



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
- 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

Datasheet for Inverter 1 [90.7 ; 110.3(C) ; R106.1]		
1616776617673-I9-[Datasheet] SolarEdge HD Wave - Deprecated.pdf	1	`
nverter 1 Manufacturer		
SolarEdge Technologies Ltd.	2	C
nverter 1 Model Number (NOTE: For AC Modules, enter the AC Module Model number here.)		
SE7600H-US [240V]	3	C
architecture type used for all inverters in this project		
String Inverter with DC-DC Converters	4	,
Jpload the datasheet for DCDC converter		
	5	`
1593103085117-I70-solaredge-optimizer-datasheet-na (2).pdf		
1593103085117-I70-solaredge-optimizer-datasheet-na (2).pdf 00 you have a 2nd Inverter?		
The state of the s	6	,
o you have a 2nd inverter?	6	`

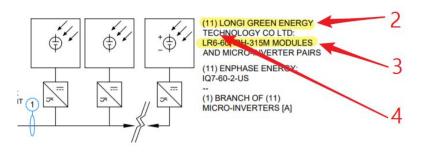
SolarAPP+: Electrical: Modules



Electrical Page

Modules

- 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.



Datasheet for Module 1 [90.7 ; 110.3(C) ; R106.1]		
1607633542851-112-[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 me	odel number.)	
Module 1 Model Number (NOTE: For AC Modules, enter the DC modules modules and LR6-60HPH-315M	odel number.)	•
Module 1 Model Number (NOTE: For AC Modules, enter the DC modules modules 1 Ac Module 1 Quantity	odel number.)	•

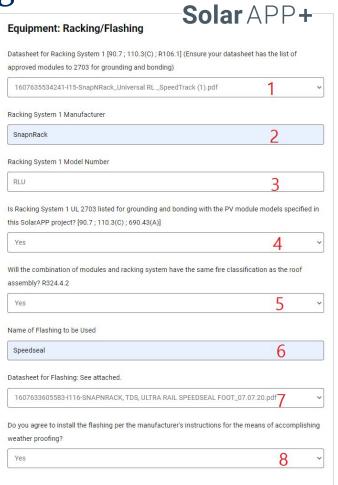
SolarAPP+: Electrical: Racking/Flashing

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**.

3 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

- 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.
- 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..

SnapNrack^{**}

Solar Mounting Solutions

RL Universal

Railless Residential Roof Mount System Installation Manual

Appendix A

snapnrack.com

PROVED 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
	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
Longi	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
	LD4 COUDH VVVM	750 790

SolarAPP+: Racking/Flashing (Continued)



Electrical Pag

Racking/Flashing

- 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.
- 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 iO™



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 Photovoltain

Investigated

E485228 1 CAMPUS DR

PARSIPPANY, NJ 07054 USA

Cat. No.	Investigated for Bonding	for Mechanical Loading	System Fire Classification (A, B or C)	Tested in Combination With
Photovoltaic mount	ing system	100		
DecoTech RI 2000	Y)	Y)	See Below	NRTL listed UL 1703 laminates 1. Solar World "Summodule Plus 270-300 mono black laminate" 2. Solar World "Summodule 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" Solara PowerXT "PowerXT-32SR BXJ330R 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"

SolarAPP+: Electrical: Rapid Shutdown for DC String Inverters



Electrical Page

Rapid Shutdown: Know your tech!

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

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

.

Is the AC module, microinverter, or DCDC converter installed on each module listed for UL 1741 PVRSS requirements for Rapid Shutdown both inside and outside the array?	S and used to comply with
Yes	~

SolarAPP+: Electrical: Installation Details



Electrical Page

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

- Existing PV systems and energy storage NOT allowed
- Conductor type = **Yes**
- Rooftop Conduit height = **Yes**
- PV wire or Use-2 = **Yes**
- Pv wire diameter = **Yes**
- Terminal rating = **Yes**
- Grounding conductor = **Yes**
- 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.

Installation Details	
s there an existing Utility interactive power production source	e connected to the home's electric service?
No	1 ~
Are DC and AC conductors copper, Class B or Class C, and Thisted and identified for the application? [690.8(B); 310.15(A)	HWN-2, NM, USE-2, PV Wire, or jacketed multiconductor cable assembl and (B)]
Yes	2 ~
Are all rooftop conduits mounted at least $^{7}/_{8}$ " above the roof	surface?
Yes	3 •
Are all PV Source Circuit conductors in free air listed as PV W	fire or USE-2?
Yes	4
Does the PV Wire have a maximum outer diameter of 0.24" (6	i.1 mm)?
W	
Yes	5 ~
	se with Copper Class B or Class C wires, and accept minimum 8 AWG
Are all power terminals rated to 75°C or greater, labeled for us	se with Copper Class B or Class C wires, and accept minimum 8 AWG
Are all power terminals rated to 75°C or greater, labeled for us wire? Yes Where Equipment Grounding Conductors (EGC) are not routed	se with Copper Class B or Class C wires, and accept minimum 8 AWG
Are all power terminals rated to 75°C or greater, labeled for us wire? Yes Where Equipment Grounding Conductors (EGC) are not routed	6 ~
Are all power terminals rated to 75°C or greater, labeled for us wire? Yes Where Equipment Grounding Conductors (EGC) are not routed protected from physical damage? [250.120(C)]	d with circuit conductors, will EGC either be minium 6 AWG or

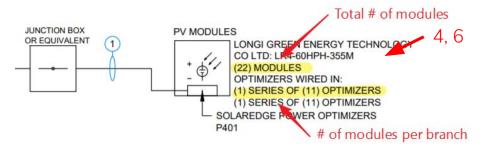
SolarAPP+: Electrical: DC-String Inverters Circuit Requirements



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+.



Circuit Requirements: Inverter Input I	
nput the maximum number of DC current carrying PV w	ire or USE-2 conductors in raceway
0	1
nput the maximum number of DC current carrying THWI	N-2 conductors in raceway
4	2
Are any series strings combined in parallel, with a maxim	num of 2 strings in parallel?
No	3
What is the maximum quantity of modules in a DC series	s string?
8	4
Ooes the quantity of series connected DC-DC coverters e	exceed the manufacturers instructions to ensure a maximum string volt.
of less than 600V?	9 - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1
No	_

SolarAPP+: Electrical: DC-String Inverters Circuit Requirements



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. **Electrical Page** DELTA ELECTRONICS: M4-TL-US 3840 WATT I VERTER JUNCTION BOX **PV MODULES** OR EQUIVALENT LONGI GREEN ENERGY TECHNOLOGY CO LTD: LR6-60HPH-320M (13) MODULES (1) STRING OF (5) MODULES (1) STRING OF (8) MODULES (N) 100A PV LOAD LOAD RATEL DC (13) APSMART RSD-S-PLC MODULE CENTER DISCONNEC WITH AFCI. LEVEL RAPID SHUTDOWN DEVICES APSMART TE ANSMITTER AND TRANSMITTER-PLC DELTA ELECTRONICS M5-TL-US 4800 WATT I IVERTER JUNCTION BOX PV MODULES OR EQUIVALENT LONGI GREEN ENERGY TECHNOLOGY CO LTD: LR6-60HPH-320M (19) MODULES (1) STRING OF (10) MODULES (1) STRING OF (9) MODULES LOAD RATEL DC 20A BREAKER (A) (19) APSMART RSD-S-PLC MODULE DISCONNEC WITH AFCI. 25A BREAKER (B) LEVEL RAPID SHUTDOWN DEVICES APSMART TE ANSMITTER AND TRANSMITTER-PLC

DC Current Carrying Conductors

	2				
DC	CON	DUIT 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
AC	4	3/4" EMT OR EQUIV.	(2) 8 AWG THHN/THWN-2	(1) 10 AWG THHN/THWN-2	(1) 8 AWG THHN/THWN-2

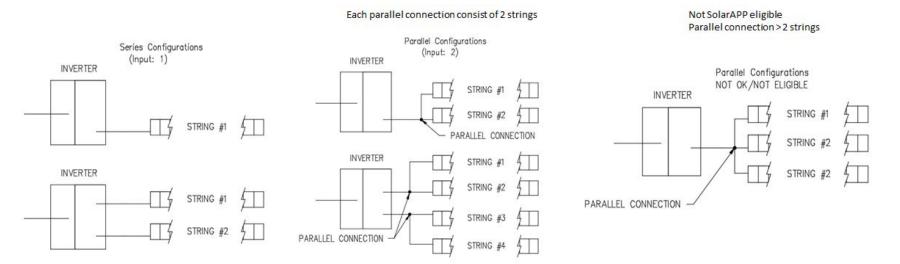
SolarAPP+: Electrical: DC-String Inverters Circuit Requirements



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.



Solar APP+



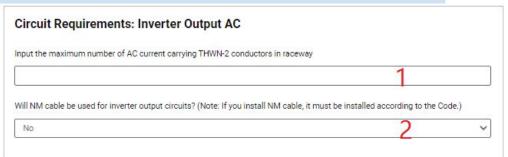
SolarAPP+ Contractor Input Training (All Jobs continued)

SolarAPP+: Electrical: Inverter Output AC



Electrical Page

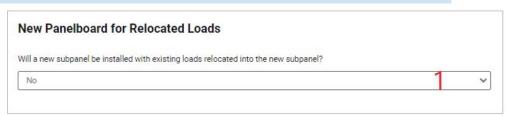
- Max number of AC CCC THWN wire in raceway = (3) per inverter in a single raceway. The output of the combiner panel is default to (3)
- Will NM cable be used? = **No** (See conduit schedule)
 - Except: Microinverter Array conductors using NM cable in the attic for new construction =Yes



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

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

Will a new subpanel be installed with existing loads reloc	ated into the new subpanel?	
Yes	1	
s The OCPD ampere size supplying the relocated loads stalculation may be required at inspection)	subpanel will be selected according to the code? (Verification of	load
Yes	2	
nter the busbar size of the new subpanel:		
125	3	
Enter the OCPD rating protecting the new subpanel with	relocated loads:	
<u>.</u>		

SolarAPP: Electrical: Relocated Loads = Yes



Electrical Page

- When Branch Circuit conductors for relocated loads are relocated greater than 2ft = **See site plan** (typically = NO)
- 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**
- 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**

No	1	
Are relocated branch circuits extended = $< 10'$ and = $< 10\%$ of total circuit length? [310.15 (A)(2)) Ex.]	
Yes	2	
Maximum quantity of current carrying conductors in raceway with relocated branch circuit cond	ductors?	
8	3	
re branch circuits extended > 6'? [210.12 (D)] Yes	4	
Yes	4	
Yes	4 es 5	
Will raceway size for new sub panel feeders be selected according to 300.17 and Chapter 9? YE	5	

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



Electrical Page

- When Branch Circuit conductors are relocated greater than 2ft = NO
- Are branch circuit conductors less than = YES
- Busbar Ampere rating = **See system design**
- Sub Panel feeder breaker ampere rating = **See system** design
- 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**
- Relocated branch circuits do not require ampacity derates if installed less than 2ft from panelboard. = **See** Site plan detail

No	_1_	,
Are relocated branch circuits extended = < 10' and = < 10% of total circuit length? [310.15 (A)(2) Ex.]		
	2	,
Maximum quantity of current carrying conductors in raceway with relocated branch circuit conductors?		
	3	
are branch circuits extended > 6'? [210.12 (D)]		
	4	1
Vill raceway size for new sub panel feeders be selected according to 300.17 and Chapter 9? YES		
	5	,
Will raceway size for branch circuit conductors be selected according to 300.17 and Chapter 9? YES		
	6	

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 the maximum inverter output, main breaker and main bus ratings to determine code compliance.
- The method of interconnection will be a listed circuit breaker

Point of Connection at Main Panel	
Point of Interconnection compliance method at MSP:	
705.12 (B) (2) (3) (d) 120% rule on center-fed panels	~
Main Bus Ampere Rating (A)	
100	
Main Breaker/Service Disconnect Ampere Rating (A)	
100	
What is the Utility service feed rated for?	
What is the Utility service feed rated for?	
What is the Utility service feed rated for? 100 Will power production inverter outputs be connected directly to an existing subpanel?	

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



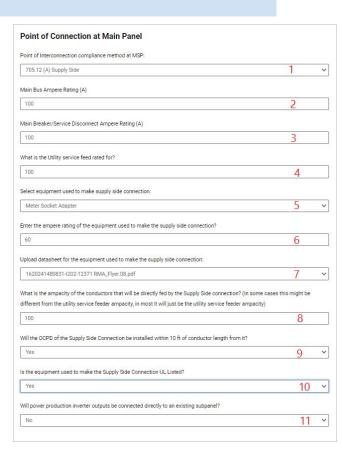
Electrical Page

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...

- POI method at MSP = **705.12(A) Supply-side**
- Main bus rating = **see SLD**
- Main Breaker rating = **See SLD**
- Utility service feed rated for = See Main Breaker/Main bus rating
- Service Equipment used = **Meter Socket Adapter as an example**
- Enter the AMP rating of the equipment = As an example **60A**
- Datasheet
- Ampacity of the conductors fed by the SST = Same as utility service rating
- 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 = \mathbf{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.

Point of Interconnection compliance method at MSP:		
705.12 (B) (2) (3) (b) 120% rule	1	
Main Bus Ampere Rating (A)		
100	2	
Main Breaker/Service Disconnect Ampere Rating (A)	3	
100	3	
100	3	
What is the Utility service feed rated for?		

For example...

- POI method at MSP = 705.12(B)(2)(3)(c) Sum of Breakers rule
- 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.

Yes	1
What is the subpanel busbar Amp rating?	
125	2
What is the subpanel over current protection (breaker) Amp rating?	3
What is the subpanel over current protection (breaker) Amp rating? 60 Point of Interconnection compliance method at Subpanel:	3

For example, when applicable...

- Interconnection at sub-panel = **Yes**
- 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



Standard Certifications

Workers' Comp

Agree to the terms and conditions and submit the project.

SolarAPP Standard Certifications

Standard Certifications.

Workers' Comp Information

By applying for this permit, you represent and warrant that you (i) have (and will have during the performance of the work) all valid approvals, certifications, and licenses required for the performance of the work for which this permit is issued, (ii) carry (and will carry during the performance of the work) all necessary insurance required by law or governmental authority in the jurisdiction and (iii) will comply with all applicable laws required in the performance of the work.



I agree to these terms and conditions.

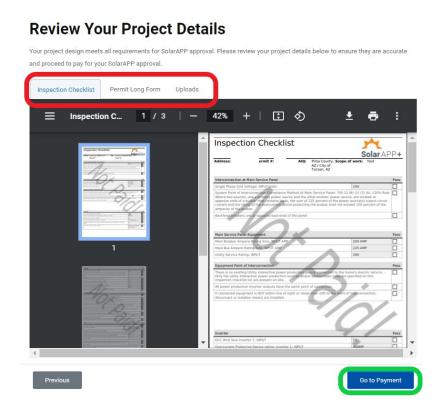
Save as a draft

Review your Project Details



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.
- If permit approval is also required via AHJ website, SolarAPP+ will prompt and provide direct link to AHJ permit submittal page.
- Complete permit application through AHJ website and upload SolarAPP+ approval documents and uploads (per instructions from AHJ).

