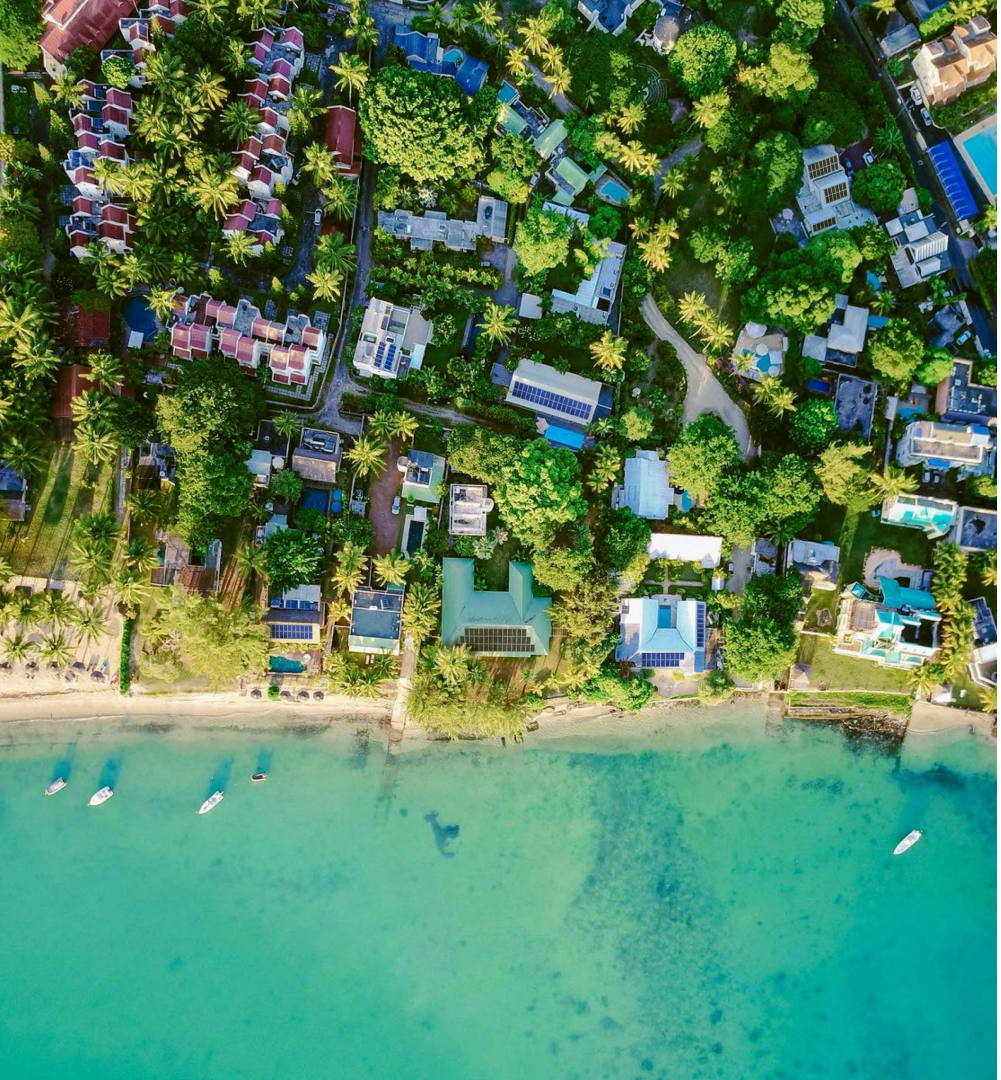


SolarAPP+ Contractor Input Training – Electrical (String w/DC)

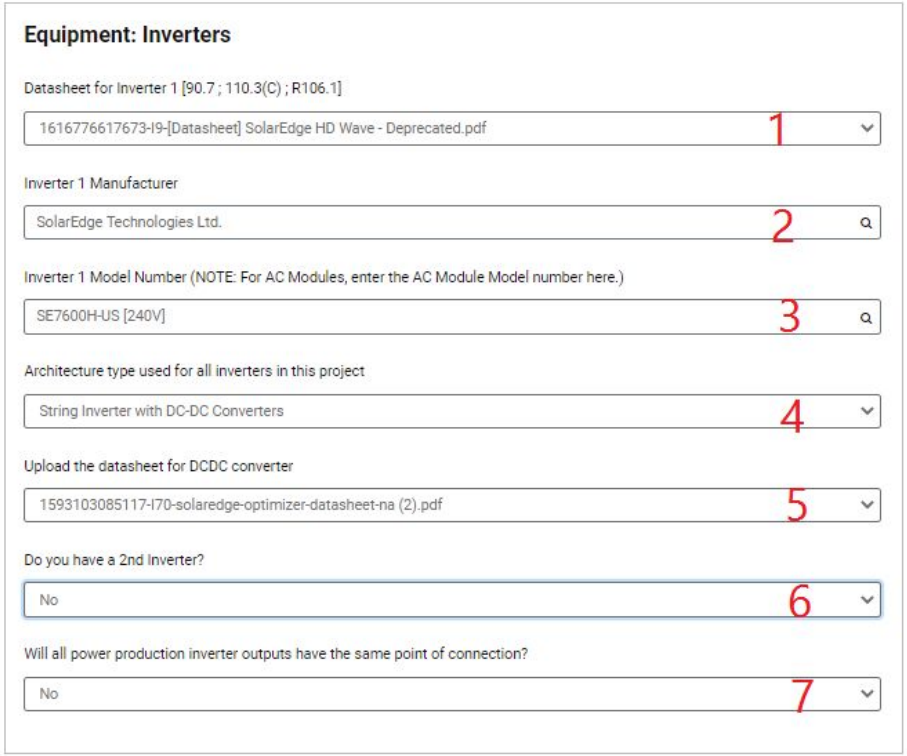
SolarAPP+: Electrical: String Inverters with DC-DC Converters

Electrical Page

With DC-DC converters i.e. Solaredge SE7600H

1. Datasheet = pre-populate from drop down (after first submission), Select the appropriate model number.
2. Manufacturer = Select from the dropdown list
3. Select the inverter model number
   - This question is accessing a database of approved equipment based on the manufacturer selection. Model numbers are required to match exactly.
4. Architecture type = String inverter with DC-DC converters
5. Datasheet - pre-populate from drop down (after first submission, select the appropriate model number.
6. 2nd Inverter = if yes, see scope of work and/or refer to electrical diagram. If so, provide details in similar fashion as first inverter.
7. Inverter outputs must have the same point of interconnection method for eligibility in SolarAPP+.

SolarAPP Standard Electrical Permit

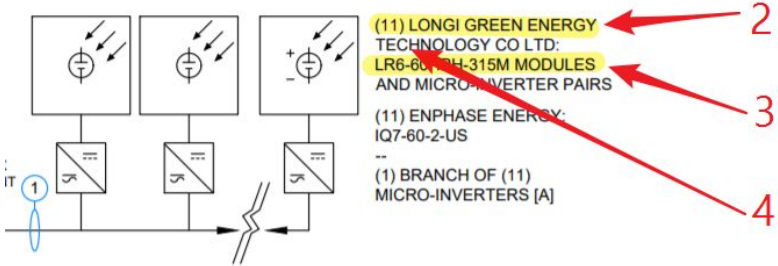


SolarAPP+: Electrical: Modules

Electrical Page

Modules

1. Datasheet = pre-populated from dropdown (after first submission), Select the appropriate model number.
2. Manufacturer = Select from the dropdown list
3. Select the inverter model number
   - This question is accessing a database of approved equipment based on the manufacturer selection. Model numbers are required to match exactly.
4. Module Quantity can be gleaned from the single line diagram and/or the scope of work.



Equipment: Modules

Datasheet for Module 1 [90.7 ; 110.3(C) ; R106.1]

1607633542851-I12-[Datasheet] LONGi LR6-60HPB 300-320W.pdf 1

Module 1 Manufacturer

LONGi Green Energy Technology Co., Ltd. 2

Module 1 Model Number (NOTE: For AC Modules, enter the DC modules model number.)

LR6-60HPH-315M 3

Module 1 Quantity

11 4

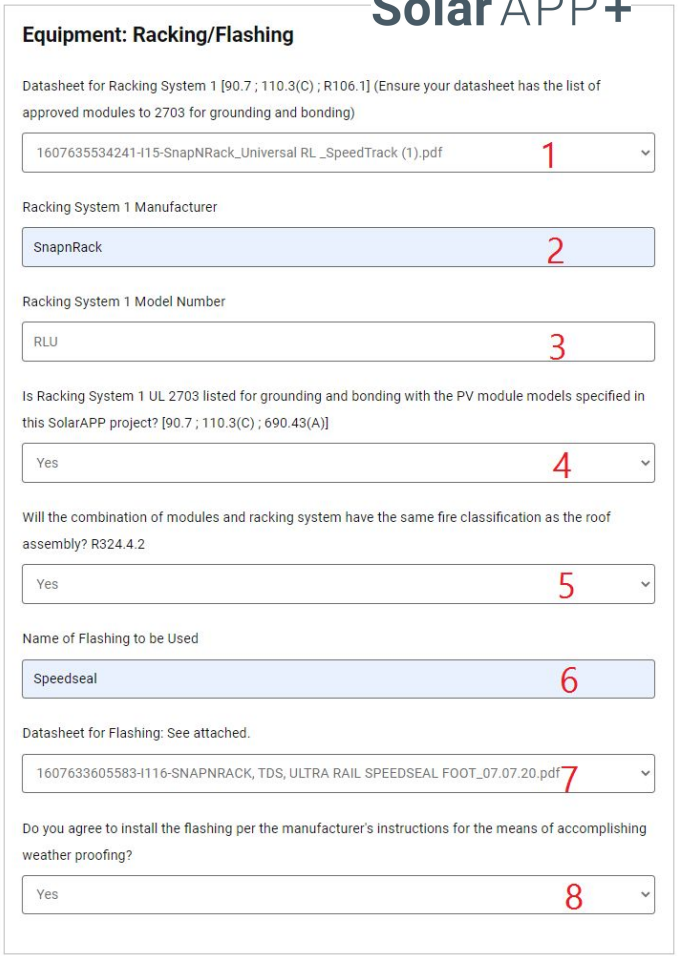
SolarAPP+: Electrical: Racking/Flashing

Electrical Page

Racking/Flashing

1. Datasheet = pre-populate from drop down (after first submission), Select the appropriate model number.
2. Manufacturer = see details on design data sheet for manufacturer name in this case **SnapNRack**
3. Model Number = **See detail on design and the related data sheet.**
4. Combination of racking and modules listed to UL 2703 = **Yes**
5. Fire Classification = **Yes**
6. Flashing = **See detail on design and related data sheet.**
7. Datasheet = pre-populate from drop down (after first submission), Select the appropriate model number.
8. Flashing installed per MFG instruction = **Yes**.

G INFO			ATTACHMENT INFORMATION		
	Max Span	OC Spacing	Detail	Max Landscape OC Spacing	Max Landscape Overhang
	11' - 3"	24"	RL UNIVERSAL, SPEEDSEAL TRACK ON COMP, SEE DETAIL SNR-DC-00436	6' - 0"	1' - 6"



SolarAPP+: Racking/Flashing

Electrical Page

Racking/Flashing

1. To specify fire classification for the combination of racking system and modules to UL 2703 the contractor is required to upload the installation manual that clearly lists the approved modules that match the SolarAPP submission.
2. For a SolarAPP project employing the RL Universal Racking system with Longi LR4-60HPH-360M modules, the contractor would upload a copy of the Racking system installation manual containing the specific model numbers for the installed module as shown here..

Appendix A

APPROVED MODULE INFORMATION

The following modules have completed the UL 2703 Listing process for bonding and fire classification and have been approved for use with the RL Universal mounting system by the module manufacturer. Module manufacturer approval letters can be found at www.snapnrack.com.

RL Universal has been evaluated for Bonding of the following UL/NRTL Listed PV modules to UL 2703 requirements:

Manufacturer	Model	Wattage
Longi	LR6-60-XXXM	270-300
	LR6-60BK-XXXM	270-300
	LR6-60HV-XXXM	270-300
	LR6-60PB-XXXM	280-320
	LR6-60PE-XXXM	280-320
	LR6-60PH-XXXM	280-320
	LR6-60HIB-XXXM	295-320
	LR6-60HPB-XXXM	295-320
	LR6-60HIH-XXXM	300-330
	LR6-60HPH-XXXM	300-320
	LR4-60HIB-XXXM	335-365
	LR4-60HPB-XXXM	335-365
	LR4-60HIH-XXXM	350-380

SolarAPP+: Racking/Flashing (Continued)

Electrical Pa

Racking/Flashing

1. The contractor could also collect this information directly from a NRTL and their product information page, which verifies the 2703 certification of the mounting system with a specific module for bonding, grounding, mechanical loading, and system fire classification.
2. Here we show an example using GAF's DecoTech RI 2000 mounting system and an example module: Solaria PowerXT-325R-BX / 330R-PX.

UL Product iQ™

QIMS.E485228 - Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels

Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels

See General Information for Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels

GAF
1 CAMPUS DR
PARSIPPANY, NJ 07054 USA

E485228

Cat. No.	Investigated for Bonding	Investigated for Mechanical Loading	System Fire Classification (A, B or C)	Tested in Combination With
Photovoltaic mounting system				
DecoTech RI 2000	Y	Y	See Below	NRTL listed UL 1703 laminates 1. Solar World "Sunmodule Plus 270-300 mono black laminate" 2. Solar World "Sunmodule Protect 270-300 mono black laminate 3. "Stion "STL models" 4. Solaria PowerXT "PowerXT-325R-BX|330R-PX" 5. Silfab Solar "SLA-M300|M310"
DecoTech RI 2000	See Above	See Above	A	Any listed fire performance type 3 modules. And NRTL listed UL 1703 laminates: Solar World "Sunmodule Plus 270-300 mono black laminate " Solaria PowerXT "PowerXT-325R-BX|330R-PX" Silfab Solar "SLA-M300|M310"
GAF Energy Solar System	Y	Y	See Below	NRTL Certified, Solaria PowerXT "PowerXT-360R-PD-L"
GAF Energy Solar System	See Above	See Above	A	NRTL Certified, Solaria PowerXT "PowerXT-360R-PD-L"

Last Updated on 2020-02-24

SolarAPP+: Electrical: Rapid Shutdown for DC String Inverters

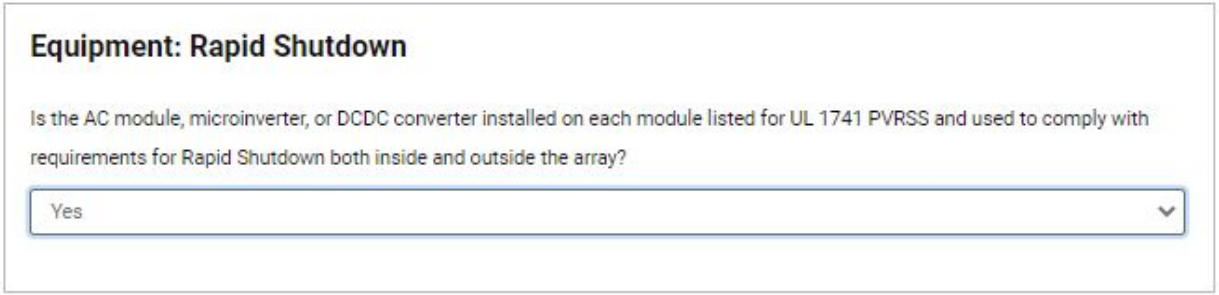
Electrical Page

Rapid Shutdown: Know your tech!

1. RSD listed to UL 1741 = **Yes**. Find this info on the datasheet for Optimizers or DCDC converters..

.

For DC String inverter (i.e. Delta, Solaredge, or SMA) = Yes



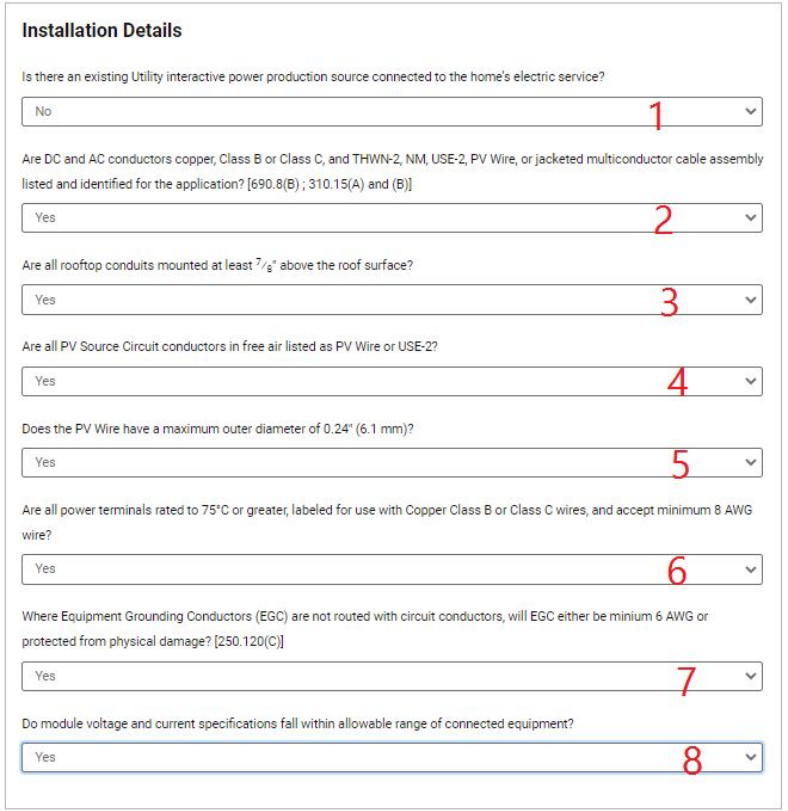
SolarAPP+: Electrical: Installation Details

Electrical Page

Installation details is about the materials we use for install, except....

1. **Existing PV systems and energy storage NOT allowed**
2. Conductor type = **Yes**
3. Rooftop Conduit height = **Yes**
4. PV wire or Use-2 = **Yes**
5. Pv wire diameter = **Yes**
6. Terminal rating = **Yes**
7. Grounding conductor = **Yes**
8. Voltage and current spec within range of connected equipment? = **Yes**

The Installation Details section sets the minimum requirements for installation materials that inform SolarAPP+ code compliance checks. The contractor MUST adhere to these requirements at installation in order to maintain SolarAPP+ eligibility. Diameter, height, and rating contribute to the calculations used for conductor size, conduit fill, and conductor ampacity derating.

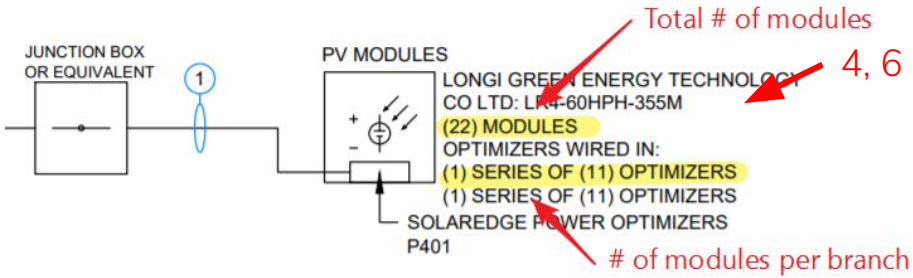


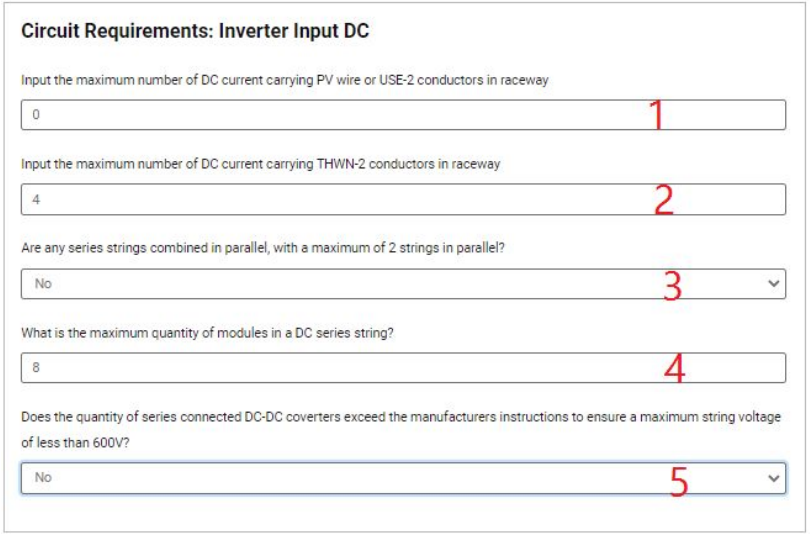
SolarAPP+: Electrical: DC-String Inverters Circuit Requirements

Electrical Page

For "With DC-DC converters" (aka Solaredge)

1. Max number of DC Current carrying conductor (CCC) PV wire in raceway = enter 2 per the number of circuits from roof to ground in the same raceway, one 10AWG THWN-2 EGC is used for conduit fill calculations. See conduit schedule.
2. Max number of DC CCC THWN wire in raceway = Enter 0 for PV wire used from array to inverter directly or (2) per the number of circuits from roof to ground in a single raceway. See conduit schedule.
3. Are any series strings combined in parallel? Enter "No" or "Yes" depending if you choose to combine strings in parallel on the roof to reduce the amount of wires in the raceway.
4. Max number of modules in a branch = **Branch of (X)**
5. Is string voltage less than 600V = **Must be specified on datasheet or not eligible for SolarAPP+.**



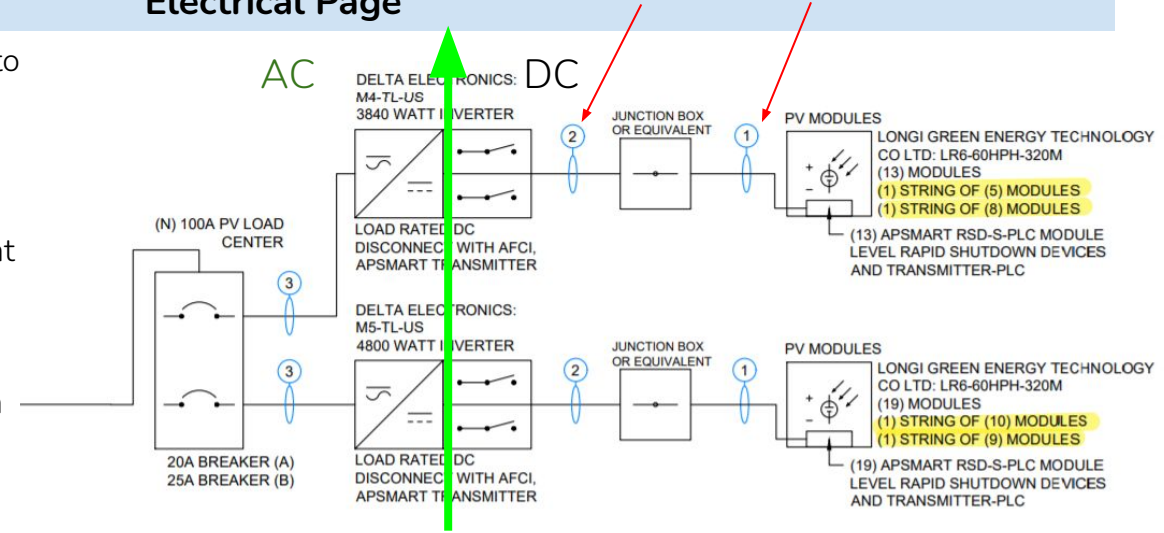


SolarAPP+: Electrical: DC-String Inverters Circuit Requirements

Electrical Page

DC current carrying conductors (CCC) refers to the DC source circuit conductors from the array to the inverter. Each branch circuit will have (2) CCC. The SolarAPP+ is using this value to calculate conduit and DC wire size. This value will increase with each subsequent branch circuit of modules. A circuit with 2 branches of modules will have (4) CCC. AC CCC refers to the inverter output circuits and per the example, each inverter has (3) CCC in a single raceway. The output of the PV load center is always assumed to have (3) CCC.

- For more information on this topic see the appended slides.



DC Current Carrying Conductors

DC

AC

CONDUIT SCHEDULE

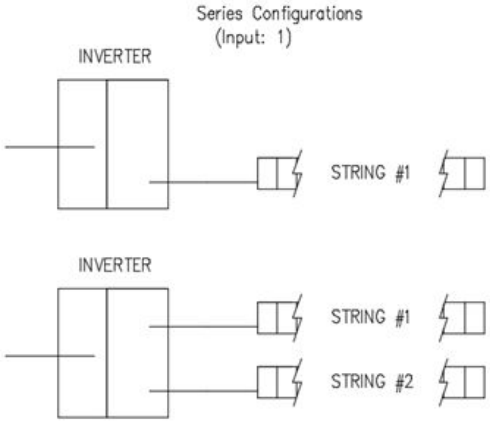
#	CONDUIT	CONDUCTOR	NEUTRAL	GROUND
1	NONE	(4) 10 AWG PV WIRE	NONE	(1) 10 AWG BARE COPPER
2	1" EMT OR EQUIV.	(4) 10 AWG THHN/THWN-2	NONE	(1) 10 AWG THHN/THWN-2
3	3/4" EMT OR EQUIV.	(2) 10 AWG THHN/THWN-2	(1) 10 AWG THHN/THWN-2	(1) 8 AWG THHN/THWN-2
4	3/4" EMT OR EQUIV.	(2) 8 AWG THHN/THWN-2	(1) 10 AWG THHN/THWN-2	(1) 8 AWG THHN/THWN-2

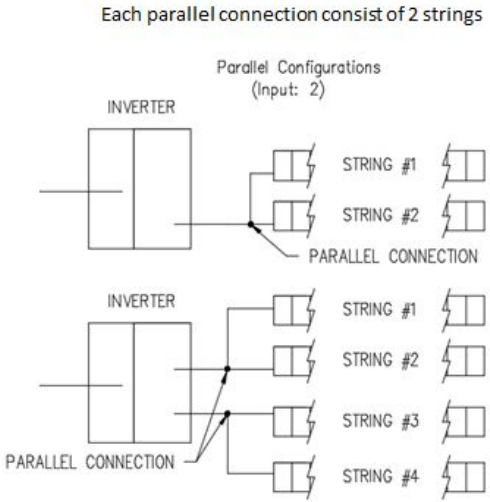
SolarAPP+: Electrical: DC-String Inverters Circuit Requirements

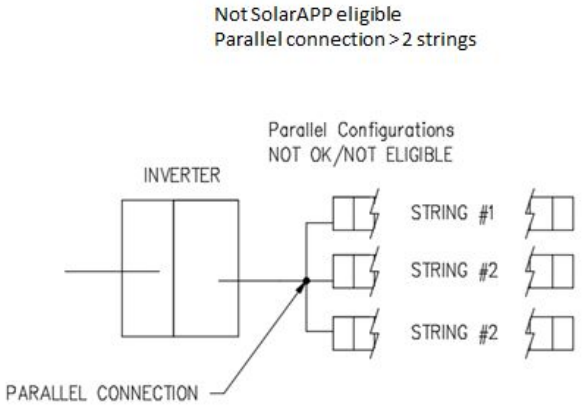
Series Strings in Parallel

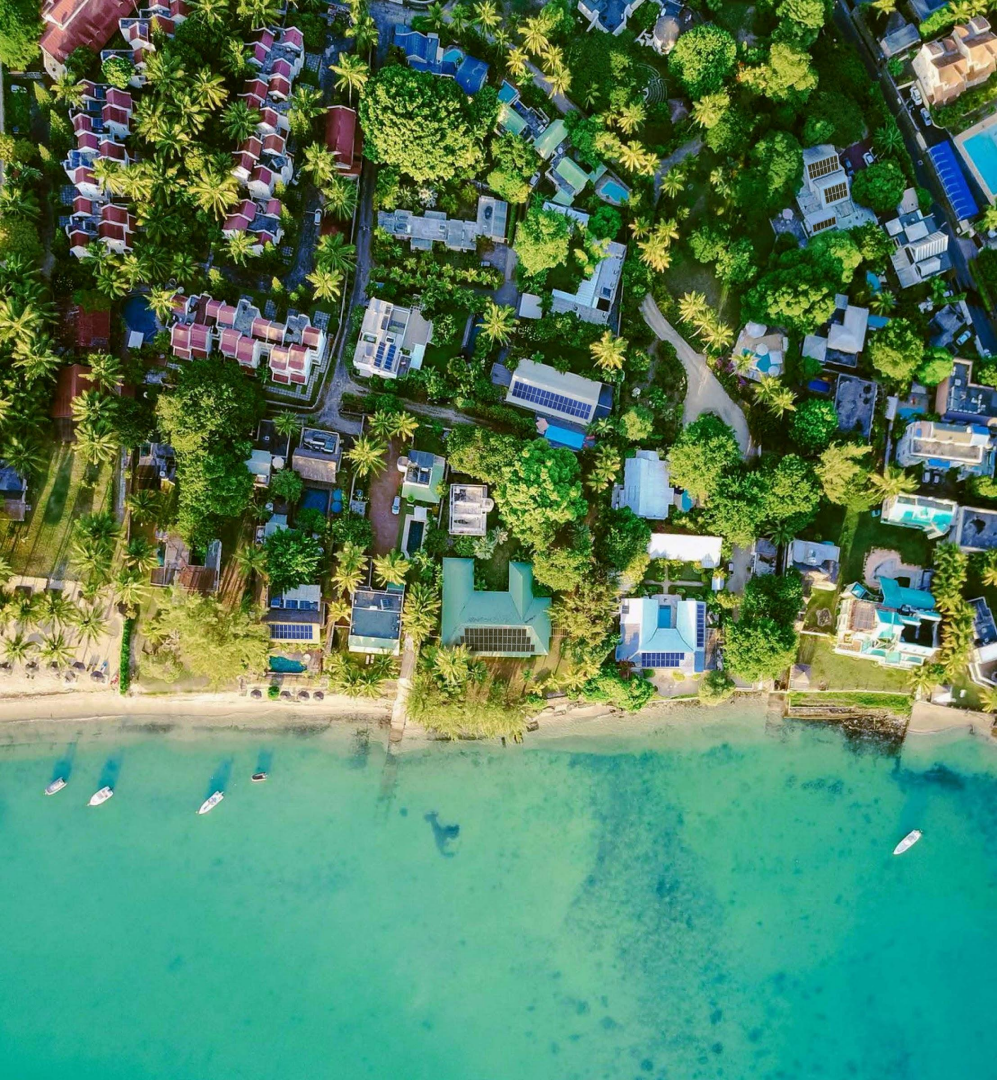
For "With DC-DC converters" (aka Solaredge)

1. How many series strings are combined in parallel?
   - When no strings combined in parallel enter 1.
   - When combining two series strings in parallel, enter 2.
2. An electrical parallel connection must consist of no more than 2 strings.
3. Note: ok to have multiple parallel connected strings so long as each connection consist of no more than 2 strings. See examples below.
   - See conduit schedule.









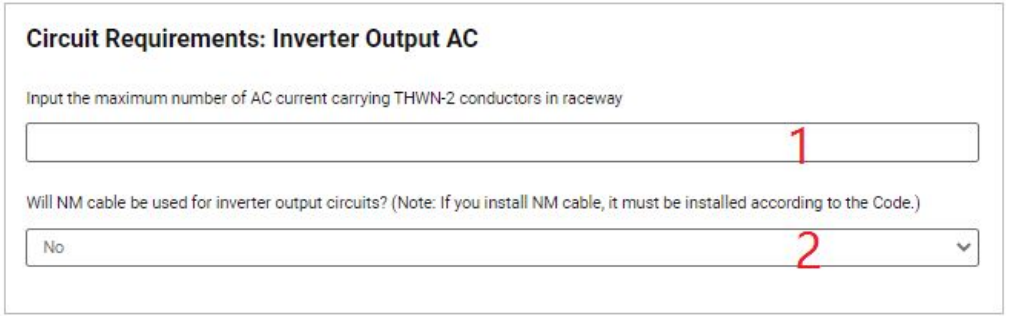
SolarAPP+ Contractor Input Training (All Jobs continued)

SolarAPP+: Electrical: Inverter Output AC

Electrical Page

For all architectures

1. Max number of AC CCC THWN wire in raceway = **(3) per inverter in a single raceway. The output of the combiner panel is default to (3)**
2. Will NM cable be used? = **No** (See conduit schedule)
   - Except: Microinverter Array conductors using NM cable in the attic for new construction =Yes



SolarAPP+: Electrical: Relocated Loads = No

Electrical Page

For all architectures

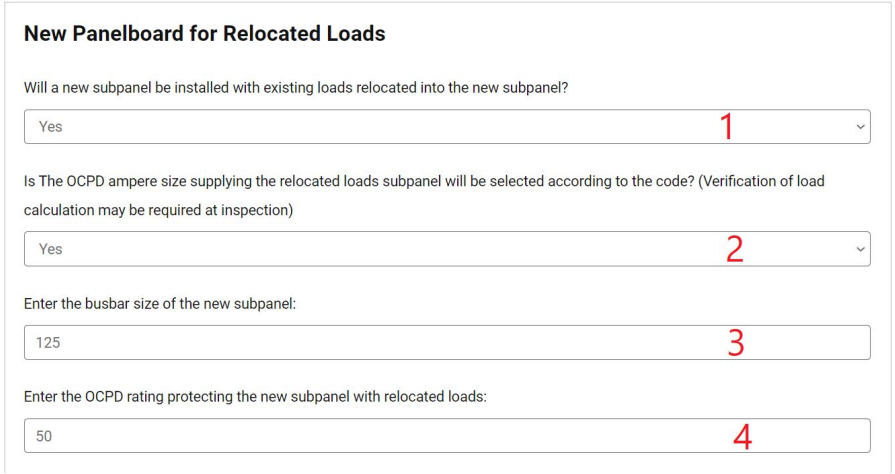
1. Sometimes, interconnection at a panelboard requires that certain circuit breakers be relocated to a new sub-panel to allow space to land the PV overcurrent protective device. See the electrical circuit diagram for new (N) sub-panels and their ratings.

SolarAPP: Electrical: Relocated Loads = Yes

Electrical Page

For all architectures

1. When relocating loads from the main panel to a NEW sub panel to make room for the point of interconnection, = **See SLD for details**
2. Properly sized OCPD = **YES**
3. Busbar Ampere rating = **See system design**
4. Relocated loads Overcurrent protective device ampere rating = **See system design**
5. Is the subpanel located adjacent to the panelboard? = **See site plan detail**
6. Current Carrying Conductors includes relocated branch circuits AND Sub panel feeder conductors IF in a single raceway = **See system design**
7. Relocated branch circuits do not require ampacity derates if installed less than 2ft from panelboard. = **See Site plan detail**

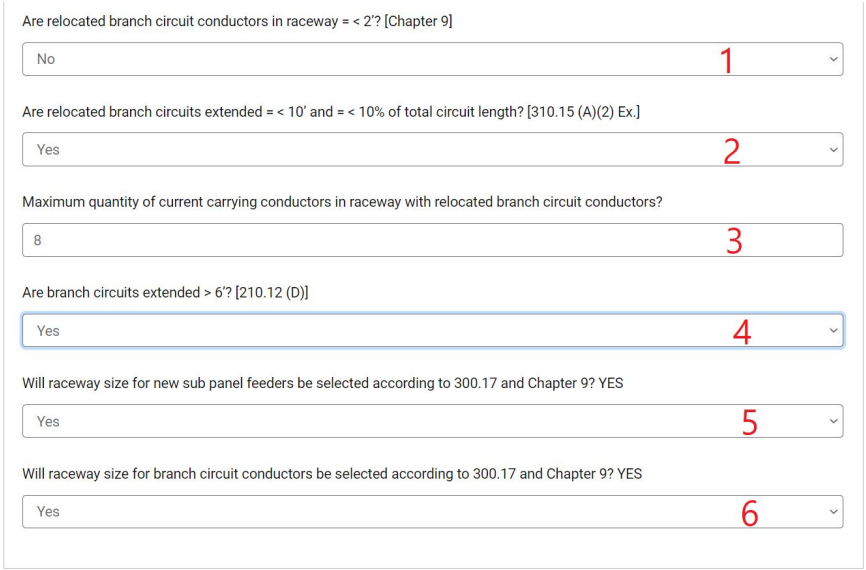


SolarAPP: Electrical: Relocated Loads = Yes

Electrical Page

For all architectures

1. When Branch Circuit conductors for relocated loads are relocated greater than 2ft = **See site plan** (typically = **NO)**
2. Are relocated branch circuit conductors extended less than 10ft or 10% of total circuit length = **See Site plan** (typically = YES**)**
3. Current Carrying Conductors includes relocated branch circuit conductors AND Sub panel feeder conductors IF in a single raceway = **See system design**
4. Are branch circuit conductors for relocated loads extended more than 6ft = **See Site plan**
5. Will the raceway size for Sub Panel feeders be sized according to the code = **Yes**
6. Will the raceway size for relocated branch circuit conductors be sized according to the code = **Yes**

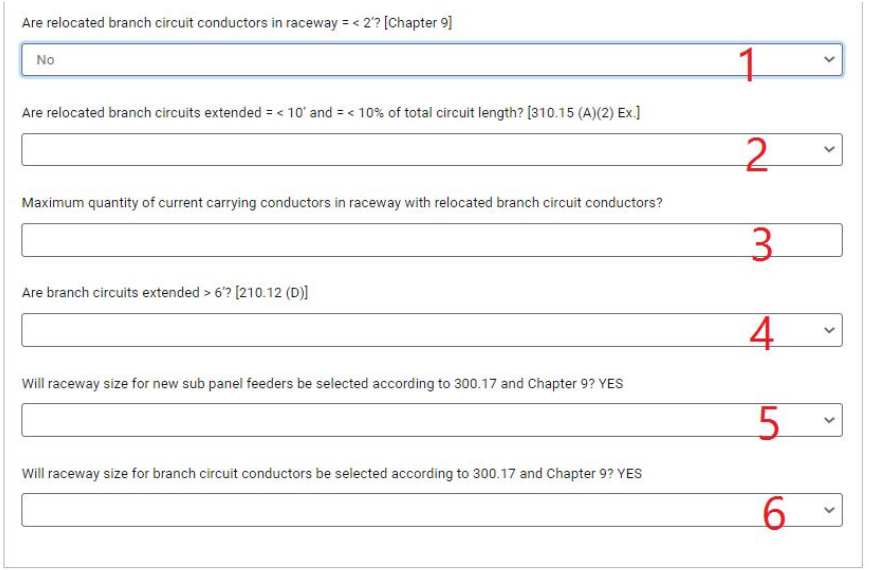


SolarAPP: Electrical: Relocated Loads = Yes (con't)

Electrical Page

For all architectures

1. When Branch Circuit conductors are relocated greater than 2ft = **NO**
2. Are branch circuit conductors less than = **YES**
3. Busbar Ampere rating = **See system design**
4. Sub Panel feeder breaker ampere rating = **See system design**
5. Is the subpanel located adjacent to the panelboard? = **See site plan detail**
6. Current Carrying Conductors includes relocated branch circuits AND Sub panel feeder conductors IF in a single raceway = **See system design**
7. Relocated branch circuits do not require ampacity derates if installed less than 2ft from panelboard. = **See Site plan detail**

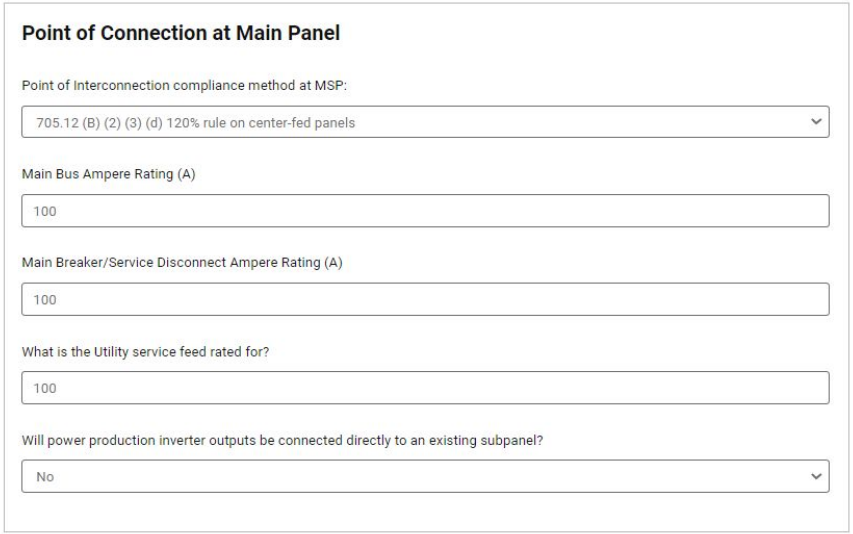


SolarAPP+: Electrical: Point of Connection at Main Panel Load Side 120% Rule

Electrical Page

For all architectures

- A loadside interconnection using the 120% rule is the most common method of installation for PV only projects. It relies on tl maximum inverter output, main breaker and main bus ratings to determine code compliance.
- The method of interconnection will be a listed circuit breaker



For example…

1. POI method at MSP = **705.12(B)(2)(3)(b) 120% rule** or **705.12(B)(2)(3)(d) 120% rule on center-fed panels** based on MSP
2. Main bus rating = **see SLD**
3. Main Breaker rating = **See SLD**
4. Utility service feed rated for = **See Main Breaker/Main bus rating**
5. Will inverter outputs be connected directly to a sub-panel = **No** for Meter socket adapter, check the SLD

SolarAPP+: Electrical: Point of Connection at Main Panel Supply Side

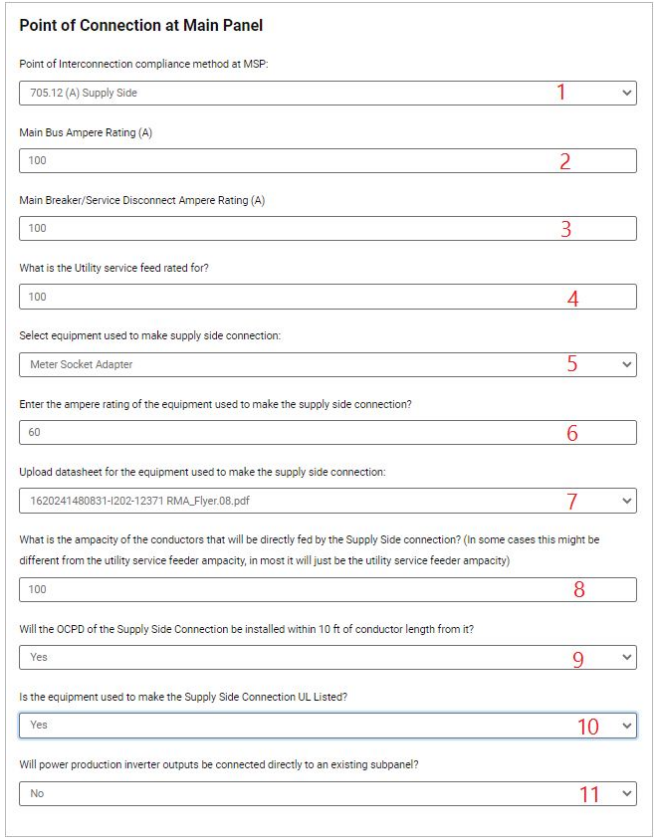
Electrical Page

For all architectures

- A supply-side interconnection is when the point of interconnection (POI) is ahead of the service disconnect (aka Main breaker). This can be accomplished through the use of an insulation-piercing connector, multi-port connector, breaker connector, meter lug connector, meter socket adapter, field evaluated supply-side connection, breaker connection at a main lug only (MLO) panel (aka “hot bus”), or a “solar-ready” panel slot.
- Each of these methods will have a specific “allowable backfeed” that SolarAPP+ will evaluate based on the answer to certain questions.

For meter socket adapter example…

1. POI method at MSP = **705.12(A) Supply-side**
2. Main bus rating = **see SLD**
3. Main Breaker rating = **See SLD**
4. Utility service feed rated for = **See Main Breaker/Main bus rating**
5. Service Equipment used = **Meter Socket Adapter as an example**
6. Enter the AMP rating of the equipment = As an example **60A**
7. Datasheet
8. Ampacity of the conductors fed by the SST = **Same as utility service rating**
9. Supply-side conductor length less than 10ft = **Yes**
10. Is the equipment used UL listed = **Yes**
11. Will inverter outputs be connected directly to a sub-panel = **No** for Meter socket adapter, check the SLD

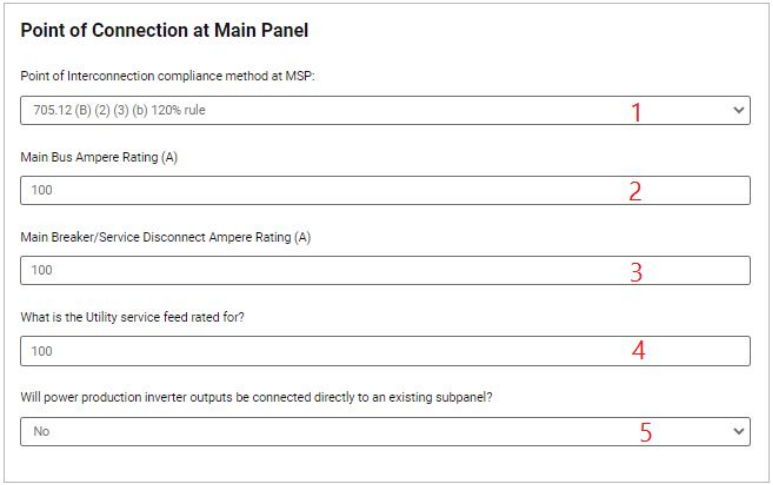


SolarAPP+: Electrical: Point of Connection at Main Panel Load Side Sum of Breakers Rule

Electrical Page

For all architectures

- A loadside interconnection using the Sum of Breakers rule is the most common method of installation for PV + Storage projects. It weighs the sum of breaker ratings on the bus plus the rating of the OCPD against the rating of the main bus. Design may relocate loads to a new subpanel to make this condition true.
- The method of interconnection will be a listed circuit breaker
- The sum of breakers will be validated at inspection by the AHJ.



For example…

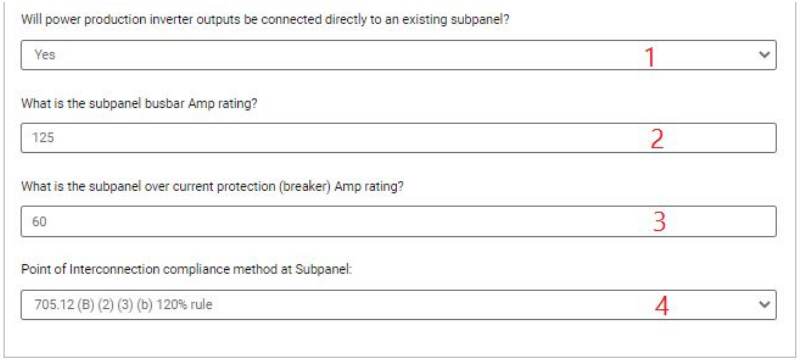
1. POI method at MSP = **705.12(B)(2)(3)(c) Sum of Breakers rule**
2. Main bus rating = **see SLD**
3. Main Breaker rating = **See SLD**
4. Utility service feed rated for = **See Main Breaker/Main bus rating**
5. Will inverter outputs be connected directly to a sub-panel = **Check the SLD for a sub-panel interconnection**

SolarAPP+: Electrical: Point of Connection at Sub-Panel

Electrical Page

For all architectures

- A loadside interconnection may occur at a sub-panel. Specific compliance methods can be chosen at both the sub-panel and main panel boards.
- The method of interconnection will be a listed circuit breaker
- The sum of breakers will be validated at inspection by the AHJ.
- Interconnection rules must be maintained for all panelboards and conductors that carry the system backfeed to the utility grid.



For example, when applicable…

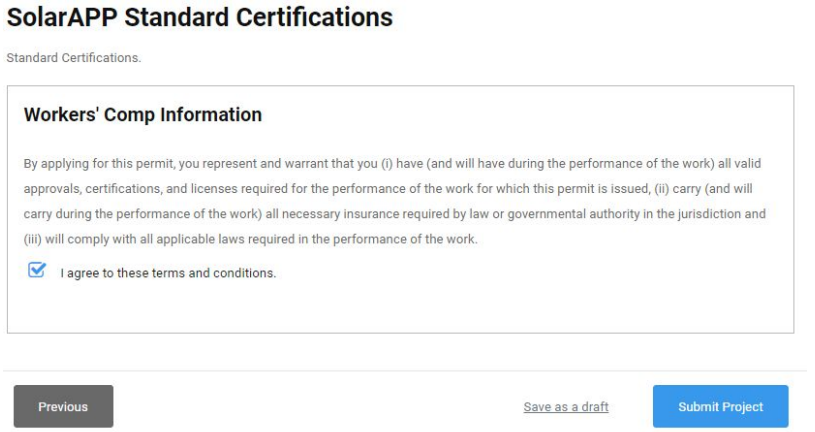
1. Interconnection at sub-panel = **Yes**
2. Main bus rating = **see SLD**
3. Main Breaker rating = **See SLD**
4. POI method at MSP = **705.12(B)(2)(3)(c) Sum of Breakers rule**

Workers' Comp

Standard Certifications

Workers' Comp

1. Agree to the terms and conditions and submit the project.

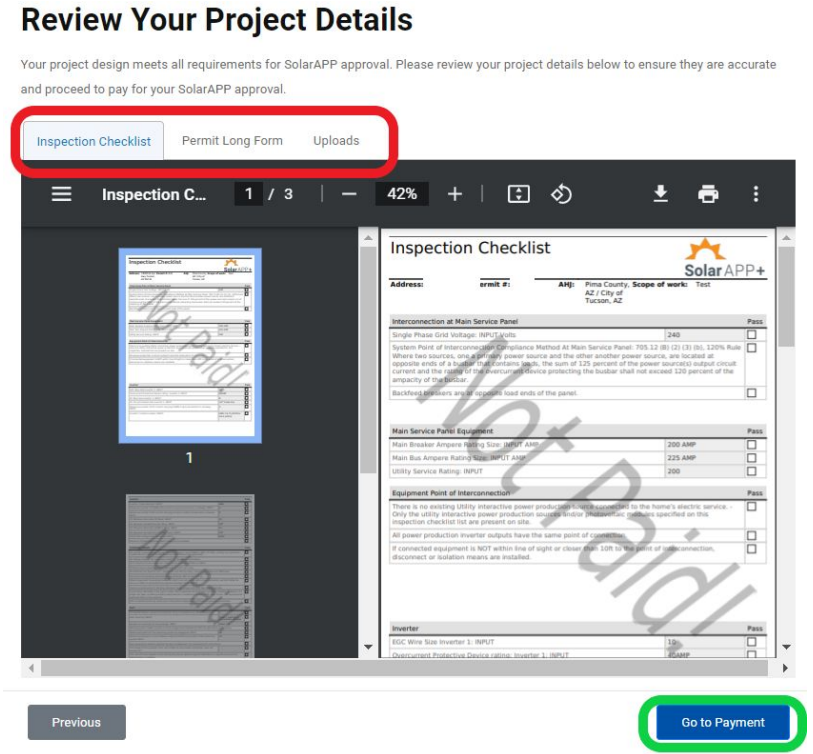


Review your Project Details

Solar APP+

Review Your Project Details

1. Review Inspection checklist and Permit Long form for accuracy
2. Go to payment.



SolarAPP+ Fee Payment

Review Your Project Details

1. Enter card information and submit payment.
2. If permit approval is also required via AHJ website, SolarAPP+ will prompt and provide direct link to AHJ permit submittal page.
3. Complete permit application through AHJ website and upload SolarAPP+ approval documents and uploads (per instructions from AHJ).