



PCS Certificate of Compliance

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Subject: UL3141 PCS Aggregate Power Export Limit 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
UL1741 3rd Ed CRD for Power Control Systems (PCS), Dated April 8, 2023
UL1741 2nd Ed CRD for Power Control Systems (PCS), Dated March 8, 2019

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

The PCS evaluation was conducted on a representative Enphase Energy System 4.0 and the certification applies to the following configurations which were part of the tested system in the PCS modes defined below.

PCS Modes ¹	PV Model ²	ESS Model ²	Max PV Ratings	Max ESS Ratings	Max PV+ESS Rating	Range of PCS controlled export power ³	Additional Devices needed for PCS functionality	Measured Average/ Maximum OLRT	Average Settling Time
Aggregate Power Export Limit	IQ8/IQ 9 PV	None	80A/ 19.20kVA	N/A	80A/ 19.20kVA	24,000 to 0 Watts	IQ Combiner 6C / CTs / Meter Collar	1.6s / 1.04s	1.65s
	IQ8/IQ 9 PV	IQ Battery 10C	80A/ 19.20kVA	118A/ 28.32kVA	198A/ 47.52kVA				

¹ Tested with PCS eSW 1.4.0

² Please see System configuration table further for exact variations of SKU model numbers.

³ The system with PV nameplate as stated in Maximum continuous PV current/Power column and PV + ESS nameplate as stated in Maximum continuous PV+ESS current/ Power column can be controlled via PCS to limit power exported (to the AC line) to a value within the range stated in this column.

Aggregate Power Export Limit:

This is a PCS mode where an Enphase PV and Storage system was evaluated for its ability to control export levels to the AC line (grid connection). Export levels by the energy storage and PV were monitored. Tests verified that when PV power or system load levels were subjected to step changes, the system controlled the power within the configurable limits set. The system continued to maintain export power to this limit after the step change across the range configurable power limits set i.e., between 0 to 24,000W.

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, IQ9N-A-US, IQ9N-A-DOM-US, IQ9N-A-DOM-US-CPA, IQ9N-A-DOM-US-CPB, IQ9N-A-DOM-US-HPA, IQ9N-A-DOM-US-HPB, IQ8PLUS-72-M-DOM-US, IQ8HC-72-M-DOM-US, IQ8MC-72-M-DOM-US, IQ8AC-72-M-DOM-US, IQ8X-80-M-DOM-US	Required
Enphase Battery	Enphase IQ Battery 10C (Encharge battery 4th generation): IQBATTERY-10C-1P-NA, IQBATTERY-10CS-1P-NA, B05-C01-US00-1-3-RMA rated at 120/240Vac	Optional
Enphase IQ Combiner 6C	X-IQ-AM1-240-6C	Required
CTs	For Monitoring consumption: At least 2 units of CT-200-SPLIT or CT-200-CLAMP PV and battery monitoring CTs are integrated into the IQ Combiner 6C	Required ¹
Meter Collar	For Monitoring consumption: At least 1 unit of MC-200-011-VXX	Required ¹

¹Either Meter Collar (OR) Consumption CTs placed at the Point of Common Coupling (PCC) and required for operation in this mode.

This PCS supports:

- Up to 3 circuit inputs, one PV aggregate breaker input and two ESS, each with up to 4 daisy-chained IQ Battery 10C units

Each ESS circuits' charge/discharge current with IQ Battery 10C can be limited from 64 Amps to 8 Amps continuous.

- PV inverter breakers on the combiner box must be properly sized.
 - The maximum breaker size for each PV inverter branch in the combiner PV Bus is 20A.
 - The maximum breaker size for PV aggregate breaker circuit in the combiner is 100A.
- Battery inverter breakers on the combiner box must be properly sized.
 - The maximum breaker size for a single IQ Battery 10C-based branch in a combiner box is 40A.
 - The maximum breaker size for each battery branch in the combiner is 80A per circuit.
- 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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Revision History:

Date/ Project No.	Project Engineer / Reviewer	Description
		None.