

Senate Bill 1 (SB1) defines the solar incentive programs for California, and flat plate PV modules¹ must be listed on the SB1 compliant module list to be eligible for incentives in California. Senate Bill 1 encompasses two state-run programs for investor owned utility (IOU) territories, the California Solar Initiative (CSI) and the New Solar Homes Partnership (NSHP), as well as solar incentive programs administered by publicly owned utilities. CSI is for all market segment, with the exception of new residential construction, in IOU territories. NSHP is for the new residential construction market segment in IOU territories.

The process for adding PV modules to the SB1 list is as follows:

1. Data submitted to the Energy Commission will be made public.
2. The factory measured maximum power of each production module and the lower bound of the manufacturer's stated tolerance range must be no less than 95% of the Maximum Power reported to the Energy Commission.
3. The manufacturer gets their product certified to UL 1703 by a NRTL whose OSHA scope includes UL 1703². UL, CSA, and Intertek are the NRTLs who can currently perform this certification. **Each module power rating shall have a unique model number identified in the UL 1703 certification.** The "List of Eligible SB1 Guidelines Compliant Photovoltaic Modules" will only include unique model numbers specified in the UL 1703 certification.
4. The manufacturer gets additional performance parameter testing completed by an ILAC-affiliated laboratory. Additional information on the required testing, including a table of the required performance parameters, a non-exhaustive list of ILAC affiliated laboratories, and information on grouping modules for testing purposes is found in this document.
5. The manufacturer fills out the Energy Commission equipment application form, found here: http://gosolarcalifornia.org/equipment/documents/EQUIPMENT_REQUEST_PV.XLS
6. The manufacturer emails a copy of the UL 1703 certification indicating authorization to apply the NRTL's mark, the ILAC laboratory test report, and the Energy Commission equipment application form to [KEMA, Inc.](#) **All documentation must be in English – KEMA will reject any test reports that are not in English.**
7. The PV module eligibility list is updated monthly on the first of the month. The cut-off date for the monthly update is the 15th day of the preceding month; all documentation must be submitted before this date.
8. Private labeling of PV modules: Some businesses wish to private label PV modules for another manufacturer. Such products will be accepted as eligible should the application form be submitted with a Multiple Listee letter from the listing agency (the NRTL). The Multiple Listee process is how the listing agency certifies private-labeled products. The Multiple Listee letter is evidence of certification of the product to UL 1703. If the comparable module from the original equipment manufacturer (OEM) is already eligible, no re-testing of the performance parameters or submittal of a performance parameter test report is required for the private labeled modules.

¹ For the SB1 Guidelines, "PV" refers to flat-plate non-concentrating photovoltaic modules.

² For a list of NRTLs and to view NRTL OSHA scopes, visit <http://www.osha.gov/dts/otpca/nrtl/>

Required Performance Parameter Testing:

Attach documentation from laboratory accredited by the International Laboratory Accreditation Cooperation (ILAC) according to the following sections of either the International Electrotechnical Commission Standard 61215, Crystalline Silicon Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval, Edition 2.0, 2005-04, or the International Electrotechnical Commission Standard 61646, Thin-film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval, Edition 2.0, 2008-05:

Crystalline modules	Thin-film modules
IEC 61215, Edition 2.0, Sections:	IEC 61646, Edition 2.0, Sections:
10.2 Maximum Power Determination	10.2 Maximum Power Determination
10.4 Measurement of Temperature Coefficients ³	10.4 Measurement of Temperature Coefficients ³
10.5 Measurement of Nominal Operating Cell Temperature (NOCT)	10.5 Measurement of NOCT
10.6 Performance at Standard Test Conditions (STC) and NOCT	10.6 Performance at STC and NOCT
10.7 Performance at Low Irradiance	10.7 Performance at Low Irradiance
	10.19 Light Soaking

Special Mounting Specifications for NOCT determination for Building Integrated Photovoltaic (BIPV) Modules:

Tilt angle: the test BIPV modules shall be positioned so that they are tilted at 23 degrees \pm 5 degrees (5:12 roof pitch) to the horizontal.

Configuration: the test BIPV modules shall be located in the middle of an array that is at least four feet high and four feet wide. The array shall be surrounded on all sides with a minimum of three feet of the building system for which the BIPV system is designed to be compatible, and the entire assembly shall be installed and sealed as specified by the manufacturer for a normal installation.

Substrate and underlayment: the test BIPV modules shall be installed on a substrate of oriented strand board with a minimum thickness of 15/32 inch that is covered by #30 roofing felt with a minimum R-10 continuous insulation under and in contact with the oriented strand board and include any other manufacturer-recommended underlayments.

³ The performance parameter testing requires the measurement and reporting of five temperature coefficients: temperature coefficient of short-circuit current, temperature coefficient of open-circuit voltage, temperature coefficient of maximum power current, temperature coefficient of maximum power voltage, temperature coefficient of maximum power.

Non-exhaustive list of ILAC affiliated laboratories:

- Bodycote Materials Testing Canada Inc. (Canada)
- ETL SEMKO Laboratory of Intertek Testing Services Shanghai Co., Ltd. (China)
- Metrology & Testing Center of China Electronics Technology Group Corporation No. 18th Research Institute (Tianjin, China)
- National Center of Supervision & Inspection on Solar Photovoltaic Products Quality (Jiangsu, China)
- TÜV Rheinland (Shanghai) Co., Ltd. (China)
- Fraunhofer - ISE, Institut für Solare Energiesysteme (Germany)
- PI Photovoltaik Institut Berlin AG (Germany)
- SGS Germany GmbH (Kurort Hartha, Germany)
- TÜV Rheinland Immissionschutz und Energiesysteme GmbH (Germany)
- VDE Testing and Certification Institute (Germany)
- Electronics Test & Development Centre (Bangalore, India) – **61215 ONLY**
- European Solar Test Installation (Italy)
- Eurotest Laboratori Srl (Italy)
- Japan Electrical Safety and Environment Technology Laboratories (Tokyo, Japan)
- TÜV Rheinland Japan, Ltd. (Yokohama, Japan)
- Korea Testing Laboratory (Seoul, Korea) – **61215 ONLY**
- AT4 wireless, S.A. (Spain)
- CIEMAT – PVlabDER (Spain)
- Fundacion Cener – CIEMAT (Spain) – **61215 ONLY**
- TÜV Rheinland Taiwan Ltd. (Taiwan)
- Florida Solar Energy Center (USA)
- Intertek Testing Services NA, Inc. (Lake Forest, CA, USA) (*formerly known as ETL*)
- Renewable Energy Test Center (RETC) (Fremont, CA, USA)
- TÜV Rheinland PTL, LLC (USA) (*formerly known as ASU-PTL*)
- UL Photovoltaic Technology Center of Excellence (San Jose, CA, USA)

Table of required performance parameter testing:

Modules must be tested to all values unless otherwise noted. Tested values will be on the laboratory test report that is submitted.

Parameter	Symbol	Units	Notes
Maximum Power	P_{max}	Watts	1, 5
Voltage at maximum power	V_{Pmax}	Volts	1, 5
Current at maximum power	I_{Pmax}	Amps	1, 5
Open Circuit Voltage	V_{oc}	Volts	1, 5
Short Circuit Current	I_{sc}	Amps	1, 5
Nominal Operating Cell Temperature	NOCT	°C	3
Temperature Coefficients	β_{Voc}	%/°C	2
	β_{Vpmax}	%/°C	
	α_{Isc}	%/°C	
	α_{Ipmax}	%/°C	
	γ_{Pmax}	%/°C	
Voltage at maximum power and low irradiance	$V_{Pmax,low}$	Volts	4
Current at maximum power and low irradiance	$I_{Pmax,low}$	Amps	4
Open Circuit Voltage at low irradiance	$V_{oc,low}$	Volts	4, 6
Short Circuit Current at low irradiance	$I_{sc,low}$	Amps	4, 6
Voltage at maximum power and NOCT	$V_{Pmax,NOCT}$	Volts	5
Current at maximum power and NOCT	$I_{Pmax,NOCT}$	Amps	5
Open Circuit Voltage at NOCT	$V_{oc,NOCT}$	Volts	5, 6
Short Circuit Current at NOCT	$I_{sc,NOCT}$	Amps	5, 6

Notes:

- 1) Values shall be measured at Standard Test Conditions after preconditioning according to IEC Standard 61215, Section 5, or after light-soaking according to IEC Standard 61646, Section 10.19. Modules may be light-soaked by the manufacturer prior to submitting the modules to a testing laboratory. The testing laboratory shall verify the module stabilization per IEC Standard 61646, Section 10.19.
- 2) Values shall be measured and calculated according to IEC Standards 61215 and 61646, Section 10.4.
- 3) Values shall be measured according to IEC Standards 61215 and 61646, Section 10.5. For BIPV modules the measurements shall be made using the mounting specified below.
- 4) Values shall be measured at low irradiance according to IEC Standards 61215 and 61646, Section 10.7.
- 5) Values shall be measured at STC and NOCT according to IEC Standards 61215 and 61646, Section 10.6.
- 6) The submission of this data is optional.

Grouping of modules for performance parameter testing purposes:

For testing and reporting of performance values by an ILAC accredited laboratory, families of similar modules may be grouped together to reduce the required number of tests.

Multiple model numbers may be included in a group, provided that the models are identical except for the STC power rating. Identical applies to all of the following, but is not limited to: all materials, processes (including cell process), cell technology, cell size, encapsulation system, superstrate, backsheet/substrate, cell interconnection materials and techniques, and internal electric circuitry.

For each group, the following tests shall be performed on a model number that has a STC power rating that is within 95 percent (rounded to the nearest Watt) of the highest STC power rating in the group:

1. Nominal Operating Cell Temperature (NOCT) determination
2. Temperature coefficient of short-circuit current
3. Temperature coefficient of open-circuit voltage
4. Temperature coefficient of maximum power current
5. Temperature coefficient of maximum power voltage
6. Temperature coefficient of maximum power

Each group can be further categorized into subgroups where one model number will have further testing performed. All model numbers included in the subgroup shall have the same number of cells. The subgroup may contain model numbers such that the highest STC power rating in the subgroup is 105 percent (rounded to the nearest Watt) of the subgroup's tested model number's STC rating and the lowest STC power rating in the subgroup is 95 percent (rounded to the nearest Watt) of the subgroup's tested model number's STC rating. The tested model number in each subgroup shall be tested for:

Performance at STC:

1. Short-circuit current
2. Open-circuit voltage
3. Current at maximum power
4. Voltage at maximum power
5. Maximum power

Performance at NOCT:

1. Short-circuit current (optional)
2. Open-circuit voltage (optional)
3. Current at maximum power
4. Voltage at maximum power

Performance at low irradiance:

1. Short-circuit current (optional)
2. Open-circuit voltage (optional)
3. Current at maximum power
4. Voltage at maximum power

Example: If a manufacturer has a family of identical modules with STC power ratings of 160 W, 165 W, 170 W, 175 W, 180 W, 185 W, 190 W, 195 W, and 200 W, the following testing is required. For the 190 W module, NOCT determination and temperature coefficient testing shall be performed. The results from these tests are applicable to the entire group of modules. Subgroups can then be created as follows:

185 W, 190 W, 195 W, and 200 W

170 W, 175 W, and 180 W

160 W and 165 W

For the 190 W, 175 W, and 160 W modules, the performance testing at the following conditions shall be performed: STC, NOCT, and low irradiance. The results from these tests are applicable to the modules in the respective subgroup.