

PV Module Listing Request Procedure

General Guidance for PV Module Listing Request:

- SB 1 states that flat plate PV modules¹ must be listed on the PV Modules List to be eligible for incentives in California.
- **All equipment listing requests and required documentation must be submitted by the Equipment Manufacturer.** (The NRTL may provide assistance.)
- The Energy Commission will only accept listing requests, test reports and documents written in English.
- Manufacturers submitting a PV module listing request must provide all the required documentation. If any documents are missing information as required by the Energy Commission and SB 1 Guidelines, the listing request will not be reviewed.
- Manufacturers must obtain PV module certification to ANSI/1703 standards by a Nationally Recognized Testing Laboratory (NRTL) whose Occupational Safety and Health Administration (OSHA) Scope of Recognition includes UL 1703.²
- Manufacturers must obtain performance parameter testing from a third-party, International Laboratory Accreditation Cooperation (ILAC) affiliated laboratory and follow the Criteria for Testing and Certification requirements found in the SB 1 Guidelines, Appendix B. NOCT and temperature coefficients must be tested on the same module and by the same laboratory.
- The electrical characterization data is from testing on a single, manufacturer-selected sample and is for incentive calculation purposes.
- Manufacturers or testing laboratories that provide falsified PV module data and/or laboratory test results, or alter locked formulas or links for the purpose of enhancing performance characteristics, may be permanently removed from the Energy Commission's Go Solar California Eligibility List.
- Refer to the Glossary at the end of this document for definitions of common terms.
- Data and information submitted to the Energy Commission will be made public.

Procedure for Submitting a PV Module Listing Request:

The process for submitting a request to add equipment to the Energy Commission's PV Module list is as follows:

- Manufacturers must complete all required product certification and additional performance testing before submitting a request to the Energy Commission for listing of equipment.
 - For information on equipment eligibility and required laboratory-tested data, please refer to the [SB 1 Guidelines, Appendix B](#).
- Instructions for completing the *PV Module Listing Request Form* are contained in the next section of this document.
- The manufacturer fills out the Energy Commission [PV Module Listing Request Form](#).

¹ For the SB1 Guidelines, "PV" refers to flat-plate, non-concentrating photovoltaic modules. For information on equipment eligibility and required laboratory-tested data please refer to the [SB 1 Guidelines](#), Appendix B

²The [current list of NRTLs with OSHA scopes](#)

- Save the request form as "[Manufacturer Name] _ [Module group Name] _ [Today's Date].xlsx".
- Submit the request form and all supporting documentation to SolarEquipment@energy.ca.gov.
 - Manufacturers must email a completed PV Module Listing Request Form, a copy of the NRTL/ILAC ANSI/UL 1703 Certificate of Compliance/Authorization To Mark, associated test reports.
 - **All equipment listing requests and required documentation must be submitted by the Equipment Manufacturer.** (The NRTL may provide assistance.)
 - Each email request should include a subject line stating which includes the purpose (new or revised request) and the equipment type (PV Module, Inverter, etc.) and the Manufacturer's Name.
 - Please note that all submitted information are public records; do not submit any proprietary or confidential information.
- Depending on the nature of the request, the Energy Commission may require additional documentation to verify new or revised information.
- The deadline for submitting listing requests to the Energy Commission is the last day of each month; all documentation must be submitted in on email request before this date to be reviewed during the following month.
- Revisions to current listings may require different documentation. Please contact the Energy Commission to confirm the information needed for a revision to a current listing.
 - To change a currently listed Manufacturer Name, provide a letter on company letterhead that is signed by an authorized manufacturer's representative which clearly identifies both the old and new names, and also explains the reason for the name change.

PV Module Listing Request Form Instructions:

- Complete one (1) PV Module Listing Request Form for each group of modules.
- Enter information only in the yellow-colored cells.
- Enter the NRTL/ILAC Test Report Number.

Table 1 Manufacturer Nameplate Rated Values - ("Requested" Sheet)

- 1.1. Use the Drop Down Menu in Column A to indicate if adding a new model to the list or revising an existing model that is already listed.
- 1.2. Use the Drop Down Menu in Column B to explain the reason for the revision. If adding a new model, select "N/A." If "Other" is selected, provide a brief explanation in the "Notes" box at the bottom of the table.
- 1.3. Enter the Manufacturer's legal name in Column C. Do not leave spaces or hidden characters before or after the Manufacturer Name.
- 1.4. Enter all model numbers in Column D from the highest Pmax value to the lowest Pmax. The model numbers must be exactly as listed on the UL 1703 certification. Wildcards in the model number are only acceptable for non-technical features that don't affect module performance such as frame type or connector type, but not power rating. Do not leave spaces or hidden characters before or after the Model Number.

1.5. Enter Nameplate Rated values for Pmax, Isc, Voc, Ipmax, and Vpmax in Columns E through I.

1.6. Enter any other pertinent information about the modules in the "Notes" box. For example, explain the characteristic differences of modules within same group that have different model numbers (other than power rating).

Table 2 Tested vs. Nameplate Comparison for Laboratory Tested Model (LTM) - ("Requested" Sheet)

- Table 2 calculates the percentage differences between the LTM Tested Values and the associated Nameplate Rated Values. Do not alter formulas or links.
- Table 2 may not be applicable for minor revisions to existing modules or when adding a multiple listing of an existing base model already on the list.
- Enter information only in the yellow-colored cells.
- Do not enter information in the grey-colored cells.

2.1 Step 1 - For each group/subgroup(s), determine the LTM's Pmax which is at least 95% of Highest Nameplate Rated Pmax for that group/subgroup.

- a) Multiply the highest Nameplate Rated Pmax in the group/subgroup by 0.95 = Θ . Round up to the next highest Nameplate Rated Pmax value in Table 1 – this is the LTM's Nameplate Rated Pmax, Ψ .
- b) Enter the value for Ψ in Table 2, Group/Subgroup 1, Column E.
- c) Enter the corresponding model number with the Pmax value of Ψ in Table 2, Group/Subgroup 1, Column D.

NOTE: If it is necessary to identify more subgroups, Repeat Steps 2.2 through 2.11 to fill out additional Table 2 Group/Subgroup tables as needed.

2.2 Step 2 - Determine the range of group/subgroup's Pmax values within 110 % and 90% of the LTM's Pmax value (Ψ).

- a) The group/subgroup's highest Pmax is $1.10 \times \Psi = \Omega$.
- b) The group/subgroup's lowest Pmax is $0.90 \times \Psi = \delta$.
- c) The group/subgroup's Pmax range is Ω through δ . Pmax range in descending value: Ω , Ψ , and δ (Also see the Example in the Instructions for additional guidance).

2.3 Enter the LTM's corresponding laboratory tested values for Pmax, Isc, Voc, Ipmax, Vpmax, NOCT, γ pmax, α sc, β Voc, α Ipmax, β VPmax, Ipmax,low, Vpmax,low, Vpmax,NOCT, and Vpmax,NOCT in Table 2, Group/Subgroup 1, Columns E through S.

2.4 Enter the LTM's corresponding nameplate rate values from Table 1 for Pmax, Isc, Voc, Ipmax, Vpmax in Columns E through I.

2.5 Tested vs. Nameplate Pmax = (Tested Pmax - Nameplate Rated Pmax)/Nameplate Rated Pmax x 100%. Generally, the acceptable value is between -5% and +5% in addition to lab accuracy. If not, the group/subgroup is not eligible and a module retest may be required.

2.6 Tested vs. Nameplate Isc = (Tested Isc - Nameplate Rated Isc)/Nameplate Rated Isc x 100%. If the value is between -10% and +10%, the group/subgroup is eligible. If not, a module retest may be requested.

2.7 Tested vs. Nameplate Voc = (Tested Voc - Rated Voc)/Nameplate Rated Voc x 100%. If the value is between -10% and +10%, the group/subgroup is eligible. If not, a module retest may be requested.

2.8 Tested vs. Nameplate I_{pmax} = (Tested I_{pmax} - Nameplate Rated I_{pmax})/Nameplate Rated I_{pmax} x 100%. If the value is between -10% and +10%, the group/subgroup is eligible. If not, a module retest may be requested.

2.9 Tested vs. Nameplate V_{pmax} = (Tested V_{pmax} - Nameplate Rated V_{pmax})/Nameplate Rated V_{pmax} x 100%. If the value is between -10% and +10%, the group/subgroup is eligible. If not, a module retest may be requested.

2.10 Enter the Tested Average NOCT in Column J.

Note: NOCT and temperature coefficients must be tested by on the same module that has a P_{max} that is at least 95% of the highest P_{max} rating in the same submitted group of modules.

2.11 Enter the Tested γ_{pmax} in Column K.

2.12 Enter any other pertinent information about the subgroup in the "Notes" box. For example, indicate if the average NOCT and temperature coefficient values were taken from the subgroup's LTM test report.

Note: Any red-colored value in the "Tested vs. Nameplate" row may indicate ineligibility for that criterion. Only group/subgroup(s) whose LTM's tested performance meet eligibility criteria for P_{max}, I_{sc}, Voc, I_{pmax}, V_{pmax}, NOCT and γ_{pmax} should be shown on Table 3.

Table 3 PV Modules to be Added to the Eligibility List - ("Eligible Modules" Sheet)

- Do not fill out Table 3 until Tables 1 and 2, for each group/subgroup(s) have been completed.
- Columns A, B, M, N, O, P, and Q are linked from Table 1 and will automatically populate. Do not alter formulas or links.
- Hide the rows containing all ineligible PV modules that are outside of the eligible P_{max} model range(s).
- Enter data in yellow-colored cells for the remaining eligible PV modules in Table 3.
- Enter data in yellow-colored Columns C, D, F, G, H, I, J, K, and L.

3.1 Enter Description in Column C: Limit to 30 characters. Specify the backsheet color if applicable. Do not use any subjective terms in the description such as "high efficiency."

3.2 Enter BIPV in Column D: Use the drop-down menu to select "Y" if equipment is a Building Integrated Photovoltaic Module (BIPV). If the module is rack mounted, select "N."

3.3 PTC in Column E is automatically calculated based on A_c, P_{max}, NOCT and γ_{pmax} . Do not alter formula or links.

3.4 "Enter Notes in Column F: Use the drop-down menu to identify ACPV modules or Multiple Listings, if applicable; if not, enter "N/A." For ACPV modules enter, "This component is specific to ACPV and is not available as an individual unit."

3.5 If the PV model is a multiple listing, enter the name(s) of the other manufacturer(s) in Column G. Wildcards in the model number are only acceptable for non-technical features that don't affect module performance such as frame type, connector type, but not power rating. Private labeling of PV models: Some manufacturers may wish to private label PV models for another

manufacturer. Such products should be submitted with a Multiple Listee letter from the NRTL. The Multiple Listee letter is evidence of UL 1703 certification.

- 3.6** In Column H, enter the model number(s) of the PV modules for each multiple listed manufacturer(s) identified in Column G.
- 3.7** Enter Family in Column I: Use the drop-down menu to select Monocrystalline, Polycrystalline, or Thin Film as appropriate.
- 3.8** Enter Aperture Area, A_c (square meters, m^2) in Column J: Excluding the frame, multiply the long side of the module by the short side.
- 3.9** Enter Number of Cells in Series, N_s in Column K: Cells in series may vary, however cells in parallel must be 1.
- 3.10** Enter Technology in Column L: Use the drop-down menu to select Mono-c-Si, Multi-c-Si, a-Si/nc, 1-a-Si, CdTe, or Thin Film as appropriate.
- 3.11** Columns R through AA are linked to Tables 1 and 2, and will automatically populate. Do not alter formulas or links.

Example: How to Determine Laboratory Tested Model (LTM) subgroups (See "Requested" Sheet, Table 2)

A manufacturer has a group of identical flat plate, DC, monocrystalline, in-series modules with the following Nameplate Rated P_{max} values at STC: 200 W, 195 W, 190 W, 185 W, 180 W, 175 W, 170 W, 165 W, 160 W. The P_{max} values correspond to model numbers: Del-200-60M, Del-195-60M, Del-190-60M, Del-185-60M, Del-180-60M, Del-175-60M, Del-170-60M, Del-165-60M, and Del-160-60M.

Step 1 - For each group/subgroup(s), determine the LTM's P_{max} at least 95% of highest Nameplate Rated P_{max} in the group.

- a)** The highest P_{max} in the group = 200 W.
- b)** The LTM's P_{max} value is at least $0.95 \times 200 = 190$ W.
- c)** Enter 190 W in Table 2, Group/Subgroup 1, Column E.
- d)** The corresponding LTM is Del-190-60M. Enter this model number in Table 2, Group/Subgroup 1, Column D.

Step 2 - Determine the range of group/subgroup's P_{max} values within 110% and 90% of the LTM's P_{max} value (190 W).

- a)** The LTM's P_{max} value = 190 W.
- b)** Subgroup 1's highest P_{max} is $1.10 \times 190 = 209$ W (round down to 200).
- c)** Subgroup 1's lowest P_{max} $0.90 \times 190 = 171$ W (round up to 175 W).
- d)** Subgroup 1's P_{max} values range is: 200 W, 195 W, 190 W, 185 W, 180 W and 175 W. This calculation indicates that there are at least two subgroups.
- e)** From NRTL or ILAC Test Report enter the laboratory tested values for P_{max} , I_{sc} , V_{oc} , I_{oc} , V_{pmax} , $NOCT$, α_{isc} , α_{pmax} , β_{Voc} , β_{Vpmax} , and γ_{pmax} in Table 2, Group/Subgroup 1, Columns E through S. The test results are applicable to this entire subgroup of modules.
- f)** Enter into Table 2, Group/Subgroup 1 the LTM's corresponding nameplate rated values from Table 1 for P_{max} , I_{sc} , V_{oc} , I_{pmax} , V_{pmax} in Columns F through I.

Step 3 - Determine the range of Subgroup 2's Pmax values within 110% and 90% of the highest Pmax value not included in Subgroup 1.

- a) The highest Pmax not included in Subgroup 1 = 170 W.
- b) The LTM's Pmax value = $0.95 \times 170 = 161.5$ (round up to 165 W). Enter 165 W, in Table 2, Subgroup 2 of Group 1, Column E.
- c) In Table 2, Subgroup 2 of Group 1, Column D, enter the LTM as Del-165-60M.
- d) Subgroup 2's highest Pmax is then $1.10 \times 165 = 181.5$ W (round down to 170 W, since 180 W and 175W are already included in Subgroup 1).
- e) Subgroup 2's lowest Pmax is $0.90 \times 165 = 148.5$ W (round up to 160 W).
- f) Subgroup 2's Pmax range is: 170, 165 and 160 W.
- g) From the NRTL or ILAC Test Report, enter the laboratory tested values for Pmax, Tested Isc, Voc, Ioc, Vpmax, NOCT, α_{Isc} , α_{Ipmax} , β_{Voc} , β_{Vpmax} , and γ_{pmax} in Table 2, Group/Subgroup 2, Columns E through S. The test results are applicable to this entire subgroup of modules.
- h) Enter the LTM's corresponding Nameplate Rated values from Table 1 for Pmax, Isc, Voc, Ipmax, Vpmax in Table 2, Group/Subgroup 2, Columns E through I.

GLOSSARY

Ac - Aperture Area (square meters, m^2): Excluding the frame, multiply the long side of the module by the short side

BIPV - Building Integrated Photovoltaic Module. If module is rack mounted, select "N."

Family - Use the drop-down menu to select Monocrystalline, Polycrystalline, or Thin Film as appropriate

Group - A set of modules with the same physical characteristics where the only difference among the modules in the group is the Nameplate Rated Maximum Power.

Ipmax (Amps) - Current at Maximum Power

Ipmax, NOCT (Amps) - Current at Maximum Power and NOCT

Ipmax,low (Amps) - Current at Maximum Power and Low Irradiance

Isc (Amps) - Short Circuit Current

LTM - Laboratory Tested Model

Multiple Listing Manufacturers & Associated Model Numbers: If the PV module is a multiple listing, enter the names of the other manufacturers and their associated model numbers. Wildcards are only acceptable for non-technical features such as frame type, connector type, but not power rating

Private labeling of PV modules: Some manufacturers may wish to private label PV modules for another manufacturer. Such products should be submitted with a Multiple Listee letter from the NRTL. The Multiple Listee letter is evidence of UL 1703 certification

NOCT - Nominal Operating Cell Temperature. The temperature reached by open circuited cells in a PV module under the following conditions: 800 watts per square meter irradiance on cell surface, 20 degrees Celsius air temperature, 1 meter per second wind velocity, and open back side mounting

Ns - Number of Cells in Series: Cells in series may vary, however cells in parallel must be 1

Pmax (Watts) - Maximum Power. Nameplate rating at Standard Test Conditions

PTC - Power value at PV USA Test Conditions. This value is automatically calculated based on A_c , P_{max} , NOCT and γ_{pmax} . The test conditions are 1,000 watts per square meter solar irradiance, 20 degrees Celsius air temperature, and 1 meter per second wind speed at 10 meters above ground level

PV - Photovoltaic

SB 1 - Senate Bill 1 (Murray, Chapter 132, Statutes of 2006, § 4)

STC - Standard Test Conditions. The test conditions are 1000 watts per square meter irradiance, 25 degrees Celsius cell temperature, and Air Mass 1.5 spectrum.

Technology - The type of PV module technology (Mono-c-Si, Multi-c-Si, a-Si/nc, 1-a-Si, CdTe, or Thin Film)

Voc (Volts) - Open Circuit Voltage

$V_{P_{max}}$ (Volts) - Voltage at Maximum Power

$V_{P_{max,low}}$ (Volts) - Voltage at Maximum Power and Low Irradiance

$V_{P_{max,NOCT}}$ (Volts) - Voltage at Maximum Power and NOCT.

$\alpha_{I_{pmax}}$ (%/°C) - Temperature Coefficient of Current at Maximum Power, percent per degrees Celsius (alpha I_{pmax})

$\alpha_{I_{sc}}$ (%/°C) - Temperature Coefficient of Short Circuit Current, percent per degrees Celsius (alpha I_{sc})

$\beta_{V_{oc}}$ (%/°C) - Temperature Coefficient of Open Circuit Voltage, percent per degrees Celsius (beta V_{oc})

$\beta_{V_{P_{max}}}$ (%/°C) - Temperature Coefficient of Voltage at Maximum Power, percent per degrees Celsius (beta V_{pmax})

$\gamma_{P_{max}}$ (%/°C) - Temperature Coefficient of Maximum Power, percent per degrees Celsius (gamma P_{max})