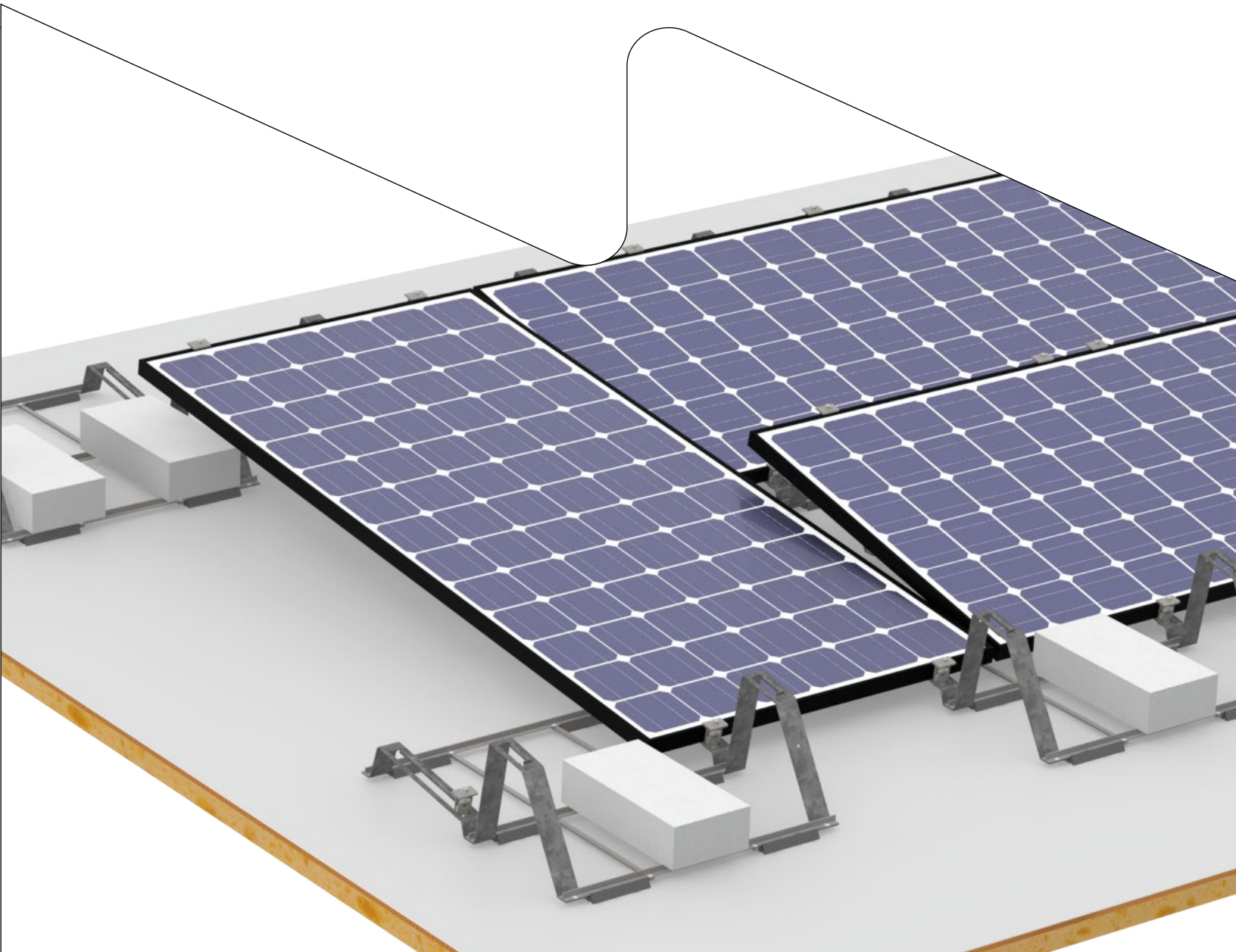
Connecting Strength

The South Face

UL 3741 PV Hazard Control

INSTALLATION ADDENDUM



Content

Engineering strength is at our core

With sophisticated product innovations and a deep customer focus, K2 Systems is the engineering leader for all your mounting system needs. We are a market leader with more than 32 GW installed worldwide.

We offer proven product solutions and innovative designs. Wind tunnel testing along with advanced structural and electrical validation to facilitate permitting, design and installation. Our designs result in cost competitive racking systems with dedicated support that will position you to win more projects.

We partner with our customers and suppliers for the long-term. High quality materials and cutting edge designs provide a durable, yet functional system. Our product line is comprised of a few, coordinated components that lower the cost of materials, and simplify installation, saving you time and money. All backed by German engineering, a long track record of quality and a company that is here to stay.

Thank you for choosing K2 Systems for your Solar PV Project.

Quality tested - several certifications

K2 Systems stands for secure connections, highest quality and precision. Our customers and business partners have known that for a long time. Independent institutes have tested, confirmed and certified our capabilities and components.

Please find our quality and product certificates under:
https://k2-systems.com/en-us/company/quality-management/

Disclaimer

This manual describes proper installation procedures and provides the necessary standards required for product reliability. Warranty details are available at k2-systems.com/en-us. All installers must thoroughly read this manual and have a clear understanding of the installation procedures prior to installation. Failure to follow these guidelines may result in property damage, bodily injury or even death

INSTALLER'S RESPONSIBILITY:

- Ensure safe installation of all electrical aspects of the array. All electrical installation and procedures should be conducted by a licensed and bonded electrician or solar contractor. Routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path of the system. All work must comply with national, state and local installation procedures, product and safety standards.
- Comply with all applicable local or national building and fire codes, including any that may supersede this manual.
- Ensure all products are appropriate for the installation, environment, and array under the site's loading conditions.
- Use only K2 Systems parts or parts recommended by K2 Systems; substituting parts may void any applicable warranty.
- If needed, use K2 System's design tool, Base, to obtain accurate system design prior to installation.
- Ensure provided information is accurate. Issues resulting from inaccurate information are the installer's responsibility.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- Refer to components list and respective manufacturers for best practices on inspection frequency. K2 Systems recommends annual inspection. If loose components or loose fasteners are found during periodic inspection, re-tighten immediately. Any components showing signs of corrosion or damage that compromise safety shall be replaced immediately.
- Provide an appropriate method of direct-to-earth grounding according to the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems.
- Disconnect AC power before servicing or removing modules, microinverters and power optimizers.
- Review module manufacturer's documentation for compatibility and compliance with warranty terms and conditions.
- Installers shall refer to the South Face assembly instructions for complete installation instructions.
- Review all third-party equipment installation manuals for specific instructions such as installation configurations, mounting, Clearances, compatible connectors, and rapid shutdown initiation methods.
- Ensure that the roof is in good condition prior to installing any K2 System's components.

CAUTION: Module removal may distrupt the bonding path and could introduce the risk of electric shock. If during servicing a module is required to be removed, a bonding jumper shall be installed between the adjacent modules from where the module was removed to maintain the bond path.

WARNING: To reduce the risk of injury, read all instructions.

Ratings

UL 2703 LISTED
UL 3741 LISTED

#5031193

CONFORMS TO STD ANSI/UL 3741 STANDARD FOR SAFETY PHOTOVOLTAIC HAZARD CONTROL SYSTEM

Max PVHCS System Voltage: 1000V

South Face List of Approved PV Hazard Control Equipment or Components evaluated at 1000V Max System Voltage:
(Not all listed items must be implemented in a single system to achieve compliance to UL 3741. Rather these are the items approved for use to meet the criteria outlined in this manual.)

- All Modules listed in the Approved Modules section of the South Face Assembly Instructions

- The South Face System

- South Face Accssories
  - MLPE Module Frame Mount Kit (4000083)
  - SF UL 3741 Plate, Kit (4000390)
  - SF UL 3741 Rapid Shutdown, Sticker (7000465)
  - SF UL 3741 MLPE Shutdown, Sticker (7000466)

- PV Connectors (UL 6703 Lsted) shall be compatible and approved for the application

- Conductors
  - PV Wire (UL 4703 Listed)
  - USE-2 Wire (UL 854 Listed)
  - RHW-2 Wire (UL 44 Listed)
  - DG Cable (UL 3003 Listed)

- Wire Clips
  - HellermannTyton Edge Clip and Cable Ties
    (PNs CTT60R-PA66HS, T50RECB-PA66HS & T50RECA-PA66HS) (UL 62275 Listed)

- RayTray v2 Solar Wire Management System (UL 870 Listed)

- Listed Conduit (all sizes apply)
  - Electrical Metallic Tubing (EMT), size 3/4" or greater (UL 797 Listed)
  - Rigid Metal Conduit (RMC), size 3/4" or greater (UL 6 Listed)
  - Intermediate Metal Conduit (IMC), size 3/4" or greater (UL 1242 Listed)
  - Liquid-Tight Flexible Nonmetallic Conduit, size 3/4" or greater (UL 1660 Listed)
  - Liquid-Tight Flexible Metal Conduit, size 3/4" or greater (UL 360 Listed)
  - PVC Schedule 40 or 80, size 3/4" or greater (UL 651 Listed)
  - Bonding Bushings, size 3/4" or greater (UL 467)
  - Various Listed Conduit, Connectors and Fittings

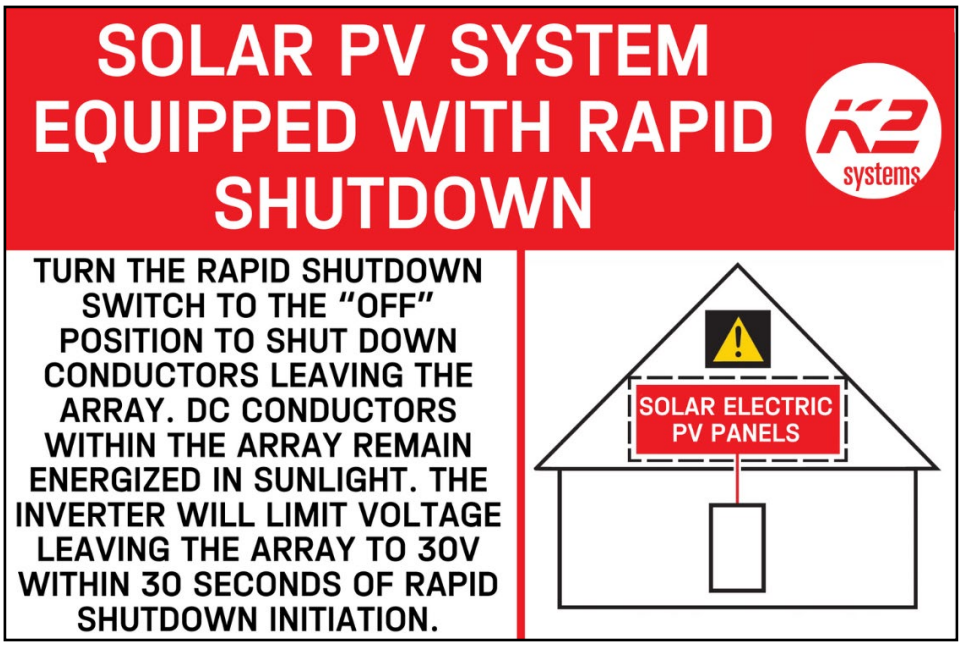
Please see page 7 for list of UL 3741 approved electrical equipment.

Markings

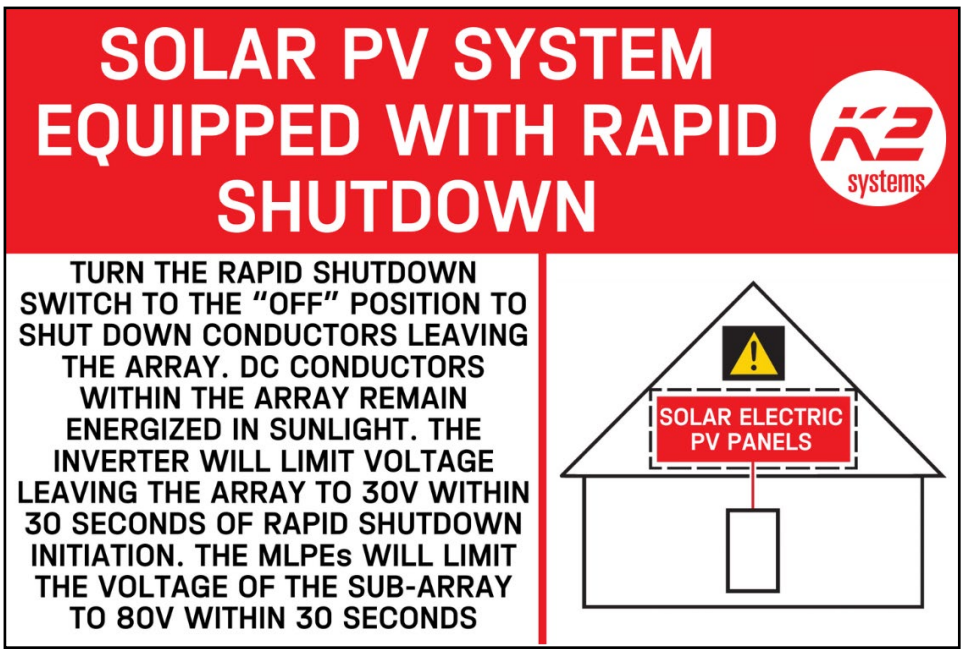
Verify that the system is labeled at each service equipment location to which the PV system is connected or at an approved readily visible location outside the array boundary. Attach one label at or near the Rapid Shutdown Switch. Labels are provided by K2 Systems within the UL 3741 Labeling Kit.

A separate label was designed for systems that utilize MLPEs. Where MLPEs are used to control circuits within subarrays, make sure to install the correct label for the system. Please refer to the sample labels in the next page to distinguish between the two.

"Rapid Shutdown Switch" refers to the AC disconnect, breaker, and/or isolation devices used as initiation devices for the system.



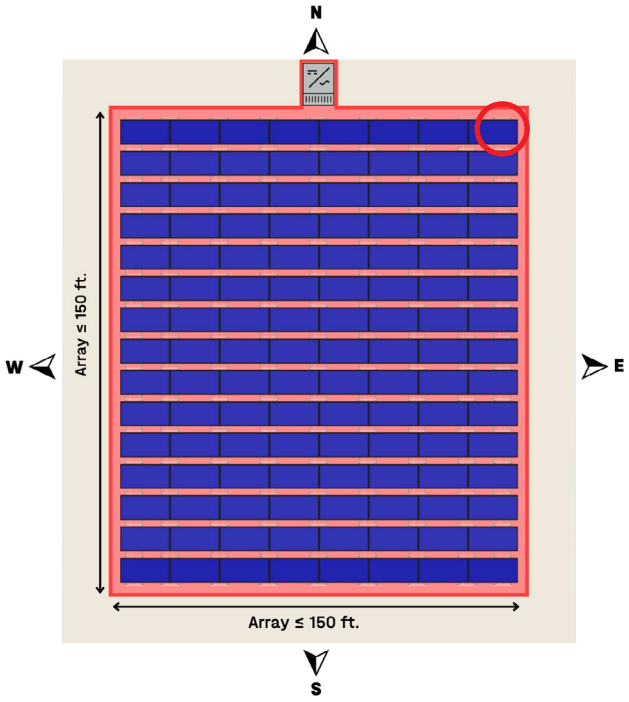
Rapid Shutdown Switch Label, no MLPEs used.



Rapid Shutdown Switch Label, for systems with MLPEs.

Markings

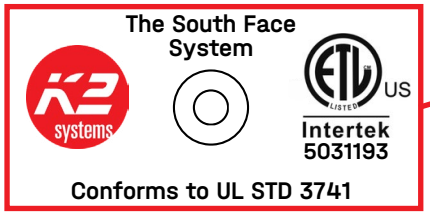
The UL 3741 marking is visible on the K2 Systems nameplate, which is to be installed at the end chassis. The nameplate must be installed at the northernmost row by eastern most chassis (as denoted by the red circle):

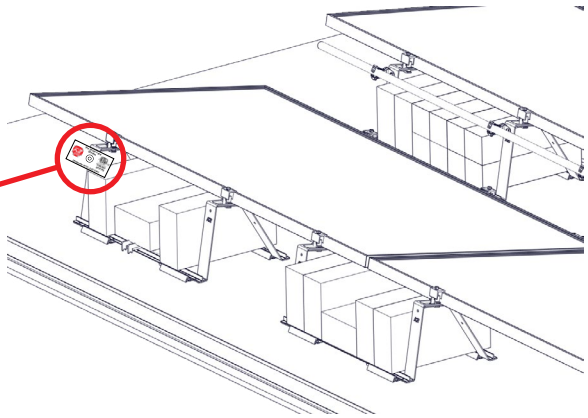


Installation:

- Align the hole of the UL 3741 nameplate to the accessory hole of the South Face Ridge or Summit chassis (The accessory hole is located above the K2 Systems logo on the back leg)
- Connect the nameplate to the chassis using the Serrated Hex Head M8×20 Bolt and Serrated Head Flange Nut within the kit
- Tighten the bolt to a torque of 12 ft-lbs
- Ensure that the writing faces outward and is legible

NOTE: THE UL 3741 NAMEPLATE IS PROVIDED WITHIN THE SF UL 3741 PLATE, KIT.





Approved Electrical Equipment (UL 1741 Listed)

INVERTERS:

- **Canadian Solar Inverters**
  - CSI-75K-T480GL02-U
  - CSI-80K-T480GL02-U
  - CSI-90K-T480GL02-U
  - CSI-100K-T480GL02-U
  - CSI-30KTL-GS-FLB
  - CSI-40KTL-GS (followed by -FLB or -B)
  - CSI-60KTL-GS-B
  - CSI-25K-T480GL01-UB
  - CSI-30K-T480GL01-UB
  - CSI-36K-T480GL01-UB
  - CSI-40K-T480GL01-UB
  - CSI-50K-T480GL01-UB
  - CSI-60K-T480GL01-UB
  - CSI-66K-T480GL01-UB
- **Chint Inverters**
  - CPS SCA25KTL-DO/US-208
  - CPS SCA25KTL-DO-R/US-480
  - CPS SCA36KTL-DO/US-480
  - CPS SCA50KTL-DO/US-480
  - CPS SCA60KTL-DO/US-480
- **Fronius Inverters**
  - Fronius Symo Advanced 10.0-3 208-240/Lite
  - Fronius Symo Advanced 12.0-3 208-240/Lite
  - Fronius Symo Advanced 15.0-3 480/Lite
  - Fronius Symo Advanced 20.0-3 480/Lite
  - Fronius Symo Advanced 22.7-3 480/Lite
  - Fronius Symo Advanced 24.0-3 480/Lite
- **GoodWe Inverters**
  - GW50K-SMT-US
  - GW60K-SMT-US
  - GW6000 (followed by -MS-US30 or A-MS)
  - GW7600 (followed by -MS-US30 or A-MS)
  - GW8600A-MS
  - GW9600 (followed by -MS-US30 or A-MS)
- **SMA Inverters**
  - STP 33-US-41
  - STP 50-US-41
  - STP 62-US-41
  - STP 20-US-50
  - STP 25-US-50
  - STP 30-US-50
- **Solectria Inverters**
  - PVI 25TL-208
  - PVI 25TL-480-R
  - PVI 36TL-480-V2
  - PVI 50TL-480
  - PVI 60TL-480
- **Solis Inverters**
  - Solis-25K-US (followed by -SW, -F-SW or -LSW)
  - Solis-30K-US (followed by -SW, -F-SW or -LSW)
  - Solis-36K-US (followed by -SW, -F-SW or -LSW)
  - Solis-40K-US (followed by -SW, -F-SW or -LSW)
  - Solis-50K-US (followed by -SW, -F-SW, -F-LSW or -LSW)
  - Solis-60K-US (followed by -F-SW or -F-LSW)
  - Solis-66K-US (followed by -F-SW or -F-LSW)
  - S5-GC75K-US
  - S5-GC80K-US
  - S5-GC90K-US
  - S5-GC100K-US
- **Sungrow Inverters**
  - SG36CX-US
  - SG60CX-US

MLPE:

- **APsmart (Rapid Shutdown Device)**
  - RSD-S-PLC-A
  - RSD-D-15-1000
  - RSD-D-20-1000
- **Beny (Rapid Shutdown Device)**
  - BFS-21
  - BFS-22
- **IMO (Rapid Shutdown Device)**
  - FRS-01
  - FRS-02
- **SMA (Rapid Shutdown Device)**
  - JMS-F

PVRSE:

- **IMO (Rapid Shutdown Switch)**
  - FRS-ESW1
  - FRS-ESW2

Introduction: Understanding UL 3741 and NEC 690.12

UL 3741 and NEC Rapid Shutdown Compliance

The South Face Photovoltaic Hazard Control System (PVHCS) is a UL 3741 Listed system that provides compliance with the National Electrical Code's (NEC) Rapid Shutdown of PV Systems on Buildings, found in section 690.12. The PVHCS must be installed in accordance with the manufacturer's installation instructions utilizing the materials and methods listed in this addendum.

NEC 690.12 and South Face Compliance

NEC requires that specific PV circuits be controlled to reduce shock hazards to firefighter (FF) interactions. The code differentiates the requirements based on the circuit's location in relation to the array boundary. The array boundary is defined as one foot in all directions from the array. In a South Face System, the one-foot boundary extends from the edge of the PV modules or racking, whichever is exposed after installation.

NEC 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.

Outside the Array Boundary

- NEC requires PV system circuit conductors to be reduced to ≤ 30V within 30 seconds within rapid shutdown initiation.
- The South Face PVHCS complies with this requirement through the use of listed inverters. For proper installation of the inverters, see their respective installation criteria and requirements.

Inside the Array Boundary

- NEC has multiple methods to meet requirements to control conductors within the array boundary. The South Face System has been tested to UL 3741 to provide proper protection from shock hazards imposed on FF by system components within the array boundary.
- The South Face listing includes the use of multiple isolation devices to control the PV system circuits. Refer to the installation instructions for the string isolation devices as well as this addendum to verify proper installation with the specific isolation device used.

Initiation Devices

- Initiation device(s) shall initiate the rapid shutdown function of the PV system.
- The South Face System utilizes initiation devices integrated with the Power Conversion Systems (inverters). Proper installation will include installing the inverters and any associated initiation devices as required.

Installation Methods per UL 3741 and NEC 690.12

The following case studies are provided by K2 Systems to show examples of installation configurations that comply with NEC 690.12, compliance is not limited to these examples.

The simplest installation method to comply with NEC690.12 is to utilize the South Face 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 can comply by using a single or combining one or more of the three options below (Cases 2-3).

Case 1: UL 3741 Listed System

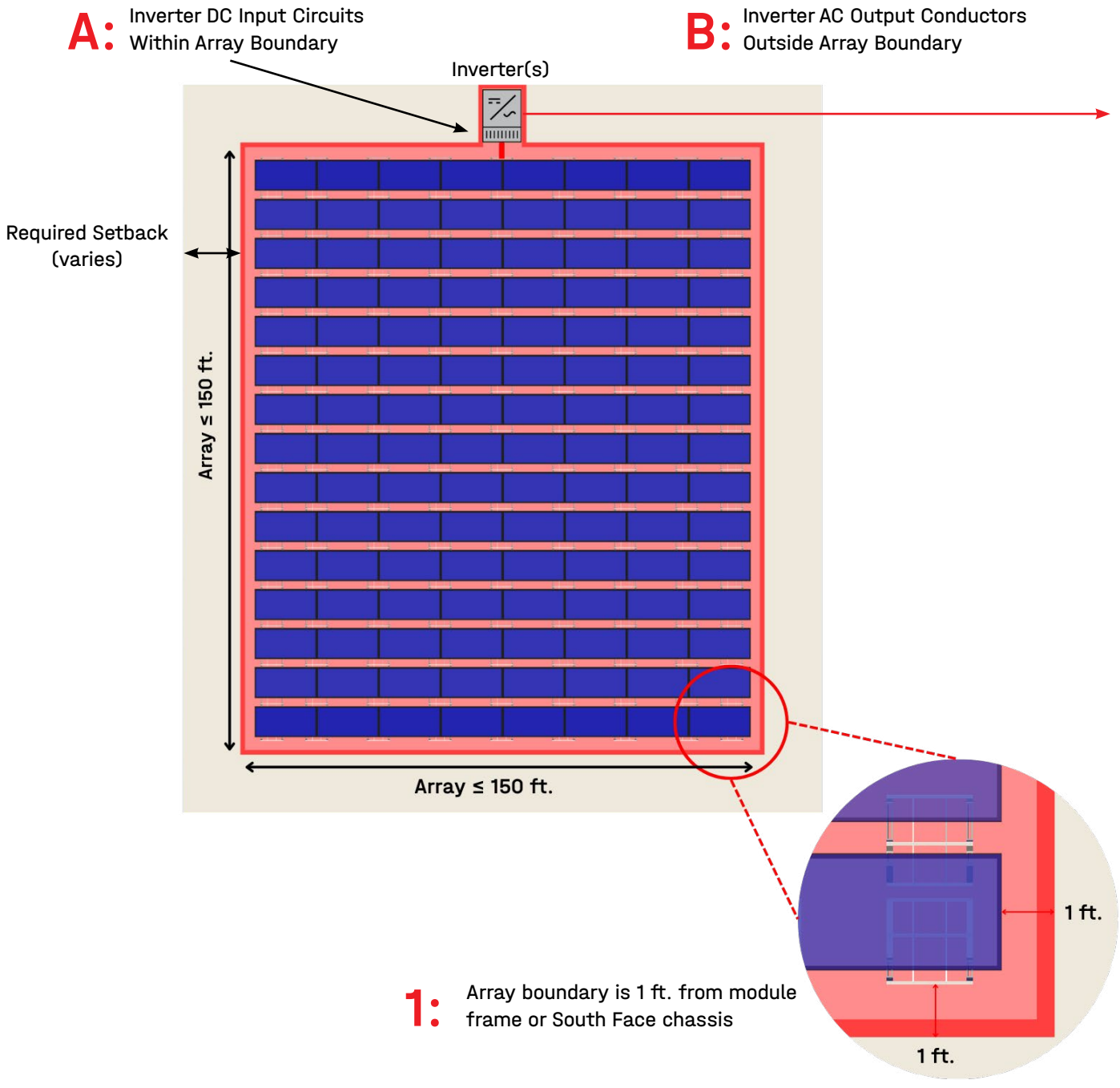
Array(s) comply with NEC 690.12

- Outside Array Boundary: ≤ 30V within 30 Seconds
- Inside Array Boundary: ≤ 1000V

Array(s) complies with 690.12 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 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 requirement after initiation (AC breaker or AC disconnect).

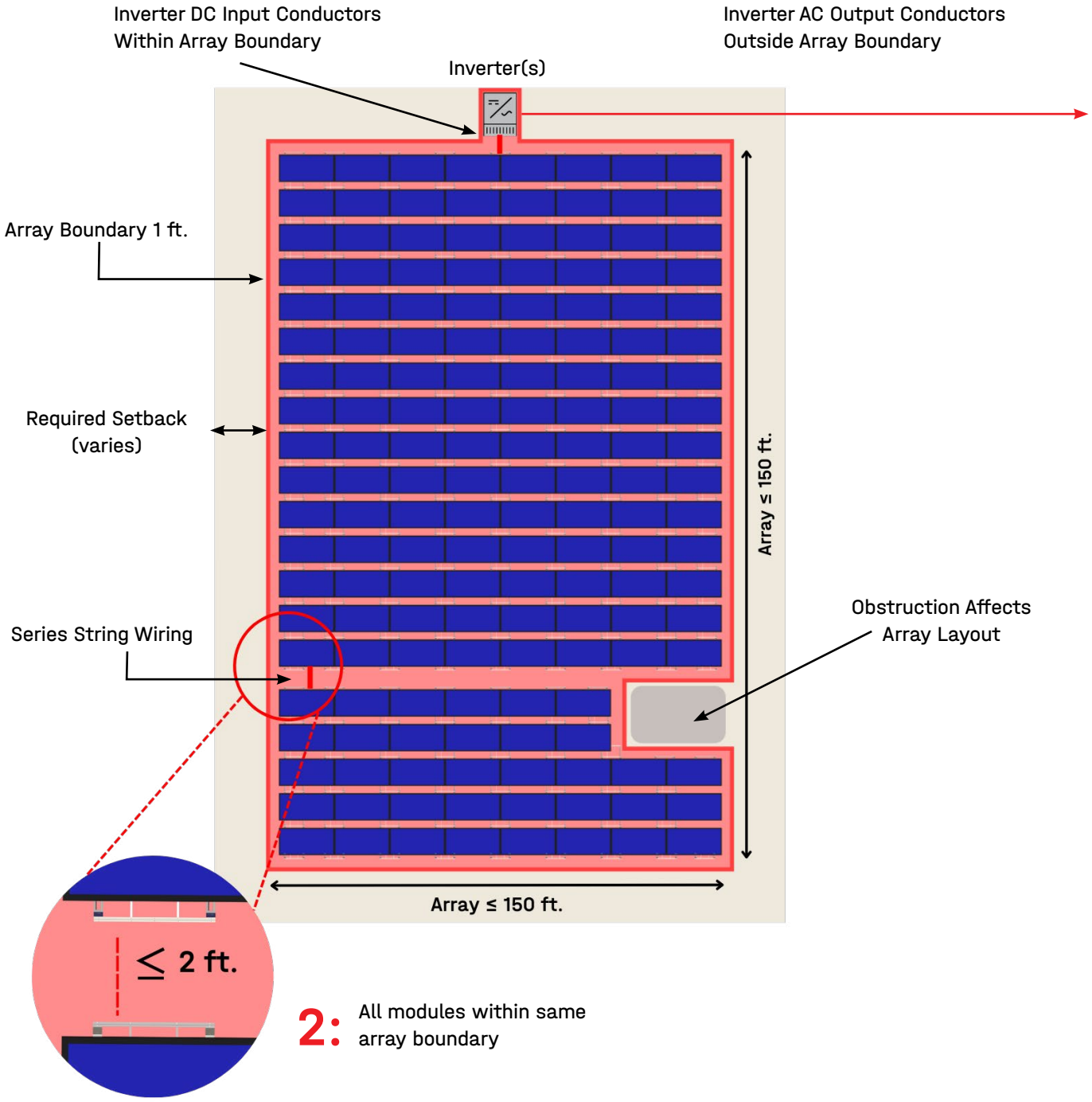


1: Array boundary is 1 ft. from module frame or South Face chassis

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

Sub-Arrays(s) are within the same Array Boundary and Array(s) comply with NEC 690.12
- Outside Array Boundary: ≤ 30V within 30 Seconds
- Inside Array Boundary: ≤ 1000V

Maintaining NEC Compliance with sub-array(s) within array boundary
Maximum 2 ft. spacing between all array components resulting in a single array boundary.



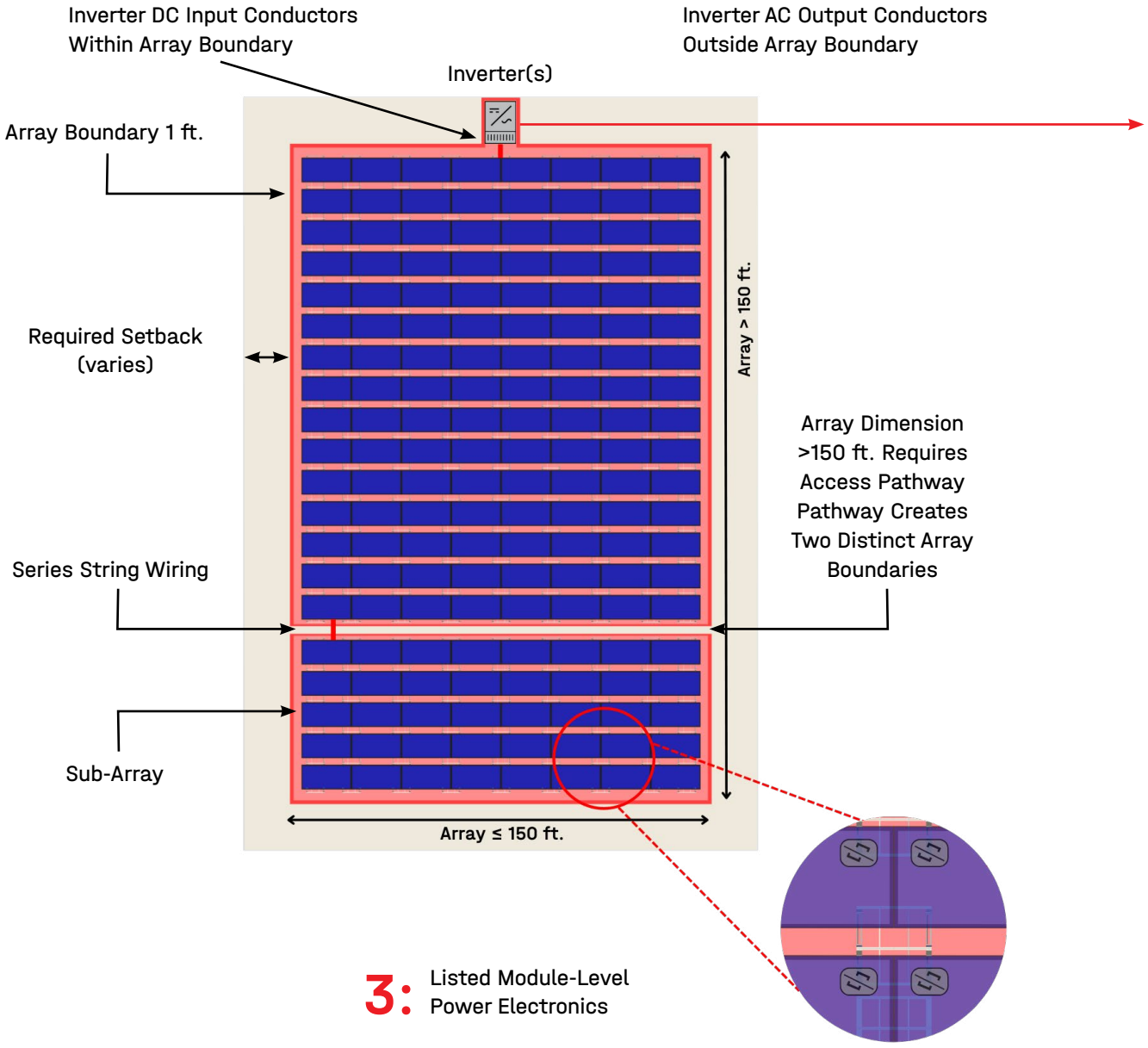
2: All modules within same array boundary

Case 3: South Face UL 3741 Listed System with MLPE Sub-Array

Sub-array(s) using MLPEs to control circuits for the 690.12 compliance
- Outside Array Boundary: ≤ 30V within 30 Seconds
- Inside Array Boundary: ≤ 1000V
- Inside Sub-Array Boundary: ≤ 80V inside within 30 Seconds

Maintaining NEC Compliance with sub-array(s) outside of array boundary
Utilize Module-Level Power Electronics (MLPEs) 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.

NOTE: When using MLPE devices, review installation instructions for both the MLPE device and inverter to verify that both devices comply with UL1741 Rapid Shutdown requirements. If required for rapid shutdown functionality, install necessary transmitters outside the array boundary.



3: Listed Module-Level Power Electronics

UL 3741 Wire Management Guidelines

The South Face Wire management components noted in the list of approved PVHCS equipment on page 2 were evaluated and approved for providing wire protection against potential FF interactions. To achieve wire protection as required per UL 3741, all wires shall be routed such that they are not exposed to potential FF interactions. This is achieved using the following methods:

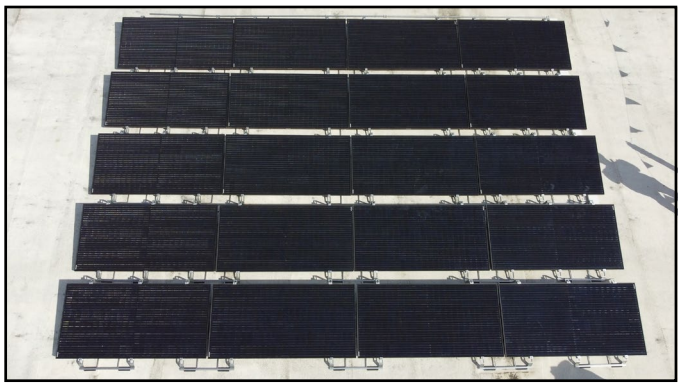
Wire Clips:

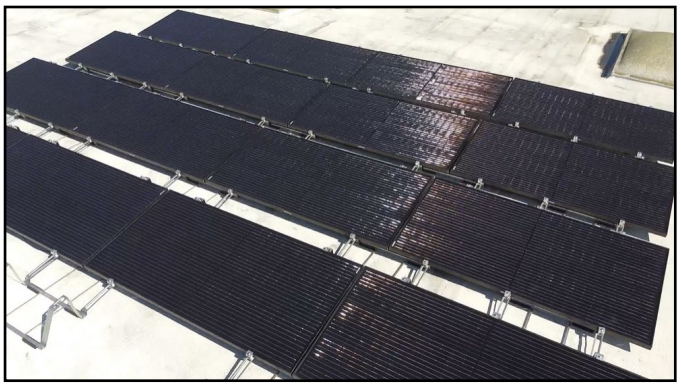
- Route PV wires under the cover of modules using approved cable ties and clips
- Do not allow wires to sag between clips, with a minimum of one clip every 24 inches (per NEC 690.31)
- Do not over tighten or pinch wires
- Position clips to prevent contact between the wire and metallic components of the module and the racking system

Raceways

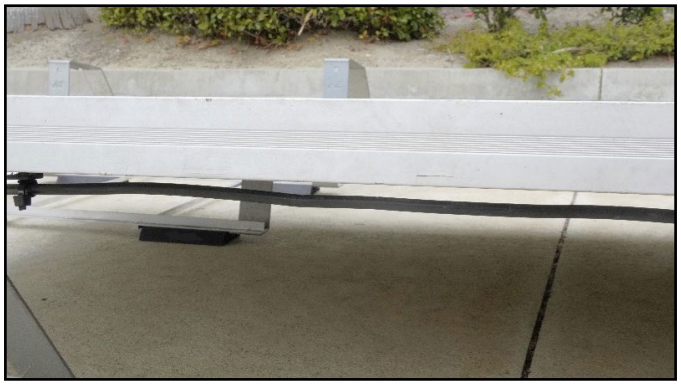
- Protect wires in exposed areas such as inter-row spaces and pathways by utilizing the listed raceways on page 2 (RayTray, conduit, etc.)
- Ensure that PV wire is not exposed to sharp edges when entering or exiting the raceway

See photos for examples of under module and under chassis wire management



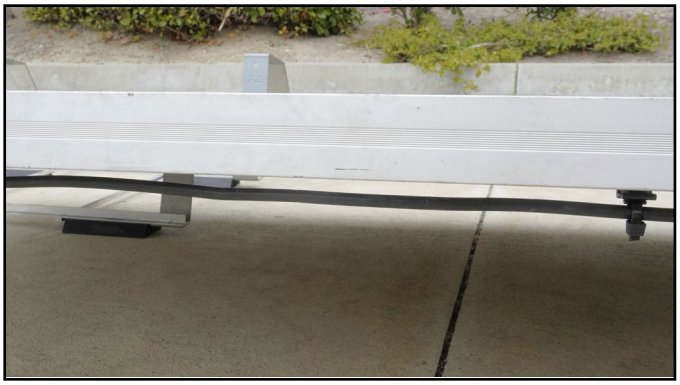


All wiring managed under module; required conduit, raceways, and cable ties are not shown in the example above.



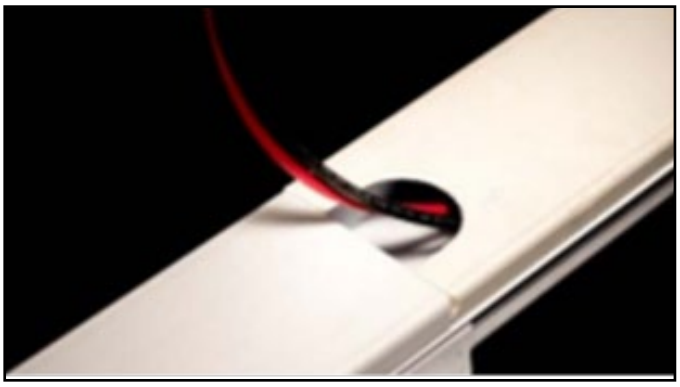
Examples of wire installation under module frame.

UL 3741 Wire Management Guidelines



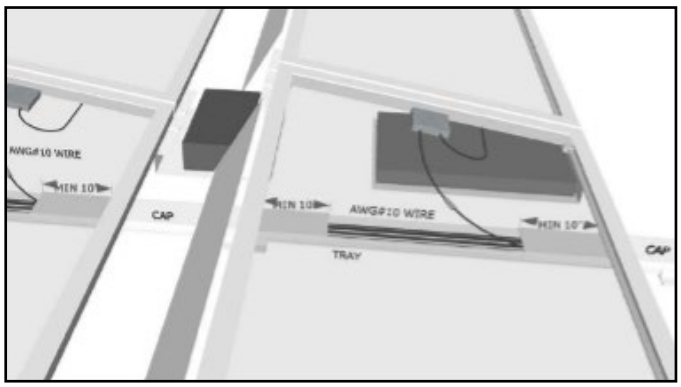
Examples of wire installation under module frame and attached to South Face chassis.

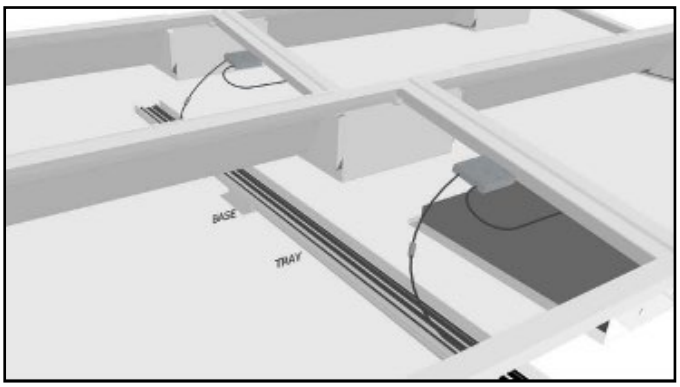
Manage larger bundles of cables using RayTray or another listed raceway. When entering and exiting the raceway, installers shall ensure PV wires are routed away from exposure to Fire Fighter interactions.



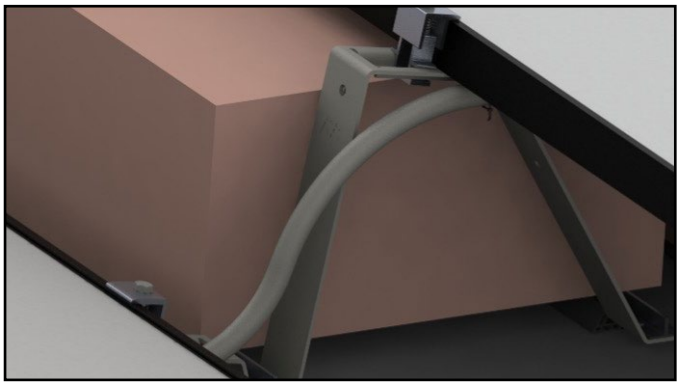
Examples of wire installation in RayTray.

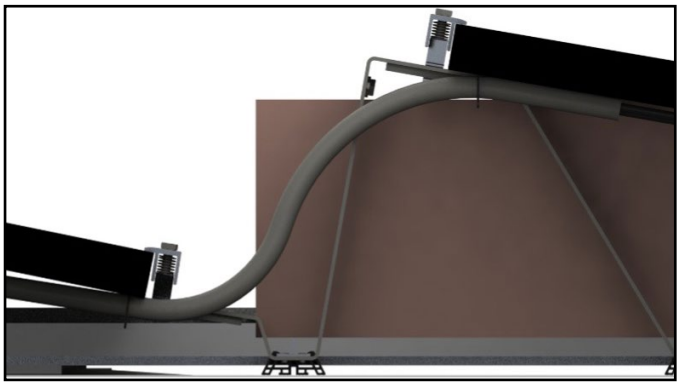
UL 3741 Wire Management Guidelines





Examples of wire installation in RayTray underneath modules.





Examples of row-to-row wire installation through listed conduit.

Notes

Notes

Connecting Strength

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