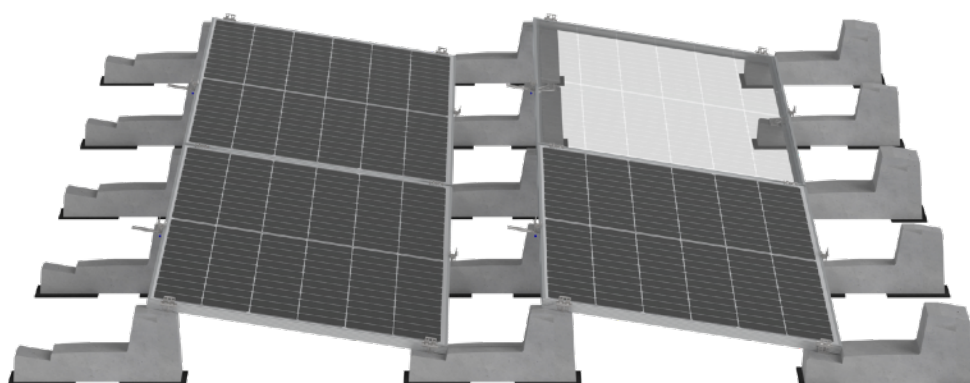
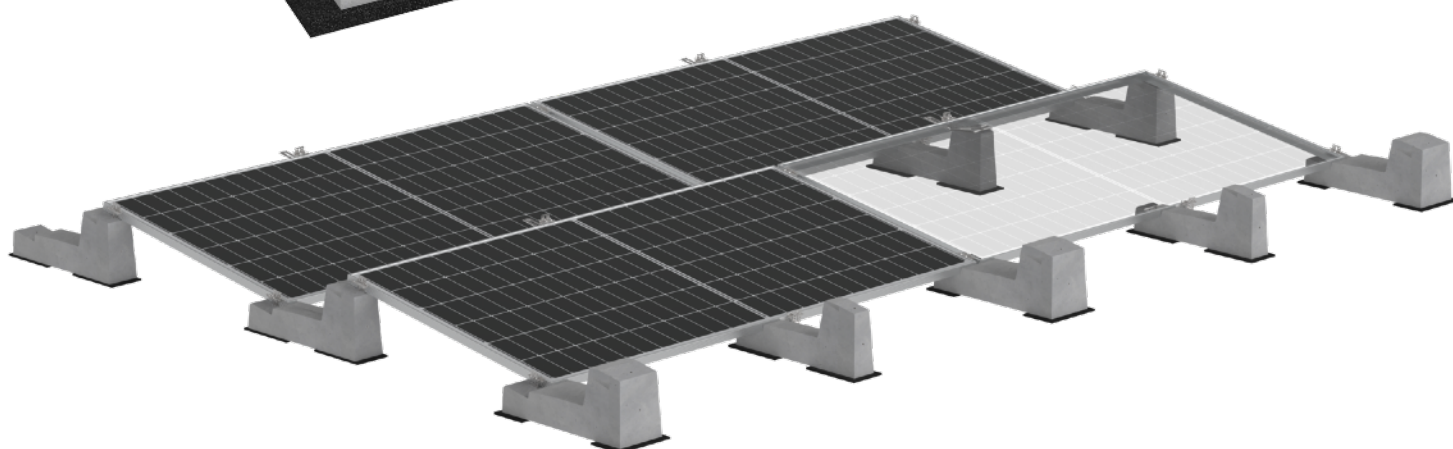
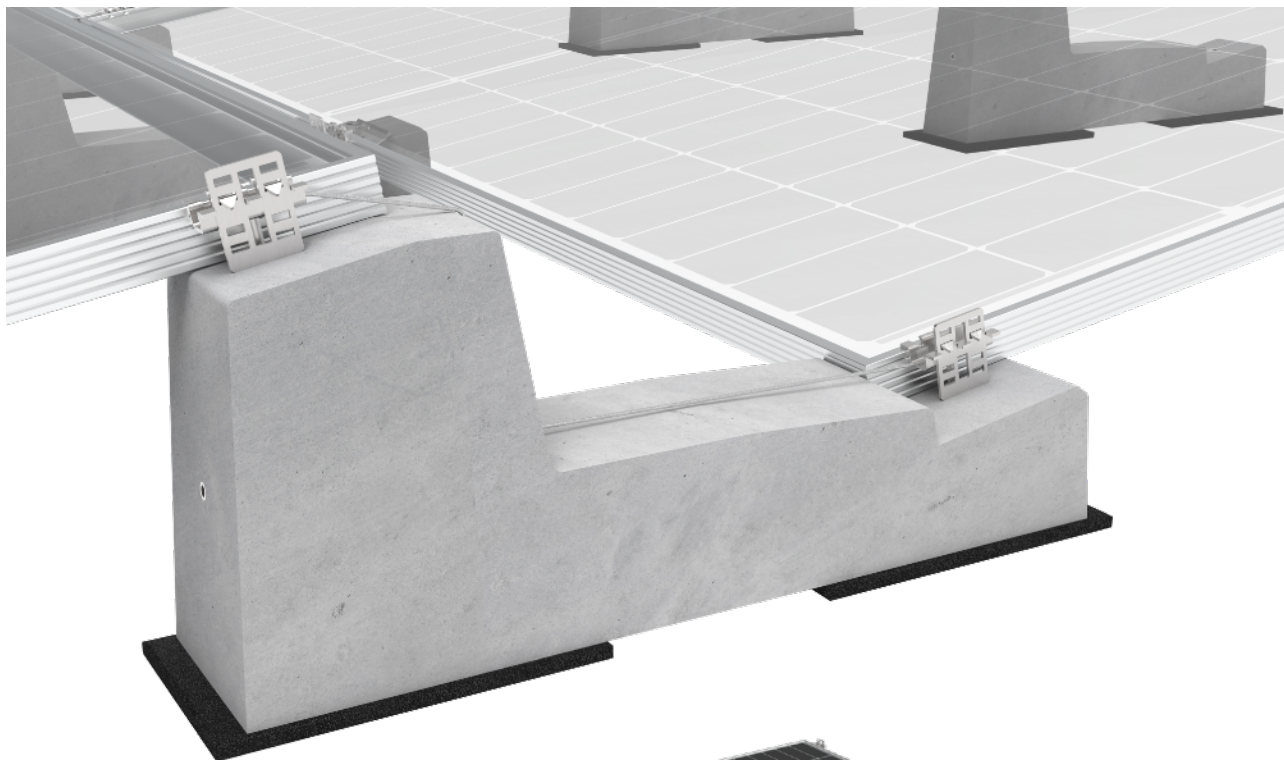


SUNBALLAST UL3741 INSTALL ADDENDUM



DISCLAIMERS

This installation addendum provides a detailed guide on how to install SunBallast's Connect System PV Hazard Control System to meet UL3741 requirements. Refer to the full installation manual for assembly instructions.

LIABILITY

The installer of each project is responsible for the safe and proper installation of each system. It's their responsibility to follow all OSHA guidelines and safe practices on site as well as provide and use all relevant PPE.

SunBallast doesn't perform any of the installation directly, therefore it's not liable and responsible for the installation's code compliance or building's integrity nor injury to any of the installers or third parties

PERSONAL & SITE SAFETY

A structural analysis of the roof should be conducted prior to installing to determine the load capacity. Always observe all governing codes and ordinances. Only qualified professionals should install solar modules, DC cabling, and any anti-lightning safety devices. Some safety considerations include:

PPE – While installing the PV system, proper safety equipment should be worn. Wear safety gloves when handling parts. Newly fabricated parts may have sharp edges.

Fall Prevention – If roof/building has a fall distance of 10ft (3m) or greater, appropriate safety measures must be taken (i.e., harnesses) for installation of modules closer than 6.5ft (2m) to roof edges or skylights. SunBallast requires all arrays to be no closer than 3ft (0.9m),, from a building's roof edge to validate wind load calculations and ensure the system is safely ballasted.

Roof Debris – Inspect the roof for damages prior to installation and record any existing damage with a camera. Clean the roof surface and remove all dirt and debris.

Roof Flooding – Ensure proper drainage on the roof. Water accumulations may lower the load reserve of the rooftop and decrease lifespan. Additionally, constant submersion of PV supports in water may damage

RATINGS

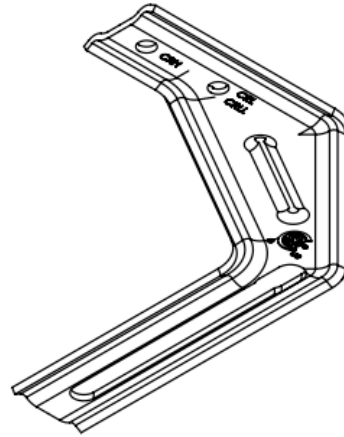
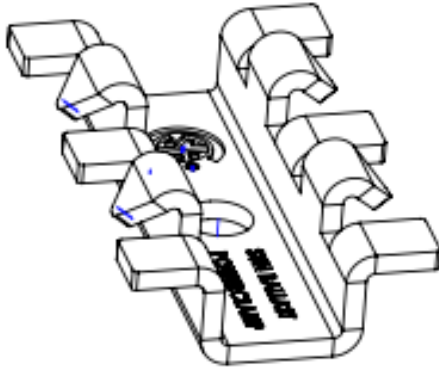


SUN BALLAST
CONNECT SYSTEM
CONFORMS TO UL2703
2305.CRH.US
1NH24 - PATENTED

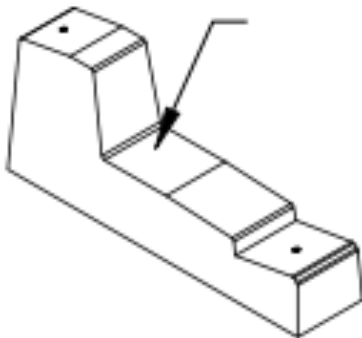
CONFORMS TO ANSI/UL 3741 FOR SAFETY PHOTOVOLTAIC HAZARD CONTROL SYSTEM
- MAX SYSTEM VOLTAGE 1000V

UL 2703 MARKING

All clamps and No-Flex brackets bear the CSA mark, embossed during the stamping process



The ballasts are inkjet printed in the location shown with the following mark, stating UL2703 and UL3741 compliance.



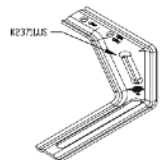
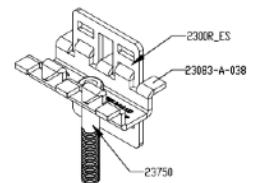
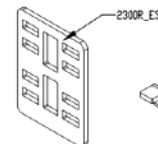
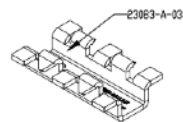
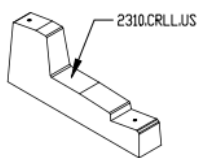
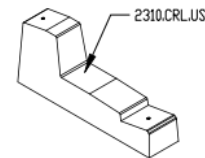
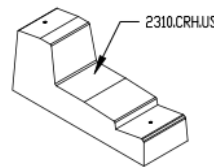
APPROVED PV HAZARD CONTROL EQUIPMENT AND COMPONENTS

List of approved PV HCE:

- **All modules listed in SunBallast** UL 2703 Installation Manual for tested compatibility, including Fire Type 1, 2, 29, 30 modules with areas up to 33.29ft²
- **Approved Electrical Equipment** - (UL 1741 Listed)
 - Any electrical equipment (inverters and RSDs) with PVRSS/PVRSE functions certified to UL 1741 are acceptable components for a compliant 3741

- **All SunBallast Connect System components**

- 2305.CRLL.US 32lbs block
- 2305.CRL.US 64lbs block
- 2305.CRH.US 96lbs block
- 2310.CRLL.US 32lbs block
- 2310.CRL.US 64lbs block
- 2310.CRH.US 96lbs block
- GN23115 rubber mat
- 23083-A-038 grounding mid clamp
- 2300_ES end plate
- K14GND.JMP Grounding Jumper
- K23711.US No-Flex bracket



- 3rd party MLPE mounts
- PV wire (UL4703 Listed)
- PV Connectors - (UL 6703 Listed)
- RayTray V2 and V3 Solar Wire Management System (UL870 Listed)
- Heyco PV cable clips
- EZ-Solar GripClips (UL1565)
- **Listed Conduit**
 - EMT Electric Metallic Tubing (UL797)
 - RMC Rigid Metal Conduit (UL6)
 - IMC Intermediate Metal Conduit(UL 1242)
 - FMC Flexible Metal Conduit(UL1)
 - LMFC LiquidTight Metal Flexible Conduit (UL360)
 - LNMFC LiquidTight Non Metallic Flexible Conduit (UL360)
 - Schedule 40/80 Rigid PVC Conduit (UL 651)
 - All listed fittings and Grounding Components

UNDERSTANDING UL 3741 AND NEC 690.12

2020 NEC 690.12(B)(2) Controlling Conductors within the array boundary

The SunBallast Photovoltaic Hazard Control System (PVHCS) is a UL 3741 Listed system that complies with NEC 690.12(B)(2)

(1), when installed by qualified persons per the installation procedures outlined in the Connect System Installation Manual and this Addendum. Please refer to the following pages of this addendum for various example cases of system designs that comply with 690.12(B)(2).

2020 NEC 690.12 Background

NEC 690.12 Rapid Shutdown of PV Systems on Buildings requires that all PV arrays installed on or in buildings shall include rapid shutdown functions to reduce shock hazard for Fire Fighters (FF) in accordance with 690.12(A) through (D):

(A) Controlled Conductors

- (1) PV system DC circuits
- (2) Inverter output circuits originating from inverters located within array boundary

(B) Controlled Limits

- (1) Outside Array Boundary: $\leq 30V$ within 30 seconds
- (2) Inside Array Boundary:
 - (1) Listed PV Hazard Control System (UL 3741)
 - (2) $\leq 80V$ within 30 seconds after rapid shutdown initiation
 - (3) PV array without exposed wiring methods or conductive parts (NEC 2020 only)

(C) Initiation devices

Initiation device(s) shall initiate the rapid shutdown function of the PV system

(D) NEC 2020 - Equipment

Equipment that performs the rapid shutdown functions, other than initiation devices such as listed disconnect switches, circuit breakers, or control switches, shall be listed for providing rapid shutdown protection.

(D) NEC 2023 - Building with Rapid Shutdown

Buildings with PV systems shall have a permanent label located at each service equipment location to which the PV systems are connected or at an approved readily visible location and shall indicate the location of rapid shutdown initiation devices.

➤ **NEC 690.2 (2020) or Article 100 (2023) defines the array as a mechanically and electrically integrated grouping of modules with support**

structure, including any attached system components such as inverter(s) or dc-to-dc converter(s) and attached associated wiring.

➤ **NEC 690.12(B) defines the array boundary as 1ft from array in all directions. This indicates that the array boundary can extend 1ft from the edge of the SunBallast racking, inverter or module.**

➤ **The inverter is considered within the array boundary if mechanically attached and within 1 foot of the mounting system or module.**

INSTALLATION METHODS PER UL 3741 AND NEC 690.12

The following case studies are provided by SunBallast to show examples of installation configurations that comply with NEC 690.12(B), compliance is not limited to these examples.

Case 1: UL 3741 Listed System

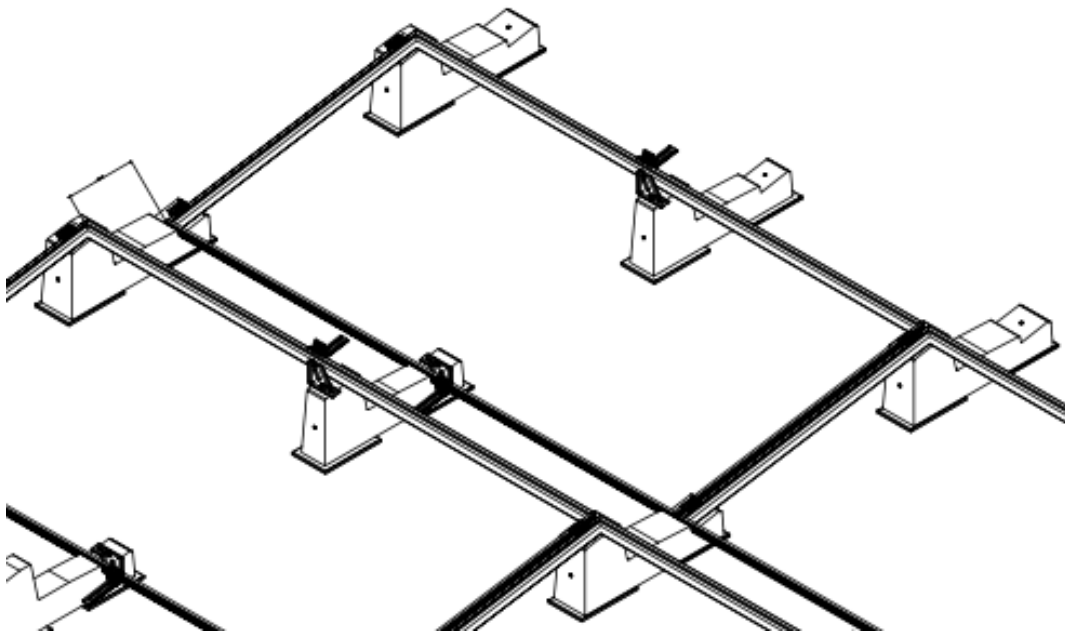
Case 2: UL 3741 Listed System with Contiguous Sub-Array

Case 3: UL 3741 Listed System with Non-Contiguous Sub-Array

Case 4: UL 3741 Listed System with MLPE Sub-Array

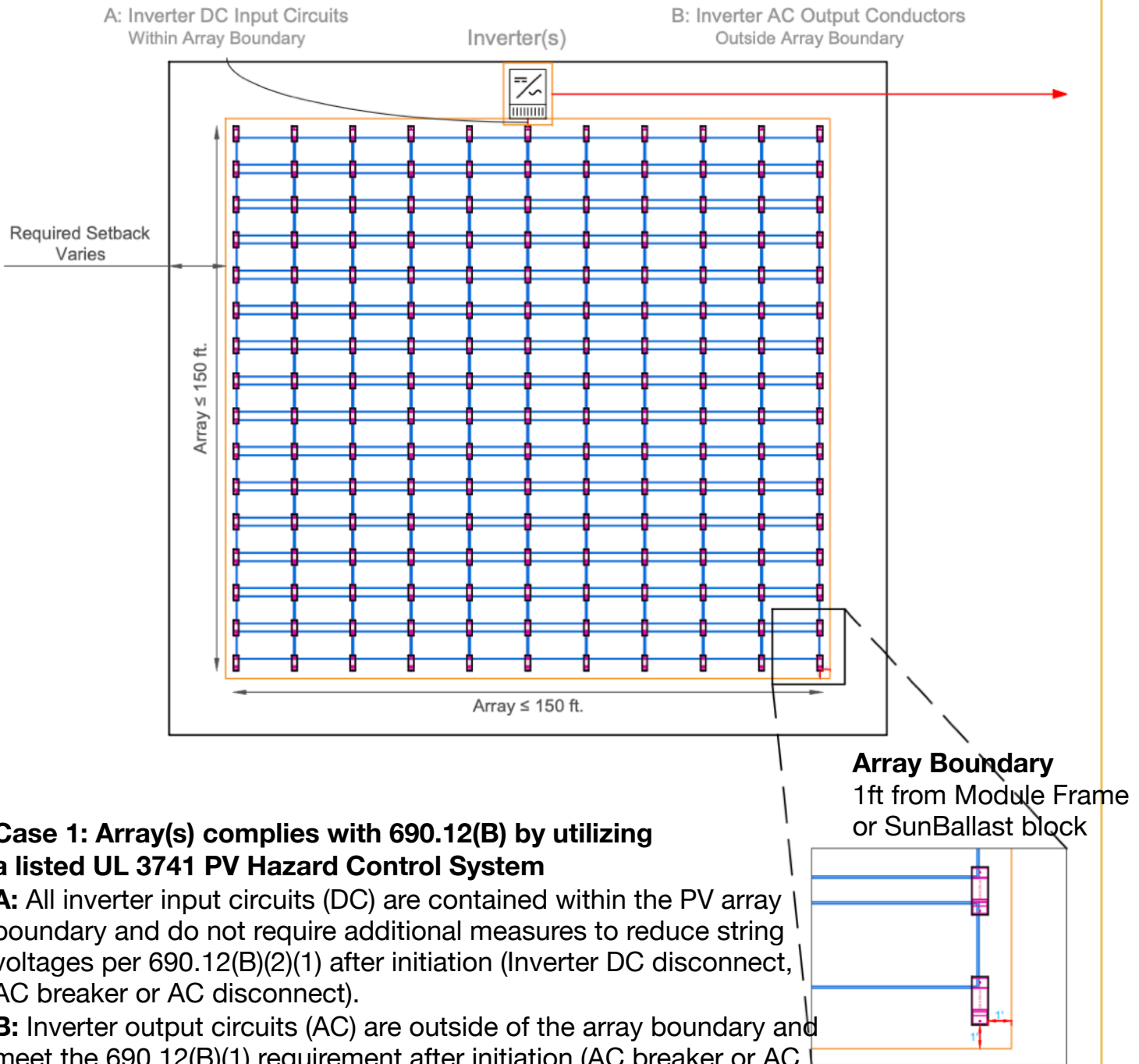
The simplest installation method to comply with NEC690.12(B) is to utilize the SunBallast Connect UL 3741 system with a contiguous array with one or more collocated inverters, as all inverter DC input circuits are within the 1ft array boundary (Case 1).

Installations where sub-arrays are required and cannot be included within the 1ft array boundary can comply by using a single or combining one or more of the three options below (Cases 2-4). Case studies and NEC guidance have not been verified by CSA Group.



Case 1 : Array(s) comply with NEC 690.12(B)(2)(1)

- Outside Array Boundary : $\leq 30V$ within 30 sec
- Inside Array Boundary : $\leq 1000V$



Case 1: Array(s) complies with 690.12(B) by utilizing a listed UL 3741 PV Hazard Control System

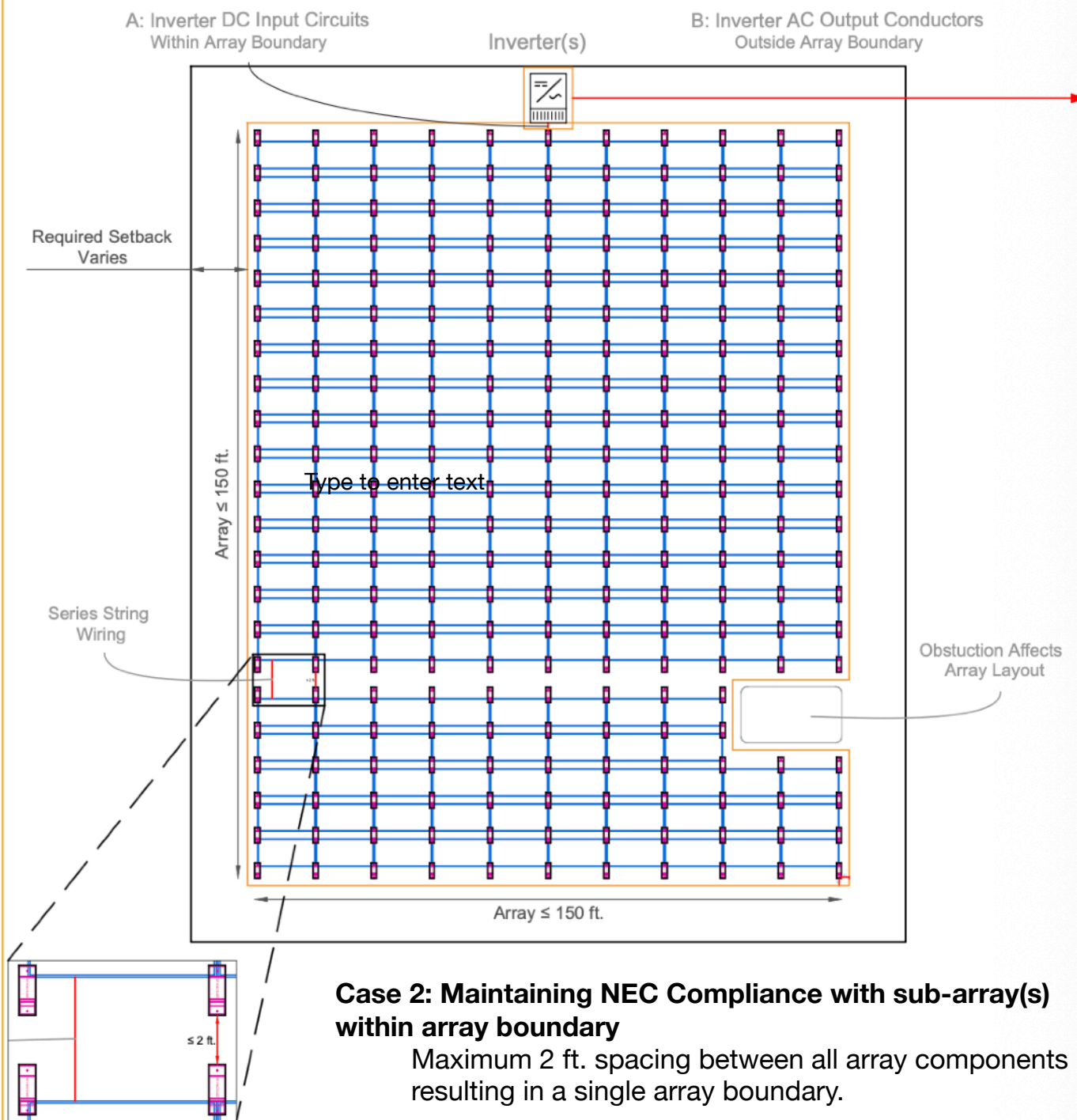
A: All inverter input circuits (DC) are contained within the PV array boundary and do not require additional measures to reduce string voltages per 690.12(B)(2)(1) after initiation (Inverter DC disconnect, AC breaker or AC disconnect).

B: Inverter output circuits (AC) are outside of the array boundary and meet the 690.12(B)(1) requirement after initiation (AC breaker or AC disconnect).

Case 2: Sub-Array(s) are within the same Array Boundary

and Array(s) comply with NEC 690.12(B)(2)(1)

- Outside Array Boundary: $\leq 30V$ within 30 Seconds
- Inside Array Boundary: $\leq 1000V$



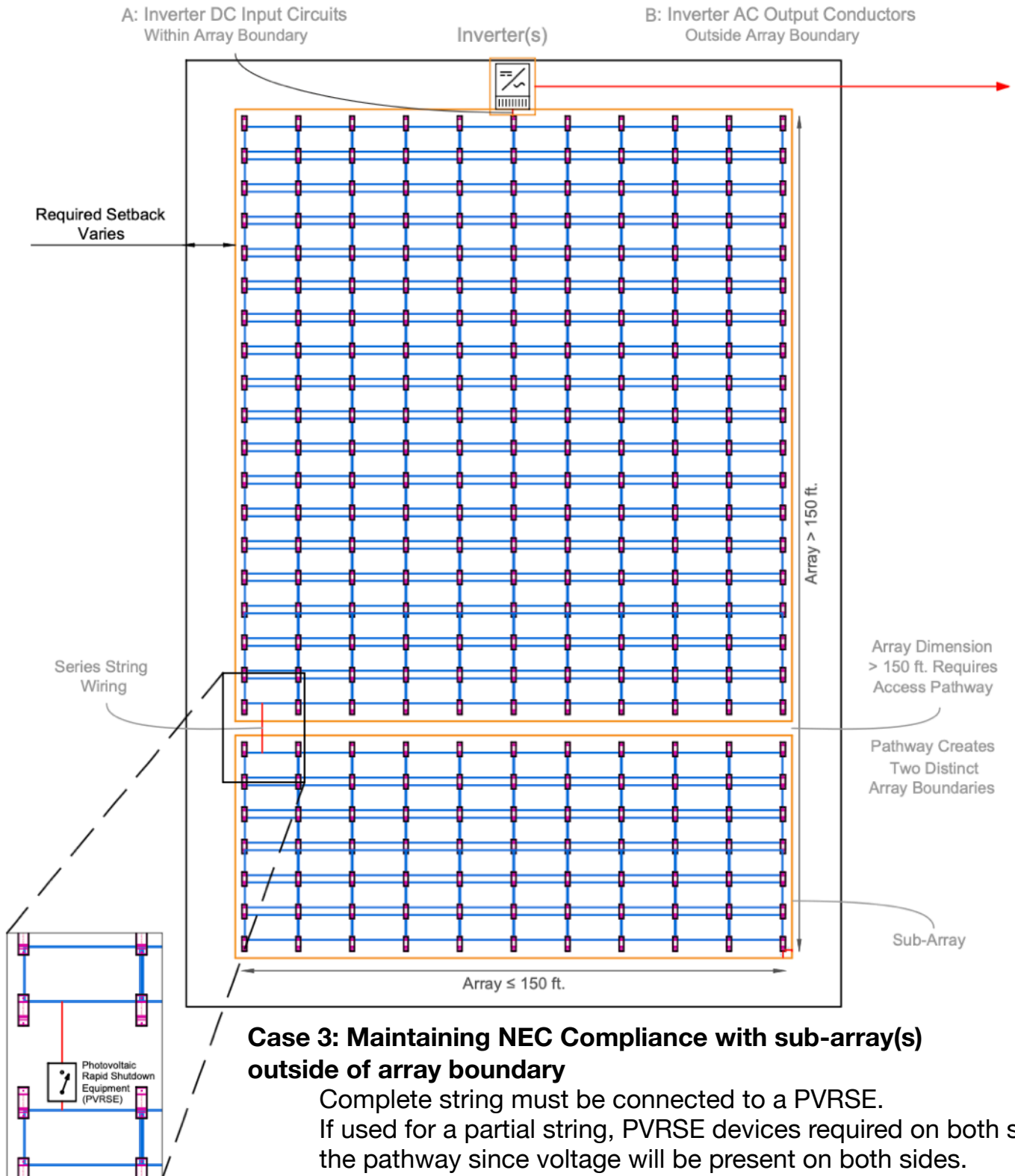
Case 2: Maintaining NEC Compliance with sub-array(s) within array boundary

Maximum 2 ft. spacing between all array components resulting in a single array boundary.

2: All Modules Within
Same Array Boundary

Case 3: Multiple Sub-Arrays with conductors outside of Array Boundary are controlled via Photovoltaic Rapid Shutdown Equipment (PVRSE)

- Outside Array Boundary: $\leq 30V$ within 30 Seconds
- Inside Array Boundary: $\leq 1000V$



Case 3: Maintaining NEC Compliance with sub-array(s) outside of array boundary

Complete string must be connected to a PVRSE.

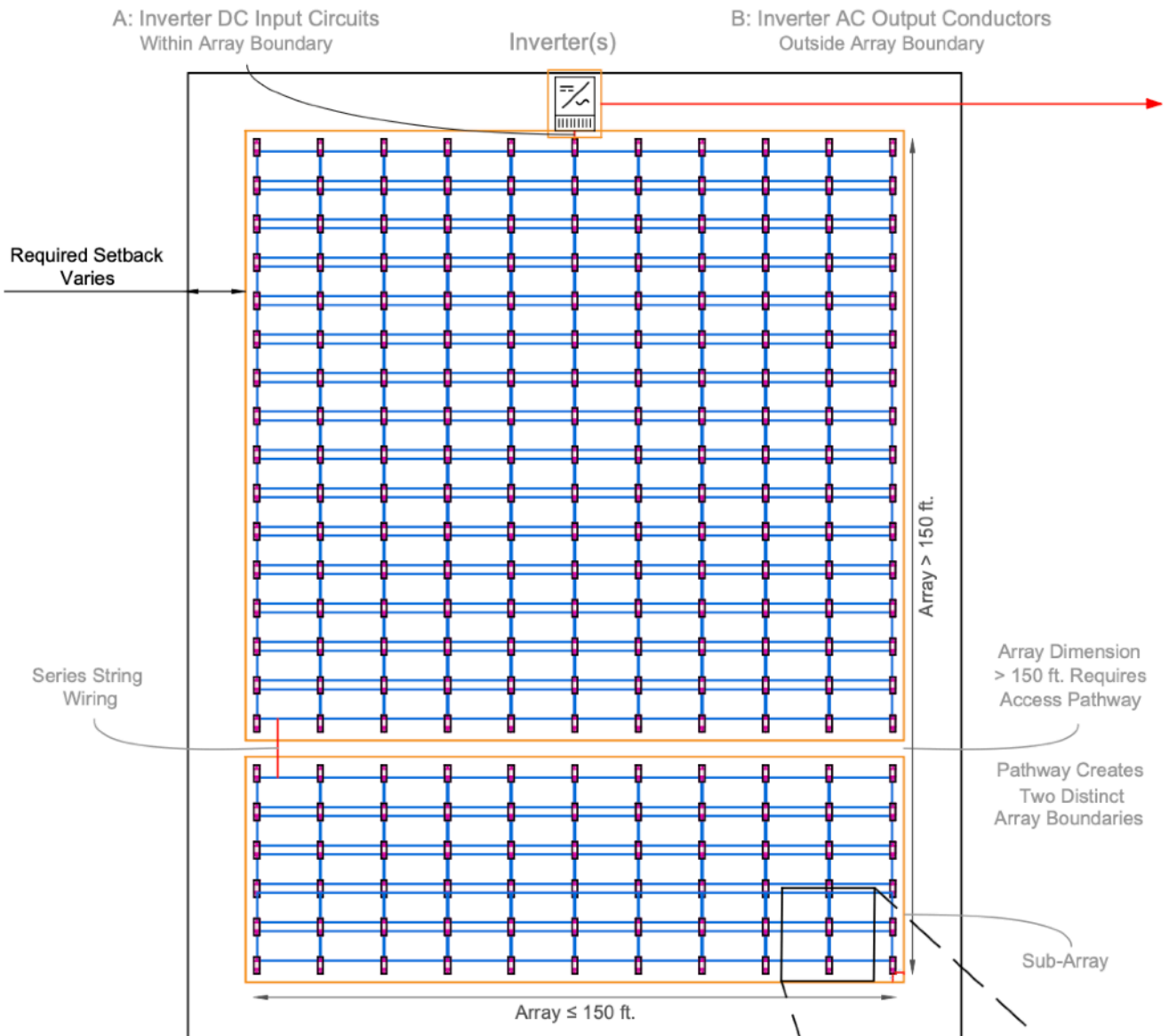
If used for a partial string, PVRSE devices required on both sides of the pathway since voltage will be present on both sides.

3: Photovoltaic Rapid Shutdown

Equipment to control conductor outside of array boundary

Case 4: (using MLPE): sub-array circuits are controlled to meet 690.12(B)(2)(2)

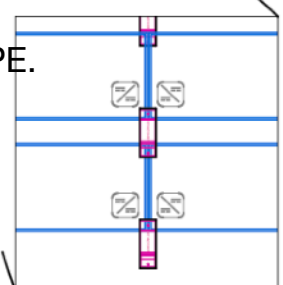
- **Outside Array Boundary:** $\leq 30V$ within 30 Seconds
- **Inside Array Boundary:** $\leq 1000V$
- **Inside Sub-Array Boundary:** $\leq 80V$ within 30 Seconds



Case 4: Maintaining NEC Compliance with sub-array(s) outside of array boundary

Utilize Module-Level Power Electronics on lower sub-array.
All modules on the same inverter input must be connected to an MLPE.
Upper array utilizes UL3741 listing without MLPEs for compliance.

4: Listed MLPE



WIRE MANAGEMENT GUIDELINES

Maintaining proper wire management is critical in order to achieve a safe and compliant install that will fully meet UL3741 and provide FF protection from any potentially harmful voltage.

It is crucial that wires aren't left exposed to potential FF interaction in order to be compliant with UL3741, therefore installers should seek to always route wires underneath modules with approved cable clips, in approved raceways or conduit.

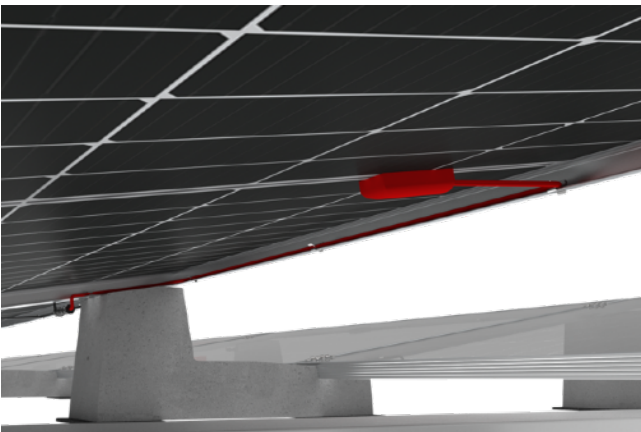
Below are some visuals of what a compliant wire management job would look like with the SunBallast Connect System.



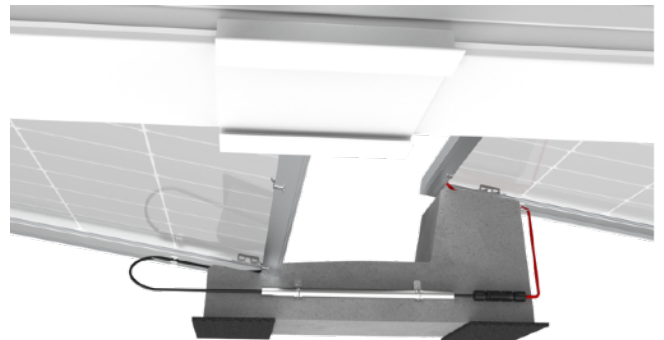
Connector properly clipped to the frame and tucked under modules



All wires cleanly routed under modules without any loose or touching roof



Conductors are routed along the underside of frame with use of clips



EMT is strapped to the block to protect series wiring when jumping rows N-S

Inverter is within array boundary and DC inputs are protected from direct interaction from FF, all homers are properly protected inside a RayTray raceway

