**Informative (*\*Customer to review then remove this page from submitted witness test procedure*)**

Customers seeking to interconnect a distributed generation (“DG”) facility to National Grid’s[[1]](#footnote-1) electric power system (“EPS”) must demonstrate that such facility has met all protective relaying requirements necessary to safely and reliably interconnect to the EPS (“Connection Requirements”). The Company has developed this template solely for the purpose of providing a more standardized format for customer documented witness testing procedures (“Procedures”) to assist the Company’s review of such Procedures and the testing of the DG facility in accordance therewith.

This template contains only a sample of the minimum Connection Requirements for most DG facilities. There may be additional or fewer requirements applicable to any specific facility. It is the customer’s sole obligation to determine the Connection Requirements applicable to the facility and to update this witness testing procedure template as necessary (including, without limitation, to the extent any Connection Requirement contained herein is incomplete, inaccurate, or subsequently amended).

In general, the customer shall write the witness test procedure for each Connection Requirement using the following format:

Descriptive Test Title

<Required Function to be Demonstrated>

<Detailed steps to prove the above statement>

<Witness Testing Sign off>

It is the customer’s responsibility to arrange the tests in this template in an order that is appropriate for the facility being tested. The customer shall identify the devices to be operated for each test and any steps required to move from one test condition to another. If the customer’s witness testing will take place over two or more days, the customer shall indicate in its Procedures the number of days of testing expected, and the tests expected to occur on each day.

To the extent the customer includes Procedures for the testing of functions that are not required to be witnessed by the Company, the Company, in its discretion, may request that such functions be removed from the testing Procedures, or may refrain from witnessing that portion of the Procedure. This shall not be construed to mean that the testing of such functions is not required for the operation of the facility, and it shall be the customer’s obligation to perform the testing of such functions separate from the Company’s witness testing if necessary.

The customer must complete this document in sufficient detail, and provide applicable supporting documentation such as project drawings, to identify the scope of work for each individual test necessary to demonstrate that the Connection Requirements have been met, including without limitation, the Company’s Electric Service Bulletin (ESB) 756 and Institute of Electrical and Electronics Engineers (IEEE) 1547, as the same may be amended from time to time. The Company is relying upon the information provided by the customer herein, and the customer shall ensure that all information provided is true, complete and accurate.

Procedures must be approved by the Company in writing before the customer performs the witness testing for the facility. The Company’s approval of the customer’s Procedures does not mean that the customer is authorized to interconnect to the Company’s EPS.

It is the customer’s sole obligation to ensure that the facility meets all applicable federal, state, and local, codes, rules, regulations, and laws (collectively “Applicable Laws”). The Company’s approval of the Procedures does not mean, by implication or otherwise, that the customer’s facility complies with the Connection Requirements or Applicable Laws.

Once the witness test is completed, it is the customer’s sole obligation to ensure that the facility, including all devices and equipment, is returned to its normal operating state and is secured.

By using this template (in whole or part) the customer acknowledges that he/she understands and agrees with the statements contained in this section.

**Project Information**

**CUSTOMER LEAD CONTACT:**

**Contact Person Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Contact Person Phone: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**TESTING AGENT LEAD CONTACT:**

**Contact Person Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Contact Person Phone: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*<Where multiple testing days are expected, customer shall provide contact information for each day if different than above>*

**System Description:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project Aggregate Alternator / Inverter AC Rating** | *< For sites with multiple gensets, or multiple inverters, list quantity, and individual nameplate rating of each. >* | | | | | |
| **Interconnection Voltage** | *< Enter utility line voltage in kV >* | | | | | |
| **Interconnecting Circuit** | *< Enter National Grid feeder number >* | | | | | |
| **Inverter Make/ Model/ Firmware Version** | *< Enter manufacturer name, specific inverter model, and specific firmware version >* | | | | | |
| **Interconnection Transformer Data <Enter for each interconnection transformer>** | Configuration | kVA | | X/R | | %Z |
| **Grounding Transformer Rating** | kVA | | X/R | | %Z | |
| **Protective Relay(s) Make(s) / Model(s)** | *< Enter manufacturer name and specific model number >* | | | | | |

**Project Site Description:**

**Full site address:**

*< Address Line 1 >*

*< Address Line 2 >*

*< City, State, Zip >*

*<Customer to fill in with brief description of site>*

**Project Drawings Referenced:**

*< Customer to identify relevant drawings and attach them to the witness test procedure document >*

Functional One Line Diagram Drawing Number(s):

AC Elementary/3-Line Drawing Number(s):

DC Elementary Drawing Number(s):

**Test Procedures**

**Safety Brief:**

*<Customer shall prepare and lead (on each day of witness testing) a safety brief addressing all applicable safety policies and procedures.>*

**In case of emergency, dial 911 *<(****or Customer to provide the town emergency numbers if 911 is not active for the town)>*

**Location of nearest hospital:** *<list address for nearest hospital>*

**Procedure:** Effective safety policies and procedures must be in place, and all persons on site must be familiar with and committed to following such safety policies and procedures, in order to prevent accident or injury during the witness test.

*<Customer to write in steps to prove the above statement, which may include, without limitation, the minimum requirements below>*

**Minimum Requirements**

* Designate qualified personnel for testing and lockout/ tagout. For reference see, without limitation, Article 100 in NFPA 70 (the National Electrical Code®, “NEC”) and NFPA 70E.
* Conduct an overall site assessment to ensure that everything at the site is in good condition and working conditions are safe
* Lockout/ tagout (LOTO) procedures: For reference see, without limitation 29 CFR 1910.147 and NFPA 70E.
* Personal Protective Equipment (PPE) and other safety equipment as per Occupational Safety and Health Administration (“OSHA”) requirements and NFPA 70E.
* Verify that the most current procedures, drawings and documents needed for the job are available
* Ensure the proper tools and equipment required for the job are on hand and in good condition
* Procedure for safely disconnecting live circuits: Designated qualified personnel shall only operate the electrical disconnects as per Company approved energization plan.
* Safety specific signage and warnings.

**Customer Parties Acknowledgement of Safety Brief**

|  |
| --- |
|  |

**Print Name(s):**

**Signature(s):**

**Date:**

**National Grid Parties Acknowledgement of Safety Brief**

|  |
| --- |
|  |

**Print Name(s):**

**Signature(s):**

**Date:**

*<Where multiple testing days are expected, customer shall repeat signature lines for each day>*

**Verification and Inspection of Protective Relays:**

The customer shall demonstrate that each relay matches the customer’s one-line diagram. Repeat section for each protective relay.

*<Customer to provide the below table in the witness test procedure for each relay. Relays will then be verified by National Grid personnel during the witness test >*

|  |  |  |
| --- | --- | --- |
| **Customer’s Relay Designation** |  | |
| **Record Model number** |  | |
| **Record Serial number** |  | |
| **Verify operation of display(s), light-emitting diodes (LEDs), target(s)** | **PASS** | **FAIL** |
| **Verify relay settings are in accordance with the setting sheet** | **PASS** | **FAIL** |
| **Record CT/PT ratios** |  | |
| **Verify CT/PT ratios match relay settings** | **PASS** | **FAIL** |
| **Visual and Mechanical Inspection** | **PASS** | **FAIL** |

|  |  |  |  |
| --- | --- | --- | --- |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Verification and Inspection of Fuses**

*<If applicable, customer to identify any pertinent fuses and specify their ratings (manufacturer, model, and ampacity) >*

|  |  |  |  |
| --- | --- | --- | --- |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Relay Protective Function Tests:**

The customer will demonstrate that each protective function operates as expected and confirm that each protective function trips its designated output contact(s). Applicable functions shall be tested on a per-phase basis.

*< Customer to complete the settings, test points, and expected trip times in the table below. The customer shall modify the table (add elements, applicable units, etc.) as applicable to their facility. Protective functions will then be verified by National Grid personnel during the witness test.>*

| **Line-to-Neutral Voltage Base \_\_\_\_\_\_\_ Line-to-Neutral Secondary Nominal Voltage \_\_\_\_\_\_\_\_ PT Ratio\_\_\_\_\_\_\_\_\_ CT Ratio\_\_\_\_\_\_\_\_\_\_** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Protection**  **Functions** | **Pickup**  <Indicate units below as applicable> | **Curve and Time Dial, OR Set Time Delay**  <Indicate units as applicable below> | **Pickup Tests**  <Indicate units below> | **Test Points (overcurrents only)** | **Expected Time Delay**  <Indicate units> | **Measured Time Delay**  <Indicate units> | **Trip Contact Operates**  (PASS/  FAIL) | **National Grid Witness**  **Initials** | **Comments** |
| **51P** |  |  | A | 3X ( A) |  | A: |  |  |  |
| B: |
| C: |
| B | 5X ( A) |  | A |
| B |
| C |
| C | 10X ( A) |  | A |
| B |
| C |
| **51G** |  |  |  | 3X ( A) |  |  |  |  |  |
| 5X ( A) |  |  |
| 10X ( A) |  |  |
| **51 C\*\*(See footnote\*\*)**(Include voltage control value if used) |  |  | A | 3X ( A) |  | A |  |  |  |
| B |
| C |
| B | 5X ( A) |  | A |
| B |
| C |
| C | 10X ( A) |  | A |
| B |
| C |
| **27-1** |  |  | A | - |  | A |  |  |  |
| B | B |
| C | C |
| **27-2** |  |  | A | - |  | A |  |  |  |
| B | B |
| C | C |
| **59-1** |  |  | A | - |  | A |  |  |  |
| B | B |
| C | C |
| **59-2** |  |  | A | - |  | A |  |  |  |
| B | B |
| C | C |
| **81U-1** |  |  |  | - |  |  |  |  |  |
| **81U-2** |  |  |  | - |  |  |  |  |  |
| **81O** |  |  |  | - |  |  |  |  |  |
| **(may include but not limited to 59N, 67, 25, 51V, 50, 50G, 32)** | **The customer shall include any other protective functions that are required by the Company for the interconnection of the customer’s facility to the Company’s electric power system in this table or a table in a similar format.** | | | | | | | | |

\*\*< If using voltage controlled elements such as a 51C, the Customer shall add a step to verify that the overcurrent will not operate unless a voltage sag is present>

**Functional Trip Test:**

Upon completion of relay protective function testing, the customer shall demonstrate that the relay trips on each of the protective functions. This step shall be performed for each relay output contact that trips the interrupting device. Fill in the ‘Trip Contact Operates’ Column above as the trip test for each function is completed to verify the trip string for the relay. Provided the customer demonstrates that each function trips the designated output contact(s) and that the output contact(s) trip the breaker at least once, the Company may elect not to witness the testing of the breaker tripping for all functions.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Block Close Test (IEEE1547 section 4.2.6):**

The customer shall demonstrate that:

* the intertie device cannot be closed back in during the five minute measurement of acceptable voltage and frequency as defined in IEEE1547-2003 section 4.2.6 (voltage shall be within ANSI range B and frequency 59.3Hz and 60.5Hz);
* all forms of closing the customer’s recloser / breaker (electrical / mechanical, manual / automatic) are blocked during the block close. Ensure that the interrupting device cannot be closed manually during this time or if acceptable utility voltage and frequency are not present; and
* the timer restarts if voltage and frequency fall outside of this window.

*<Customer to write in steps to prove the above statements>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Trip on Relay Failure:**

The customer shall simulate a relay alarm and demonstrate that the relay trips the interrupting device upon relay alarm contact assertion. In case of relay device failure with no relay redundancy, the interrupting device is required to trip within 2 seconds. In cases with full relay redundancy, the customer shall have the failure of both relays at the same time trip the interrupting device. Also demonstrate that the interrupting device cannot be closed back in when the relay has failed or is otherwise out of service. The customer shall specify the test switches to be opened for this step.

*<Customer to write in steps to prove the above statements>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Trip on Sudden Loss of Power Supply:**

The customer shall simulate a loss of power supply and demonstrate that the relay trips the interrupting device in a fail-safe manner. In case of relay device failure with no relay redundancy, the interrupting device is required to trip within 2 seconds. In cases with full relay redundancy, the customer shall have the failure of both relays at the same time trip the interrupting device. Also demonstrate that the interrupting device cannot be closed back in when the relay has failed or is otherwise out of service. The customer shall specify the test switches to be opened for this step.

*<Customer to write in steps to prove the above statements>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Trip on Relay Power Supply System Trouble:**

The customer shall simulate DC system trouble and confirm that the monitoring relay trips the interrupting device upon DC voltage falling out of normal operating range. (± \_\_\_%)

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DG Operational Only if Ground Source in Service:**

For DG that requires a grounding transformer to interconnect, the customer shall demonstrate that the inverters or other DG cannot operate if the grounding transformer (if applicable) is not closed in.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**In-Service Check:**

The customer shall demonstrate that the primary current and voltage magnitude readings match between the customer relay and an independent metering source. The voltage and current angles shall also be recorded.

*<Customer to write in steps to prove the above statement, which may include, without limitation, the minimum requirements below>*

* Identify the devices used in the tables below.
* Verify and record currents and voltages of all phases.
* Compare amps/voltages to a National Grid device (or other independent metering source proposed by the customer and accepted by National Grid). This is most often National Grid’s pole-top recloser.
* If possible, provide screenshots of the voltage and current phasors from each device
* \*Indicate whether the magnitudes of the device readings match, if applicable.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Quantity** | **Customer <Relay Make/Model>**  **Voltage**  Mag. Angle | | **<Indicate Device Label for Independent Metering Source> Voltage**  **(if a National Grid device is used, to be completed by National Grid)**  Mag. Angle | | **Match**  **(Y/N)\*** | |
| **VA** |  |  |  |  |  |
| **VB** |  |  |  |  |  |
| **VC** |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Quantity** | **Customer <Relay Make/Model> Current**  Mag. Angle | | **<Indicate Device Label for Independent Metering Source> Current**  **(if a National Grid device is used, to be completed by National Grid)**  Mag. Angle | | **Match**  **(Y/N)\*** |
| **IA** |  |  |  |  |  |
| **IB** |  |  |  |  |  |
| **IC** |  |  |  |  |  |
| **IN** |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Other Tests As Needed:**

It is the customer’s responsibility to write the test procedures to prove to the Company’s satisfaction that the facility has met all protective relaying requirements necessary to safely and reliably interconnect to the Company’s electric power system.

*<Customer to write in any additional witness test procedures necessary to prove all connection requirements have been met>*

Other tests that may be required include, but are not limited to:

* Interlocks to keep a DG off an adjacent feeder (commonly applicable to critical facilities with dual feeders).
* Interlocks to keep the DG disconnected from the utility line while intended to be an islanded facility.
* Synchronism check (25 function) to ensure the facility is synchronized to the grid before connecting.
* For facilities seeking to island their load behind an intertie breaker: When the generator breaker is closed, verify that the intertie breaker cannot close back in without the utility voltage being within the acceptable range in IEEE1547-2003 section 4.2.6 for 5 minutes, and synch check being performed. If the intertie breaker is already closed, test that the generator breaker cannot close if 5 minutes or more of acceptable utility haven’t been detected (note that the generator breaker may close if the intertie breaker is open for purposeful islanding).

**As Left Settings:**

Retrieve as-left settings from the relay and provide to National Grid personnel.

|  |  |  |  |
| --- | --- | --- | --- |
| **YES** |  | **NO** |  |
| *Initials:* |  | *Filename:* |  |
| *Comments* |  | | |

|  |  |
| --- | --- |
| Test Performed By:  Test Witnessed By:  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Customer representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  National Grid representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Direct Transfer Trip (“DTT”) Tests (applicable only to facilities with DTT):**

If the customer has been required to install DTT, perform the following DTT tests. The customer shall identify all test switches to be used to perform the following DTT tests. At minimum the customer shall state the relays to be tested, the test switches to be operated and the expected results including output contacts to be asserted.

For facilities where DTT is required, the DTT shall be tested and operational before the in-service current checks are performed.

**DTT Communication Test**

The customer shall demonstrate that there is communication between the signal transmitter and receiver. National Grid personnel to record signal strengths between the two devices.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Trip Test**

The customer shall demonstrate that the DTT interrupting device trips upon receiving a trip signal. The customer shall also demonstrate that trips on the relay open the interrupting device.

*<Customer to write in steps to prove the above statements>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Block Close Test**

The customer shall demonstrate that the DTT interrupting device cannot be closed when DTT trip is asserted.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Loss of Communication Trip Test**

The customer shall demonstrate that the DTT interrupting device trips upon loss of communication.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Block Close Test – Loss of Communication**

The customer shall demonstrate that the DTT interrupting device cannot be closed when DTT communication is not available.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Loss of Relay Power Trip Test**

The customer shall demonstrate that the DTT interrupting device trips upon relay failure and poor DC control power.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Loss of Relay Power Block Close Test**

The customer shall demonstrate that the DTT interrupting device cannot be closed back in if the relay is out of service.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT Status Bit Test**

The customer shall verify that the status breaker bits have been transmitted and received.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**DTT As Left Settings**

Retrieve as-left settings from the DTT relay(s) and provide to National Grid personnel.

|  |  |  |  |
| --- | --- | --- | --- |
| **YES** |  | **NO** |  |
| *Initials:* |  | *Filename:* |  |
| *Comments* |  | | |

|  |  |
| --- | --- |
| Test Performed By:  Test Witnessed By:  Date: \_\_\_\_\_\_\_\_ | Customer representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  National Grid representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Record and Verify that Inverter/Generator Controller Under/Over Voltage and Frequency Settings Match the Approved Settings:**

*<The customer must complete the proposed settings prior to witness testing. As-left settings for each inverter shall be recorded on the day of testing either in the table below or, in cases where the inverter does not display settings, a factory test sheet can be provided and attached. Record or provide the serial number of each inverter/generator.>*

| **Functions** | **Proposed Pickup <Indicate Units>** | **Proposed Time Delay <Indicate Units>** | **As-Left Pickup <Indicate Units>** | **As-Left Time Delay**  **<Indicate Units>** |
| --- | --- | --- | --- | --- |
| **27-1** |  |  |  |  |
| **27-2** |  |  |  |  |
| **59-1** |  |  |  |  |
| **59-2** |  |  |  |  |
| **81U-1** |  |  |  |  |
| **81U-2** |  |  |  |  |
| **81O** |  |  |  |  |
| **59-I (Self-Protective Overvoltage)** |  |  |  |  |
| **Firmware Version** |  | | | |
| **Power Factor Setting** |  | | | |
| **Inverter Make/Model/Serial Number** |  | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Two Second Shutdown Test:**

The customer shall demonstrate that when upstream breaker / disconnect switch is open the inverter/generator shuts down within 2 seconds.

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**Inverter/Generator Five Minute Reconnect Test (IEEE1547-2003 4.2.6):**

The customer shall demonstrate that when the breaker / disconnect switch is closed back in that the inverter/generator does not start for a minimum of 5 minutes. (For UL1741 certified generation only).

*<Customer to write in steps to prove the above statement>*

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

|  |  |
| --- | --- |
| Test Performed By:  Test Witnessed By:  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_ | Customer representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  National Grid representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

***<If the customer’s witness testing will take place over two or more days, the customer shall indicate in its testing procedures the number of days of testing expected, and the tests expected to occur on each day.>***

**New England Remote Terminal Unit (RTU) Test (applicable only to facilities required to install and own an RTU in MA/RI)**

*<If the customer has been required to install an RTU, the customer will write the test procedures necessary to demonstrate that the RTU requirements for the facility have been met, which will include, without limitation, the tests listed below. At a minimum, the customer shall identify all test switches and devices to be used to perform the RTU test procedures and the expected results, including output contacts to be asserted*.>

< *Project information, contacts, and safety brief shall be repeated below if the RTU testing is to take place separately from the relay witness testing>*

**CUSTOMER LEAD CONTACT FOR RTU TEST:**

**Contact Person Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Contact Person Phone: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |
| --- | --- |
| **Interconnection Voltage** | *< Enter utility line voltage in kV >* |
| **Interconnecting Circuit** | *< Enter National Grid feeder number >* |

**Router IP address information, as applicable:**

Router IP address: <xxx>

CE IPv4 address: <xx>

PE IPv4 address: <xx.xxx.xxx.xxx/xx>

DLCI: <xxx>

**Documentation Required for RTU Tests:**

The customer shall include the following documentation with the RTU Witness test procedure:

1. National Grid Accepted RTU Points List
2. DG Facility One-Line Diagram

**Communication Tests**

The customer shall demonstrate that there is communication between the RTU and the Company’s Energy Management System (EMS).

*<Customer to write in steps to prove the above statement, which will include, without limitation, the minimum requirements below>*

National Grid EMS personnel ping the <indicate router make/model as required by the National Grid system impact study> router at the IP Address above and verify that the communication is successful.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

National Grid EMS personnel poll the facility’s RTU from the Company’s EMS system and verify that polling responses are received from the RTU.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

**RTU Status and Control Point Tests**

The customer shall demonstrate that each utility-required status and control point functions as expected.

*<The below steps shall be repeated for each breaker control or status point identified in the Accepted RTU Points List>*

1. Digital Input Points (Status):

National Grid EMS personnel verify with the on-site National Grid test personnel that the status indications of the **status** points listed in the Accepted RTU Points List coincide with the actual present status of each point.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

1. Analog Input Points (Status):

National Grid EMS personnel verify with the on-site National Grid test personnel that the **analog** indications of the analog points listed in the Accepted RTU Points List coincide with the actual present analog value of each point and that the scaling is appropriate.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

1. Digital Output Points (Controls):
2. National Grid EMS personnel send a Trip/Block Close command (<Indicate Control Point Number>)
3. Onsite Verification: The customer shall demonstrate that the Trip/Block Close command opened the desired breaker per the Accepted RTU Points List.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

1. Onsite Verification: The customer shall demonstrate that the Trip/Block Close command blocks (prevents) closing of the desired breaker per the Accepted RTU Points List.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

1. National Grid EMS Personnel verify breaker status is OPEN.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

1. National Grid EMS personnel send a Reset/Permit Close command (<Indicate Control Point Number>)
2. Onsite Verification: The customer shall demonstrate that the Reset/Permit command permits (allows) closing of desired breaker per the Accepted RTU Points List.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

b) National Grid EMS Personnel verify breaker status changes to CLOSED after the breaker is manually closed onsite.

|  |  |  |  |
| --- | --- | --- | --- |
| **PASS** |  | **FAIL** |  |
| *Initials:* |  | *Time:* |  |
| *Comments* |  | | |

*<The customer shall include any additional test procedures necessary to demonstrate that the RTU requirements for the DG facility have been met.>*

|  |  |
| --- | --- |
| Test Performed By:  Test Witnessed By:  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_ | Customer representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  National Grid representative:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Notes and Comments:**

<*Customer to complete the RTU points list template below, and shall include any modifications to the template applicable to their facility (“RTU Points List”). The customer shall submit a completed list to the Company for review and acceptance prior to testing. The customer’s RTU test procedures will be updated and modified based on the RTU points list previously accepted by the Company (“Accepted RTU Points List”), provided, however, that the Company’s acceptance of the customer’s point list shall not be deemed to be verification of the completeness or accuracy thereof, or to be a determination that the RTU requirements have been met).>*

**<** **RTU Points List Template– customer to remove and replace with Accepted RTU Points List>**

|  |  |  |  |
| --- | --- | --- | --- |
| **Point Number** | **Digital Input Point (Status)** | **State 0** | **State 1** |
| <This column shall be filled in by the customer> | Gen Breaker 1 Status | OPEN | CLOSED |
|  | Gen Breaker 2 Status | OPEN | CLOSED |
|  | Gen Breaker 3 Status | OPEN | CLOSED |
|  |  |  |  |
|  | **Digital Output Point (Control)** | **TRIP** | **CLOSE** |
|  | Gen Breaker 1 Trip & Block Close | TRIP | CLOSE |
|  | Gen Breaker 1 Permit Close | TRIP | CLOSE |
|  | Gen Breaker 2 Trip & Block Close | TRIP | CLOSE |
|  | Gen Breaker 2 Permit Close | TRIP | CLOSE |
|  | Gen Breaker 3 Trip & Block Close | TRIP | CLOSE |
|  | Gen Breaker 3 Permit Close | TRIP | CLOSE |
|  |  |  |  |
|  | **Analog Input Point (Analog)** | **UNITS** |  |
|  | Gen Bkr 1 - A Phase Line Current | AMPERES |  |
|  | Gen Bkr 1 - B Phase Line Current | AMPERES |  |
|  | Gen Bkr 1 - C Phase Line Current | AMPERES |  |
|  | Gen Bkr 1 - Neutral Current | AMPERES |  |
|  | Gen Bkr 1 - A to B Voltage | KV |  |
|  | Gen Bkr 1 - B to C Voltage | KV |  |
|  | Gen Bkr 1 - C to A Voltage | KV |  |
|  | Gen Bkr 1 - 3 Phase MW Output | MW |  |
|  | Gen Bkr 1 - 3 Phase MVAR Output | MVAR |  |
|  | Gen Bkr 1 - Power Factor | PERCENT |  |
|  | Gen Bkr 1 - 3 Phase MVA | MVA |  |
|  | Gen Bkr 2 - A Phase Line Current | AMPERES |  |
|  | Gen Bkr 2 - B Phase Line Current | AMPERES |  |
|  | Gen Bkr 2 - C Phase Line Current | AMPERES |  |
|  | Gen Bkr 2 - Neutral Current | AMPERES |  |
|  | Gen Bkr 2 - 3 Phase MW Output | MW |  |
|  | Gen Bkr 2 - 3 Phase MVAR Output | MVAR |  |
|  | Gen Bkr 2 - Power Factor | PERCENT |  |
|  | Gen Bkr 2 - 3 Phase MVA | MVA |  |

**ONE-LINE**

**DIAGRAM**

**AND**

**OTHER REQUIRED DRAWINGS**

1. National Grid or the Company shall mean only Massachusetts Electric Company, The Narragansett Electric Company, or Niagara Mohawk Power Corporation, each d/b/a National Grid, depending on the location of the customer’s facility. [↑](#footnote-ref-1)