PCS Certificate of Compliance

October 11, 2024

Project #Y0510
Report #LIT10240510

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Subject: UL3141 PCS NEM Integrity Mode Testing for the Enphase PV + Battery Energy storage system

Dear Mr. Baligar

This test report represents the results of our evaluation/testing of the PV + Battery Energy storage system to the requirements contained in following standards:

UL3141 Issue 2 Outline of Investigation for Power Control Systems (PCS) Dated Oct 9, 2024

Compliance includes management, control, and limitation of power exchange between PV and Energy Storage Systems and Area EPS/AC utility systems.

The PCS evaluation was conducted on a representative Enphase Energy System 3.0 and the certification applies to the following configurations which were part of the tested system in the PCS modes defined below.

PCS Modes	PV Model[2]	ESS Model[2]	Max PV Ratings	Max ESS Ratings	Max PV+ESS Rating	Additional Devices needed for PCS functionality	Optional Devices	Measured Average/ Maximum OLRT	Max Settling Time
NEM Integrity Mode	IQ8 PV	None	64A/ 15.36kVA	N/A	64A/ 15.36kVA	IQ Gateway/ CT's	IQ System Controller[2]	1.15s / 2s	4.25s
	IQ8 PV	IQ Battery 5P	64A/ 15.36kVA	128A/ 30.72kVA	192A/ 46.08kVA	IQ Gateway/ CT's	IQ System Controller[2]		
		IQ Battery 3T/10T		64A/ 15.36kVA	128A/ 30.72kVA				

[1] Tested with PCS eSW 1.3.0
[2] Please see System configuration table further for exact variations of SKU model numbers.

NEM Integrity Mode:
This is a PCS mode where the PV and energy storage system (ESS) was evaluated for its ability to limit export levels of a PCS controlled PV / ESS system to the grid, when operated in the presence of a uncontrolled PV / ESS Legacy System. In this mode, the output power of the PCS controlled PV and ESS are controlled such that the instantaneous power being exported by the combined system does not exceed the power being generated by the Legacy System. Export levels and power being generated by the PV and ESS were monitored during the test. The test verified that when system was subjected to step changes in load and step changes in generation, the instantaneous power exported to the grid did not exceed the power produced by the Legacy system. The test was conducted at various Legacy system generation and Load power levels.

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The table below describes the System configuration and SKUs associated with tested PCS mode(s)

System Component	Product SKUs	Equipment required in PCS mode?
Enphase PV	IQ8H-240-72-2-US, IQ8-60-2-US, IQ8PLUS-72-2-US, IQ8M- 72-2-US, IQ8A-72-2-US, IQ8-60-M-US, IQ8PLUS-72-M-US, IQ8M-72-M-US, IQ8A-72-M-US, IQ8H-240-72-M-US, IQ8MC- 72-M-US, IQ8AC-72-M-US, IQ8HC-72-M-US, IQ8X-80-M-US	Required
Enphase Battery	Enphase IQ Battery 5P (Encharge battery 3rd generation): IQBATTERY-5P-1P-NA, B05-T02-US00-1-3-RMA consisting of UL (Listed) IQ8D- BAT/IQ8D-BAT-240 Inverter(s) rated 120/240Vac, intended to be connected to a battery and will charge and discharge the battery. Enphase IQ Battery 3T/10T (Encharge battery 2nd generation): ENCHARGE-3T-1P-NA, ENCHARGE-10T-1P-NA. consisting of UL (Listed) IQ8X-BAT-US/IQ8X-BAT-US-NB Inverter(s) rated 120/240Vac, intended to be connected to a battery and will charge and discharge the battery.	Optional
Enphase IQ Gateway	X-IQ-AM1-240-5, X-IQ-AM1-240-5C, ENV-IQ-AM1-240, ENV2-IQ-AM1-240, ENV-S-AM1-120, X-IQ-AM1-240-3, X-IQ- AM1-240-3C, X-IQ-AM1-240-3-ES, X-IQ-AM1-240-3C-ES, X-IQ-AM1-240-4, X-IQ-AM1-240-4C, X2-IQ-AM1-240-4, X2-IQ- AM1-240-4C	Required
CTs	For solar production monitoring: At least 1 unit CT-200-SOLID For consumption monitoring: At least 2 units of CT-200-SPLIT or CT-200-CLAMP For battery monitoring: At least 1 unit of CT-200-SPLIT or CT- 200-CLAMP	Required
Enphase IQ System Controller	IQ System Controller 3/3G: SC200D111C240US01, SC200G111C240US01 IQ System Controller 2: EP200G101-M240US01	Optional

This PCS supports:

- Up to 3 circuit inputs, one PV and two ESS, each with up to 8 daisy-chained IQ Battery 5P units (or)
- Up to 2 circuit inputs, one PV and one ESS with 12 IQ Battery 3T units.

Each ESS circuits' charge/discharge current with IQ Battery 5P can be limited from 64 Amps to 8 Amps continuous.

1. PV inverter breakers on the combiner box and system controller must be properly sized.
    a. The maximum breaker size for a PV inverter branch in a combiner box is 20A.
    b. The maximum breaker size for PV inverter circuits in the system controller is 80A.
2. Battery inverter breakers on the combiner box or system controller must be properly sized
    a. The maximum breaker size for a single IQ Battery 5P-based branch in a combiner box is 20A
    b. The maximum breaker size for the batteries in the system controller input is 80A per circuit.
3. The back feed breaker in the Main Panel must be sized properly based on the main panel busbar and grid breaker, maximum breaker size of 80A is tested with the test setup.
4. Please refer to the equipment installation instructions for system configuration details.

If there are any questions regarding the results contained in this report, please contact me or any Bureau Veritas CPS customer service representative.

Sincerely,

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Reviewed by,

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