**Inverter:** A machine, device or system that changes direct-current power to alternating-current power.

**Islanding:** A situation where electrical power remains in a portion of an electrical power system when the Company's transmission or Electric Power System has ceased providing power for whatever reason (emergency conditions, maintenance, etc.) Islanding may be intentional, such as when certain segregated loads in a Generator's premises are provided power by a Generating Facility after being isolated from the Company Electric Power System after a power failure.

**ISO-NE:** The Independent System Operator established in accordance with the NEPOOL Agreement and applicable FERC approvals, which is responsible for managing the bulk power Generation and transmission systems in New England, or any successor organization to ISO-New England that is approved by FERC.

**Line Section:** That section of the Electric Power System between two sectionalizing devices.

**Low Voltage Secondary Network Grid System:** A Network Secondary Distribution System typically with a nominal voltage of 208Y/120 volts in which the secondaries of distribution transformers are connected to a common network bus through network protectors. The distribution transformers, network protectors and network buses are located in multiple locations that are interconnected to form a grid.

**Metering Point:** The point at which the billing meter is connected (for meters that do not use instrument transformers). For meters that use instrument transformers, the point at which the instrument transformers are connected.

**MPUC:** Maine Public Utility Commission.

**NEPOOL:** New England Power Pool.

**Net Metering:** The process, in accordance with applicable Company tariffs whereby the metered electrical energy production by a Generating Facility is subtracted from the metered Company electrical energy sales to the customer at the Generating Facility.

**Network Protector (power and distribution transformers):** An assembly comprising a circuit breaker and its complete control equipment for automatically disconnecting a transformer from a secondary network in response to predetermined electrical conditions on the primary feeder or transformer, and for connecting a transformer to a secondary network either through manual control or automatic control responsive to predetermined electrical conditions on the feeder and the secondary network.

**Network Secondary Distribution System:** A system of alternating current distribution in which the secondaries of the distribution transformers are connected to a common network for supplying light and power directly to consumer's services.

**Network Service:** Network service consists of two or more primary distribution feeders electrically connected together on the secondary (or low voltage) side to form a single power source for one or more customers.

**Non-Islanding:** Describes the ability of a Generating Facility to avoid unintentional islanding through the operation of its interconnection equipment.

**Point of Common Coupling (PCC):** The point where the Generating Facility's local electric power system connects to the Company's Electric Power System, such as the electric power revenue meter or premises service transformer.

**Point of Delivery:** See Contract Path.

**Point of Interconnection:** The point where the Generating Facility is electrically connected to the Generator's electrical system.

**Point of Receipt:** See Contract Path.

**Pre-certified, Pre-certification:** A specific generating and protective equipment system or systems that have been certified and documented as meeting applicable test requirements and standards relating to safety and reliability by a nationally recognized testing laboratory or, in the absence of such test requirements and standards, by tests and standards approved by the MPUC.

**Qualifying Facility (QF):** A generation facility that has received certification as a Qualifying Facility from FERC in accordance with the Federal Power Act, as amended by the 1978 Public Utilities Regulatory Policies Act ("PURPA"). The standards for a "QF" are defined in Title 18, Code of Federal Regulations, Part 292 Subpart A-General Provisions and Subpart B-Qualifying Cogeneration and Small Power Production Facilities.



**Scoping Meeting:** A scoping meeting is to discuss the interconnection application, review any existing studies relevant to the application, and discuss whether the Company should perform a Feasibility Study or proceed directly to a System Impact Study, or a Facilities Study, or an Interconnection Agreement.

**Spot Network:** A small network typically with a nominal voltage of 480Y/277 volts in which the secondaries of two or more distribution transformers are connected to a common network bus through network protectors usually in a single location.

**Switchgear:** Components for switching, protecting, monitoring and controlling the Electric Power System.

**Synchronous Generator:** A synchronous alternating-current machine which transforms mechanical power into electric power. (A synchronous machine is one in which the average speed of normal operation is exactly proportional to the frequency of the system to which it is connected.)

**Telemetry:** The transmission of Generating Facility data using telecommunications techniques.

**Transfer Switch:** A switch designed so that it will disconnect the load from one power source and reconnect it to another source.

**Utility Grade Relay:** A relay that is constructed to comply with, as a minimum, the most current version of the following standards; ANSI/ IEEE C37.90, ANSI/ IEEE C37.90.1, ANSI/ IEEE C37.90.2, ANSI/ IEEE C37.90.3 and; IEEE C37.98 Seismic Testing (fragility) of Protective and Auxiliary Relays, ANSI C37.2 Electric Power System Device Function Numbers, IEC 255-21-1 Vibration, IEC 255-22-2 Electrostatic Discharge, and IEC 255-5 Insulation (Impulse Voltage Withstand).

## ***Attachment 2: Typical Interconnection One-Line Diagrams***

The one line diagrams on the following pages provide typical characteristics of interconnection designs of various generator types and sizes. They are not meant to be all-inclusive of every project. Additional project specific requirements are possible, depending on the impact to the system and generator design variations.

Typical one line diagrams included are described below:

Type I – Single Phase Inverter-based interconnection, less than 25 kW

Type II – Three Phase interconnection, less than 100 kW

Type III (a) - Three Phase interconnection, less than 5 MW, high side grounded transformer

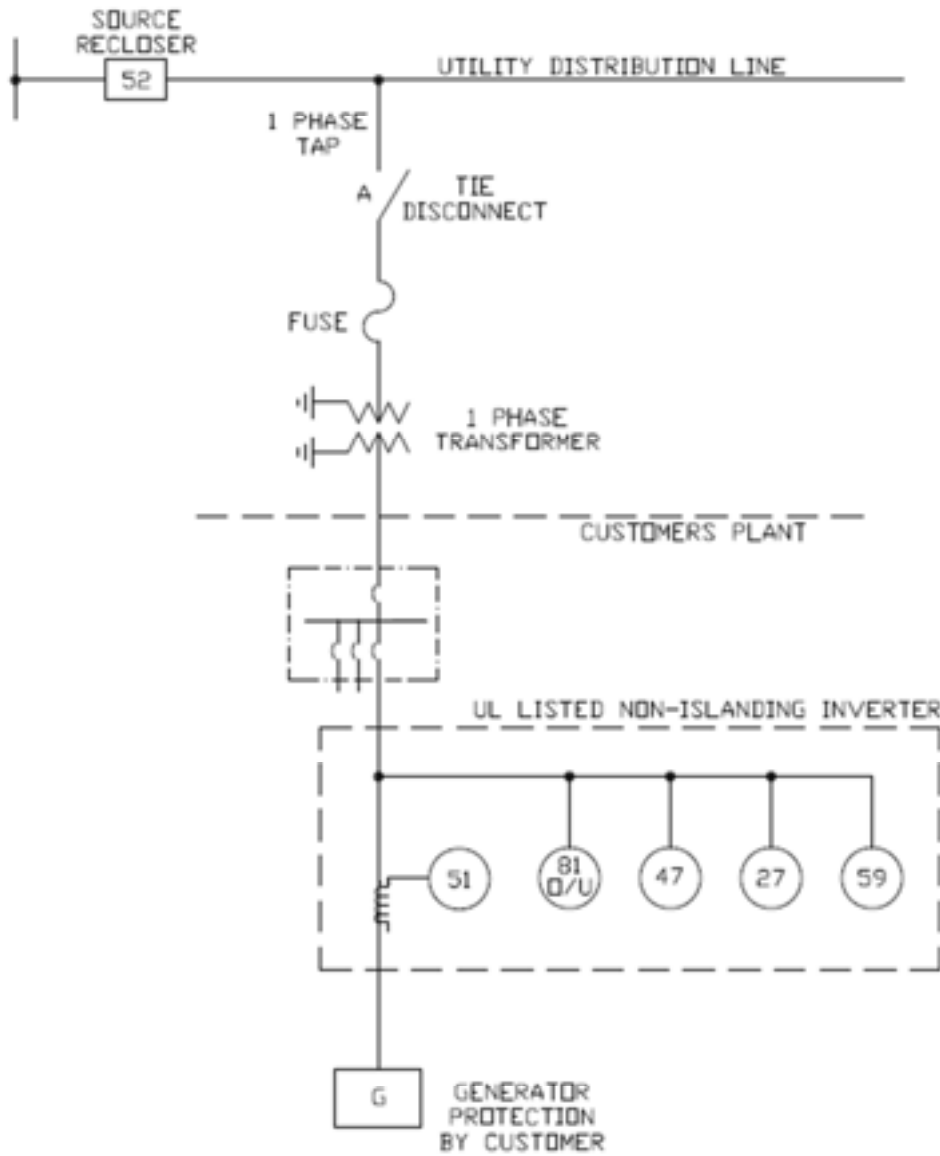
Type III (b) - Three Phase interconnection, less than 5 MW, high side delta transformer

Type IV (a) - Three Phase interconnection, less than 20 MW, high side grounded transformer

Type IV (b) - Three Phase interconnection, less than 20 MW, high side delta transformer

Type V - Three Phase interconnection, greater than 20 MW

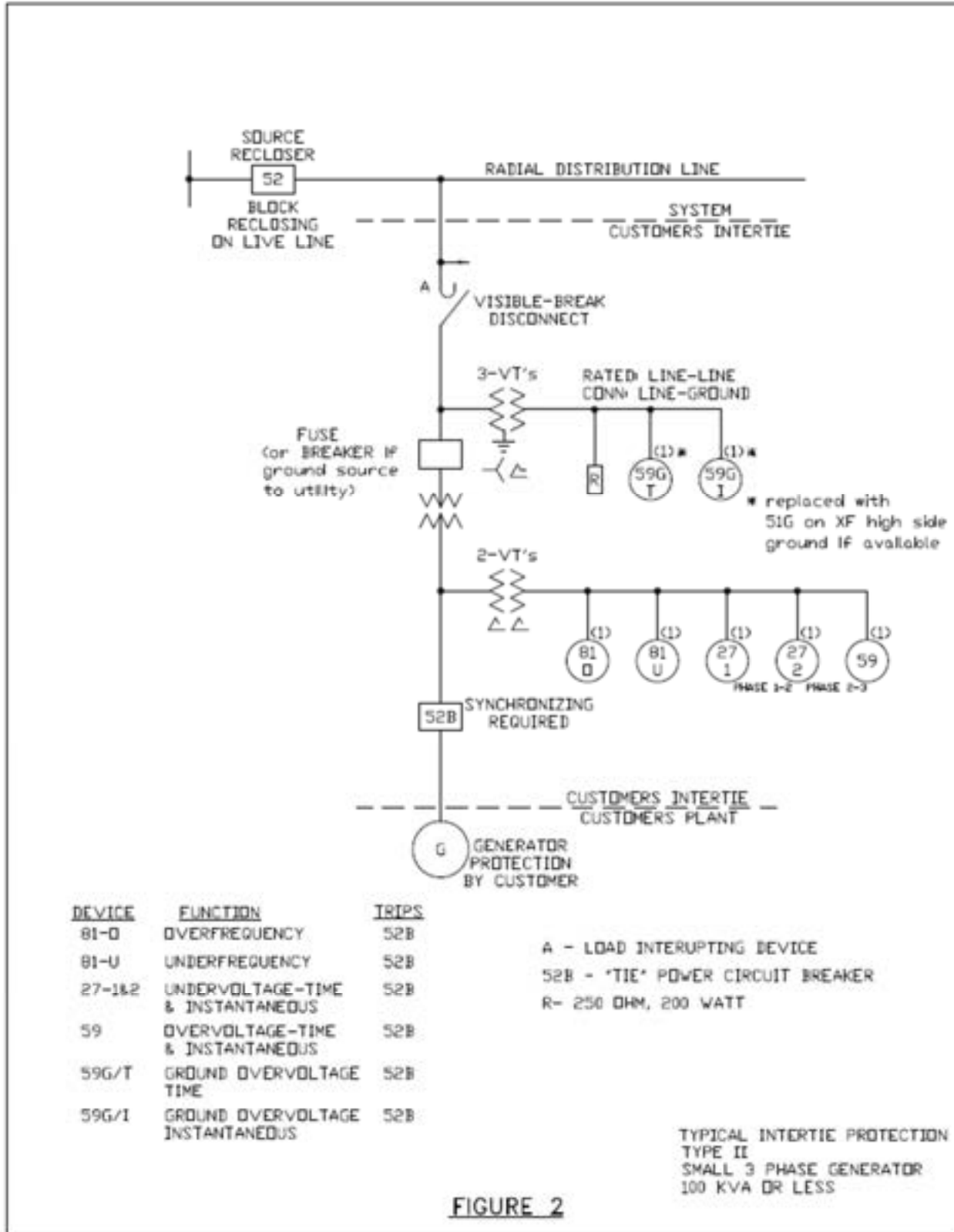
**Attachment 2-1: Typical Interconnection One-Line Diagrams**



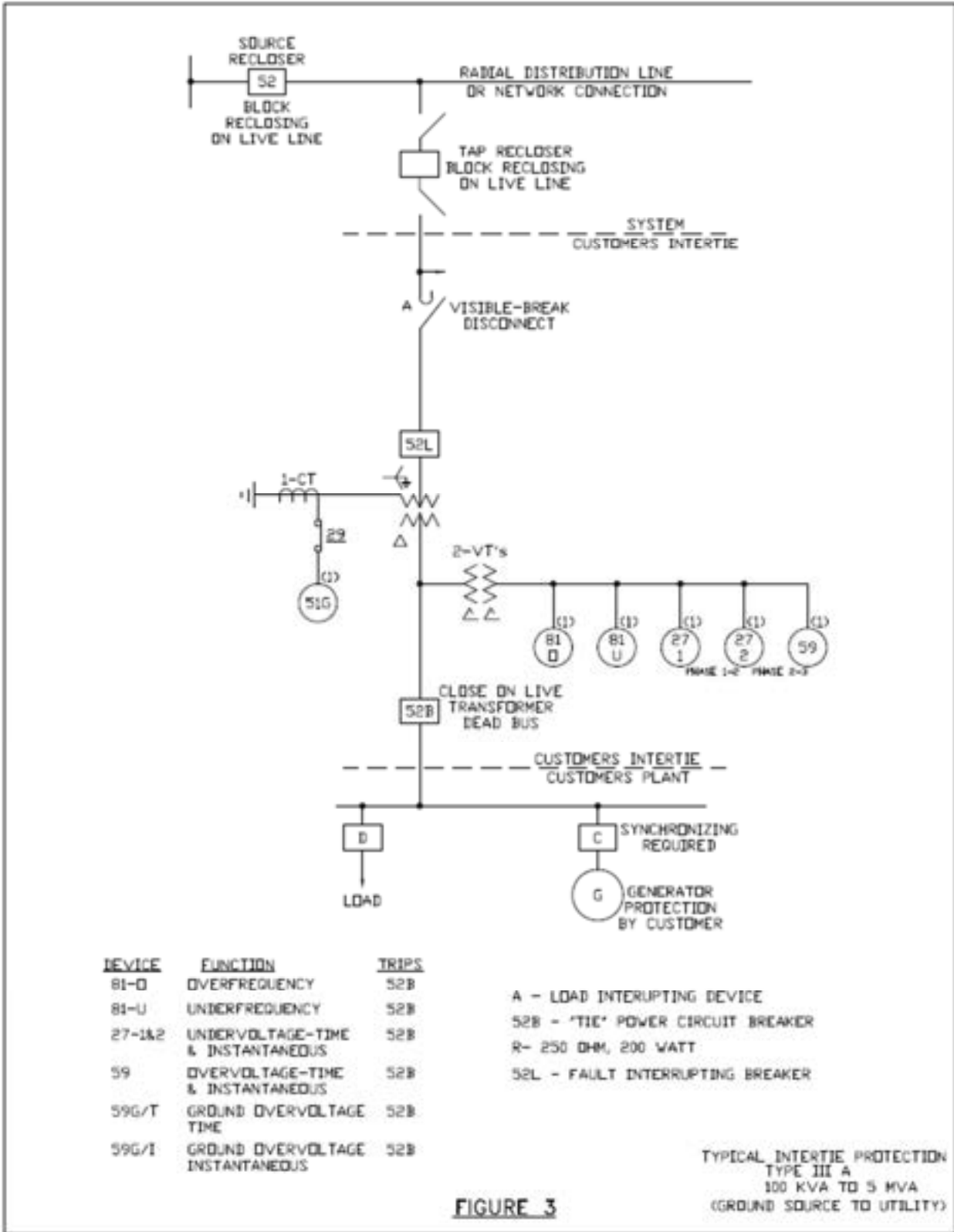
TYPICAL INTERTIE PROTECTION  
 TYPE I  
 SINGLE PHASE INVERTER-  
 BASED INTERCONNECTION  
 25 KW OR LESS

**FIGURE 1**

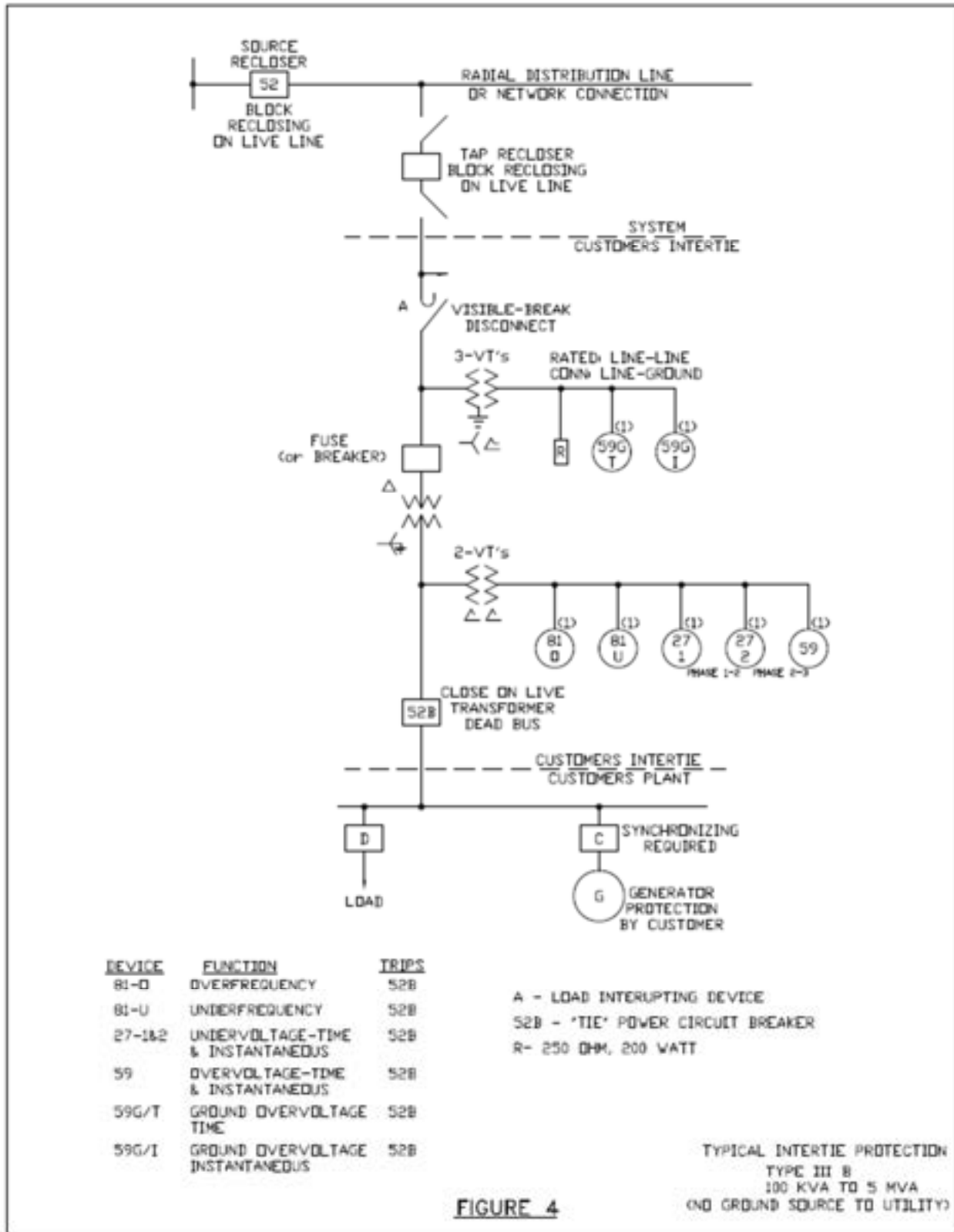
Attachment 2-2: Typical Interconnection One-Line Diagrams



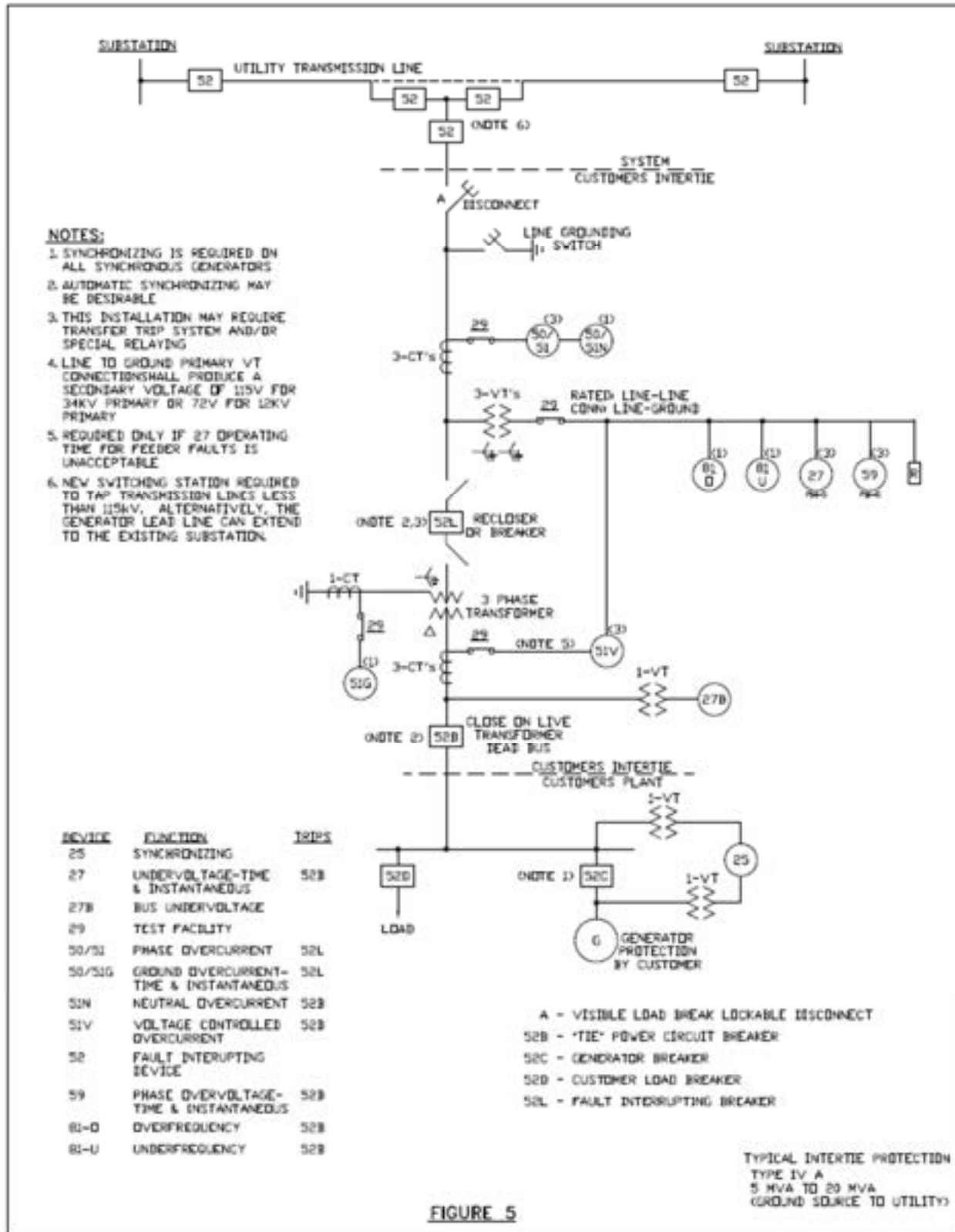
**Attachment 2-3: Typical Interconnection One-Line Diagrams**



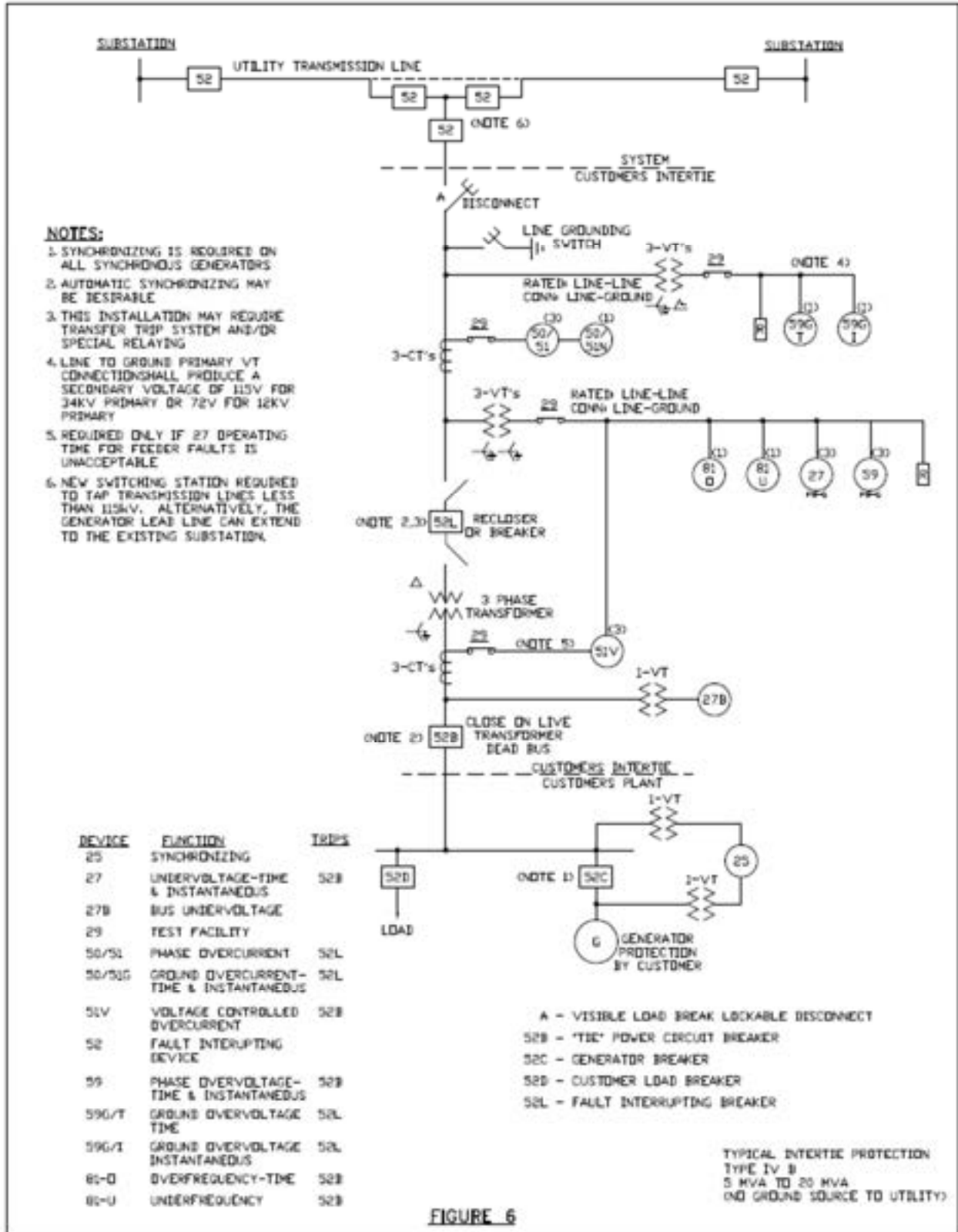
Attachment 2-4: Typical Interconnection One-Line Diagrams



## Attachment 2-5: Typical Interconnection One-Line Diagrams



## Attachment 2-6: Typical Interconnection One-Line Diagrams





## Attachment 2-7: Typical Interconnection One-Line Diagrams

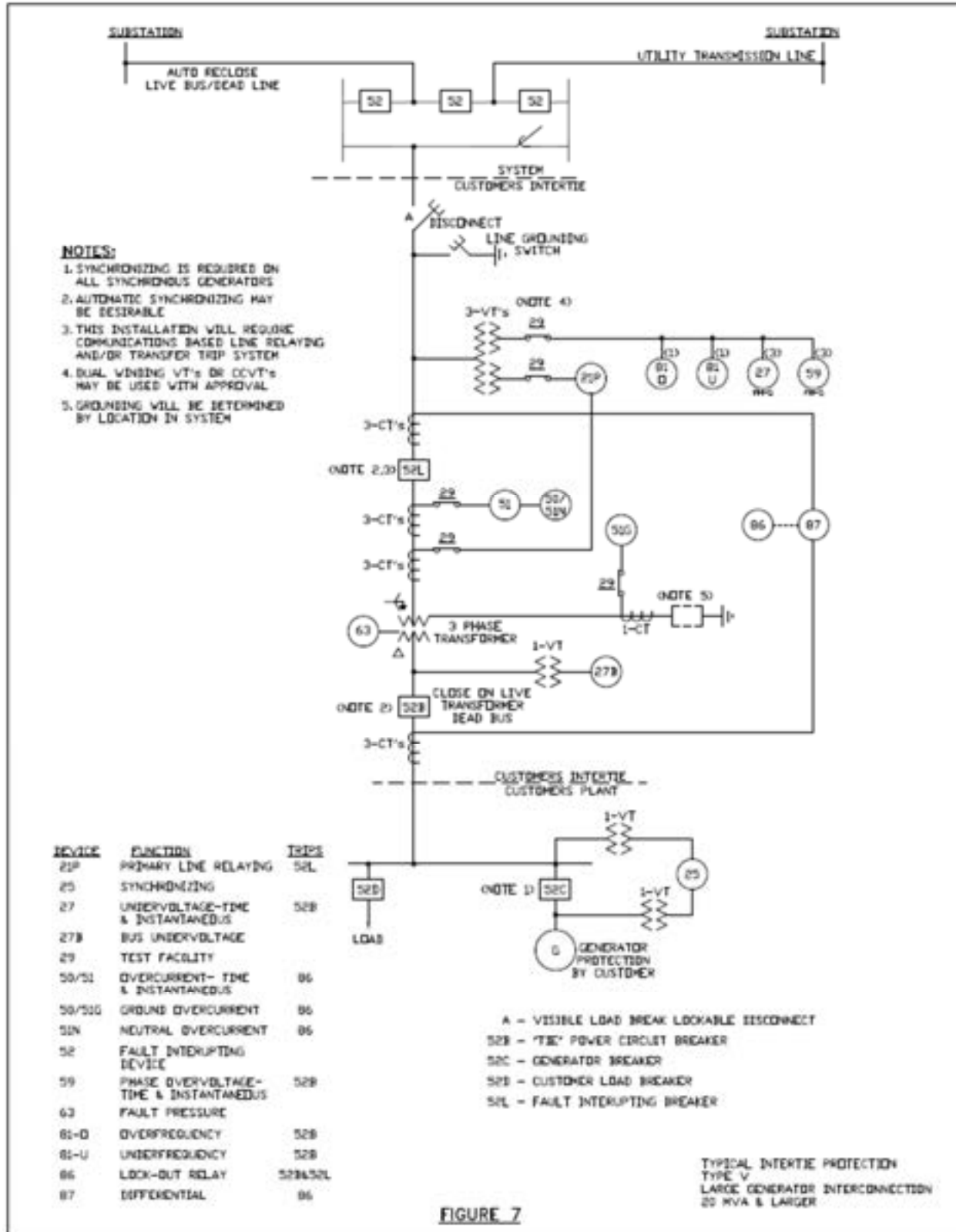


FIGURE 7

### ***Attachment 3: VERSANT POWER Screening Criteria***

The following criteria are used as a guide in conducting the Application Review to help evaluate the proposed generator's impact on the EPS and whether further detailed study is required by the Company to determine impact on EPS.

If the proposed Generating Facility installation meets the following screens, the Company will not charge for any studies for that installation. The Company reserves the right to conduct additional studies if deemed necessary and at no additional cost to the Generator, such as, but not limited to: protection review, aggregate harmonics analysis and power quality review, aggregate power factor review and voltage regulation review. If the studies indicate corrections are required, the Generator shall be responsible for the cost of the material/the cost of the correction.

#### PUBLIC UTILITIES COMMISSION CHAPTER 324

##### **Level 1: Inverter-Based Generators Not Greater 25kW**

Application- Customer submits a completed application indicating which certified interconnection equipment the Customer intends to use. Within five (5) business days, Versant Power acknowledges to the customer receipt of the application and notifies Customer that the application is complete or incomplete. If the application is incomplete, Versant Power shall provide notice to the Customer that the application is incomplete and a written list detailing all information that must be provided to complete the application. The Customer will have ten (10) business days after receipt of the list to submit the listed information, or to request an extension of time to provide such information. Otherwise, the application will be deemed withdrawn. A Customer may pre-execute standard Interconnection Agreement for Level 1 and submit the application.

Applicable Screens- Screens 7A, 7E. For interconnections to distribution networks, proposed facilities must also pass screen 8A.

Time to Process Under Screens- Within ten (10) business days after Versant Power notifies the Applicant that the application is complete, Versant Power shall notify the Applicant whether the Customer-Generator Facility meets all the applicable screens above. If the Customer-Generator Facility fails one or more of the applicable screens, the Customer may request the application continue to be processed under Level 2, 3 or 4.

Approval- If a facility meets all of the applicable screens above, within five (5) days, Versant Power shall send a partially executed Level 1 Interconnection Agreement (or a fully executed Interconnection Agreement where the Customer has pre-executed the Interconnection Agreement).

Execution of Agreement- An Applicant that receives an Interconnection Agreement pursuant to this Section shall execute the agreement and return it to Versant Power no later than thirty (30) business days from receiving the Interconnection Agreement. The applicant shall indicate the anticipated start date for operation of the Customer-Generator Facility, the Applicant shall provide at least five (5) business days notice to Versant Power prior to the initiation of operations.

Default Approval- If Versant Power does not notify a Level 1 Applicant in writing or by email whether the interconnection is approved or denied within twenty (20) business days after the receipt of an application; the interconnection shall be deemed approved. The 20 days shall begin on the date that Versant Power send the written or e-mail notice that the application is received.

Application Fee- The fee for Level 1 Interconnection application is \$100.00.

##### **Level 2: Generators Not Greater than 2MW**

Application- Customer submits a completed application indicating which certified interconnection equipment the Customer intends to use. Within five (5) business days, Versant Power acknowledges to the customer receipt of the application and notifies Customer that the application is complete or incomplete. If the application is incomplete, Versant Power shall provide notice to the Customer that the application is incomplete and a written list detailing all information that must be provided to complete the application. The Customer will have ten (10) business days after receipt of the list to submit the listed information, or to request an extension of time to provide such information. Otherwise, the application will be deemed withdrawn.

Applicable Screens- Screens 7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H. Interconnections to distribution networks must pass applicable screens under Section 8.

Time to Process Under Screens- Within fifteen (15) business days after Versant Power notifies the Applicant that the application is complete, Versant Power shall notify the Applicant whether the Customer-Generator Facility meets all the applicable screens above.

Screens Failure- If the Customer-Generator Facility fails one or more of the applicable screens, then Versant Power shall provide the Customer with detailed information on the reason or reasons for failure. The Customer may request the application continue to be processed under additional review (see below), Level 3 or Level 4. Despite the failure of one or more screens, Versant Power at its sole option may approve the interconnection provided such approval is consistent with safety and reliability.

Approval- If a facility meets all of the applicable screens above or is otherwise approved by Versant Power, within five (5) business days Versant Power shall send a partially executed Interconnection Agreement.

Execution of Agreement- An Applicant that receives an Interconnection Agreement pursuant to this Section shall execute the agreement and return it to Versant Power no later than thirty (30) business days from receiving the Interconnection Agreement. The applicant shall indicate the anticipated start date for operation of the Customer-Generator Facility, the Applicant shall provide at least five (5) business days notice to Versant Power prior to the initiation of operations.

Witness Testing- Versant Power may require witnessing of the commissioning test. If witnessing of the commissioning test is required, this shall be stated in the Interconnection Agreement. The commissioning test shall be scheduled within the time frames in this section or on a date mutually agreeable to the Parties.

Additional Review- If a Customer-Generator Facility has failed to meet one or more of the Level 2 screens, but the initial review indicates that additional review may enable Versant Power to determine that the Customer-Generator Facility can be interconnected consistent with safety, reliability and power quality. In such a case, Versant Power shall offer to perform additional review to determine whether minor modifications to the electric distribution system (e.g., changing meters, fuses or relay settings) would enable the interconnection to be made consistent with safety, reliability and power quality. Versant Power shall provide to the Applicant a non-binding, good faith estimate of the costs of such additional review, and/or such minor modifications. Versant Power shall undertake the additional review or modifications only after the Applicant consents to pay for the review and/or modifications.

Application Fee- The fee for Level 2 interconnection applications is \$100.00 plus \$2.00 per kW of generator capacity.

### **Level 3: Non-Exporting Generators Not Greater than 10 MW**

**Application-** Customer submits a completed application indicating which certified interconnection equipment the Customer intends to use. Within five (5) days, Versant Power acknowledges to the customer receipt of the application and notifies Customer that the application is complete or incomplete. If the application is incomplete, Versant Power shall provide notice to the Customer that the application is incomplete and a written list detailing all information that must be provided to complete the application. The Customer will have ten (10) business days after receipt of the list to submit the listed information, or to request an extension of time to provide such information. Otherwise, the application will be deemed withdrawn.

**Applicable Screens-** All screens under Section 7. Interconnections to distribution networks must pass applicable screens under Section 8. In addition, a Customer-Generator must use reverse power relays or otherwise ensure no export to Versant Power's system.

**Time to Process Under Screens-** Within seventeen (17) business days after Versant Power notifies the Applicant that the application is complete, Versant Power shall notify the Applicant whether the Customer-Generator Facility meets all the applicable screens 10B above.

**Screens Failure-** If the Customer-Generator Facility fails one or more of the applicable screens, then Versant Power shall provide the Customer with detailed information on the reason or reasons for failure. The Customer may request, within five (5) days of receiving notice of failure, the application continue under Level 4, otherwise the application will be deemed denied. Despite the failure of one or more screens, Versant Power at its sole option may approve the interconnection provided such approval is consistent with safety and reliability.

**Approval-** If a facility meets all of the applicable screens above or is otherwise approved by Versant Power, within five (5) business days Versant Power shall send a partially executed Interconnection Agreement.

**Execution of Agreement-** An Applicant that receives an Interconnection Agreement pursuant to this Section shall execute the agreement and return it to Versant Power no later than thirty (30) business days from receiving the Interconnection Agreement. The applicant shall indicate the anticipated start date for operation of the Customer-Generator Facility, the Applicant shall provide at least five (5) business days notice to Versant Power prior to the initiation of operations.

**Witness Testing-** Versant Power may require witnessing of the commissioning test. If witnessing of the commissioning test is required, this shall be stated in the Interconnection Agreement. The commissioning test shall be scheduled within the time frames in this section or on a date mutually agreeable to the Parties.

**Application Fee-** The fee for Level 3 interconnection applications is \$100.00 plus \$3 per kW of generator capacity.

#### **Level 4: All Other Generators Not Subject to FERC Jurisdiction**

Application- Customer-Generator submits standard application form for Level 4 interconnection; or a Customer's interconnection application is transferred from the Level 1, Level 2 or Level 3 procedures for failure to meet all of the requirements of those procedures. An application for a Level 4 interconnection must include documentation of Site Control for the Facility. Acceptable documentation of Site Control shall include copies of executed agreements (which may be redacted for commercially sensitive information) or recorded memoranda thereof.

Acknowledgement of Receipt- Versant Power acknowledges to the interconnecting Customer receipt of the application or the transfer from the simplified or expedited interconnection procedures within five (5) business days, or within five (5) business days from the date of transfer from the simplified or expedited interconnection procedures..

Notification of Completeness- Versant Power evaluates the application and notifies the Customer within ten (10) business days of receipt that the application is complete or incomplete. If the application is incomplete, Versant Power shall provide notice to the Customer that the application is incomplete and a written list detailing all information that must be provided to complete the application. The Customer shall provide the required information to complete the application within ten (10) business days from receipt of the notice, with limited exceptions for system models that the Customer will use Commercially Reasonable Efforts to obtain from the manufacturer. When the application is complete, Versant Power will assign a queue position based on the date of completed application.

Queue Position- The queue position of each Interconnection Request will be used to determine the order of interconnection review in those circumstances where one pending interconnection application could affect the analysis of other pending interconnection applications as well as any cost responsibility for the facilities necessary to accommodate the generator interconnection. Queue Position is based on the date of receipt of a completed application.

If the Customer has failed to meet the timelines described below under Section 12(C), (E), (I), (J), (L), (O), (Q), and (R), or the Customer has not responded to Versant Power's written communications for three (3) consecutive months, Versant Power will notify the Customer of impending loss of Queue Position. Ten (10) business days after this notice, Versant Power will remove the Customer from the Queue if the Customer does not cure the failure to meet such timelines. A Customer is considered inactive if the Customer has ceased communication with Versant Power and is not actively working on interconnection requirements.

Allowed Modifications to Interconnection Requests. The following modifications are allowed to an Interconnection Request without the loss of Queue Position:

- Prior to commencement of the Feasibility Study under Section 12(I), a decrease in the MW (AC) nameplate capacity of the generator
- Prior to commencement of the Impact Study under Section 23(J), the Customer may consolidate the capacity of multiple Interconnection Requests for multiple generators if the following conditions are met: the generators share common ownership and the generators have directly dependent Queue Positions.
- At any time, an In-Kind Modification to the technical parameters associated with the generator's technology, that does not increase the AC export capability of the generator.

At or within fifteen (15) business days after the meeting between the Customer and Versant Power to review results of either the Feasibility Study under Section 12(I) or the Impact Study under Section 12(J), a one-time modification of the interconnection configuration, including an In-Kind Modification, that does not increase the AC export capability of the generator, as a result of information from the interconnection study process (including a decrease in the MW (AC) nameplate capacity of the generator or due to non-interconnection circumstances beyond the Customer's control (including reductions due to permitting requirements or wetland considerations). If electing this modification, the Customer shall provide a modified electrical one-line diagram and site plan within fifteen (15) business days of the meeting to review the study results, and Versant Power shall notify the Customer within ten (10) business days of receipt of the modified electrical one-line diagram and site plan if any additional information is needed. If additional information is needed or document corrections are required, the Customer shall

provide the required information or corrections within ten (10) business days from receipt of Versant Power's notice, with limited exceptions for system models that the Customer will use Commercially Reasonable Efforts to obtain from the manufacturer.

The actual costs to Versant Power for any necessary re-studies as a result of a modification described above shall be paid by the Customer. Such re-studies should be limited to the impacts of the modification and shall be billed to the Customer at cost and not for work previously completed. Versant Power shall use Commercially Reasonable Efforts to limit the scope of such re-studies to what is necessary and in no event shall Versant Power complete any such re-studies outside of the timeframes set forth in Section 12. If a Customer elects to consolidate Facilities pursuant to subparagraph above, then the allowed modifications under the next two subparagraphs shall be allowed with respect to the consolidated Facilities. Termination of any Interconnection Requests consolidated shall be included in the Customer's allowed one-time modification without requiring termination of all consolidated Interconnection Requests, and the Customer may modify the consolidated Interconnection Request(s) at the same time.

**Initial Review and Scoping-** Versant Power will conduct an initial review that includes a scoping meeting/discussion with the Customer (if necessary) within ten (10) business days of determination that an application is complete. At the scoping meeting Versant Power will provide pertinent information such as: the available Fault Current at the proposed location, the existing peak loading on the lines in the general vicinity of the proposed generator, and the configuration of the distribution lines at the proposed point of interconnection. By mutual agreement of the Parties, the feasibility study, system impact study or facilities study may be waived.

**Feasibility Study Estimates-** At the Customer's request and within five (5) business days of the scoping meeting, Versant Power will provide a good faith estimate of the cost and time to undertake a feasibility study that provides a preliminary review of the potential impacts on the distribution system from the proposed interconnection. The feasibility study will provide a preliminary review of short circuit currents, including contribution from the proposed generator, and coordination and potential overloading of distribution circuit protection devices. Provided there are no violations found in the feasibility study, the system impact study (below) may be waived.

**System Impact Study-** Within ten (10) business days of the completion of the feasibility study, Versant Power shall provide an impact study agreement, including the cost estimate for the system impact study. Where the proposed interconnection may affect electric transmission or distribution systems other than that of Versant Power where the interconnection is proposed, Versant Power shall transfer the interconnection application to the relevant RTO or other transmission provider for processing under FERC interconnection rules.

**Certified Generators-** For generators that are certified, no review of the generator's protection is required. While Versant Power may review a certified generator's protection scheme, it cannot charge for such review. Otherwise Versant Power shall conduct a review a generator protective devices for adherence to IEEE Standard 1547.

**Description of System Impact Studies-** Versant Power will include in its compliance tariff a description of the various elements of an impact study it would typically undertake pursuant to this section, including:

1. Load-Flow Study
2. Short-Circuit Study
3. Circuit Protection and Coordination Study
4. Impact on System Operation
5. Stability Study (and the conditions that would justify including this element in the System Impact Study)
6. Voltage-Collapse Study (and the conditions that would justify including this element in the System Impact Study).

Start of System Impact Study- Once the interconnecting Customer executes the system impact study agreement and pays pursuant to the good faith estimate contained therewith, Versant Power will conduct the interconnection system impact study.

Minor System Modifications- If Versant Power determines that electric system modifications required to accommodate the proposed interconnection are Minor System Modifications, the system impact study will identify the scope and cost of the modifications as defined in the study results and no facilities study shall be required.

Substantial System Modification- If Versant Power determines that the system modifications to the Versant Power electric system are substantial, the results of the system impact study will produce an estimate for the modification costs (within +/- 25 %). The detailed costs of, and the electric system modifications necessary to interconnect the Customer's proposed generator will be identified in a facilities study to be completed by Versant Power.

Facilities Study Agreement- A facilities study agreement, with a good faith estimate of the cost of completing the facilities study, shall be submitted to the Customer for the Customer's approval.

Start of Facilities Study- Once the interconnecting Customer executes the facilities study agreement and pays pursuant to the terms thereof, Versant Power will conduct the facilities study.

Notice of Facilities Study Completion- Within five (5) business days of completion of the system impact and/or facilities study, Versant Power shall send the Customer an executable Interconnection Agreement including a quote for any required electric system modifications.

Execution of Interconnection Agreement- Within thirty (30) days of the receipt of an Interconnection Agreement above, the Customer shall execute and return the Interconnection Agreement.

Installation Milestones- The facilities study shall indicate the milestones for completion of the Customer installation of its generator and the Versant Power completion of any electric system modifications, and the milestones from the facilities study (if any) shall be incorporated into the Interconnection Agreement.

Generator Inspection- Versant Power shall inspect the completed generator installation for compliance with requirements and attends any required commissioning tests pursuant to IEEE Standard 1547.

Notification of Approved Operation- Provided any required commissioning tests are satisfactory, Versant Power shall notify the Customer in writing that operation of the generator is approved.

Notification of Changes to Initial Operations Date- The Customer shall notify Versant Power if there is any anticipated change in the proposed date of initial interconnected operations of the generator.

Application and Other Fees- An application fee shall not exceed \$100.00 plus \$4.00 per kW capacity (capped at \$3,000), as well as charges for actual time spent on the interconnection study. Costs for Versant Power facilities necessary to accommodate the Customer's generator interconnection shall be the responsibility of the Customer.

## **Attachment 4: Screening Definitions**

7A-For interconnection of a proposed generator to a radial distribution circuit, the aggregated generation, including the proposed generator on the circuit will not exceed 15% of the line section annual peak load as most recently measured at the substation. A line section is that portion of the distribution system connected to a customer bounded by automatic sectionalizing devices or the end of the distribution line.

7B-The proposed generator, in aggregation with other generation on the distribution circuit, will not contribute more than 10% to the distribution circuit's maximum fault current at the point on the high-voltage (primary) level nearest the proposed point of common coupling.

7C-The proposed generator, in aggregate with other generation on the distribution circuit, will not cause any distribution protective devices and equipment (including but limited to substation breakers, fuse cutouts, and line reclosers), or customer equipment on the system, to exceed 90% of the short circuit interrupting capability; nor is the interconnection proposed for a circuit that already exceeds 90% of the short circuit interrupting capability.

7D-The proposed generator is interconnected to the EPS as shown in the table below:

<u>Primary Distribution Line Config</u>	<u>Interconnect to Primary Distribution Line</u>
Three-Phase, three-wire-----	If a three-phase or single-phase Generator, interconnection must Be phase-to phase
Three-Phase, four-wire-----	If a three-phase (grounded) or Single-phase generator, Interconnection must be line-to-neutral

7E-If the proposed generator is to be interconnected on a single-phase shared secondary, then the aggregate generation capacity on the shared secondary, including the proposed generator, will not exceed 20 kilovolt-amperes (kVA).

7F-If the proposed generator is single-phase and is to be interconnected to a transformer center tap neutral of a 240-volt service, its addition will not create an imbalance between the two sides of the 240-volt service of more than 20% of nameplate rating of the service transformer.

7G-The proposed generator, in aggregate with other generation interconnected to the distribution low-voltage side of the substation transformer feeding the distribution circuit where the generator proposes to interconnect, will not exceed 10MW in an area where there are known or posted transient stability limitations to generating units located in the general electrical vicinity.

7H-The proposed generator's point of common coupling will not be on a transmission line unless the Interconnection Request falls under an authorized exemption under Schedule 23 of the ISO-NE Small Generator Interconnection Procedures..

8A-For interconnection of a proposed generator to a spot network circuit where the generator or aggregate of total generation exceeds 5% of the spot network's maximum load, the generator must utilize a protective scheme that will ensure that its currents flow will not affect the network protective devices, including reverse power relays or a comparable function.

8B-For interconnection of a proposed generator that utilizes inverter-based protective functions to an area network, the generator, in aggregate with other exporting generators interconnected on the load side of network protective devices, will not exceed the lesser of



10% of the minimum annual load on the network or 500kW, For a photovoltaic customer-generator facility without batteries, the 10% minimum shall be determined as a function of the minimum load occurring during an off-peak daylight period.

8C-For interconnection of generators to area networks that do not utilize inverter-based protective functions or inverter-based generators that do not meet the requirements of screen 8B above, the generator must utilize reverse power relays or other protection devices and/or methods that ensure no export of power from the customer's site including any inadvertent export that could adversely affect protective devices on the network circuit.

## ***Attachment 5: Codes and Standards***

Company recommends that the following existing codes and standards (in addition to any successor codes and standards) shall be applied as appropriate:

- ANSI C12.1-2001 “American National Standard for Electric Meter Code for Electricity Metering”
- ANSI C12.11-1993 “Instrument Transformers for Metering 15 kV and Below
- ANSI C84.1-1995 Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
- ANSI/IEEE C37.90-1989 IEEE Standard “Relays and Relay Systems Associated with Electric Power Apparatus”
- ANSI/IEEE C37.90-1-1989 IEEE Standard “Surge Withstand Capability [SWC] Tests for Protective Relays and Relay Systems”
- ANSI/IEEE C57.13-1987 “Requirements for Instrument Transformers”
- ANSI/IEEE Std C37.90.2 (1995), IEEE Standard “Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers”
- ANSI/IEEE C62.41-1991 “Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits”
- ANSI/IEEE Std C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and Less) AC Power Circuits
- ANSI/IEEE Std C62.45-1992 (R2002), IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
- IEC 1000-4-15 Flickermeter- Functional and Design Specifications
- IEC 61400-21 Wind Turbine Generator Systems
- IEC 61400-21 Part 21 Measurement and Assessment of Power Quality Characteristics of Grid Connected Wind Turbines
- IEEE Std p1453 Draft, Recommended Practices for Measurement and Limits of Voltage Flicker on AC Power Systems
- IEEE p 1547.1 Draft Std for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
- IEEE p 1547.2 Draft Application Guide for IEEE Standard 1547 for Interconnecting Distributed Resources with Electric Power Systems
- IEEE p 1547.3 Draft Guide for Monitoring, Information Exchange and Control of DR Interconnection with Electric Power Systems
- IEEE 1547-2003 IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.
- IEEE Std 100-2000, IEEE Standard Dictionary of Electrical and Electronic Terms
- IEEE Std 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE Std 929-2000 IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems
- IEEE Std C37.108-1989 (R2002), IEEE Guide for the Protection of Network Transformers
- IEEE Std C57.12.44-2000, IEEE Standard Requirements for Secondary Network Protectors  
National Electrical Code, NFPA/ANSI 70, 2003
- NEMA MG 1-1998, Motors and Small Resources, Revision 3
- UL (Underwriters Laboratories) Std 1741, November 1, 2002, Inverters, Converters and Charge Controllers for Use in Independent Power Systems

- ANSI/ IEEE C37.90.3
- IEEE C37.98 Seismic Testing (fragility) of Protective and Auxiliary Relays
- ANSI C37.2 Electric Power System Device Function Numbers
- IEC 255-21-1 Vibration
- IEC 255-22-2 Electrostatic Discharge
- IEC 255-5 Insulation (Impulse Voltage Withstand)
- Maine Public Utilities Commission, 65-407, Chapter 324: Small Generator Interconnection Procedures

***Attachment 6: Applications and Agreements***

## Attachment 7:

# Default New England Bulk System Area Settings Requirement

## Purpose

The purpose of this document is to create a required profile (NE Required Utility Profile) of settings from IEEE 1547-2018 (as amended by IEEE-1547a-2020) to ensure robust and predictable performance of DER for events on the bulk power system. This can help maintaining bulk power system reliability with increasing penetration of DER. This document was developed by the MA TSRG in conjunction with ISO-NE and supersedes the “Inverter Source Requirement Document of ISO New England.”

## Applicability

The requirements described in this document shall apply to all DER in applications submitted on or after 04/01/2022.

*Exception: DER projects 100 kW or less will be allowed to submit applications with original ISO-NE source requirement document until 06/01/2022.*

This document states the requirements for all DERs with the following sections:

Section 1-Requirements that apply to ALL DER

Section 2-Requirements that apply for DERs certified as UL1741-SB Grid Support Interactive Inverters

Section 3-Requirements that apply for non-inverter based DERs

The settings presented below are required default settings. Settings for individual facilities may need to be adjusted on a case-by-case basis per the utility requirements.

NOTE: All graphics in this document are used as a visualization tool. In the case of any differences between the graphics and the tables, the tables shall supersede the graphics and any discrepancies should be reported to the interconnecting utility and/or the MA TSRG.

## Section 1-Requirements common to ALL DER

### **All applicable DER:**

- Shall be compliant with the latest revision of IEEE-1547-2018 (as amended by IEEE-1547a-2020).
- Shall comply with the required default settings in this document. Tighter settings are not permitted unless otherwise approved in writing by the interconnecting utility.

### **1.1 Unintentional islanding for ALL DER**

Per IEEE 1547- 2018 (as amended by IEEE-1547a-2020) Clause 8.1.1 “For an unintentional island in which the DER energizes a portion of the Area EPS through the PCC, the DER shall detect the island, cease to energize the Area EPS, and trip within 2 s of the formation of an island.” No requirements in this document shall be construed as an amendment, alteration or rescindment of this requirement.

## 1.2 Frequency trip settings for ALL DER

**Table I: DER response (shall trip) to abnormal frequencies-Category I, Category II and Category III**

Shall Trip Function	Required Settings		Comparison to default IEEE std. 1547-2018 for Category I, II, III		
	Frequency (Hz)	Clearing Time(s)*	Frequency	Clearing Time (s)	Within Ranges of Allowable settings?
OF2	62.0	0.16	Identical	Identical	Yes
OF1	61.2	300.0	Identical	Identical	Yes
UF1	58.5	300.0	Identical	Identical	Yes
UF2	56.5	0.16	Identical	Identical	Yes

\* ALL DER device trip times shall account for relay/inverter processing times as prescribed by IEEE 1547-2018. In no instance may relay and/or inverter settings trip faster than permitted by IEEE 1547-2018.

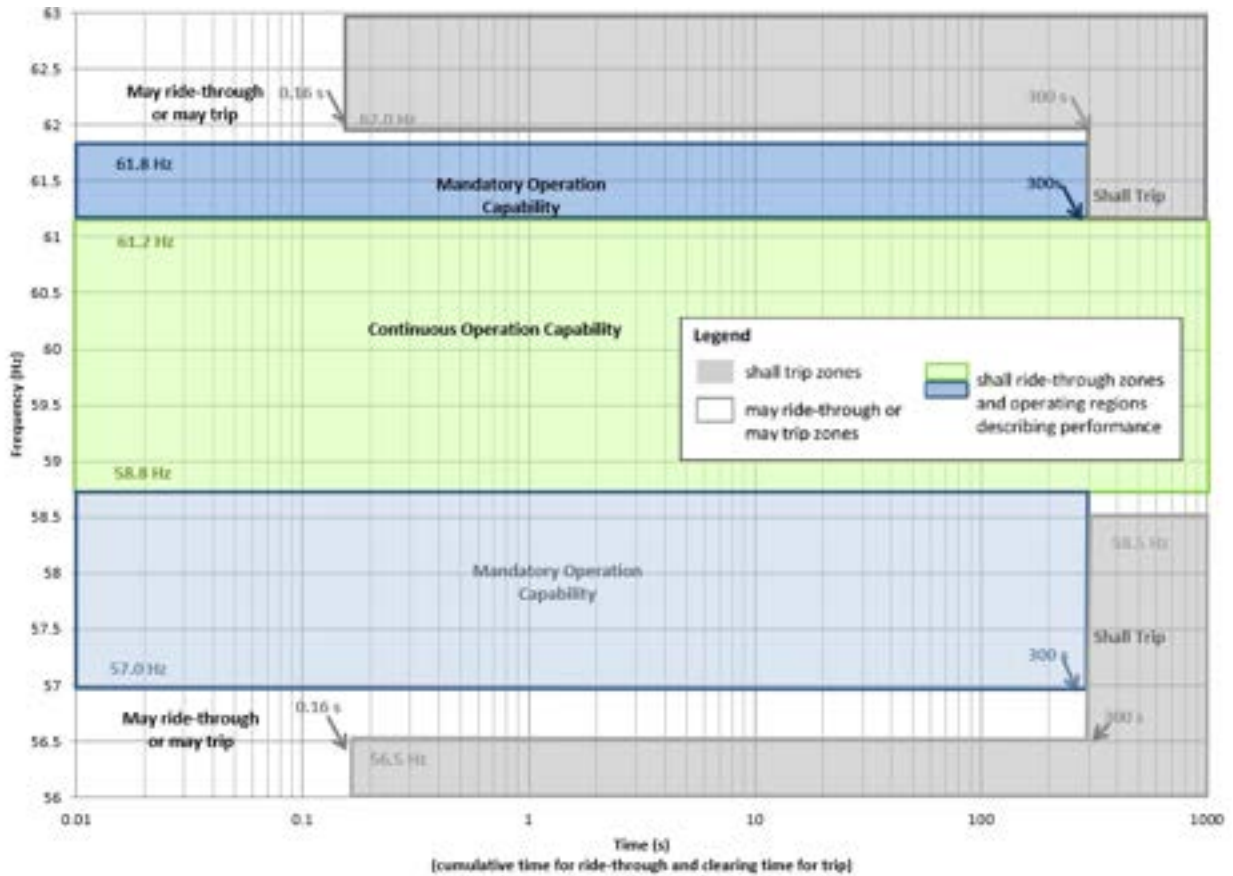
## 1.3 Abnormal frequency performance capability (ride-through) requirements for ALL DER

The DER shall have the ride-through capability per abnormal performance Category I, Category II and Category III as specified in IEEE 1547-2018 Section 6.5.2.1. Except when tripping in accordance with the other requirements of IEEE 1547-2018 and this document, the DER must ride through abnormal frequency conditions as required in IEEE 1547-2018. This is shown in Table II and Figure 1 in this document and the DER shall be capable of the entire ride through region required by the standard if the tripping requirements were to be adjusted or disabled.

NOTE: Per IEEE 1547- 2018, Clause 8.1.1, false detection of an unintentional island that does not actually exist shall not justify non-compliance with ride-through requirements.

**Table II: Frequency ride-through requirements for DER of abnormal operating performance-Category I, Category II, and Category III**

Frequency Range (Hz)	Operating Mode	Comparison to IEEE Std. 1547-2018 for Category I, II, III
$f > 62.0$	No ride-through requirements apply to this range	Identical
$61.2 < f \leq 61.8$	Mandatory Operation	Identical
$58.8 \leq f \leq 61.2$	Continuous Operation	Identical
$57.0 \leq f < 58.8$	Mandatory Operation	Identical
$f < 57.0$	No ride-through requirements apply to this range	Identical



NOTE: All diagrams are for illustrative purposes only and in no way change the requirements from those stated in the tables in this document and IEEE 1547-2018.

**Figure 1: Frequency ride-through and trip requirements for DER of abnormal operating performance—Category I, Category II, and Category III**

### 1.4 Grid Support Default Functions Statuses

The functions below required by IEEE 1547-2018 shall comply with the requirements specified in Table III by default.

**Table III: Grid support utility interactive inverter default functions status**

IEEE 1547-2018 Function	Default Activation State
Constant power factor mode	Unity
Frequency-droop mode (Freq-Watt)	ON <sup>1</sup>
Voltage—reactive power mode (Volt/VAR)	OFF
Active power—reactive power mode (Watt/VAR)	OFF
Constant reactive power mode (Fixed VAR)	OFF
Voltage—active power (Volt-Watt) mode	OFF

<sup>1</sup> Per IEEE 1547-2018, frequency-watt is not allowed to be turned off.

## 1.5 Return to service

The DER shall not connect or return to service following a trip (including any ground fault current sources) until detecting 5 minutes of healthy utility voltage and frequency in accordance with IEEE 1547-2018 Clause 4.10. The DER shall enter service in accordance with IEEE 1547-2018 Clause 4.10.3, part c. The DER active power output shall increase linearly or in a stepwise linear ramp with a default time of 300s, with steps no greater than 20% of the DER rating. The DER may increase slower than specified, or by other means requested by the DER impact study in accordance with 1547-2018.

Default Enter service delay<sup>2</sup>: 300s

Default Enter service duration: 300s (DER shall ramp according to IEEE 1547 for 5 minutes by default).

*Exception 1: is permitted for all small-scale DERs in accordance with IEEE 1547-2018.*

*Exception 2: will be evaluated on a case-by-case basis. DERs 500kVA and larger desiring to use Exception 2 shall send the rationale and request to the utility. An additional 10 Business Days will be required to be added to all tariff milestones to accommodate utility processing/review as well as ISO review. All requests are subject to utility and ISO acceptance.*

## 1.6 Rate of change of frequency (ROCOF) ride-through requirements

The DER shall ride through as stated in IEEE 1547-2018 Section 6.5.2.5 (Category III or Category I as applicable). The UL 1741 SB certification shall be considered sufficient for individual inverter based DER devices meeting ride through requirements for this function.

In addition, no site equipment (e.g. relays, controllers, etc. outside the inverter) is permitted to trip using this function.

The utility reserves the right to verify that protective relay settings & controller settings do not have ROCOF. Note that this will not verify ride through, nor does it imply that verification is required. No device(s) outside the certified inverter are permitted to enable ROCOF.

## 1.7 Voltage phase angle change ride through

All DERs shall meet the minimum voltage phase angle change ride through requirements in IEEE 1547-2018 Clause 6.5.2.6. The UL 1741 SB certification shall be considered sufficient for individual inverter-based DER devices meeting ride through requirements for this function.

In addition, no site equipment (e.g. relays, controllers, etc. outside the inverter) is permitted to trip using this function.

The utility reserves the right to verify that protective relay settings & controller settings do not have Voltage Phase Angle Change trip settings enabled. Note that this will not verify ride through, nor does it imply that verification is required. No device(s) outside the certified inverter are permitted to have Voltage Phase Angle Change trip settings enabled.

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<sup>2</sup> The Enter Service delay is the legacy IEEE 1547-2003 five-minute healthy utility check, in which the inverter measures 5 minutes of healthy utility voltage & frequency prior to the DER coming back online.



## 1.8 General Requirements on Tripping

In accordance with IEEE 1547-2018, DER tripping requirements specified in this document shall take precedence over the abnormal performance capability (ride-through) requirements in this section, subject to the following:

1. Where the prescribed trip duration settings for the respective voltage or frequency magnitude are set at least 160 ms or 1% of the prescribed tripping time, whichever is greater, beyond the prescribed ride-through duration, the DER shall comply with the ride-through requirements specified in this section prior to tripping.
2. In all other cases, the ride-through requirements shall apply until 160 ms or 1% of the prescribed tripping time, whichever is greater, prior to the prescribed tripping time.

## Section 2-Requirements for UL1741 SB certified inverter based DER

All applicable **inverter based DER**:

- Shall be compliant with the latest revision of IEEE 1547-2018
- Shall be certified under UL 1741 SB as a Grid Support Interactive Inverter to IEEE 1547-2018 Category III requirements.
- Shall provide documentation verifying certification, (e.g. UL 1741 SB certification document)
- Shall comply with the required default settings in this document. Tighter settings are not permitted unless otherwise approved in writing by the interconnecting utility.

### 2.1 Voltage trip settings

Applicable DER shall have the voltage trip settings specified in Table IV below.

**Table IV: Certified inverter response (shall trip) to abnormal voltages -Category III**

Shall Trip Function	Required Settings		Comparison to default IEEE Std. 1547-2018 (as amended by IEEE-1547a-2020) for Category III		
	Voltage (p.u. of nominal voltage)	Clearing Time(s)*	Voltage	Clearing Time (s)	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Much shorter (default is 13 s)	Yes
UV1	0.88	3.0	Identical	Much shorter (default is 21 s)	Yes
UV2	0.50	1.1	Identical	Shorter (default is 2 s)	Yes

\* ALL DER device trip times shall account for relay/inverter processing times as prescribed by IEEE 1547-2018. In no instance may relay and/or inverter settings trip faster than permitted by IEEE 1547-2018.

NOTE: No DER is permitted to energize an unintentional island for more than 2 seconds per IEEE 1547-2018 Clause 8.1.1 and Clause 1.1 of this document. The settings above do not change that requirement in any way.

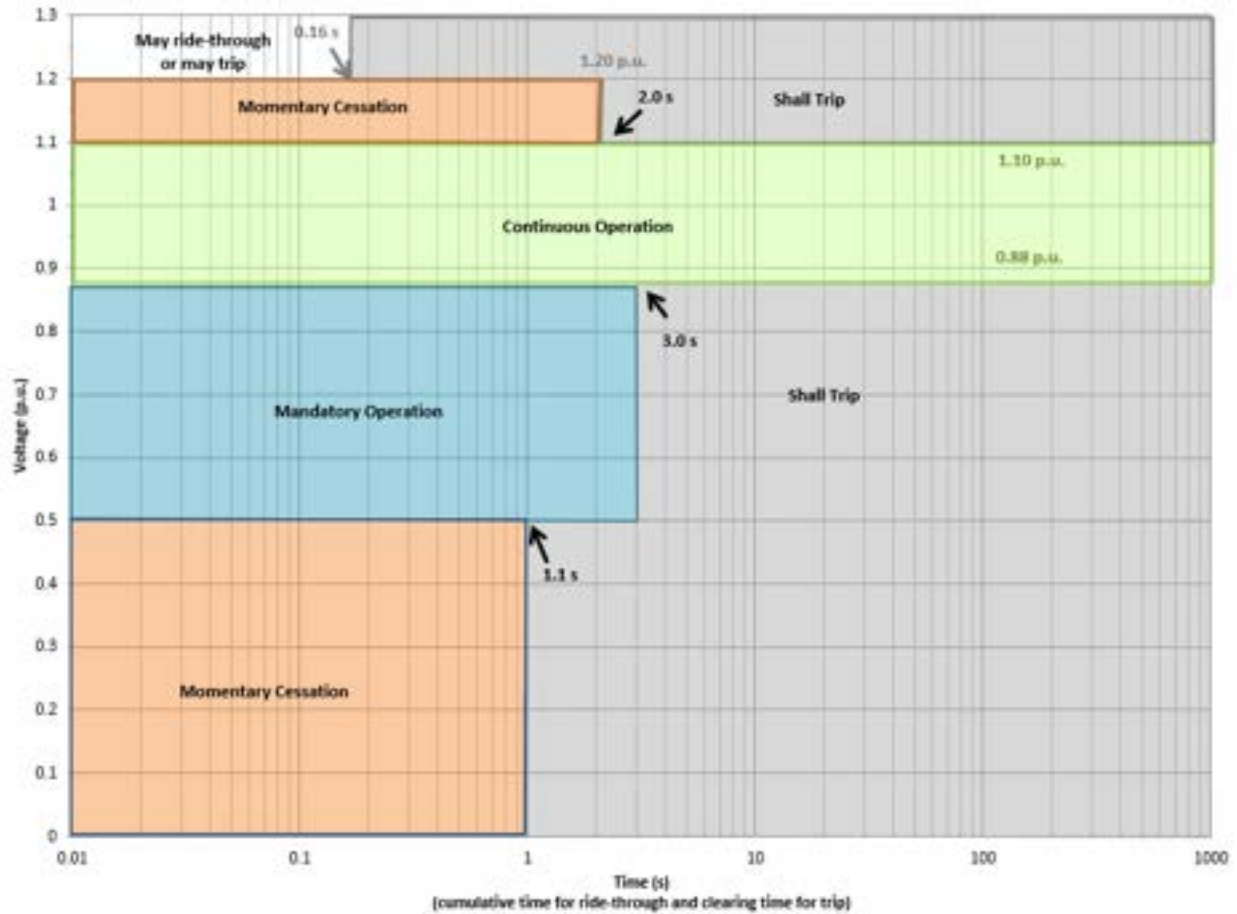
## 2.2 Abnormal voltage performance capability (ride-through) requirements

The DER shall have the ride-through capability per abnormal performance Category III of IEEE Std 1547-2018 Section 6.4.2.1. Except when tripping in accordance with the other requirements of IEEE 1547-2018 and this document, the DER must ride through abnormal voltage conditions as required by IEEE 1547-2018. This is shown in Table V and in Figure 2 in this document, and the DER shall be capable of the entire ride through region required by the standard if the tripping requirements were to be adjusted or disabled.

NOTE: Per IEEE 1547- 2018, Clause 8.1.1, false detection of an unintentional island that does not actually exist shall not justify non-compliance with ride-through requirements.

**Table V: Voltage ride-through requirements for certified inverter abnormal operating performance-Category III**

Voltage Range (p.u.)	Operating Mode/ Response	Comparison to IEEE Std. 1547-2018 for Category III
$V > 1.20$	Cease to Energize	Identical
$1.10 < V \leq 1.20$	Momentary Cessation	Identical
$0.88 \leq V \leq 1.10$	Continuous Operation	Identical
$0.5 \leq V < 0.88$	Mandatory Operation	Identical
$V < 0.50$	Momentary Cessation	Identical



NOTE: All diagrams are for illustrative purposes only and in no way change the requirements from those stated in the tables in this document and IEEE 1547-2018.

**Figure 2: Voltage ride-through and trip requirements for certified Inverter abnormal operating Performance-Category III<sup>3</sup>**

<sup>3</sup> As defined in IEEE 1547:

**Mandatory Operation:** Required continuance of active current and reactive current exchange of DER with utility's distribution system as prescribed, notwithstanding disturbances of the utility's distribution system voltage or frequency having magnitude and duration severity within defined limits.

**Momentary Cessation:** Temporarily cease to energize the utility's distribution system while connected to the utility's distribution system, in response to a disturbance of the applicable voltages or the system frequency, with the capability of immediate restore output of operation when the applicable voltages and the system frequency return to within defined ranges.

**Continuous operation:** Exchange of current between the DER and an EPS within prescribed behavior while connected to the Area EPS and while the applicable voltage and the system frequency is within specified parameters.

## 2.3 Frequency-droop (frequency-power) capability

**Table VI: Parameters of frequency droop (frequency power) operation of certified Inverter based DER-Category III**

Required Default Settings		Comparison to IEEE Std. 1547-2018 Default Settings for Category III	
Parameter	Settings	Settings	Within ranges of allowable settings?
dbOF, dbUF (Hz)	0.036	Identical	Yes
kOF, kUF	0.05	Identical	Yes
T-response (small-signal) (s)	5	Identical	Yes

## Section 3-Settings for non-inverter based DER

All applicable **non-inverter based DER:**

- Shall be compliant with the latest revision of IEEE 1547-2018
- Shall meet IEEE 1547-2018 Category I requirements
- Shall provide documentation verifying compliance to IEEE 1547-2018 Category I (e.g. UL 1741 SB certification document)
- Shall comply with the required default settings in this document. Tighter settings are not permitted unless otherwise approved in writing by the interconnecting utility.

### 3.1 Voltage trip settings

Applicable DER shall have the voltage trip settings specified in Tables VII below.

**Table VII: Non- Inverter Based DER response (shall trip) to abnormal voltages – Category I**

Shall Trip Function	Required Settings		Comparison to IEEE Std. 1547-2018 for Category I		
	Voltage (p.u. of nominal voltage)	Clearing Time(s)*	Voltage	Clearing Time (s)	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Identical	Yes
UV1	0.88	2.0	Higher (default is 0.70 p.u.)	Identical	Yes
UV2	0.50	0.16	Slightly higher (default is 0.45 p.u.)	Identical	Yes

\* ALL DER device trip times shall account for relay/inverter processing times as prescribed by IEEE 1547-2018. In no instance may relay and/or inverter settings trip faster than permitted by IEEE 1547-2018.

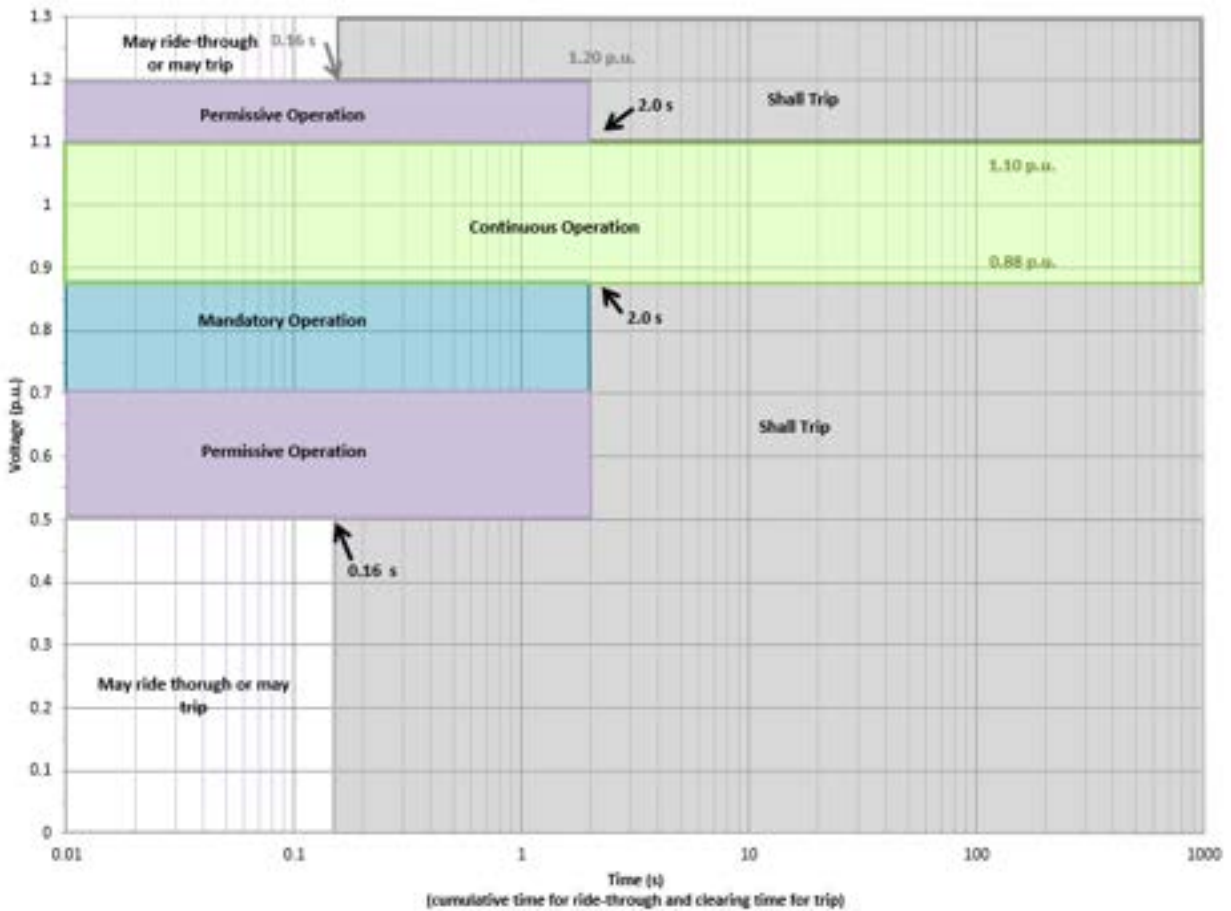
### 3.2 Abnormal voltage performance capability (ride-through) requirements

The non-inverter based DER shall have the ride-through capability per abnormal performance Category I of IEEE Std 1547-2018 Section 6.4.2.1. Except when tripping in accordance with the other requirements of IEEE 1547-2018 and this document, the DER shall ride through abnormal voltage conditions as required in IEEE 1547-2018. This is shown in Table VIII and Figure 3 in this document and the DER shall be capable of the entire ride through region required by the standard if the tripping requirements were to be adjusted or disabled.

NOTE: Per IEEE 1547- 2018, Clause 8.1.1, false detection of an unintentional island that does not actually exist shall not justify non-compliance with ride-through requirements.

**Table VIII: Voltage ride-through and trip requirements for non – inverter based DER abnormal operating performance-Category I**

Voltage Range (p.u.)	Operating Mode/ Response	Comparison to IEEE Std. 1547-2018 for Category I
$V > 1.20$	Cease to Energize	Identical
$1.1 < V \leq 1.20$	Permissive Operation	Identical
$0.88 \leq V \leq 1.10$	Continuous Operation	Identical
$0.70 \leq V < 0.88$	Mandatory Operation	Identical
$0.5 \leq V < 0.70$	Permissive Operation	Identical
$V < 0.50$	Cease to Energize	Identical



NOTE: All diagrams are for illustrative purposes only and in no way change the requirements from those stated in the tables in this document and IEEE 1547-2018.

**Figure 3: Voltage ride-through and trip requirements for non- inverter based DER abnormal operating performance - Category I<sup>4</sup>**

<sup>4</sup>As defined by IEEE 1547-2018: Permissive Operation: Operating mode where the DER performs ride-through either in mandatory operation or in momentary cessation, in response to a disturbance of the applicable voltages or the system frequency.

### 3.3 Frequency-droop (frequency-power) capability

**Table IX: Parameters of frequency droop (frequency power) default settings for non-inverter based DER-Category I**

Required Settings		Comparison to IEEE Std. 1547-2018 for Category I Default Settings	
Parameter	Settings	Settings	Within ranges of allowable settings?
dbOF, dbUF (Hz)	1	Much higher (default is 0.036)	Yes
kOF, kUF	0.05	Identical	Yes
T-response (small-signal) (s)	10	Much higher (default is 5)	Yes



## Attachment 8:

# Developer Requirements & Checklist

<b>Project Number</b>		<b>Developer</b>	
<b>Developer Authorized Signature</b>			
<b>Date</b>			
<b>1. APPLICATION TO SYSTEM IMPACT STUDY (SIS) PHASE</b>			<b>Date Completed</b>
Application Complete			
All required project information received by the T&D Utility. Including PSCAD models, one-line diagrams, site plans, etc.			
Scoping meeting complete.			
System Impact Study Agreement (SISA) Executed.			
System Impact Study Deposit received by Versant Power.			
<b>2. INTERCONNECTION AGREEMENT/DESIGN PHASE</b>			<b>Date Completed</b>
Developer to provide information from transformer manufacturer, including per unit in-rush peak versus time (TCC plot). <b>MUST PROVIDE ACTUAL CALCULATIONS BASED ON SPECIFIC TRANSFORMER.</b>			
Interconnection Agreement fully executed, and project has successfully completed all necessary cluster and impact studies.			
Net Energy Billing (NEB) Agreement fully executed, and project has successfully completed all necessary cluster and impact studies.			
Down payment of system upgrades received by Versant Power.			
Updated one-line and three-line diagrams received by Versant Power.			
Site visits or marked up Google Maps/site plans received to complete design			
<b>3. PRE-CONSTRUCTION PHASE</b>			<b>Date Completed</b>
Changes of ANY type have been submitted to Versant Power via a change notification form, with change review fee and applicable revised documents, and deemed acceptable by Versant Power Project team. <b>ALL EQUIPMENT MUST MATCH AS PLANNED/EXPECTED FROM ORIGINAL SIS/FACILITIES STUDY WITH THE EXCEPTION OF CHANGE REQUESTS PREVIOUSLY APPROVED BY VERSANT POWER.</b>			
Developer agrees to provide regular updates to Versant Power as key developer milestones are known/met. This enables Versant Power to provide an updated schedule, which will be based upon improved information provided by the developer, and allows for a more accurate resource and execution plan.			
Versant Power detailed design complete. Draft construction schedule provided with estimated "COD" ( <i>Commercial Operations Date</i> ) / "ISD" ( <i>In-Service Date</i> ) defined. <b>VERSANT POWER RESERVES THE RIGHT TO CHANGE THE SCHEDULE FOR ANY REASON, INCLUDING, BUT NOT LIMITED TO, SUPPLY CHAIN ISSUES, PANDEMIC-RELATED WORKFORCE IMPACTS, DEVELOPER'S CHANGES TO PROJECT DESIGN, AND/OR FAILURE OF DEVELOPER TO PROVIDE A CONSTRUCTION SCHEDULE. VERSANT POWER'S ABILITY TO PROVIDE A MORE PRECISE CONSTRUCTION SCHEDULE IS DEPENDENT UPON THE DEVELOPER PROVIDING A DETAILED, FINAL PROJECT DESIGN AND CONSTRUCTION SCHEDULE AT THE TIME OF INITIAL DOWNPAYMENT TO VERSANT POWER PURSUANT TO CHAPTER 324 §12(T).</b>			

Project Number	Developer Name	Date Completed
Payment in Full, including study costs, system upgrade estimate, re-study costs (if applicable), change notification costs (if applicable). <b>ALL INVOICES MUST BE PAID PRIOR TO VERSANT POWER SUBMITTING RFP FOR LINE CONSTRUCTION.</b>		
All necessary permits and approvals obtained by both parties; could include but not limited to:		
Dig Safe	DEP Permit	
Town Permit	Landowner Easements	
Receipt of signed POI and Volt/VAR (as applicable) settings provided by Versant Power.		
NEB Customer/Account list received by Versant Power no later than 60 business days prior to COD/ISD.		
4. CONSTRUCTION PHASE		Date Completed
Installation is complete and compliant with all national codes and standards ( <i>IEEE 1547, UL 1741 SA &amp; ISO-NE SRD etc.</i> ).		
Site Inspection Complete. ( <i>Verification of all site data matches planned/ final design requirements, all equipment, and devices both utility and interconnecting customer are properly labeled and tagged</i> )		
<b>Maine Public District Only:</b> Developer awareness of providing a one year forecast of generation to NMISA		
5. COMMISSIONING		Date Completed
Liability insurance requirements have been provided to Versant Power.		
Copy of the FINAL stamped PE Drawings ( <i>As-builts</i> ) with final relay/inverter test report has been provided to the T&D Utility Engineer for review and match firmware studied or have been captured through change notification process and accepted by Versant Power Project team. Witness test procedure template, pages 1 & 2, completed and returned to Versant Power Project Manager. This should be received no less than 10 days prior to the Witness Test. <b>THE PACKAGE RECEIVED MUST MATCH WHAT WAS STUDIED IN THE SIS/FACILITIES STUDY.</b>		
Certificate of Completion received by Versant Power. <b>MUST BE SIGNED BY THE LOCAL ELECTRICAL INSPECTION AUTHORITY.</b>		
Final site inspection by Versant Power complete.		
Developer inverters: commissioned. If utility energization is required for inverter commissioning, this needs to be incorporated into the project schedule and coordinated between developer and Versant Power. Commissioning/Energization Inverter Testing Procedure document required.		
Witness test scheduled, completed, and passed. Test points confirmed, accepted and in accordance with IEEE 1547, ISO-NE SRA and Versant Power requirements. <b>DEVELOPER RELAY TESTER MUST BE PRESENT FOR WITNESS TEST OR WITNESS TEST WILL NOT PROCEED.</b>		
6. PRE-ENERGIZATION COD/ISD		Date Completed
Approval to Operate Letter has been received from Versant Power.		
Operation Requirements provided, reviewed and understood by the interconnecting customer. ( <i>Tripping of POI, Important contacts, who to notify, scheduled outage requirements etc.</i> )		
7. POST-ENERGIZATION		Date Completed
Final invoice for system upgrades have been provided and paid to Versant Power or reimbursements provided to Developer.		