



PCS Information on CEC Solar Equipment Lists



California Energy Commission
GUIDELINES

Guidelines for California's Solar Electric Incentive Programs

(Senate Bill 1)

Seventh Edition

California Energy Commission
Edmund G. Brown Jr., Governor



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Renewable Energy Division

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Agenda

1. Background
2. PCS Information in Solar Equipment Lists
3. Required PCS Documents
4. PCS Supplemental List Template
5. Documents' Criteria
6. Q&A



Background of Solar Equipment Lists

- SB1 Guidelines

<https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/solar-equipment-lists>

- Use of CEC lists for interconnection purposes
 - Continued streamlining of interconnection processes
 - Quick implementation to assist others in meeting short timelines



PCS Information in Solar Equipment Lists

- CEC Existing Equipment Lists
 - Grid Support Inverter List: solar and storage inverters
 - Includes “Smart Inverter Functionality”
 - Energy Storage System List
 - Includes “Smart Inverter Functionality”
- Current implementation within existing equipment scope
 - PCS integrated in inverter
 - PCS as a component of an energy storage system

Note: The inverter or the energy storage system model numbers must be listed on the related Inverter or ESS lists, in order to reflect PCS information.



Grid Support Inverter List

Grid Support Solar Inverter list (Full Data)
 Data has not changed since September 11, 2020

(1) Any text in brackets at the end of the Model Number is not part of the Manufacturer's Model Number. Part of the text in brackets indicates the specified voltage option for that model number, if provided; models with multiple voltage options will have multiple row entries, with one for each eligible voltage option.

(2) Hybrid inverters are capable of taking DC power input from both a solar system and an energy storage system. These models are listed on both the solar and battery inverter lists to reflect the dual functionality. Refer to the manufacturer's documentation for more information on the exact functional limitations.

(3) RPP: UL 1741 SA13 tested with reactive power priority enabled (when operating at apparent power capacity, inverter will reduce active power as needed to ensure curve-required reactive power is provided)

(4) A Y* notes the inverter has not been certified according to CSIP, but instead NRTL reported inverter was connected to a gateway during compatibility testing.

(5) The listed Firmware Version is the version used during the inverter's UL 1741 Supplement SA (SA8-SA13) testing and certified on the listed Certificate Date; multiple firmware versions may be listed for a single certificate date if all are required to comply with Supplement SA. Multiple certificate dates may be listed if new firmware versions were certified under Supplement SA and reported by the manufacturer. Additional firmware versions may be certified but not reported. Check with NRTL for the most current information.

(6) Inverter CSIP conformance information refers to the entity responsible for the documentation provided to the manufacturer. If the inverter is certified to CSIP, then the information refers to the certifying entity and the certificate date. Otherwise, the information refers to the NRTL that issued the compatibility report and the date of the report.

Blue colored text indicates that the model number occurs multiple times on the list under different manufacturer names.

Manufacturer Name	Model Number ¹	Hybrid Inverter ²	UL 1741 Supplement SA Testing	UL 1741 SA13 Volt-Var	UL 1741 SA Freq-Watt Volt-Watt	UL 1741 SA Disable Permit Service Limit Active Power	Common Smart Inverter Profile Conformance	Monitor Key Data Scheduling	Description	Maximum Continuous Output Power at Unity Power Factor	Nominal Voltage	We Effi
		PV and Battery	SA8-SA13	RPP ³	SA14-SA15	SA17-SA18	CSIP ⁴	Attestation		(kW)	(Vac)	
ABB	PVI-3.0-OUTD-S-US-Z-M-A [277V]	N	Y	Y	N	N	N	N	3 kW, 277 Vac Grid Support Utility Interactive Inverter with arc-fault detection and meter	3	277	
Delta Electronics	M6-TL-US [208V]	N	Y	Y	Y	Y	Y*	Y	5472 W, 208 Vac transformerless Grid Support Utility Interactive Inverter.	4.99	208	
Enphase Energy Inc.	IQ6PLUS-72-ACM-US [208V]	N	Y	Y	Y	N	N	N	280 W, 208 Vac Grid Support Utility Interactive Microinverter for ACPV Module applications	0.28	208	
Fronius International GmbH	Fronius Symo Advanced 12.0-3 208-240 [208V]	N	Y	Y	Y	N	N	N	12 kW, 208 Vac, three phase Grid Support Utility Interactive Inverter with arc detector and meter	12.341	208	
Generac Power Systems	X7602 [240V]	Y	Y	Y	Y	Y	Y	Y	7.6 kW, 240 Vac Grid Support Utility Interactive Inverter	7.586	240	
Ginlong Technologies Co., Ltd.	Solis-1P2.5K-4G-US [240V]	N	Y	Y	Y	Y	Y*	Y	2.5 kW, 240 Vac, 1-phase Grid Support Utility Interactive Inverter	2.5	240	
SMA America	SB3.0-1SP-US-41 [240V]	N	Y	Y	Y	Y	Y*	Y	3.0 kW, 240 Vac Grid Support Utility Interactive Inverter	3.036	240	
SolarEdge Technologies Ltd.	SE11400H-US [208V]	N	Y	Y	Y	Y	Y*	Y	The incorrect inverter model number was previously submitted, SE1000H-US 208V model should be replaced SE11400H-US 208V model.	10.001	208	



Grid Support Inverter List - Continued

Grid Support Inverter List (Full Data)
 Data has not changed since September 14, 2020

(1) Any text in brackets at the end of the Model Number is not part of the Manufacturer's Model Number. Part of the text in brackets indicates the specified voltage option for that model number, if provided; models with multiple voltage options will have multiple row entries, with one for each eligible voltage option.

(2) Hybrid inverters are capable of taking DC power input from both a solar system and an energy storage system. These models are listed on both the solar and battery inverter lists to reflect the dual functionality. Refer to the manufacturer's documentation for more information on the exact functions.

(3) RPP: UL 1741 SA13 tested with reactive power priority enabled (when operating at apparent power capacity, inverter will reduce active power as needed to ensure curve-required reactive power is provided)

(4) A Y* notes the inverter has not been certified according to CSIP, but instead NRTL reported inverter was connected to a gateway during compatibility testing.

(5) The Listed Firmware Version is the version used during the inverter's UL 1741 Supplement SA (SA8-SA13) testing and certified on the listed Certificate Date; multiple firmware versions may be listed for a single certificate date if all are required to comply with Supplement SA. Multiple certificate dates and different firmware versions may be listed if new firmware versions were certified under Supplement SA and reported by the manufacturer. Additional firmware versions may be certified but not reported. Check with NRTL for the most current information.

(6) Inverter CSIP conformance information refers to the entity responsible for the documentation provided to the manufacturer. If the inverter is certified to CSIP, then the information refers to the certifying entity and the certificate date. Otherwise, the information refers to the NRTL that issued the conformance report and the date of the report.

Blue colored text indicates that the model number occurs multiple times on the list under different manufacturer names.

Manufacturer Name	Model Number ¹	Hybrid Inverter ²	UL 1741 Supplement SA Testing	UL 1741 SA13 Volt-Var	UL 1741 SA Freq-Watt Volt-Watt	UL 1741 SA Disable Permit Service Limit Active Power	Common Smart Inverter Profile Conformance	Monitor Key Data Scheduling	Description	Maximum Continuous Output Power at Unity Power Factor	Nominal Voltage	Weight
		PV and Battery ³	SA8-SA13	RPP ³	SA14-SA15	SA17-SA18	CSIP ⁴	Attestation		(kW)	(Vac)	
BYD Auto Industry Company Limited	BEG500KTL-U [480V]	N	Y	Y	Y	N	N	N	500 kVA, 480 Vac, Grid Support Utility Interactive Battery inverter, permanently connected, bi-directional for use with battery management system	501.756	480	
CE+T Energy Solutions Inc.	30C [480V]	N	Y	Y	Y	N	N	N	30 kW, 480 Vac Grid Support Utility Interactive Battery Charge controller	29.99	480	
Chint Power Systems America	CPS ECB30KTL-O/US [480V]	N	Y	Y	Y	Y	Y*	Y	30 kW, 480 Vac, Bi-directional Grid Support Utility Interactive Battery Inverter	30.26	480	
Darfon Electronics Corp.	H5000xxxxxx [240V]	Y	Y	N	Y	Y	Y*	Y	5000 W, 240 Vac, Hybrid PV and Battery Grid support utility interactive inverter, where x = 0-9, A-Z or blank, (0-9 for color; A-Z for customer)	5.074	240	
Delta Electronics	E4-TL-US [208V]	Y	Y	Y	Y	Y	Y*	Y	3328 W, 208 Vac, transformerless, Bi-directional, Multi-mode Grid Support Utility Interactive Solar and Energy Storage Inverter	3.36	208	
Generac Power Systems	X7602 [240V]	Y	Y	Y	Y	Y	Y	Y	7.6 kW, 240 Vac Grid Support Utility Interactive Inverter	7.586	240	
LG Electronics Inc.	A005KEEN261 [208V]	N	Y	Y	Y	Y	Y*	Y	5000 W, 208 Vac, transformerless, Bi-directional, Multi-mode Grid Support Utility Interactive Energy Storage Inverter	5	208	
OutBack Power	GS4048A [240V]	N	Y	Y	Y	N	Y*	Y	3.6 kW, 240 Vac Grid Support Utility Interactive	3.6	240	

13 of 115 records found



Energy Storage System List

Energy Storage System List (Full Data)													
Data has not changed since September 11, 2020													
<p>Note: Any text in brackets at the end of the Model Number is not part of the Manufacturer's Model Number. Part of the text in brackets indicates the specified voltage option for that model number, if provided; models with multiple voltage options will have multiple row entries, with one for each eligible option.</p> <p>(1) This information references the 2019 Building Energy Efficiency Standards' Reference Joint Appendix 12. This appendix outlines requirements for energy storage systems to qualify for battery storage compliance credit. For more information, contact the Title 24 Hotline at (916) 654-5106 or Title24@energy.ca.gov.</p> <p>(2) RPP: UL 1741 SA13 tested with reactive power priority (when operating at apparent power capacity, inverter will reduce active power as needed to ensure curve-required reactive power is provided)</p> <p>(3) A Y* notes the inverter has not been certified according to CSIP, but instead NRTL reported inverter was connected to a gateway during compatibility testing.</p> <p>(4) Maximum continuous discharge rate as stated by the manufacturer on the spec sheet.</p> <p>(5) The listed Firmware Version is the version that was used during the inverter's UL 1741 Supplement SA testing and was certified on the listed Certificate Date; multiple firmware versions may be listed for a single certificate date if all are required to comply with Supplement SA. Multiple certificate dates with different firmware versions may be listed if new firmware versions were certified under Supplement SA and reported by the manufacturer. Additional firmware versions may be certified but not reported. Check with NRTL for the most current information.</p> <p>(6) Inverter CSIP conformance information refers to the entity responsible for the documentation provided to the manufacturer. If the inverter is certified to CSIP, then the information refers to the certifying entity and the certificate date. Otherwise, the information refers to the NRTL that issued the compatibility report and the date of the report.</p>													
Manufacturer Name	Brand ¹	Model Number	Technology	UL 9540 Certification			UL 1741 Supplement SA Testing	UL 1741 SA13 Volt-Var	UL 1741 SA Freq-Watt Volt-Watt	UL 1741 SA Disable Permit Service Limit Active Power	Common Smart Inverter Profile Conformance	Monitor Key Data Scheduling	Description
				Certifying Entity	Certificate Date (mm/dd/yyyy)	Edition of UL 9540	SA8-SA13	RPP ²	SA14-SA15	SA17-SA18	CSIP ³	Attestation	
Enphase Energy Inc.		ENCHARGE-10-1P-NA	Lithium Iron Phosphate	UL	5/18/2020	Ed. 1 : 2016	Y	Y	Y	Y	Y*	Y	3.84 kW, 10.08 kWh, 240 Vac lithium iron phosphate energy storage system
Generac Power Systems		PWRcell 12 [240V]	Lithium Ion	Intertek	10/29/2019	Ed. 1 : 2016	Y	Y	Y	Y	Y	Y	6.7 kW, 11.4 kWh, 240 Vac, 4 Battery Module Energy Storage System
SMA America		SMA-ESS-SBS-3.8-RESU10H	Lithium Ion	TUV Rheinland of North America	7/23/2019	Ed. 1 : 2016	Y	Y	Y	Y	Y*	Y	3.8 kW, 9.8 kWh, 240 Vac lithium-ion storage system
SunPower	SunPower	EQS-BASE 13-11-A	Lithium Ion	Intertek	6/15/2020	Ed. 1 : 2016	Y	Y	Y	Y	Y*	Y	6.8 kW, 13 kWh, 240 Vac lithium-ion energy storage system
Tesla Inc.		AC Powerwall 1092170-xx-Y	Lithium Ion	Intertek	7/17/2018	Ed. 1 : 2016	Y	Y	Y	Y	Y*	Y	5 kW, 13.5 kWh, 240 Vac Lithium-Ion Energy Storage System, where xx are numbers and y is a letter



PCS Information in Solar Equipment Lists

- The information and data collected and reflected on the online lists by the CEC were identified by the IOUs as necessary for completing the interconnection evaluation.
- All the data points reflected on the lists are obtained from the NRTL and manufacturer documentation submitted to the CEC.
- IOUs requested for all PCS information together (inverter and ESS)
- CEC created the supplemental PCS list complementing existing inverter and ESS lists
 - PCS info combined in one place
 - No changes to existing list formats



Required PCS Documents

- **Inverter** or **ESS** manufacturers to submit PCS related documents for their equipment:
 - UL 1741 CRD test report summary, issued by a NRTL
 - Manufacturer's equipment information and instructions document (as required by the UL 1741 CRD)
- *CEC asks manufacturers and NRTLs to meet the required criteria in these documents. Ultimately, the NRTL is responsible for performing a sufficient level of testing to satisfy the CRD intentions.*



PCS Supplemental List Template

Inverter and Energy Storage System PCS List												
Data has not changed since July 17, 2020												
<p>(1) Any text in brackets at the end of the Model Number is not part of the Manufacturer's Model Number. Part of the text in brackets indicates a distinguishing characteristic for the similar model numbers to prevent duplication. Some examples include output voltage and energy capacity.</p> <p>(2) The information in this list supplements the Grid Support Inverter List, and Energy Storage System List. The listed model numbers can also be found in the applicable equipment list.</p> <p>(3) Any devices identified as required to enable PCS functionality, as reported on the UL 1741 CRD test report summary.</p> <p>(4) The point in the system, identified by the equipment manufacturer, where the PCS measures the current. For more details, refer to the manufacturer's "Equipment Information and Instructions".</p> <p>Guidelines for California's Solar Electric Incentive Programs (Senate Bill 1)</p>												
Manufacturer Name	Model Number ¹	Type of Equipment ²	Additional Required PCS Devices ³	Current Measurement Reference Points ⁴	Description	UL 1741 Power Control Systems (PCS) Certification Requirement Decision (CRD)			UL 1741 PCS - ESS Operating Modes			
						Issuing Entity	Document Date (mo/day/yr)	Max Open Loop Response (Seconds)	Unrestricted Mode	Export Only Mode	Import Only Mode	No Exchange Mode
Manufacturer 123	ESS ABC-123 [120V]	ESS	Gateway XYZ	Gateway	ESS with Additional Devices	UL	6/1/2020	1.7	N	N	Y	N
Manufacturer 123	ESS ABC-123 [240V]	ESS	Gateway XYZ	External Sensor	ESS with Additional Devices	UL	6/1/2020	1.7	N	N	Y	N
Manufacturer 789	Inverter-NM-256 [208V]	Inverter	N/A	Inverter	Storage Inverter	CSA Group	6/24/2020	2.56	N	Y	Y	N



Information Needed in the UL 1741 CRD Test Report

- Signed or stamped and dated by NRTL whose OSHA Scope of Recognition includes UL 1741.
- Indicates the UL 1741 CRD issued on March 8, 2019, for PCS functionality.
- Specifies the requested model number(s) it is applicable to.
- Defines all the wildcards in the requested model number(s).
- Specifies all the additional devices required and tested for PCS functionality.
- Defines all wildcards in the model number of any required additional devices
- Specifies all the ESS Operating Modes that were tested.
- Specifies the maximum open loop response time.



Information Needed in the “Equipment Information and Instructions”

The CRD requires the PCS manufacturer to publish an “Equipment Information and Instructions” document, in addition to any other instructions required by UL 1741.

- Issued by the inverter or ESS manufacturer.
- Submitted on company letterhead.
- Includes all the requested model number(s).
- Identifies the equipment’s “current measurement reference point”.
- Includes all the required information specified in the UL 1741 CRD, Section 208.



Q&A



Contact us via email at SolarEquipment@Energy.ca.gov

Or call us at (916) 654-4120 for any further questions.