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FUNCTIONALLY EQUIVALENT NON–IMPORT CONFIGURATION TESTING REQUIREMENTS

094682

Asset Type:	Electric Transmission and Distribution	**Function:**	Design, Estimating, and Planning
Issued by:	Daniel Jantz (DWJ7)	**Date:**	03/25/2022

Rev. #00: This new document replaces PG&E Document TD–2306B–003, Rev. #01. For a description of the changes, see Page 6.

Purpose and Scope

This document outlines the scope, application, and specific steps for the testing procedure to demonstrate that the energy storage device paired with a NEM eligible generator cannot charge from the grid via a method other than utilizing a physical non–import relay. Customers applying to interconnect their energy storage device paired with a Generating Facility on PG&E's electric distribution circuits and stating the use of a functionally equivalent non–import configuration instead of a physical non–import relay for the energy storage device.

Testing Procedures

1. The purpose of this test is to demonstrate that the control system, which includes the Energy Management System (EMS), the inverter, and/or other related devices, under evaluation will not allow the energy storage device paired with an eligible NEM generating facility to charge from the grid. The test shall demonstrate that the control system will stop energy flow to the energy storage device when the electrical power flowing towards the grid, as measured at the designated Measurement Control Point (MCP), is at or below a value specified by the manufacturer. The underpinning logic of the test is that if power is flowing towards the grid, then that power will not be flowing toward the battery for charging.
2. Power is allowed to flow from the grid to the energy storage device or control system for serving the auxiliary load but that grid power is not allowed to charge the energy storage device itself. Auxiliary load is defined as the energy needed to maintain system operations (e.g., energy for the pumps and fans) and to energize the necessary control system for the storage device. The maximum level of power set to provide energy to the auxiliary load must be specified prior to testing and must be tested to ensure that the storage cannot charge at the specified level of export power.
3. This testing procedure does not specify how the control system will prevent the energy storage from charging from the grid. Below is an example approach that may be used:
   A The control system can trigger the storage's DC–to–DC converter device, inverter, or other specified device to stop charging the storage system by directing the device to reduce voltage on the DC port below the certified minimum operating DC voltage for the DC–DC converter. If the voltage of the power flow is below the certified minimum operating DC voltage of the storage device, then storage device cannot charge from that power. When utilizing this option, the performance of both the control system and the energy storage device shall be evaluated as a combined system.

Qualification for Performing Test:

4. Testing must be conducted or witnessed by NRTL personnel. NRTL personnel must also provide documentation that the testing equipment performed as specified.

Limitation of application

5. This testing procedure is used exclusively to evaluate the operations of 1) energy storage device paired with a NEM eligible generator and 2) the control system that prevent the energy storage device from charging from the grid. This testing procedure and related results do not certify these systems for other purposes, nor does it represent compliance with any safety related requirements as determined by local, state or federal compliance requirements. System owners are still required to comply with all certification requirements as determined by their local jurisdiction.
6. Any changes to the operational parameters, such as a firmware update, which may affect test results will require a new NRTL evaluation and submission of the NRTL re–evaluation to PG&E.

System Arrangement – Control System Under Test (CSUT)

7. The generating facility's power system and the related sensing devices used for testing must be setup in one of the following two configurations. The control system shall take the measurement information from the MCP and prevent the charging of energy storage device from the grid.
8. Measurement Points definitions:
   - A Measurement Control Point (MCP) – the control point where power flow is to be measured for control purposes. This MCP may be located within the inverter(s) or between the inverter/converter AC port and any customer load. No customer load can be located between MCP and the inverter/converter.
   - B Measurement Point A (MP–A) – the measure point by the energy storage pack used to provide verification of control system performance but are not used as control points.
   - C Measure Point B (MP–B) – the measure point by the PV or other NEM eligible generator used to provide verification of control system performance but are not used as control points.
   - D MP–A (Storage) and MP–B (NEM eligible generator) are for performance verifications only and are not used for control purposes in this testing demonstration.
   - E MP–A, MP–B, and MCP may be external sensors or may be internal to the DC–DC converters, inverters, or other power control devices.
   - F External monitoring or sensors shall be required to verify the performance of the control system during validation testing. Sensing devices and other equipment used for testing must be independent and separate from devices used as part of the Control System Under Test (CSUT).

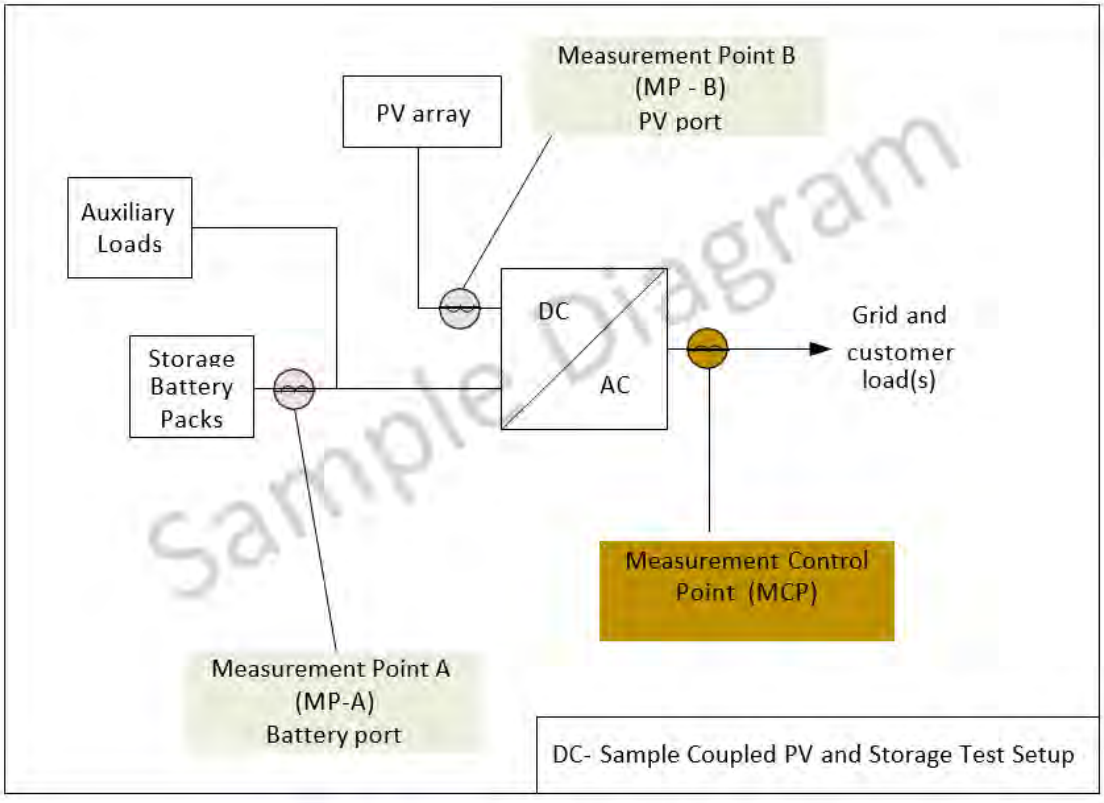

Figure 1
Example PV and Storage coupled on the DC side of the inverter (DC–Coupled)

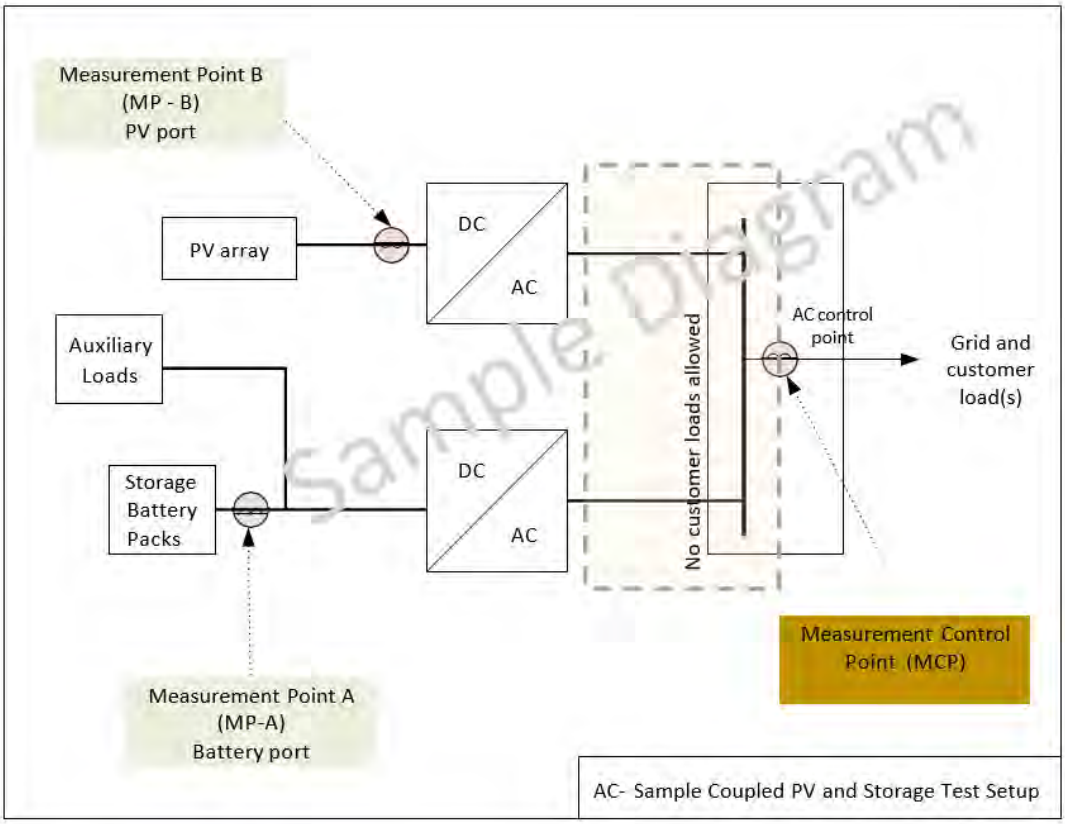

Figure 2
Example PV and Storage coupled on the AC side of the inverter (AC−Coupled)

Default Setting and Range of Adjustability

9. The following should be provided:

   A Default minimum export active power or current level at MCP and the range of adjustability. This is the level of export active power or current to the grid below which the control system is to prevent the energy storage from charging from the grid.

      1 Export refers to the power or current flow at MCP toward the grid and customer load(s).

      2 Import refers to the power flow or current at MCP toward the PV, energy storage and auxiliary loads.

   B Auxiliary power level.

   C Default charging rate, ramp rate, and range of adjustability

   D Default discharge rate, ramp rate, and range of adjustability

Test Description

10. The entire power system must demonstrate that the control system automatically prevents the energy storage from charging when the power measured at MCP exceeds the default specified value. Any one of the following methods may be used:

   A Opening the contacts on DC/DC converters or inverters for the storage devices with verification measurement at MP−A

   B Halting the gating of power electronics for the storage DC/DC converter or the inverter DC port

      1 Reducing the storage DC bus port voltage below the storage DC/DC converter minimum turn−on level with verification measurement at MP−A showing that the export level at the

MCP is below the minimum specified export level. When this option is used, certification of the DC/DC converter minimum turn on voltage must be provided.

Test Procedures Steps

11. Set up the system to its intended default operating conditions per manufacturer¿s specifications in a test environment
    - A PV Simulator or equivalent
    - B Storage Simulator or equivalent
    - C Importing power to the grid over the default import level per nameplate ratings
12. Reduce PV simulator output and maintain constant storage charging level
    - A In this step, the PV must be reduced using a specified ramp rate until power or current measured at MCP goes below the specified minimum export level provided by the manufacturer. Under such conditions, the control system must demonstrate that it will automatically stop the charging of the storage device within 5 seconds. Overshooting or positively dampening oscillations during this period is permitted but such results must be recorded.
    - B This step must be repeated five times or more to ensure operational consistency. The following data points over the entire testing period must be recorded:
        1. PV power production and ramp rate
        2. Power or current flow data at MCP – export to grid and import from the grid
        3. Power or current flow data at MP–A (storage)– Power or current flow data at MP–B (NEM eligible generator)– PV production
        4. Storage DC port voltage data when DC voltage regulation is used as part of charging control
        5. Response time, as define as the time from when the deviation was detected at MPC to when storage stops charging. This should be no greater than 5 seconds. This can be verified by measurement at MP–A
        6. All power measurements must be shown on the same chart with common time base reference. Please see Figure 3 for example.
        7. The sampling rate used to verify the performance of the system.
13. Maintain constant PV output and increase charging levels
    - A In this step, the simulated PV output must be maintained at a constant level, but the charging level of storage must increase to a ramp rate where the power measured at MCP from the grid is below the default value. Under such conditions, the control system must demonstrate that it will automatically stop the charging of the storage device within 5 seconds.
    - B This step must be repeated five times or more to ensure operational consistency. Record the following data:
        1. PV power production rate
        2. Power or current flow data at MCP – export to the grid
        3. Power or current flow data at MP–A – Storage charging load
        4. Power or current flow data at MP–B – PV production
        5. Storage DC port voltage data when DC voltage regulation is used as part of charging control
        6. Response time. Time from when the deviation was detected at MCP to when storage stop charging should be no greater than 5 seconds. This can be verified by measurement at MP–A
        7. All measurements must be synchronized in the same output chart or may utilize a common time base reference.

Reporting

14. The following should be provided to the utility:
    - A Description of control system

1 Provide a block diagram of control system being utilized and a basic explanation of how it prevents the storage from charging from the grid

2 Describe the DER system components as applicable, including:

(a) Storage

(b) NEM eligible generator (e.g., PV)

(c) Converter

(d) Inverter

(e) Control System (e.g., the Energy Management System)

(f) Communication system

(g) Firmware version(s) for EMS and DC–DC charger (if applicable)

3 Specify the equipment used for testing, including:

(a) Sensing equipment

(b) Measurement equipment

(c) Power supplies (AC & DC)

4 Provide the power, current, and voltage data results as outlined in the section above

5 Letter from NRTL indicating the results of the test (pass/fail)

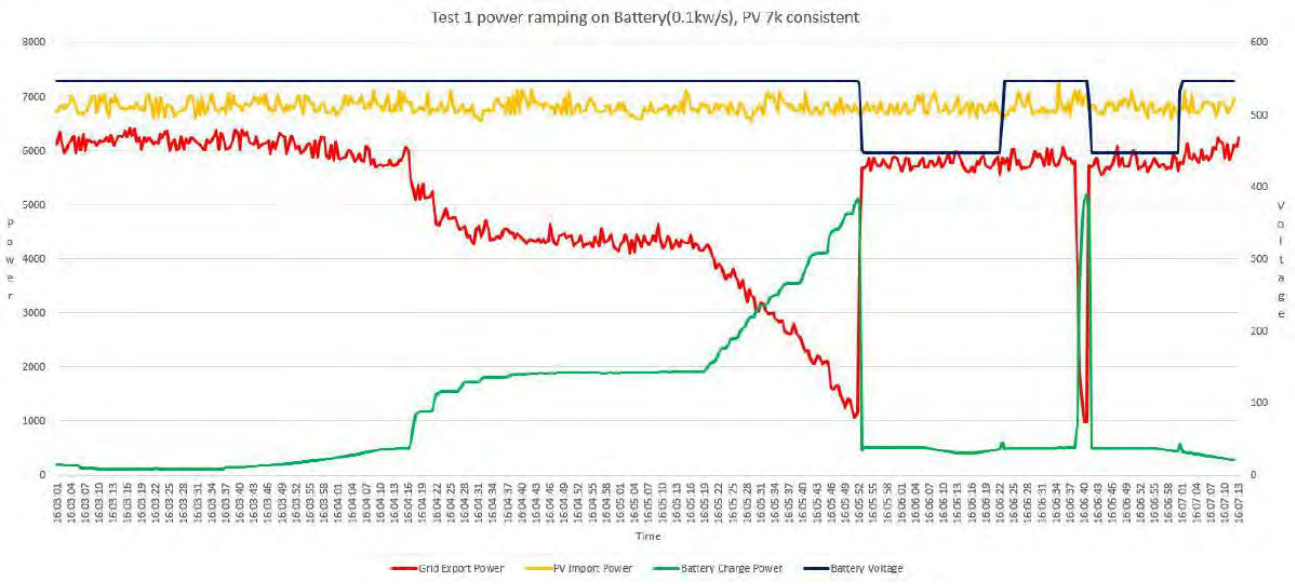

Figure 3
Required Data Measurement Display Format

References	Location	Document
Distributed Generation Protection Requirements		094680
Distributed Generation Protection Requirements		094681
Mitigating Substation Power Transformer Overloads Due to PV and BESS		094685
Distribution Interconnection Handbook (DIH)	D I H	TD–2306M
Transmission Interconnection Handbook	T I H	TD–1013M

Revision Notes

Revision 00 has the following changes:

1. Converted TD–2306B–003 to this numbered engineering document.