



PWRcell Systems and Photovoltaic (PV) Rapid Shutdown for One- and Two-Family Dwellings

Rapid PV Shutdown Requirements throughout the NEC

This document is intended to assist Generac customers when applying NEC Section 690.12 PV system rapid shutdown requirements to PV systems using Generac Clean Energy products. It is the installer's responsibility to install the PV system in compliance with the manufacturer's instructions, and the minimum requirements of the NFPA-70 National Electrical Code (NEC) edition that has been adopted in their local jurisdiction. It is also the installer's responsibility to properly field label components of the PV system in accordance with all NEC requirements. This document is intended to provide recommendations and guidance to system designers and installers and should not be considered manufacturer's requirements.

Generac PWRcell™ Inverters, PV Link™ substring (DC) optimizers, and SnapRS™ devices have been evaluated by Intertek™ as suitable for use in PV systems and are listed to provide PV rapid shutdown protection as required in the NEC Section 690.12, editions 2014 through 2020.

It is important to recognize that NEC Section 690.12 requirements apply to circuits energized by PV sources (e.g. PV modules). Circuits that may be energized by other sources such as a utility or energy storage have other requirements for disconnection and or emergency shutdown and are not covered by the requirements within the NEC Section 690.12.

2011 and older editions of the NEC.

NEC editions prior to 2014 did not have any requirements for rapid shutdown of PV systems. Installing Generac S2502 PV Links at the PV array will provide a rapid shutdown function, however, since the opening of the PWRcell DC disconnects in the inverter, or other DC disconnect that was installed between the inverter and PV Link will cause the wiring leaving the array to reduce its voltage below 30 V within 30 seconds.

2014 NEC

The 2014 NEC is the first edition of the NEC to require the rapid shutdown of PV systems on buildings in Section 690.12. The 2014 NEC requires that upon activation of the PV rapid shutdown initiation device, the PV conductors leaving the PV array must drop to no more than 30 V and 240 VA within 30 seconds of activation. The opening of the DC disconnect(s) in the inverter connected to the PV array, or other DC disconnect installed between the inverter and the S2502 PV Link(s), will accomplish this. The 2014 NEC does not state where the Rapid PV Shutdown initiation device has to be installed so in most applications, the DC disconnects installed within the inverter will serve as the rapid shutdown initiation device, regardless of where the inverter is located.





2017 and 2020 NEC

The 2017 and 2020 NEC revisions added new requirements for rapid shutdown of conductors within a PV array.

Conductors Leaving the Array

Section 690.12(B)(1) requires that the PV conductors leaving the PV array to reduce below 30 V within 30 seconds after the activation of the PV rapid shutdown initiation device. The opening of the DC disconnect(s) in the inverter, or other DC disconnect installed between the inverter and the S2502 PV Link(s), will accomplish this.

Conductors within the Array

The term "Array Boundary" was added to describe what system conductors should be considered inside and outside of any PV array. The description of this term in Section 690.12(B)(2) effectively provides 1-foot buffer area around PV modules to allow for such things as attached equipment and wiring to be included within the identification of the array. Within this zone, one method of compliance is to shutdown the conductors within this zone to 80 V or less within 30 seconds after the activation of the PV rapid shutdown initiation device. To comply with this requirements, Generac SnapRS devices are required to be installed between the connection of any two modules within the PV array to isolate each PV module on the roof from the adjacent series connected PV module(s). The opening of the DC disconnect(s) in the inverter or other DC disconnect installed between the inverter and the S2502 PV Link(s) activate both the PVLink(s) and the SnapRS units to perform a rapid shutdown for all the PV DC system conductors both inside and outside of the array boundary.



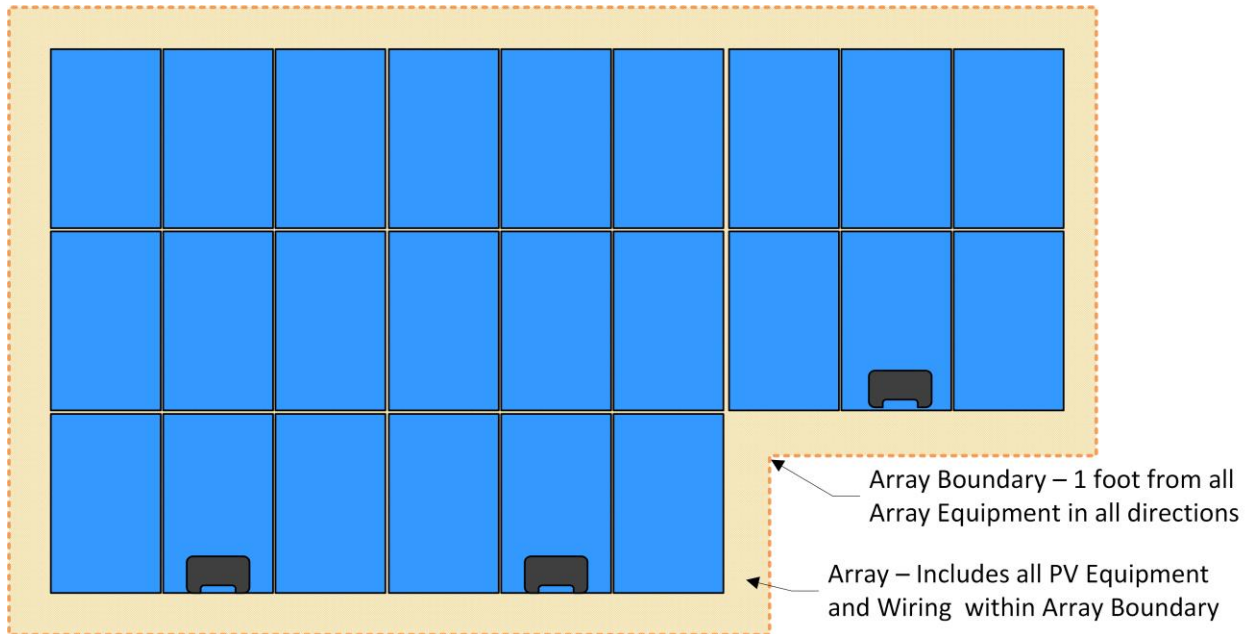


Figure 1: Array Boundary Example

PV Rapid Shutdown Initiation Device Location

Section 690.12(C) in the 2017 and 2020 NEC have specific requirements for the location of the PV rapid shutdown initiation device for PV arrays mounted on one- or two-family dwelling units. This section requires that the PV rapid shutdown initiation device(s) be installed at a readily accessible location outside of the dwelling unit. If the installer chooses to use the DC disconnects within the inverter as the PV rapid PV shutdown initiation device(s), the inverter will have to be installed outdoors to meet this requirement. Optionally, it is possible to add an additional DC disconnect located outdoors between the inverter and the S2502 PV Link(s) and identify this as the PV rapid shutdown initiation device(s).

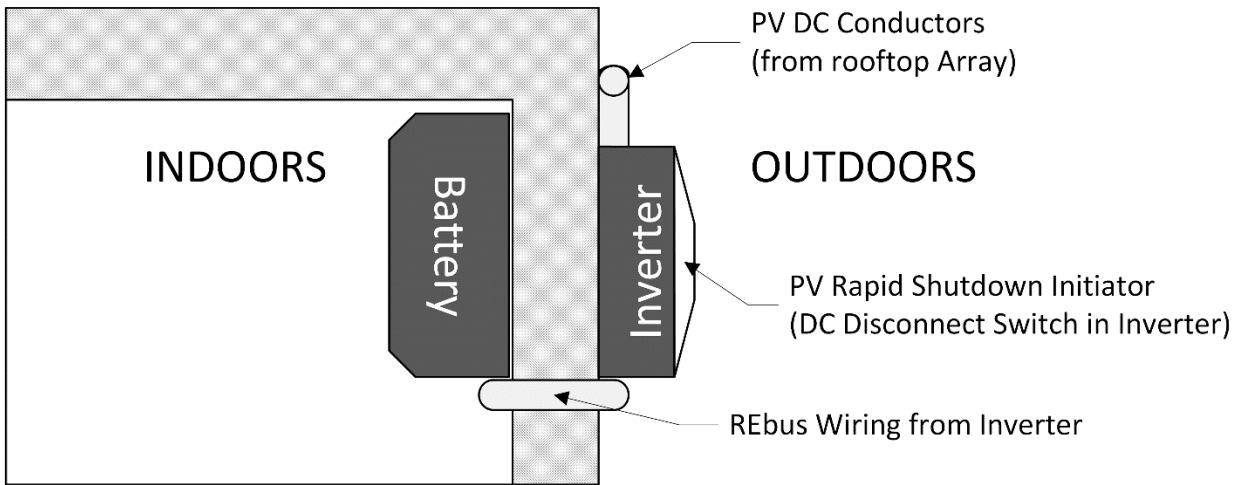


Figure 2: Outdoor Inverter Application Example

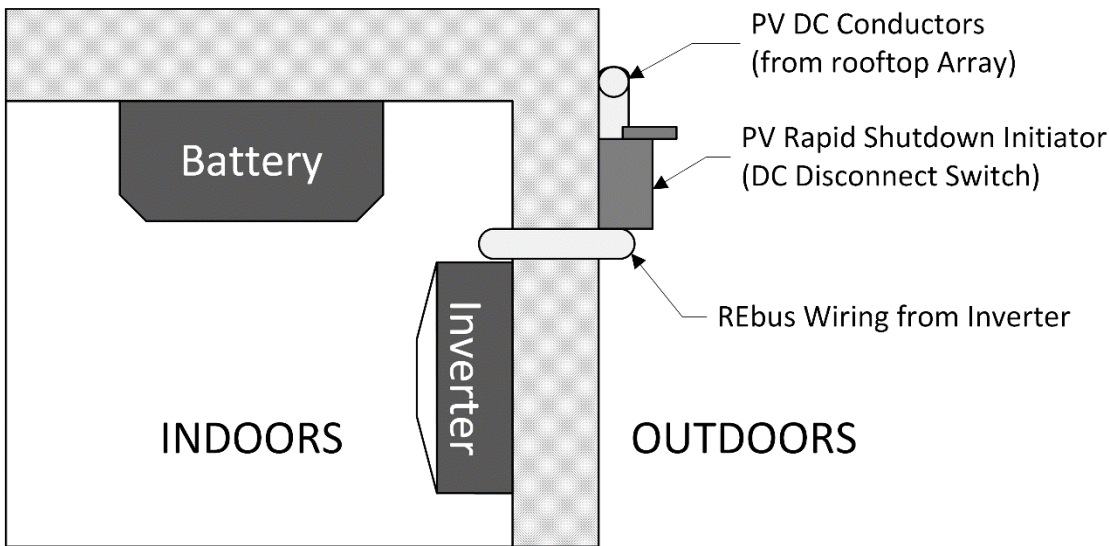


Figure 3: Indoor Inverter Application Example

PV Rapid Shutdown Initiation Device



The built-in DC disconnect(s) within the PWRcell Inverter are suitable for use as the PV Rapid Shutdown initiation switch. An additional DC disconnect switch may be added in series between the PV Link units on the roof and the inverter if desired.

IMPORTANT: Any additional DC disconnect that is installed in the field must be listed and rated at a minimum of 30 A, and 600 VDC and should be suitable for the environment it is installed.

GENERAC®

PWRCELL

Generac has identified the following products as compatible with the PWRcell system:

Manufacturer	Product Image
<p>Schneider Electric (Square D) Model: HU361RB Description: Safety switch, heavy duty, non-fusible, 30 A, 3 poles, 30 hp, 600 VAC/DC, NEMA 3R, bolt-on hub, www.se.com <i>NOTE: Follow product instructions for applications within PV DC circuits.</i></p>	
<p>IMO Automation Model: SI32-PEL64R-2, SI32-PEL64R-4 Description: Enclosed DC Switch IP66, 32 A 600 VDC, 2 Pole/4 Pole Single Throw (Single String/Two Strings, respectively) www.imopc.com <i>NOTE: Multiple circuit options available. Follow product instructions for applications within PV DC circuits.</i></p>	

Where the DC disconnect included in the inverter requires a permanent means of locking the handle in the open position, Generac has the following kit(s) available:

Manufacturer	Product Image
<p>Generac SKU: APKE00036 Description: PWRcell Inverter DC Disconnect lockout upgrade kit. www.generac.com <i>NOTE: Follow product installation instructions.</i></p>	