



PEGASUS

# SKIPRAIL<sup>®</sup> SYSTEM

## UL 3741 Photovoltaic Hazard Control

INSTALLATION SUPPLEMENT



## OVERVIEW

UL 3741 addresses safety principles and processes for evaluating rapid-shutdown PV arrays that can protect firefighters from shock hazards on homes and buildings with solar panels.

The Supplement identifies UL 3741 Listed equipment, provides case studies for NEC 690.12 compliant installations, and covers Wire Management guidelines.

### IMPORTANT NOTICE

Compliance with UL3741 requires that a qualified person(s) install the PV array in accordance with the installation instructions and all applicable installation codes and standards.

This Supplement describes the standards and requirements for compliance with UL 3741. Installers must understand and follow the specifications of this Supplement as well as all installation procedures associated with Pegasus SkipRail. Failure to follow these guidelines may negate the product warranty, and could result in property damage, bodily injury or death.

### WARNING: ADDITION SAFETY REQUIREMENTS

- The installer is responsible for ensuring all aspects of a safe installation, including but not limited to:
  - Verifying that the roof is in good condition
  - Using appropriate products for the location, environment and building conditions
  - Complying with all applicable local or national building and fire codes
  - Confirming that all provided information is accurate
  - Reviewing all third-party equipment installation manuals for specific instructions such as installation configurations, mounting, clearances, compatible connectors, and rapid shutdown initiation methods
- Electrical installation and procedures should be conducted by a licensed and bonded electrician or solar contractor. All proper protocol must be followed, including:
  - Use appropriate direct-to-earth grounding method as specified by current National Electrical Code
  - Bare copper wire should not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion
  - Always disconnect AC power prior to servicing or removing panels, microinverters or power optimizers
  - Routine maintenance must not break or disturb the bonding of the system
- Installer should consult the Pegasus Design Tool to determine appropriate design specifications, and follow all applicable installation guidance, including:
  - Use only Pegasus parts or parts recommended by Pegasus
  - Review module manufacturer's documentation for compatibility and compliance with warranty terms and conditions.
  - Refer to the Pegasus SkipRail System installation directions for complete installation instructions

# CONTENTS

INTRODUCTION TO UL 3741 AND NEC 690.12.....	3
RATINGS.....	4
APPROVED EQUIPMENT.....	4
MARKINGS.....	4
INSTALLATION METHODS PER UL 3741 AND NEC 690.12 .....	5
1. SINGLE ARRAY, SINGLE STRINGS.....	6
2. CONTIGUOUS SUB-ARRAY.....	7
3. MULTIPLE ARRAYS.....	8
WIRE MANAGEMENT GUIDELINES.....	9

## INTRODUCTION TO UL 3741 AND NEC 690.12

**ANSI/CAN/UL 3741**, Standard for Safety for Photovoltaic Hazard Control, provides a means of evaluation for photovoltaic (PV) hazard control components, equipment and systems that reduce shock hazards from energized PV system equipment and circuits in a PV array.

**NEC 690.12**, Rapid Shutdown of PV Systems on Buildings, requires all PV arrays installed on or in buildings to include rapid shutdown functions to reduce shock hazard for firefighters.

Pegasus SkipRail is a UL 3741 Listed Photovoltaic Hazard Control System (PVHCS). It complies with NEC 690.12(B)(2)(1) when installed by qualified persons per the procedures described in the Pegasus SkipRail System Installation Manual and this Supplement.

This Supplement includes four example cases of system designs that comply with 690.12(B)(2). Please refer to 2023 NEC 690.12 for full provision of the code. NEC 609.12 summary:

### (A) Controlled Conductors

Requirements for controlled conductors apply to (1) PV system dc circuits, and (2) inverter output circuits originating from inverters located within the array boundary.

### (B) Controlled Limits

The array boundary is defined as 305 mm (1ft) from the array in all directions.

(1) Controlled conductors located outside the boundary shall be limited to not more than 30V within 30 seconds of rapid shutdown initiation.

(2) Inside array boundary, the system must comply with one of the following:

- (1) Use of a PV Hazard Control System (UL 3741) installed in accordance with instructions
- (2) Limiting the voltage within the equipment to not more than 80V within 30 seconds after rapid shutdown initiation

### (C) Initiation devices

An initiation device(s) shall be provided and initiate the rapid shutdown function. For a single PV system, shutdown shall occur by the operation of a single initiation device.

### (D) Buildings with Rapid Shutdown

Buildings shall have a permanent label at each PV service equipment location or an approved location and indicate the location of the rapid shutdown initiation devices.

## RATINGS



**UL 3741 LISTED**

#80055489

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

Pegasus SkipRail System Voltage: 1000V

## APPROVED EQUIPMENT

**PEGASUS LIST OF APPROVED PV HAZARD CONTROL EQUIPMENT OR COMPONENTS EVALUATED AT 1000V:**

### Pegasus Attachments and Components

- Refer to Pegasus Installation Manual for installation methods and list of approved Pegasus components and roof attachments for Composition shingle, Metal, Tile, and Low Slope Roofs.

### Electrical Balance of System Components

- PV Connectors (UL 6703 Listed) shall be compatible and approved for the application
- PV Wire (UL 4703 Listed)

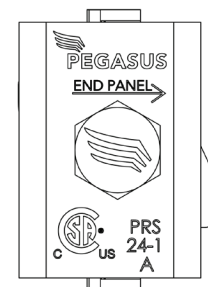
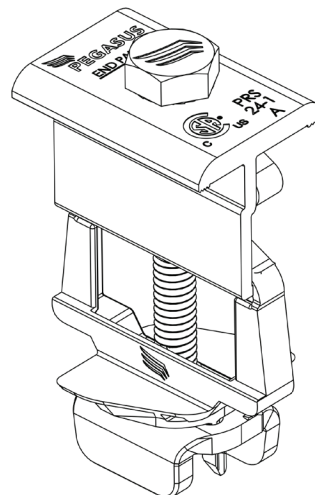
### Listed Conduit (all sizes apply)

- Electrical Metallic Tubing (EMT) (UL 797 Listed)
- Rigid Metal Conduit (RMC) (UL 6 Listed)
- Intermediate Metal Conduit (IMC) (UL 1242 Listed)
- Flexible Metal Conduit (UL 1 Listed)
- Liquid Flexible Metal Conduit (UL 360 Listed)
- Schedule 40/80 Rigid PVC Conduit (UL 651 Listed)
- Listed Tubing, Fittings and Grounding Components

*NOTE: Pegasus was evaluated up to 1000 Vdc. However, per NEC 690.7, PV system DC circuits on one- or two-family dwellings are limited to 600 Vdc maximum. PV system DC circuits on other types of buildings are limited to 1000 Vdc maximum.*

## MARKINGS

Product markings are located on the top surface of the Multi-Clamp



# INSTALLATION CASE STUDIES

The four case studies below illustrate common installation configurations in compliance with NEC 690.12(B).

1. **Single Array, UL 3741 Listed System**
2. **Contiguous Sub-Array, UL3741 Listed System**
3. **Non-contiguous Sub-Array, UL3741 Listed System**

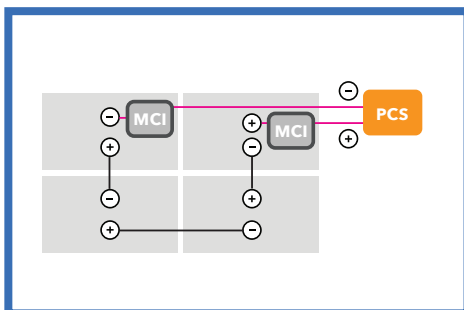
## IMPORTANT: TESLA INSTALLATION NOTES

If using Tesla Mid-Circuit Interrupters (MCI) as string isolation device (SID) with Tesla PVI or PowerWall products, note:

- PVHCS max voltage is 600Vdc
- MCI-1s must be connected at both the positive and negative end of each series-connected string to satisfy NEC 690.12 requirements for circuits exiting the array to the inverter or Powerwall. Where a single series-connected string spans across two mounting planes, an additional MCI-1 shall be connected at one end of the connection between mounting planes.
- Module connectors must be Staubli type PV-KST4/KBT4-UR or type PV-KST4/KBT4-EVO2 for compatible connection to MCIs

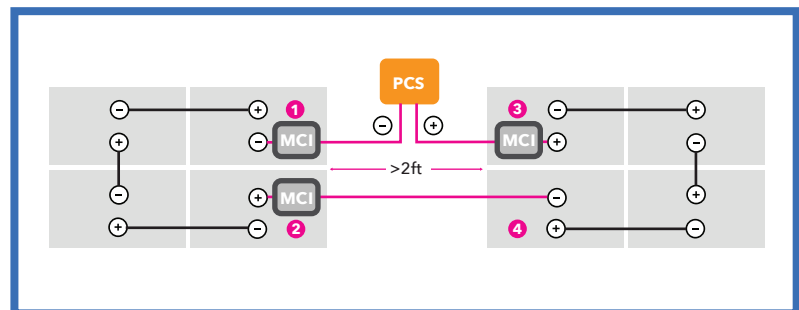
For specific instructions, including MCI-1 mounting, clearances, ratings, compatible connectors, and rapid shutdown initiation methods, consult the Tesla Inverter or Powerwall Installation Manual.

### Contiguous Arrays



Tesla MCI-1's must be installed at a minimum on both the positive and negative conductors of each string that connect back to the PCS. This is applicable to every contiguous array per installation.

### Non-Contiguous Arrays



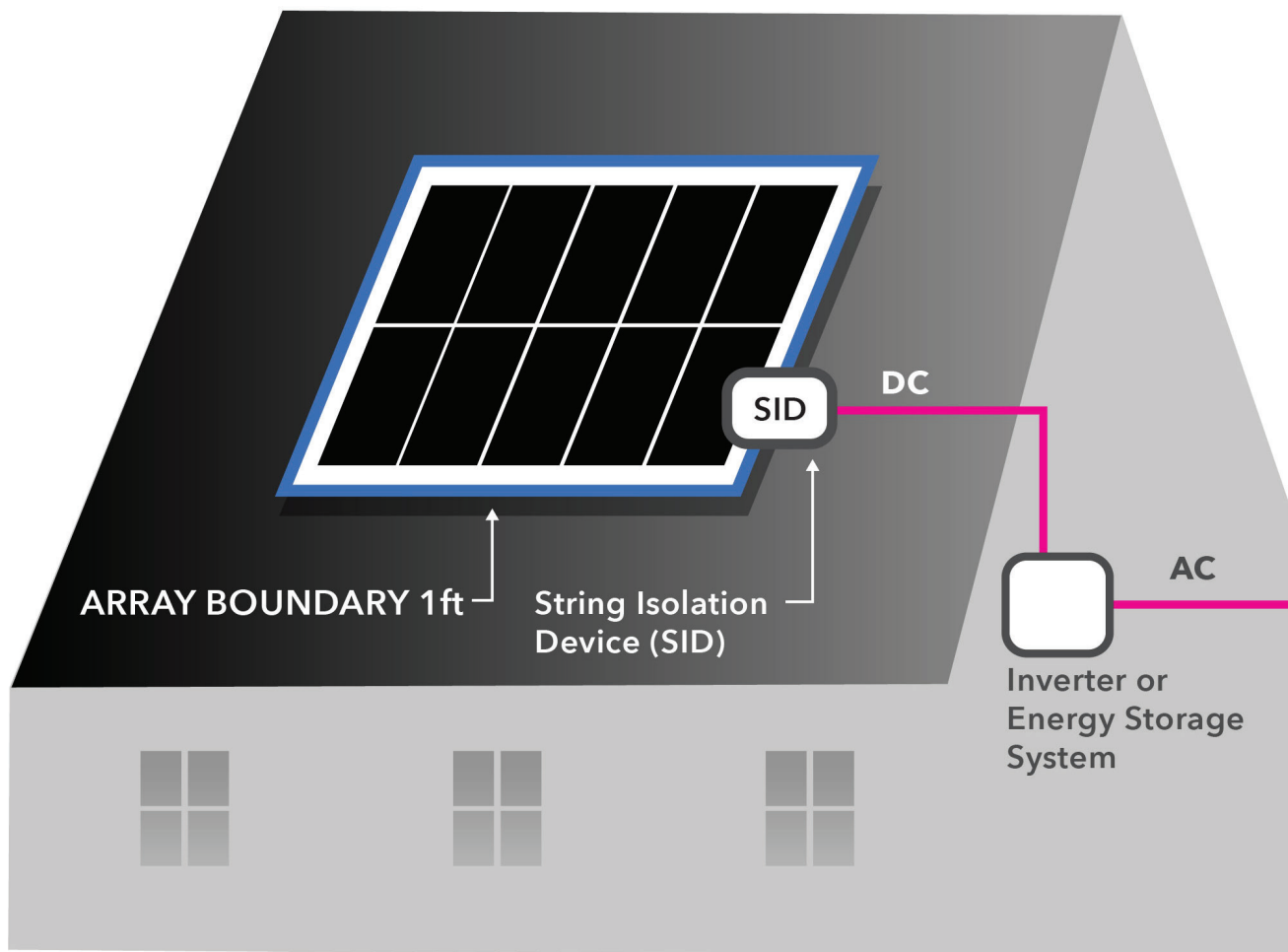
Tesla MCI-1's must be installed as illustrated when sub-arrays are separated more than 2' apart:

- Between the last module and the homerun to the PCS on the positive conductor.
- Between the last module and the homerun to the PCS on the negative conductor.
- On one of the connections between sub-arrays.

## CASE 1: SINGLE ARRAY, UL 3741 LISTED SYSTEM

Compliance for single arrays with single strings

Single arrays with single strings require the use of a string isolation device (SID) as shown in the figure below to control the conductors outside of the array boundary.



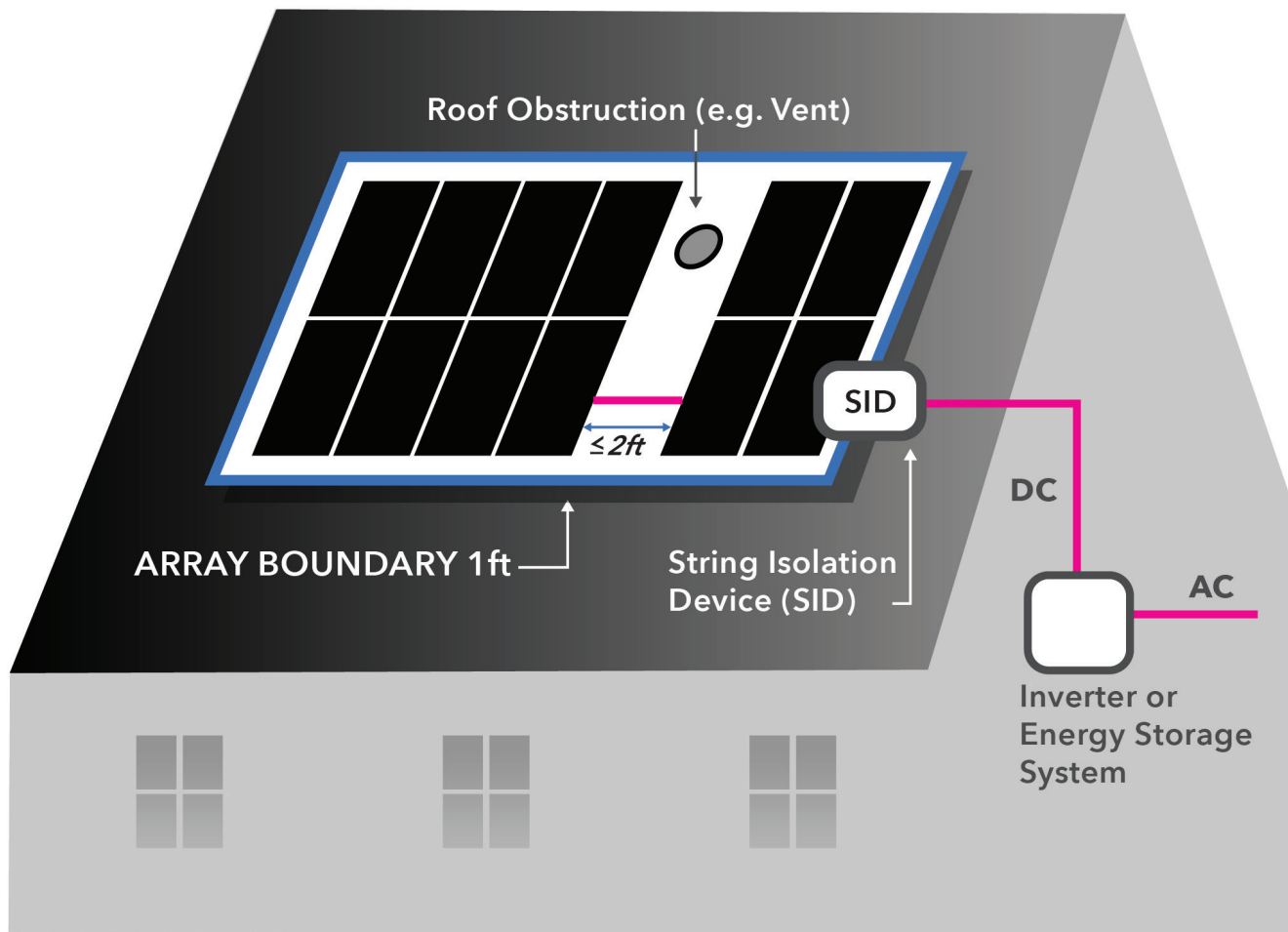
Array(s) comply with NEC 690.12(B)(2)(1)

- **Outside Array Boundary:** 30V or less within 30 seconds of rapid shutdown initiation
- **Inside Array Boundary:** 600V max for residential, 1000 V for commercial

## CASE 2: CONTIGUOUS SUB-ARRAY, UL 3741 LISTED SYSTEM

Sub-array(s) within the same array boundary

When multiple arrays are connected by no more than 2 feet of space, the result is a single array boundary. For these contiguous sub-array layouts, use a SID as shown below to control conductors outside the array boundary.

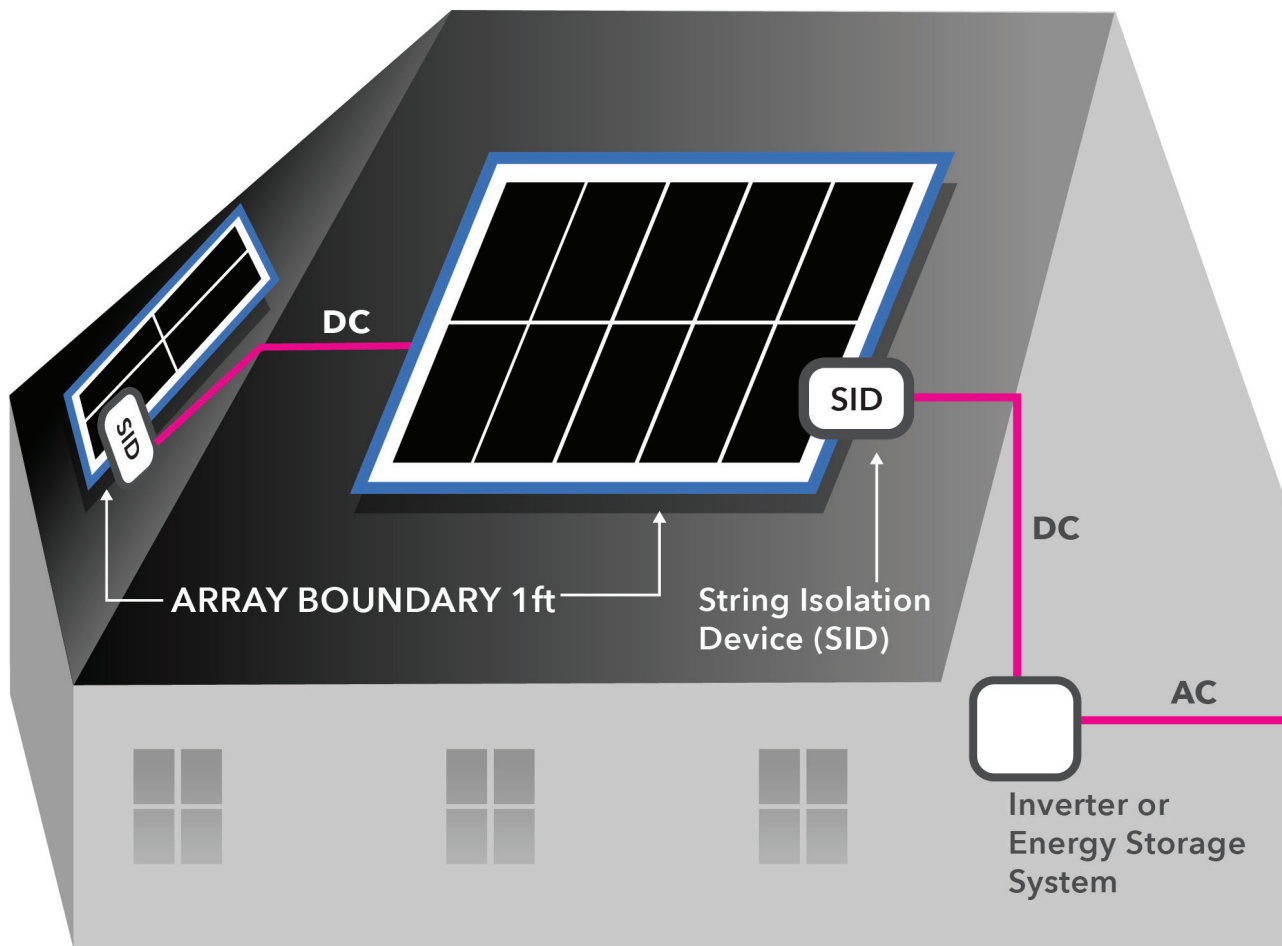


Array complies with NEC 690.12(B)(2)(1)

- **Outside Array Boundary:** 30V or less within 30 seconds of rapid shutdown initiation
- **Inside Array Boundary:** 600V max for residential, 1000V max for commercial

## CASE 3: MULTIPLE ARRAYS, UL 3741 LISTED SYSTEM

In multiple arrays with multiple strings, each string will require a SID. When a string is split across non-contiguous (>2ft) sub-arrays, a SID must be installed on both ends of the connection between sub-arrays as shown below to control conductors outside of the array boundary.



Array complies with NEC 690.12(B)(2)(1)

- **Outside Array Boundary:** 30V or less within 30 seconds of rapid shutdown initiation
- **Inside Array Boundary:** 600V max for residential, 1000V max for commercial



## WIRE MANAGEMENT GUIDELINES

UL 3741 compliance requires all wires be routed in a fashion that prevents exposure to potential firefighter interactions.

Pegasus SkipRail System wire management components are approved PVHCS equipment. Used properly, Pegasus wire management components provide wire security and positioning to prevent potential firefighter interactions.

Route wires inside of the open channel rail and under modules, and use Pegasus wire management products to secure wires in place. For connections between arrays, route wires through Pegasus rail. Do not overtighten Pegasus Cable Grip fasteners or cause permanent deformation or damage to the wires.

