

June 11, 2026

Taka Chiyoda
Chief Executive Officer
Sunstack, LLC

Emailed to: taka@sunstackracking.com

**Subject: Engineering Review of Sunstack Integrity Rail Supported by SSB1 and SSM
Roof Mount Systems - FINAL
Ontario, Alberta and British Columbia, Canada
PRI Project No.: 25-047**

Dear Mr. Chiyoda,

PRI Engineering Corp. (PRI) is pleased to submit the following analysis of the Sunstack SSB1 (SSB1) Composite Roof Mount System and Sunstack SSM (SSM) Composite Roof Mount System for its use in supporting photovoltaic (PV) panels flush mount on timber framed building roofs. The evaluation and subsequent recommendations have been determined for the configurations and criteria described below. The following reference documents have been utilized in the evaluation and recommendations provided in this letter:

- National Building Code of Canada (NBCC, 2020)
- Canadian Standards Association (CSA) O86:14, Engineering Design in Wood (CSA O86:14, Reprinted 2017)
- Aluminum Design Manual, ADM-2015 & 2020 Editions

The specific configurations evaluated are as follows:

- Direct attachment of SSB1 Composite Roof Mounting System (mount base only – “load rated” L-Foot, by others)
- Sunstack Integrity Rail System supported by SSB1 Composite Roof Mounting System consisting of rail, Universal Clamp, Rail Adapter, Integrity L-Foot, SSB1 mount base and threaded slide plate (and fasteners as described below)
- Sunstack Integrity Rail System supported by SSM Composite Roof Mounting System consisting of rail, Universal Clamp, Rail Adapter, and SSB1 mount base (and fasteners as described below)

The resulting analysis of these systems has been summarized in tables attached as **Appendix E to G** where maximum spacing of the mount system is given for a variety of loading conditions and fastening/support applications.

1 System Descriptions, Analysis and Load Capacity Derivation

The **SSB1 Composite Roof Mount System** is comprised of a 6000 series aluminum mount base and threaded slide plate, M10x25 or custom M8x20 stainless steel with M10 button head screw and multiple stainless steel 6.0 millimetre (mm) x 60 mm and/or 90 mm wood screws with built-in compression washer and rubber seal. An appropriately “load rated” L-Foot bracket, by others, may be attached to the SSB1 mount base with the provided aluminum threaded slide plate and included stainless steel button head screw, and an appropriately “load rated” rail, by others, may be attached to the ‘L-Foot’ per the rail manufacturer’s installation instructions, as noted in the attached installation manuals in **Appendix A-1**.

The installation of the SSB1 must be with the long direction (ie, narrower portion of the bracket closest to the peak) up slope and parallel to the roof framing with the curved side facing up slope, and in accordance with Sunstack’s SSB1 Installation Manual as shown in **Appendix A-1**. The system is attached to the roof wood substrate with either two (2) or five (5) stainless steel 6.0 mm x 60 mm and/or 90 mm long wood screws, also provided.

The **SSM Composite Roof Mount System** is comprised of a 6000 series aluminum mount base and threaded slide plate, M10x25 or custom M8x20 stainless steel with M10 button head screw and multiple stainless steel 6.0 mm x 60 mm wood screws with built-in compression washer and rubber seal.

The installation of the SSM must be with the long direction up slope (ie. narrower portion of the bracket closest to the peak) and parallel to the roof framing with the curved side facing up slope, and in accordance with Sunstack’s Integrity Rail Installation Manual as shown in **Appendix A-2**. The system is attached to the roof wood substrate with either two (2) or five (5) stainless steel 6.0 mm x 60 mm long wood screws, depending on whether the system is fastened to the rafters or roof decking, respectively.

The **Sunstack Integrity Rail System** is comprised of a 6000 series aluminum rail, Universal Clamp, and Rail Adapter assemblies (30-40 mm PV modules), splice and M10 diameter SS bolt to fasten the rail adapter to the SSM Mount, or M10 diameter SS bolt to fasten the rail adapter to the Integrity L-Foot which is attached to the SSB1 mount. The installation of the Integrity Rail must be in accordance with Sunstack’s Integrity Rail Installation Manual, as shown in **Appendix A-2**.

2 System Analysis and Load Capacity Derivation

The Universal Clamp and Rail Adapter to rail and bolt to SSM and SSB1 Mount capacities are based on the IAPMO Institute of Building Technology (IBT) test results using the average values multiplied by the resistance factor determined by the ADM Appendix 1 Testing Methods or the lowest tested value multiplied by the ADM resistance factor for rupture or yielding, depending on the applicable failure mode.

The Sunstack Integrity Rail's capacity was determined based on both ADM Chapter F design provisions and tested results multiplied by the ADM resistance factor for aluminum failure based on the ADM Appendix 1 Testing Methods.

The following sections outline a summary of the information reviewed as part of the engineering review, conclusions based on this information and finally our recommendations for the maximum roof mount base spacing to be used for the erection of the system in the Provinces of Ontario, Alberta and British Columbia.

3 Laboratory Testing

Three (3) test reports were provided by Sunstack detailing the tests conducted to determine the tensile, compressive, and shear capacity of the SSB1 Mount, and Sunstack Integrity Rail supported by SSB1 or SSM, installed on wood rafters, various wood decks, and rails in multiple configurations:

- *Sunstack 3469-23001*, prepared by IAPMO Institute of Building Technology (IBT), dated June 8, 2023.
- *Sunstack 3469-24003-002*, prepared by IBT, dated March 25, 2024.
- *Sunstack 3469-24004*, prepared by IBT, dated March 25, 2024.

Up to four wood substrates were tested, with the fasteners also passing through two layers of composite asphalt roof shingles and building paper. All tested sheathing was APA rated.

For the SSB1 Mount Base, the four (4) tested wood substrates consisted of the following:

1. 5/8 inch (in.) thick plywood sheathing over a 2x4 SPF #2 rafter nominal specific gravity $G=0.42$ (2x truss top chord OK by inspection);
2. 5/8 in. thick plywood only;
3. 15/32 in. thick plywood only; and
4. 7/16 in. thick Oriented Strand Board (OSB) only.

For the Sunstack Integrity Rail supported by SSB1 or SSM, the three (3) tested wood substrates consisted of the following:

1. 5/8 in. (SSB1 Mount) and 19/32 in. (SSM Mount) thick plywood sheathing over a 2x4 SPF #2 rafter nominal specific gravity $G=0.42$ (2x truss top chord OK by inspection);
2. 15/32 in. thick plywood only; and
3. 7/16 in. thick OSB only.

Testing considered a number of different variables, such as moisture condition and laboratory temperature. Two (2 - 6.0 mm x 60 mm and/or 90 mm long) wood screws are required at the rafter installations, while five (5-6.0mm x 60mm long) wood screws are required at the plywood only and OSB only installations.

For the SSB1 Mount Base, shear test loads were applied at a height of 107.5 mm (4.23 in.) measured from the mount bottom. For the Sunstack Integrity Rail supported by SSB1 or SSM, shear test loads were applied at a height of 144.3 mm (5.68 in.) and 144.46 mm (5.6875 in.), respectively, measured from the mount bottom to the center of the PV module. Any adverse effects due to additional height or eccentricity of connected components shall be considered by the end user of this letter.

4 Laboratory Test Results

As per the above-mentioned reports prepared by IBT, the primary modes of failure for the SSB1 and SSM Mounts are screw withdrawal for tension and shear loading and sheathing failure for compression. The factored capacity values utilized in the compilation of the anchor bracket spacing recommendations (**Appendix E to G**) were developed considering resistance factors of 0.8 for sheathing failure in compression, 0.6 for screw withdrawal for tension and shear loading, as per CSA O86:14. The maximum factored capacities were taken as the average of six (6) tests multiplied by the applicable resistance factor. The maximum factored capacities for anchorage in the tested wood surfaces for tension, compression, and shear are summarized in **Appendix B**.

The bolted connection of the “L-Foot” to the Sunstack SSB1 used in the testing was an M10x25 stainless steel button head screw torqued at 16 N-m (140 inch-pounds). Alternatively, a custom M8x20 stainless steel with M10 button head screw provided by Sunstack, torqued at 12 N-m (105 inch-pounds), is structurally acceptable. Any other bolt size or torque is outside the scope of this report and has not been considered in the above factored capacities or maximum span tables. While it is highly encouraged that only these fasteners are utilized for the attachment of the various brackets to the subject structure, if alternatives are to be considered, they must be approved by PRI and Sunstack. If this is not completed, neither party can be held liable for any failures arising from systems constructed with these fasteners.

In general, the primary modes of failure for the Sunstack SSB1 and SSM Composite Roof Mount System varied from plywood/OSB compression for flat panel installation orientation to shear failure of the L-Foot for SSB1 mounts and upright bracket for the SSM mounts. These governing failure conditions should be considered by the end user of this letter.

PRI has reviewed the above-mentioned reports, as well as typical loading and anchorage conditions for common rail and L-Foot type solar racking systems. PRI has determined that, subject to the limitations outlined below, the SSB1 Mount and Sunstack Integrity Rail supported by SSB1 or SSM are suitable for most rooftop solar racking systems, provided they are in accordance with Sunstack’s Installation Manual, as shown in **Appendix A** and meet the limitations outlined throughout this letter.

5 Climatic Loads, Roof Wind and Snow Loads per NBCC

Climatic loads that PV panels mounted on roofs are to be designed for are specified in the NBCC (2020) and the relevant Provincial Building Code. The primary climatic loads applicable and used in the analysis are wind roof loads, roof snow loads and seismic loads.

The wind loading on the PV panels is based on a variety of factors including those noted below and most geographically related is the reference wind pressure ($q_{1/50}$). Other factors considered in our analysis more thoroughly are described in **Appendix D**.

The specified roof zones as per Figure 4.1.7.6.-C and Figure 4.1.7.6.-E in the NBCC (2020) are displayed in **Appendix C**. **Table 1** outlines the range of the product of the pressure coefficient and gust factor $C_g C_p$ based on the varying roof slopes and effective wind areas.

Table 1: Pressure Coefficient per Roof Area

Roof Area Summary (NBC 2020 Zones)					
Roof Type	Roof Slope	NBCC 2020 Roof Areas	Effective Wind Area, m ²	$C_g C_p$ Range for Windwards Wind	$C_g C_p$ Range for Leeward Wind
Gable	0 to 7	r	1 to 10	0.5 to 0.25	-1.7 to -1.5
		s	1 to 10	0.5 to 0.25	-2.5 to -2.0
		c	1 to 10	0.5 to 0.25	-5.4 to -2.0
	7 to 27	r	1 to 10	0.75 to 0.5	-2.5 to 2.0
		s	1 to 10	0.75 to 0.5	-3.6 to -2.6
		c	1 to 10	0.75 to 0.5	-5.0 to -4.0
	27 to 45	r	1 to 10	1.6 to 1.5	-1.75 to -1.5
		s	1 to 10	1.6 to 1.5	-2.1 to -1.8
		c	1 to 10	1.6 to 1.5	-2.1 to -1.8
Hip	0 to 7	r	Not Applicable		
		s			
		c			
	7 to 27	r	1 to 10	0.75 to 0.5	-2.5 to -2.0
		s	1 to 10	0.75 to 0.5	-3.6 to -2.6
		c	1 to 10	0.75 to 0.5	-5.0 to -4.0
	27 to 45	r	1 to 10	1.6 to 1.5	-1.75 to -1.5
		s	1 to 10	1.6 to 1.5	-2.1 to -1.8
		c	1 to 10	1.6 to 1.5	-2.1 to -1.8

Roof snow loads are described further in **Appendix D**. The general factors for consideration are the ground snow load, S_s , associated rain load, S_r , and modification factors for wind exposure, basic roof snow load factor (C_b), roof slope factor (C_s) and accumulation factor (C_a). The snow load indicated in the tables provided in **Appendix E to G** are specified roof snow loads considering the above factors.

6 Comments and Considerations

The maximum anchor spacing (in meters) of the SSB1 Roof Mount System Mounts (mount base only – “load rated” L-Foot, by others) are attached in **Appendix E**. The maximum anchor spacing for the Sunstack Integrity Rack supported by SSB1 and SSM, can be found in **Appendix F** and **Appendix G**, respectively.

The tables provide maximum anchor spacings for each associated wind pressure, wind exposure category, roof pitch/angle, roof area, array zone, ground snow load, and ground rain load, for gable and hip roofs in landscape and portrait orientations for 6 metre (m) and 10 m maximum mean roof heights, and applies for the installation of the wood screws in APA rated sheathing and solid sawn lumber with a specific gravity ($G=0.42$) or greater, in accordance with sloped roofs designed as per either Part 4 or Part 9 of the NBCC 2020.

The effect of seismic loads (for all design categories A-E) has been determined to be less than the effect due to wind and snow loads in all load conditions and combinations.

This letter and associated Appendices address the maximum spacing of the SSB1 mounting system and the Sunstack Integrity Rail supported by the SSB1 or SSM mounting systems. For the SSB1 mounting system, please see the applicable rail and L-Foot manufacturer’s roof mount installation manuals and span tables for the maximum rail spans, L-Foot spacing, and other limits to their use. The lesser of the tables of this report and the applicable rail and L-Foot manufacturer’s span tables shall govern the maximum allowable spacing of the mounts, L-Foot, and spans of the rails. The maximum rail cantilever shall be limited to the smaller of 40% of the maximum mount spacing in the tables in **Appendix E** to **Appendix G** and the rail manufacturer’s specified maximum cantilever.

To use the tables in **Appendix E** to **Appendix G**, local snow and wind load values will need to be determined from Table C-2 of the NBCC (or the appropriate applicable provincial or municipal version). See **Appendix D**, outlining the appropriate values that need to be considered, snow and wind load calculations to be determined, as well as other comments and considerations to determine the maximum spacing values.

SSB1 and SSM mounts shall be skip loaded on the roof where possible and provide thermal expansion splices along the rail at intervals not to exceed 31 feet o.c. Mechanical (hard) splices are required at all cantilevers and between the first and second mounts (first bay) at either end of a rail run (refer to Sunstack’s thermal expansion and mechanical splice detailing for proper installation in **Appendix A-1**).

7 References and Assumptions

The maximum spacing for Gable and Hip roofs was tabulated based on considerations and assumptions outlined in **Appendix C** and **Appendix D**, criteria as per NBCC, 2020 and the following assumptions:

1. Solar Panel and Rail dead load = 0.12 kPa.
2. Snow loads, S , were determined in accordance with Section 4.1.6.16, for roofs with Parallel Flush solar panels (Section 4.1.6.16 [4]).
3. The specified external pressure or suction due to wind on part or all of a surface of a building, p , was determined in accordance with Section 4.1.7.13. for roof-mounted solar panels on buildings of any height.
4. Topographic Factor $C_t = 1.0$; For buildings not on hills or escarpments (Section 4.1.7.4).
5. Edge factor E was taken as 1.0 for Non-Exposed and 1.5 for Exposed (Section 4.1.7.13 [4]).
6. Pressure Equalization, $\gamma_a = 1.0$, for a panel where the chord length L_p is greater than 2.0 m or for a panel or an array that is within a distance of $2h_2$ from the roof edge or ridge, where h_2 is the height of the panel's highest point above the roof surface (Section 4.1.7.13 [3]).
7. The 1-in-50-year ground snow load, associated rain load and reference velocity pressure S_s , S_r and q are determined in accordance with Section 4.1.3 (Table C-2). No special snow conditions were considered within the tables including increased non uniform snow loads due to snow drifting, on areas adjacent to roof projections, on arch or curved roofs, on domes, in roof valleys, adjacent to parapets, due to meltwater draining from adjacent building elements and roof projections, snow loads on unobstructed slippery roofs (Sections 4.1.6.2. [6] and [8]). Tables do not include buildings with multi-level roofs.
8. Photovoltaic (PV) panels must be supported per the manufacturer's required orientation and installation requirements (ie, target torques), location and/or spacing, and across the roof slope direction. Verification of PV module capacity to support the loads associated with the given array shall be the responsibility of the Contractor or Owner and not Sunstack or PRI.
9. PV panel must comply with mechanical load requirements of UL 1703 AND 2703.
10. Sheathing shall be free of defects, including, but not limited to, water damage and delamination and must be evaluated by the project Engineer of Record (EOR).
11. The mounts may be installed through a maximum of 2 layers of composite asphalt roof shingles or a maximum 20-gauge metal decking, provided the metal is predrilled, as wood screws are not designed to penetrate the metal decking.

12. Roof rafters or trusses spaced at 24 in. (0.61 m) on center maximum and must be evaluated by the project EOR for structural integrity and capacity as required by the governing jurisdiction.
13. These values do include the load combinations without crane loads for ultimate limit states as per Table 4.1.3.2.-A for dead, snow, wind, and seismic loads for uplift, lateral and downward load cases as applicable. No additional increases or load factors shall be applied.
14. Using a 6 mm x 90 mm long woodscrew in lieu of the 6 mm x 60 mm long wood screw is acceptable if it is penetrating through a maximum of 1.5" thick decking for rafter-only attachment.

It is permissible to combine rafter and deck-only mounting. The rafter-to-deck spacing shall be the average of the rafter spacing and deck-only (OSB or Plywood Only) spacing.

PRI's analysis assumes that the connections and associated hardware are installed in a workmanlike manner in accordance with the Sunstack SSB1 Installation Manual, Sunstack Integrity Line Installation Manual, the rail and L-Foot manufacturer's Installation Manuals and generally accepted standards of construction practice. It is the responsibility of the contractor to verify that the strength of the roof framing meets the minimum properties used in the tests and can safely support the maximum imposed loads stated within this document.

PRI and Sunstack assume no liability beyond the specific configuration and orientation outlined in this letter and appendices. Any alternative configuration and/or orientation to be utilized are to be approved by PRI and Sunstack to ensure regional loading considerations and building code requirements have been met.

We trust this meets your current requirement. Please do not hesitate to contact the undersigned if you have any questions.

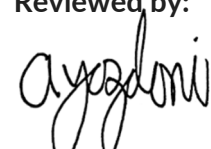
Yours truly,

PRI Engineering Corp.


Greg Kuepfer, P.Eng.
Project Engineer



Reviewed by:


Arash Yazdani, CED, FEC, P.Eng.
Chief Operating Officer

List of Appendices

Appendix A: Sunstack Installation Manuals

Appendix A-1: Sunstack SSB1 Installation Manual

Appendix A-2: Sunstack Integrity Line Installation Manual

Appendix B: Component Capacity

Appendix B-1: Sunstack SSB1 Anchor Capacity

Appendix B-2: Sunstack Integrity Rail Supported by SSB1 Capacity

Appendix B-3: Sunstack Integrity Rail Supported by SSM Capacity

Appendix C: Reference Figures as Per NBCC, 2020

Appendix D: Reference Calculations

Appendix E: Sunstack SSB1 Mounting System

Appendix E-1: Maximum Allowable Spacing for Anchorage in Wood Rafter

Appendix E-2: Maximum Allowable Spacing for Anchorage in 5/8" Plywood

Appendix E-3: Maximum Allowable Spacing for Anchorage in 15/32" Plywood

Appendix E-4: Maximum Allowable Spacing for Anchorage in 7/16" OSB

Appendix F: Sunstack Integrity Rail Supported by SSB1 Mounting System

Appendix F-1: Maximum Allowable Spacing for Anchorage in Wood Rafter

Appendix F-2: Maximum Allowable Spacing for Anchorage in 5/8" Plywood

Appendix F-3: Maximum Allowable Spacing for Anchorage in 15/32" Plywood

Appendix F-4: Maximum Allowable Spacing for Anchorage in 7/16" OSB

Appendix G: Sunstack Integrity Rail Supported by SSM Mounting System

Appendix G-1: Maximum Allowable Spacing for Anchorage in Wood Rafter

Appendix G-2: Maximum Allowable Spacing for Anchorage in 15/32" Plywood

Appendix G-3: Maximum Allowable Spacing for Anchorage in 7/16" OSB



PRI ENGINEERING

Appendix A

Sunstack Installation Manuals



PRI ENGINEERING

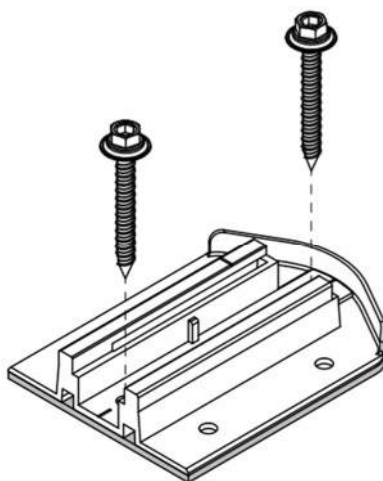
Appendix A-1

Sunstack SSB1 Installation Manual

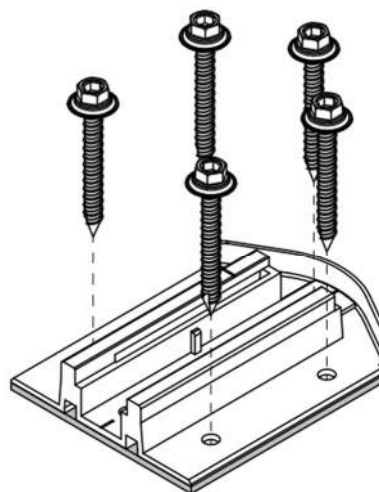
SSB1 Installation Manual

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**Rafter
Installation**



**Deck
Installation**



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ADDENDUM: Installation Instruction for Metal Roofing

ADDENDUM: Installation Instruction for Classic rib Metal Roofing

ADDENDUM: Installation Instruction for Composite Slate

ADDENDUM: Installation Instruction for Tile

1. Contents

Introduction

Please review this manual thoroughly before installing your Sunstack system. Aside from reading this manual, please review the P.E. Stamped Engineering Letters for the Sunstack Base (SSB1) products for your State. The Sunstack Structural Stamped letters are prepared based on 2 layers of shingles. We recommend the installer to carefully review the instructions provided by the other manufacturers of the products being installed with the Sunstack Base (SSB1) and become acquainted with OSHA's safety procedures prior to installing the PV system.

The installer is solely responsible for:

- Handling and installing the PV modules and rail system according to the manufacturer's instruction, with special attention for the suggested clamping locations on the frame.
- Complying with all applicable local or national building codes, standards and industry best practices including any code that may supersede this manual.
- Ensuring that Sunstack's and other products are appropriate for the particular installation and the installation location.
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions.
- Using only Sunstack parts and installer-supplied parts as specified by Sunstack. (Substitution of parts may void the warranty and invalidate the letters of certification.)
- Verifying the strength of any alternate mounting devices used in lieu of the anchoring screws.
- To maintain the flashing performance, avoid installation when the temperature is below 22F or above 176F.
- Ensuring safe installation of all electrical and mechanical aspects of the PV array.
- PE Stamped letters for the rail option are available at Sunstack website.
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factors should be confirmed by the local building official or a licensed professional engineer.
- Sunstack recommends a thermal splice every 31 Ft., however, it must be determined by the installer based on the rail system installation instructions. The installer must also determine the maximum allowed span and cantilever design parameters recommended by the rail system manufacturer. The SUNSTACK BASE (SSB1) can be installed on low slope roofs (Metal, EPDM, TPO, SBS, Modified Bitumen/Torch-on, Tar & Gravel, Asphalt) and steep slope roofs (Asphalt shingles, Metal). For low slope roofs, make sure there is positive drainage. SS Butyl is also compatible with felt and synthetic underlayment.



- UL 441
- TAS 100a
- UL2703

Fire Classification

The SSB1 Mounting system is exempt from fire classification because it is a mount only, not an entire mounting system. Be sure to check your racking components and system for fire ratings.

Mechanical Loading, maximum spans and cantilever, Fuse ratings.

Mechanical Loading: See PE reports for site specific loading, maximum span and max cantilevers. Also be sure to check the PE reports for all products used with the SSB1 for accurate application of loads, module size & quantity, and fuse ratings.

UL 2703 Certification Marking Label

Our ETL marking is on the exterior of all SSB1 Packaging.



Periodical Inspection

Sunstack LLC. recommends inspecting installed racking system periodically for loose components, loose fasteners and any corrosion. If found, those components are to be re-tightened, or replaced immediately. When a PV module needs to be removed from the PV array for maintenance and/or replacement, the electric bonding system may need to be temporarily restored to maintain the electrical bonding path. Please make sure the system electrical circuits and disconnects are in the open position and the entire system is powered down. Cover the fronts of modules in the array with an opaque material to stop the production of electricity. Use appropriate safety equipment such as insulated tools and insulating gloves to protect yourself.

Maintenance of the PV modules should be carried out by licensed contractors, according to the PV manufacturer's installation/maintenance instructions and Sunstack's installation instructions.

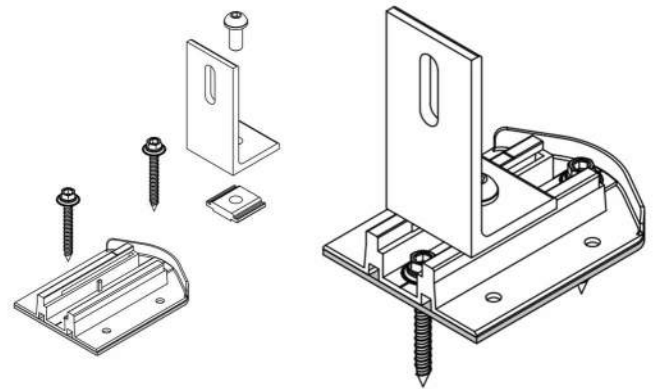
Maintenance should not be conducted under wet and/or high wind conditions.

Tools Required for Assembly

Tools needed for installing the SUNSTACK BASE (SSB1)

- Hex bit (6mm)
10mm socket can also be used for the mounting screws
- Drill and 3 mm Drill Bit or Center punch for sheet metal
(For Installation on Metal Roof)
- Measuring tape
- Chalk line
- Torque Wrench or limiter socket

L-Foot mounting option



L-Foot mounting option

Item	Torque
SS Slide Plate kit	16 Nm (140 N lb.)

Technical Note

Proper torque values for a wood screw will vary depending on the rafter and/or deck characteristics, hardness, age, and moisture of the wood. Tighten the M6x60mm wood screws until the conical washer stops rotating.

Stainless hardware is soft and if dry torqued too quickly it may cause the nut and bolt to seize.

Sunstack recommends all stainless-steel threads be lubricated. This will make it easier to tighten nuts to bolts, avoid galling, and facilitate adjustments before the nut is properly torqued. Therefore, avoid the use of an impact driver.

When driving the M6x60mm or M6x90mm into the wood, always keep a hand pressure on the SUNSTACK BASE (SSB1) to avoid the base being pulled away from the roof surface

Moisture Content

SS Butyl is to be installed on dry mounting surfaces.

Determining how wet is too wet:

First, remove the paper backing from an SUNSTACK product exposing the clean SS Butyl.

Second, press the base, SS Butyl side down against the surface.

Third, pick up the base. If the base adheres to the roof, the roof is suitably dry for installation.

For Metal, EPDM and TPO remove water from the installation area with a cloth or squeegee before placing and affixing the base.

Drying methods: A air blower, heat gun, Sodium Chloride or alcohol is suitable to remove water & ice from most roof surface.

Installation Safety

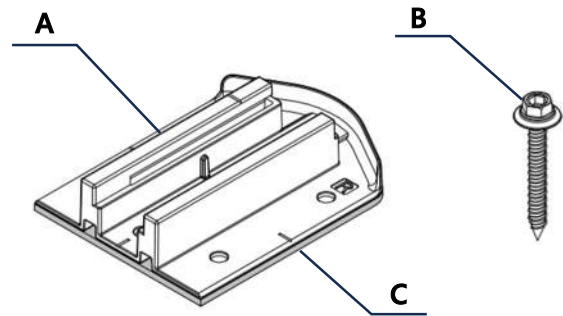
The installation process requires working on sloped and elevated building surfaces, in outdoor weather conditions, using tools and heavy components designed for the generation of electricity.

- Use properly anchored fall protection equipment. Do not anchor fall protection equipment to roof mounts, or any other inappropriate roof structure.
 - Use caution to prevent objects from falling or dropping off the roof area.
 - Cordon off ground areas directly beneath the roof work area when possible.
 - Always use personal protection equipment such as safety glasses, gloves, etc.
 - Do not perform installation in excessively wet, windy, or inclement weather conditions.
 - When working in hot weather, work crews should take care to prevent symptoms of over-heating or dehydration.
 - Use proper lifting and carrying techniques when handling heavy components at the job site.
- If conditions are challenging for moving PV modules to the roof area, use a mechanical lift.
- Follow best practices when working around high-voltage electrical equipment.

Part A : Components

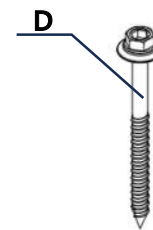
1. SUNSTACK BASE (SSB1) kit

Item	
A	SUNSTACK BASE (SSB1)
B	Wood Screw M6.0 x 60
C	SS Butyl tape



2. (Optional) Wood Screw

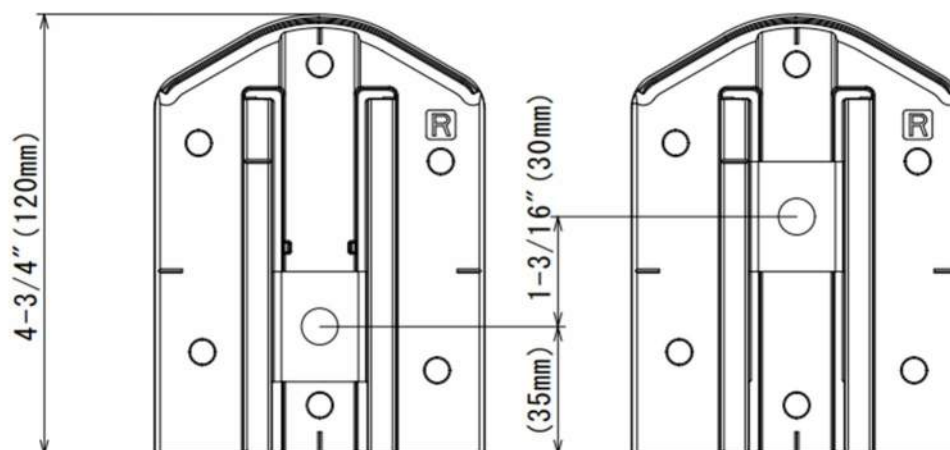
Item	
D	Wood Screw M6.0 x 90



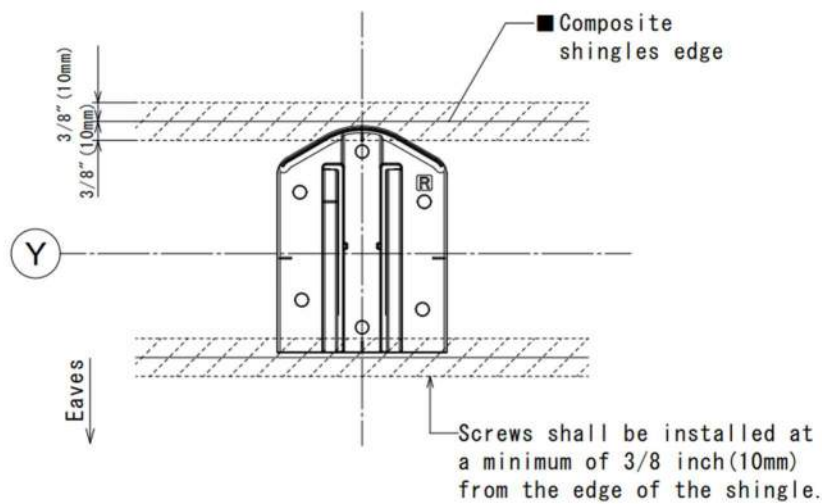
Part B : Bracket Installation

1. Bracket Layout

There is 1 3/16-inch (30mm) adjustability to secure the L-foot kit.



1. Locate and place SSB1 base on the cross section of chalk line.



* Note: The SSB1 base is structurally engineered to be mounted in the above position (structural). However, if used to mount accessories such as junction boxes or EMT with no structural value, it can then be mounted in any orientation.

2. Chalk line according to layout plans to indicate bracket's position.

3. Aligning the brackets. Choose the most suitable rafter or deck location, then mark the center.

(i) Line M: Vertical Bracket center line.

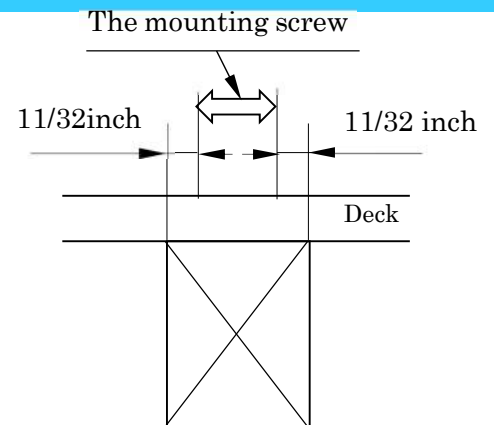
(ii) Line Y: Horizontal Bracket center line.

The Engineer of Record (EOR) shall verify the framing capacity and fastener installation for building code compliance including those of the National Design Specification for Wood Construction (NDS 2005/2012/2015) as applicable.

Attention

According to the NDS, the distance from the side edge of the rafter and the 6 mm diameter mounting screws for SSB1 shall be at least 11/32inch (9 mm) from the edge.

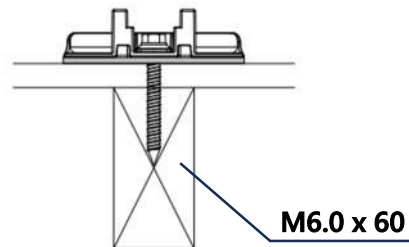
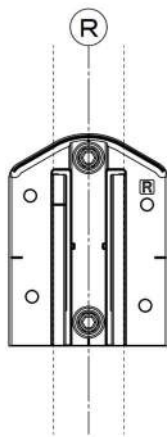
Note: Minimum Edge Distance = $1.5D$ Where D is the Diameter of the screw. Direction of Loading: Parallel to Grain
(See NDS 2015 Table 12.5.1c.)



2. SUNSTACK BASE (SSB1) Mounting Option

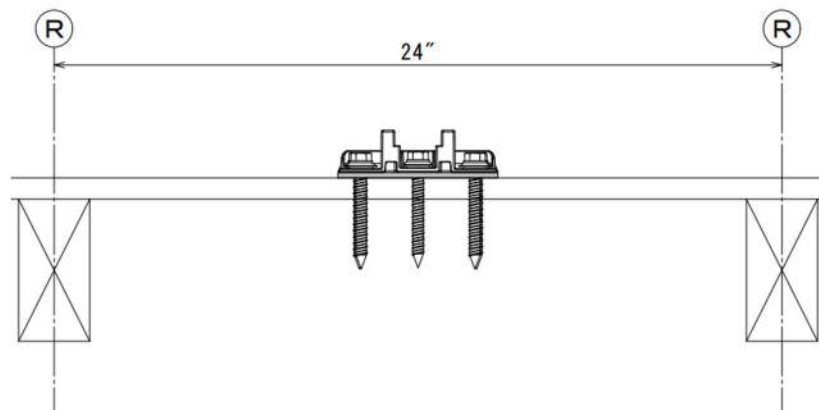
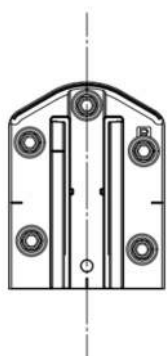
Rafter Installation

1. Rafter installation (Center) : Fastened in the center to the Rafter with 2 ea. M6.0 x 90mm



Deck Installation

2. Deck installation: Fastened to the sheathing (Plywood or OSB) with 5ea. M6.0×60 mm wood screws.



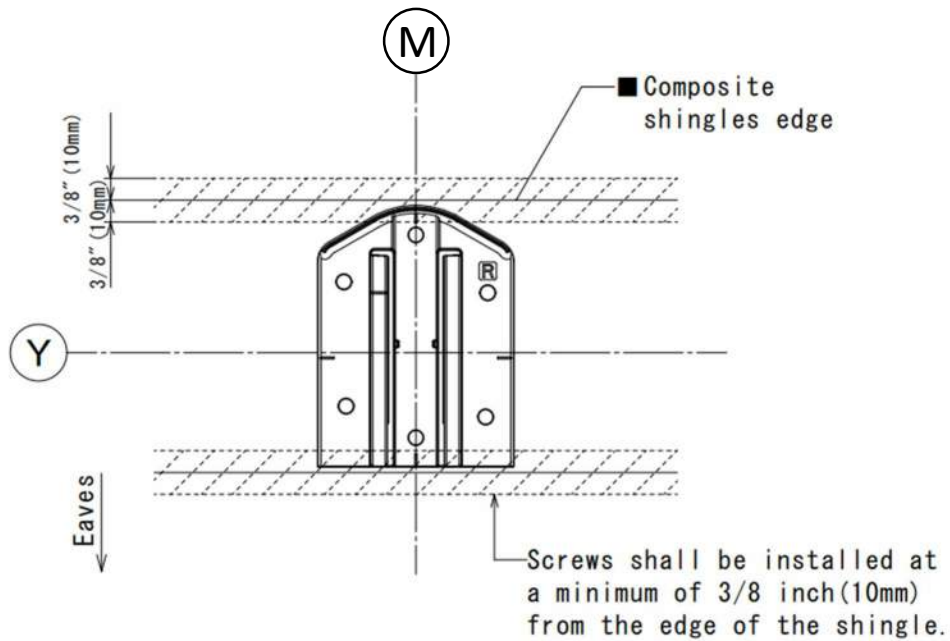
Note: Verify the PE stamped letters for maximum span values.

3. Installation steps

Attention

To maintain the flashing performance, avoid installation when the temperature is below 22F or above 176F. SS Butyl must be installed on a suitably dry surface.

1. Mark the location at the intersection of the Y Line and M Line.



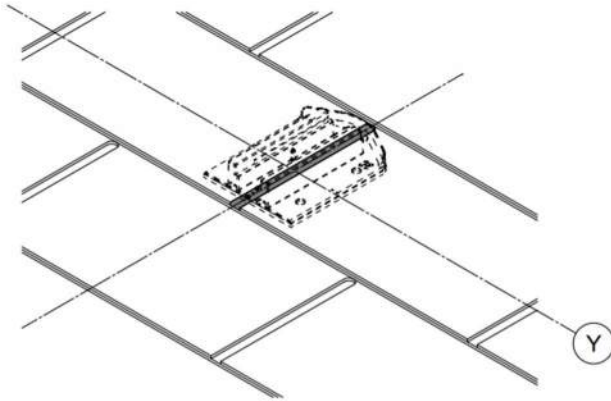
Attention

Minimum clearance between mounting screws and the edge of the roofing shingle shall be 3/8 inch (10 mm).

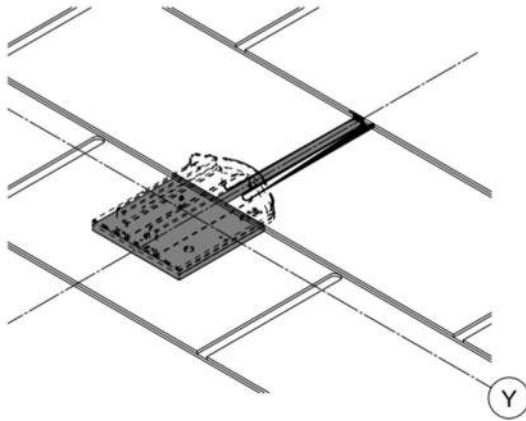
In case the stainless screw hit the nail underneath the shingle.

- 1) Tip the driver at an angle.
- 2) Use a 3 mm steel drill to make a hole.
- 3) If possible, remove the nail from underneath.

2. Adjust the SS Butyl tape to match the height of the upper shingle. When there is a gap, a slit, or a height difference at the mounting location of the bracket, use additional SS Butyl.



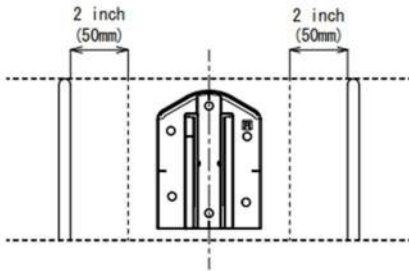
* (for tab shingles only)
When there is a slit at the installation spot, fill in with the additional SS butyl tape. The slit must be filled with SS Butyl.



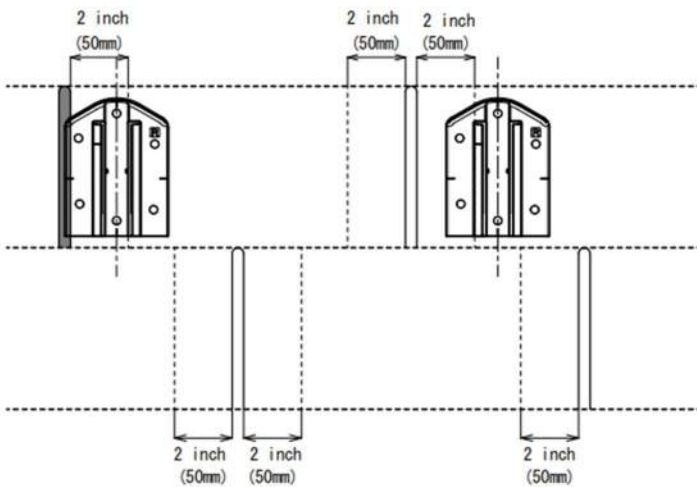
* When there is a slit above the bracket, fill it is with SS Butyl to match its shape

3. If there is a shingle gap (tab shingles only) within 2 inches from the base, sealant or SS butyl shall be applied to the gap as it is shown.

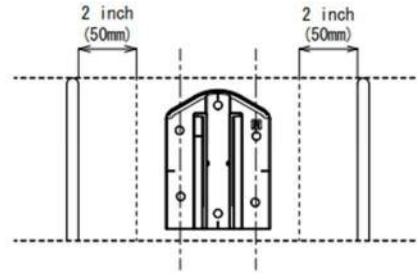
Rafter Installation



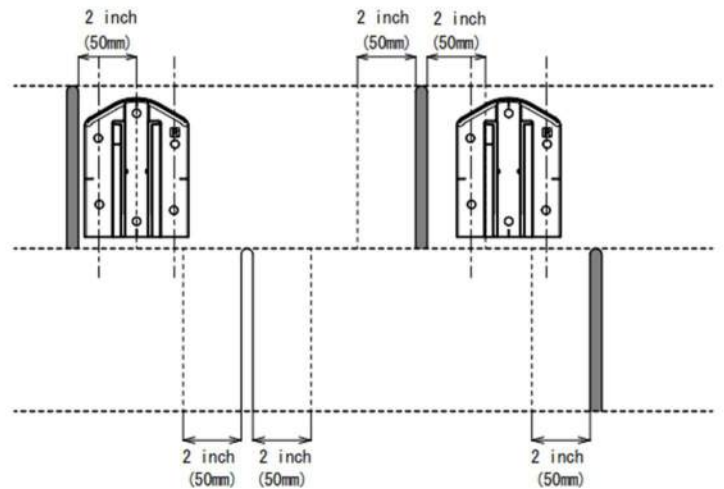
* The best position for the bracket is 2 inches away from the slits.



Deck Installation



* The best position for the bracket is at least 2 inches away from the slits.

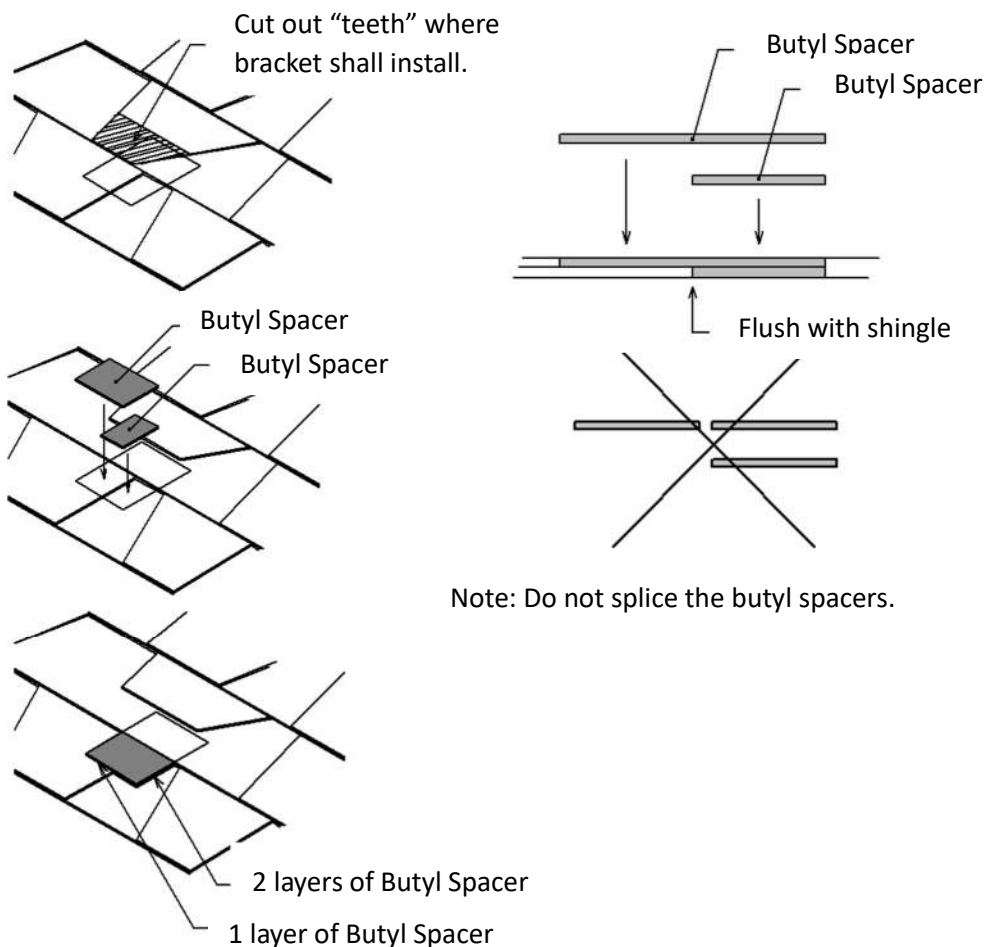


* If the mounting screw is within 2 inches from the slit, fill the slit with roof sealant or SS butyl.

Leveling the Base Option

Case 1

Use SS Butyl to level the surface of the Architectural composite shingle roof.

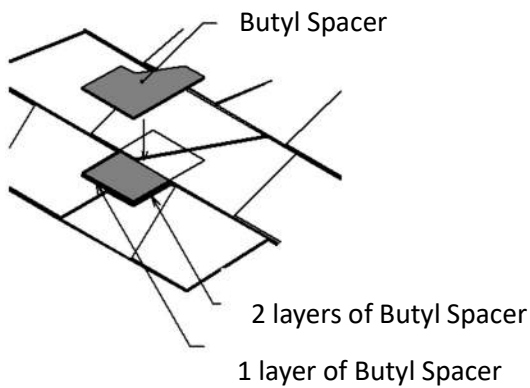
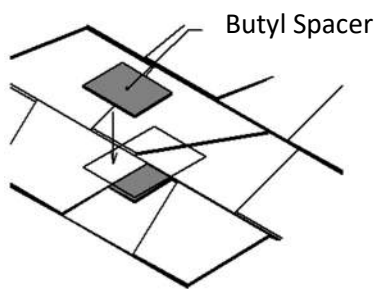
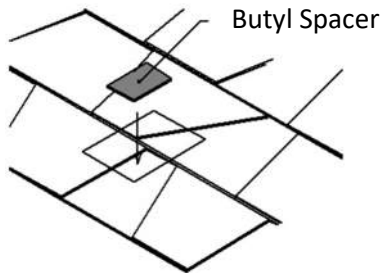


Case 2

The application of one layer of asphalt roofing shim (shingle or shingle starter roll) with the proper asphalt roofing cement is an alternative to leveling when a Sunstack base is to be installed between two levels.

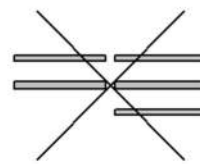
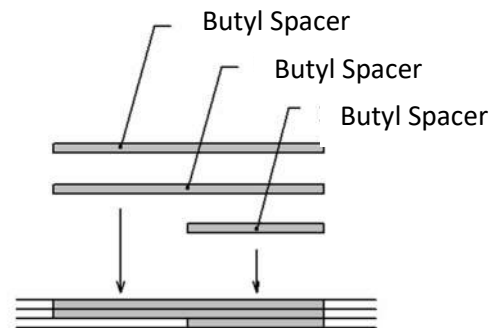
Case 3

Building payers od SS Butyl for the bracket to be mounted over the teeth area of composite shingle roofs.



- A maximum of 4 layers is recommended.
- One layer is pre-applied to the bracket.

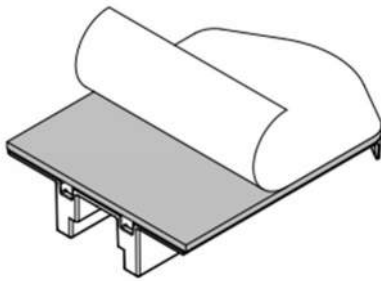
* The following layers must be cut to the shape to cover the surface of the bracket at each location, assuring a leveled surface.



Note: Do not splice the butyl tape.

Note: Do not splice the butyl spacers.

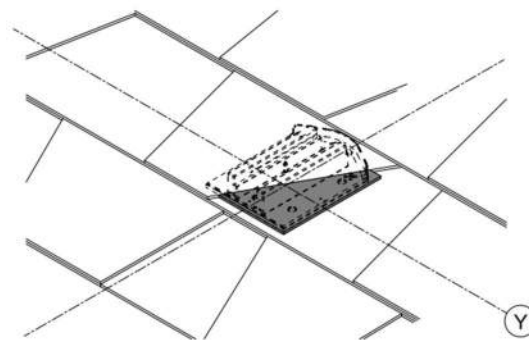
4. Peel off the protective paper from the SS Butyl.



Attention

Do not leave any protective paper on the surface of the SS Butyl, it can cause an improper seal and may allow water intrusion under the bracket.

* Use additional SS butyl to layer/build up the roof material until the surface is leveled.



* Note: Each bracket comes with SS Butyl tape installed.

Attention

Peel off the protection paper from both side of any additional SS Butyl.

Attention

Be sure to apply firm pressure when installing the first two mounting screws to endure proper adhesion to the roof.

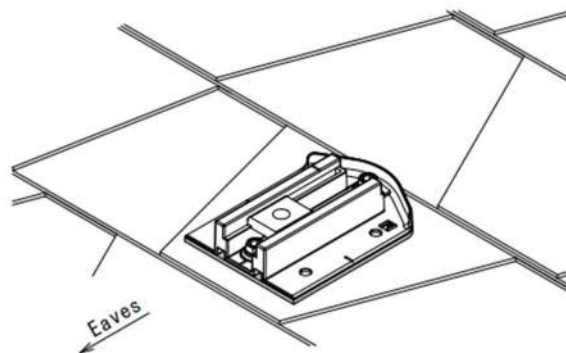
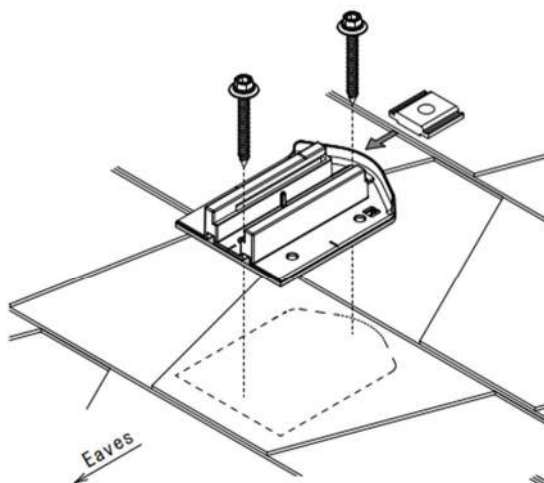
5. Install Bracket on roof

Rafter Installation

Place the brackets at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

Set the bracket with 2 ea. Screws, M6.0×60 mm stainless wood screw using 6mm hex bit or 10mm socket.

After completing the process, make sure the brackets are securely fixed.

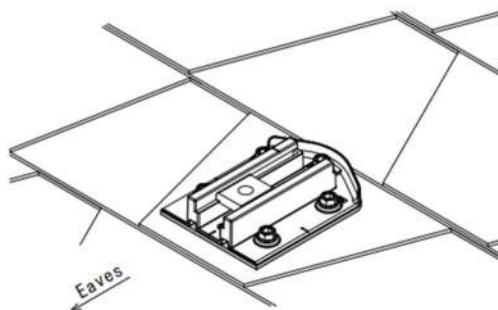
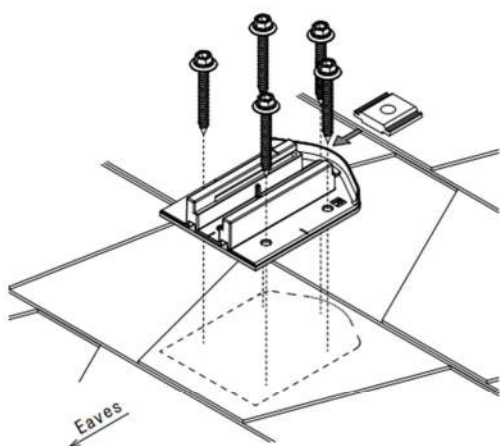


Deck Installation

Place the brackets at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

Set the bracket with 5 ea. Screws, M6.0×60 mm stainless wood screw using 6mm hex bit or 10mm socket.

After completing the process, make sure the brackets are securely fixed.



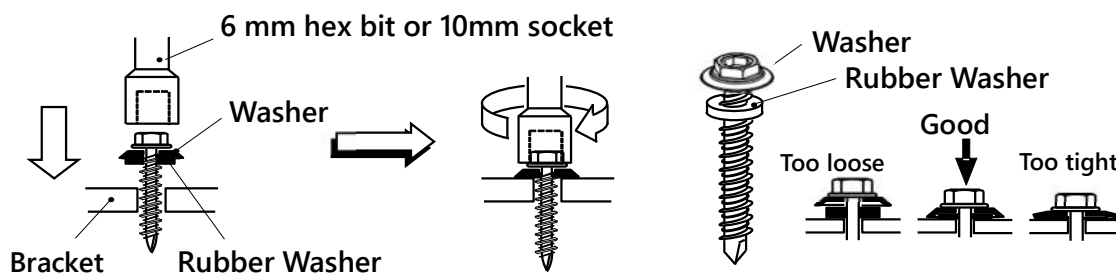
Attention

When the SSB1 base is installed on the deck, 5 screws must be used. Four screws are fixed into the sides and 1 on the center ridge side.

Note: Each SSB1 is shipped with 2 mounting screws.

IMPORTANT

Note: Proper torque values for the 6.0×60 mm screw will vary depending on the rafter and/or deck characteristics; hardness, age, and moisture of the wood etc. It should be tightened until the conical washer stops rotating.



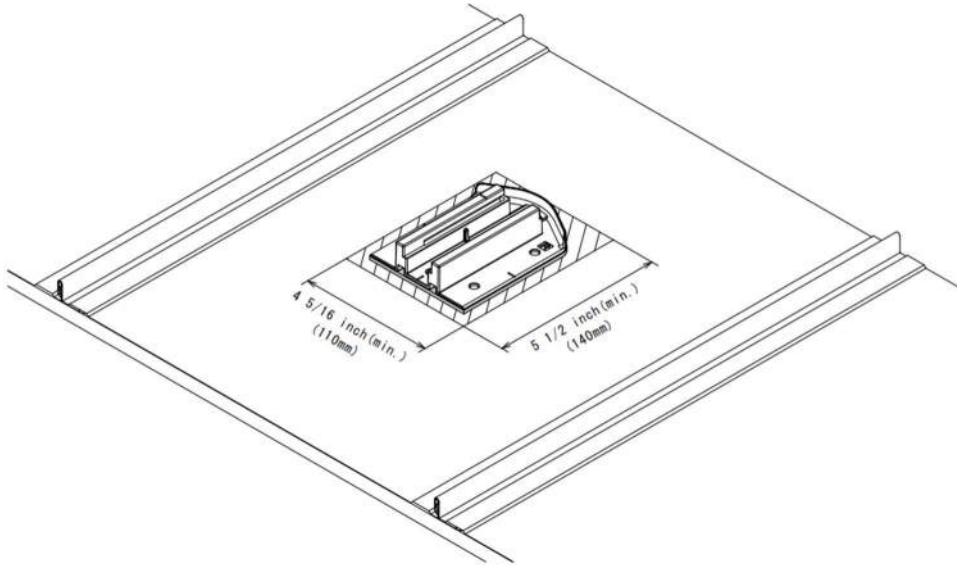
When tightening the screws please tighten all screws equally. Additionally, avoid using an impact driver as it can over torque the screws causing them to strip the threads.

Installation on a Standing Seam Metal Roofing



1. Requirement

- Applicable to maximum 20 gage metal decking.
- The roof should have sheathing (deck) board and the metal roofing should be flat and flush against the sheathing board at least 4-5/16inch (110mm) by 5-1/2inch (140mm) area at the bracket mounting location. The Sunstack P.E. Letters are created for a minimum 7/16" OSB with 2x4" rafters 24 in o.c.



Attention

When the SSB1 base is installed on the deck, 5 screws must be used. Four screws are fixed into the sides and 1 on the center ridge side.

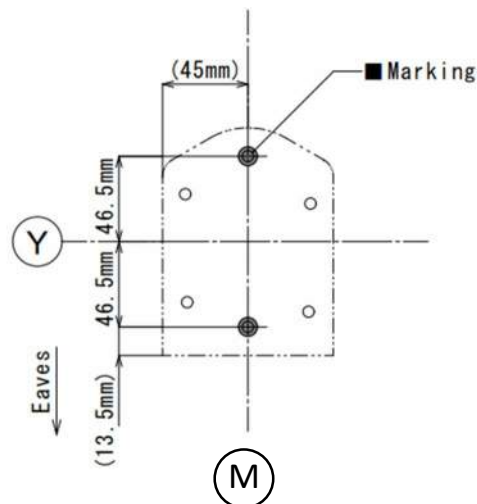
Note: Each SSB1 is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

2. Marking on the Roof

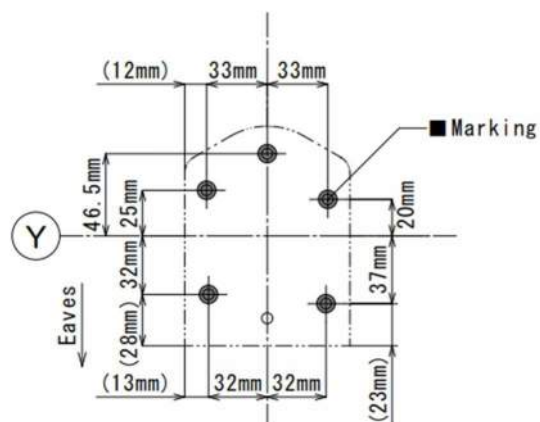
(1) Layout

1. Mark at ± 45 mm and 46.5 mm from the intersection of the M line and Y Line. (See illustration)
2. In case of Deck Installation, mark at ± 33 mm and ± 32 mm from the intersection of the M Line and Y line.
3. Then mark at 20, 37, 32, 25 mm from the intersection of the M Line and Y Line.
4. Mark at +35 mm from Y Line and M Line.

Fastening to Rafter



Fastening to Deck



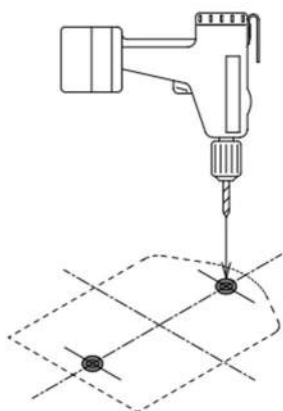
Attention

mounting holes are not symmetric when SSB1 base is installed on deck. You may want to have an extra SSB1 to assist in marking to a metal roof. (Create a SSB1 template by removing the SS Butyl from the base).

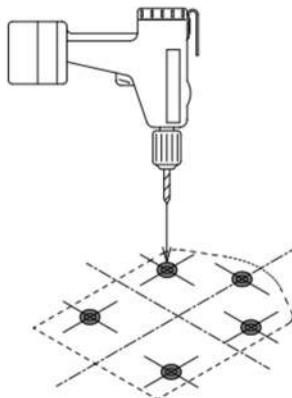
3. Bracket Installation

- (1) Drill the roofing metal sheet with a 1/8-inch (3 mm) drill bit at the markings.

Fastening to the Rafter



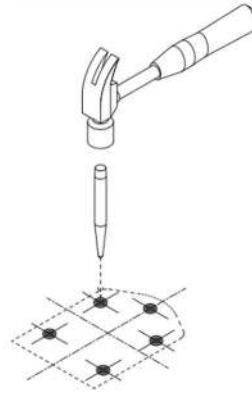
Fastening to the Deck



Attention

Be careful to minimize the intrusion of the drill bit into the roof sheathing. Drill only the metal roof.

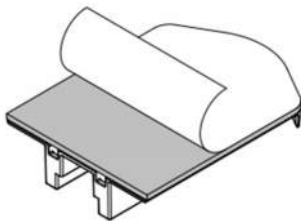
(2) Use Center punch as an option to make pilot holes. You can mark on roof using measurements, template or use base's screw hole directly from top of the base.



Attention

The "Punching method" can be used for a metal roof with a gap between deck and roof material.

(3) Peel off the protective paper from the SS Butyl.

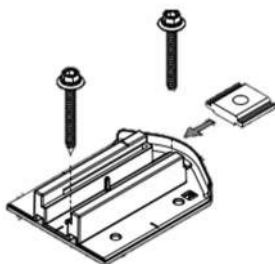


Attention

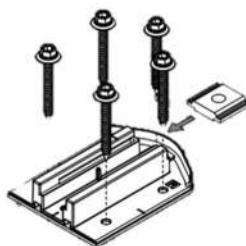
Do not leave any protective paper on the surface of the SS Butyl as it may cause an improper seal and may allow water intrusion under the bracket.

(4) Place the brackets at the specified location and make sure the SS Butyl attaches well to the roofing surface. Set the bracket with 2 ea. (for RAFTER), or 5 ea. (for Roof DECK), of M6.0×60 mm stainless wood screw using 6 mm hex bit or 10mm socket. After completing the process, make sure the brackets are securely fixed. Fix the attention title.

Fastening to Rafter



Fastening to Deck



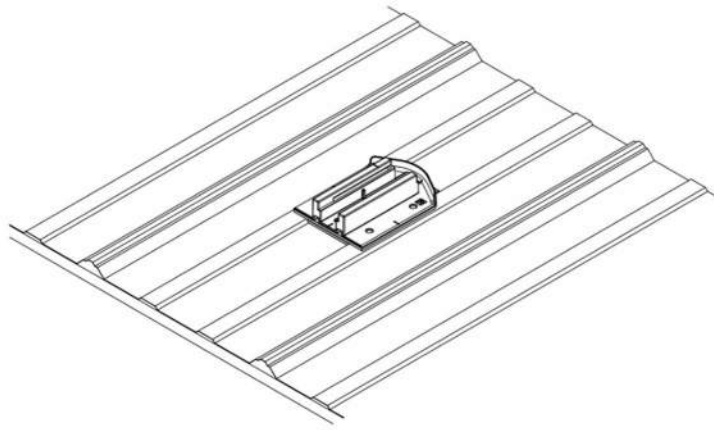
Attention

For deck installation, 5 screws must be used. Four screws are fixed into the sides and 1 on the center ridge side.

Installation on a Classic Rib Metal Roofing

1. Requirement

- The Sunstack P.E. Letters are created for a minimum 7/16" OSB with 2x4" rafters 24 in o.c.

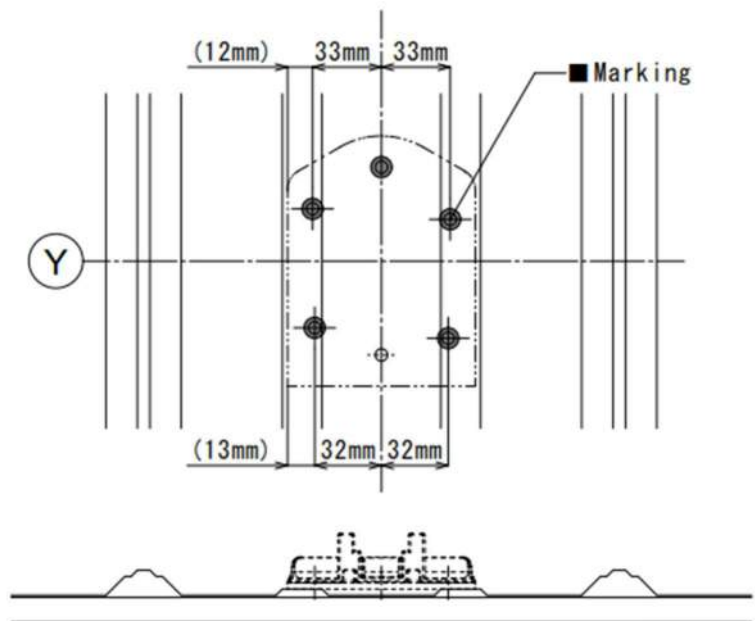


2. Marking on the Roof

Fastening to Deck

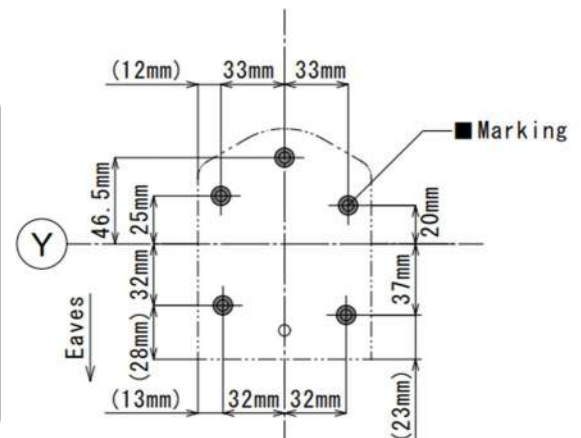
(1) Layout

- The SSB1 base must be mounted on the flat surface. Please make sure the location is not on the slope surface of metal ribs.
- For Deck Installation, mark at ± 33 mm, ± 32 mm from the intersection of the M Line and Y Line.
- Then mark at +20, -37, -32, +25 mm from the Y Line.



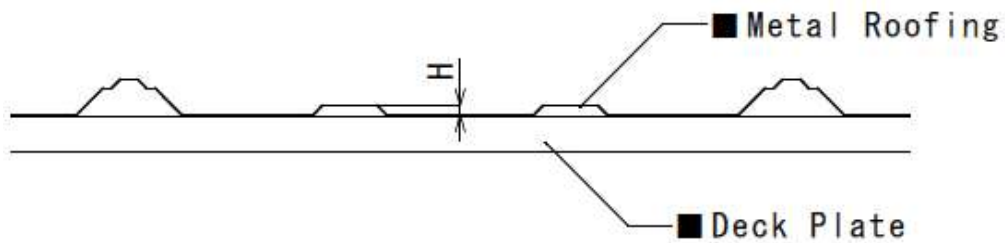
Attention

Mounting holes are not symmetric when SSB1 base is installed on deck. You may want to have an extra SSB1 to assist in marking to a metal roof. (Create a SSB1 template by removing the SS Butyl from the base.)



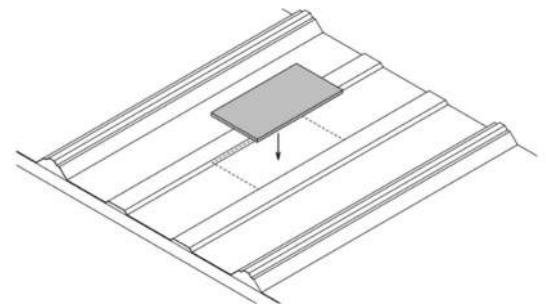
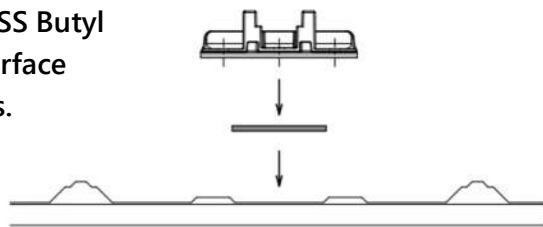
3. Check the height of the metal rib.

(1) The maximum height of the ribs must be 5 mm.



4. Bracket Installation

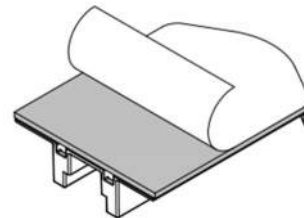
(1) Please add a SS Butyl spacer on the surface between the ribs.



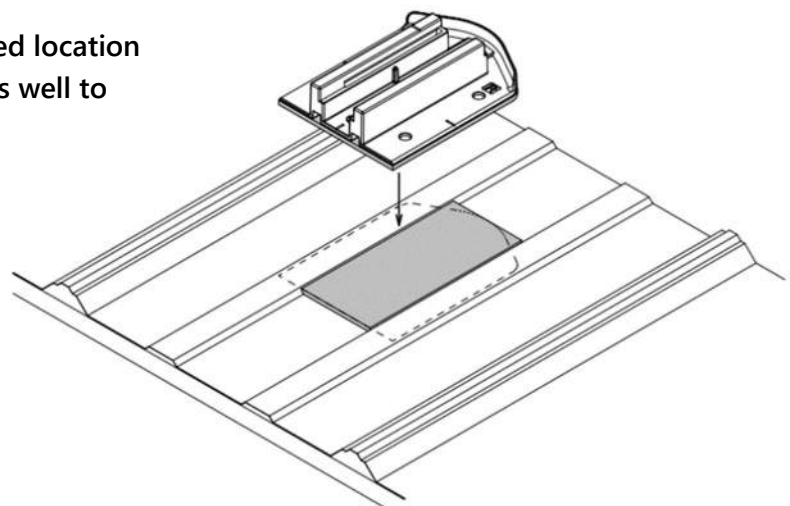
(2) Peel off the protective paper from the SS Butyl.

Attention

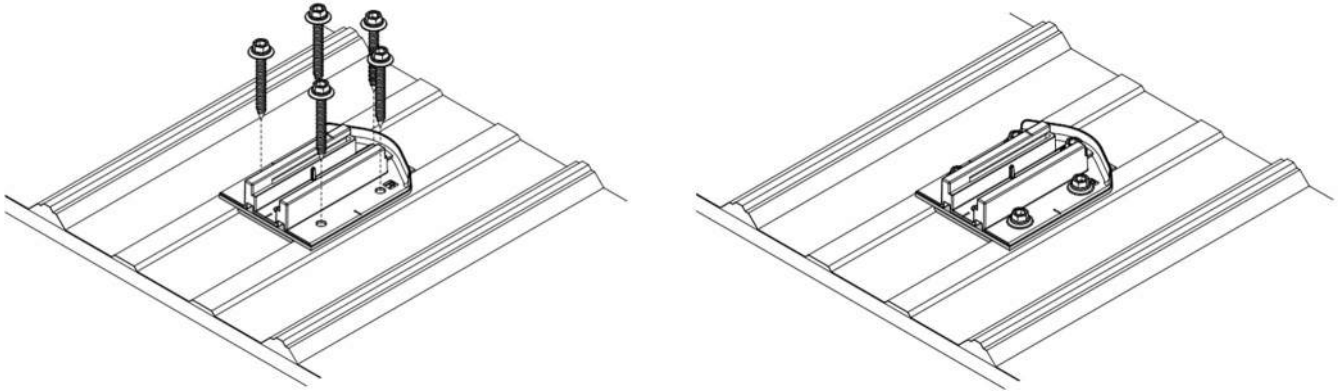
Do not leave any protective paper on the surface of the SS Butyl, it may cause an improper seal and may allow water intrusion under the bracket.



(3) Place the brackets at the specified location and make sure the SS Butyl attaches well to the roofing surface.



(4) Set the bracket with 5 ea. (For Roof Deck), of M6.0 x 60 mm stainless wood screw using 6 mm hex bit. After completing the process, make sure the brackets are securely fixed.



Attention

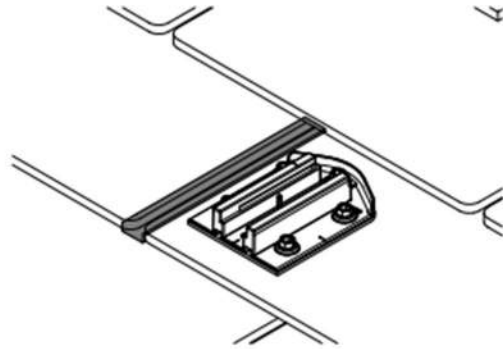
When the SSB1 base is installed on the deck, 5 screws must be used. The screws are fixed into the side 4 holes and 1 ridge center hole.

Note: Each SSB1 is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

Installation on a Composite Tile (Faux Slate & Faux Cedar)

1. Requirement

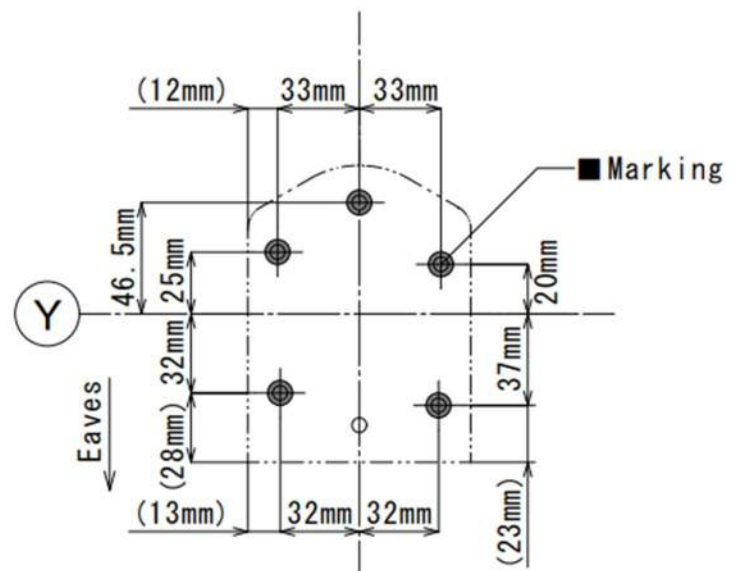
- Composite Slate must compatible with SS Butyl



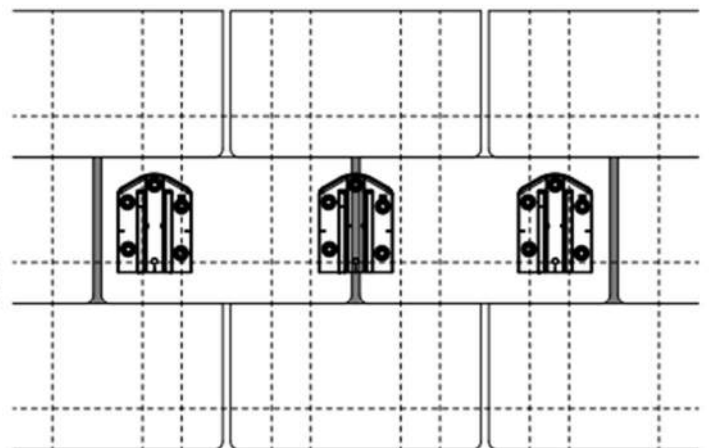
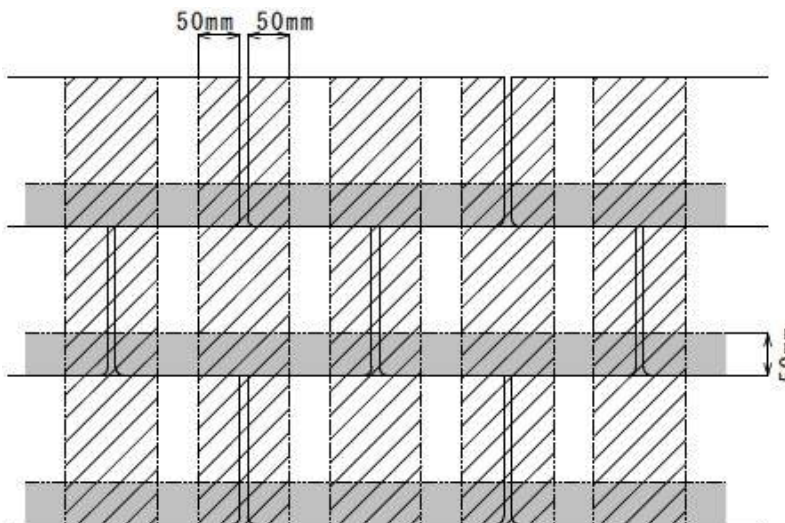
2. Marking on the Roof

(1) Layout

1. The SSB1 base must be mounted on the flat surface.
2. Mark at ± 33 mm and ± 32 mm from the intersection of the M Line and Y Line.
3. Then mark at +20, -37, -32, +25 mm from the intersection of the M Line and the Y Line.



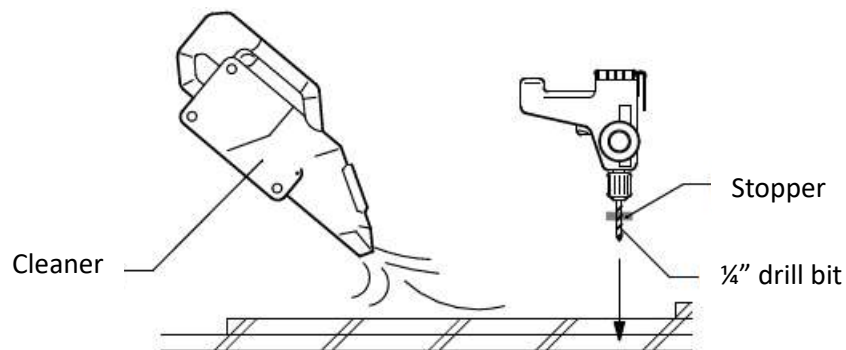
3. Do not drive the M6 x 60 screw on the butyl spacer location. Apply the butyl spacer if the base is installed in the shaded area.



3. Bracket Installation

(1) Drill the roofing metal sheet with a 1/4-inch (6.5 mm) drill bit at the markings.

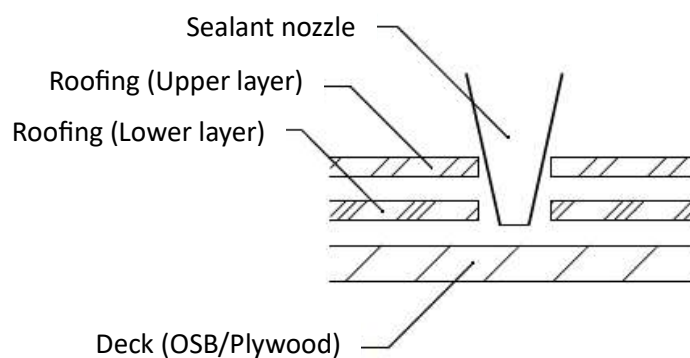
Note : Avoid drilling through the underlayment!



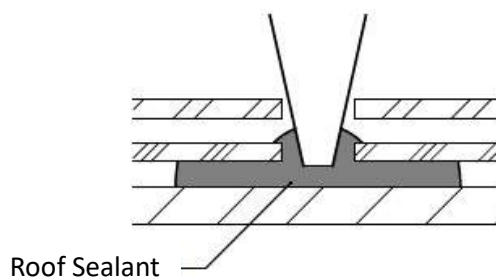
Attention

Installer must avoid drilling into the wood underneath.

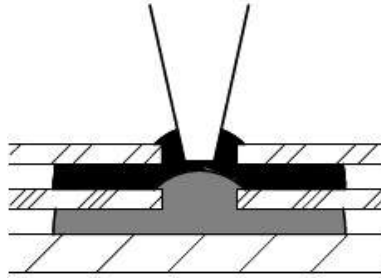
(2) Fill the cavity with a sealant listed in this Installation Manual.
The sealant must be flush with the slate surface.



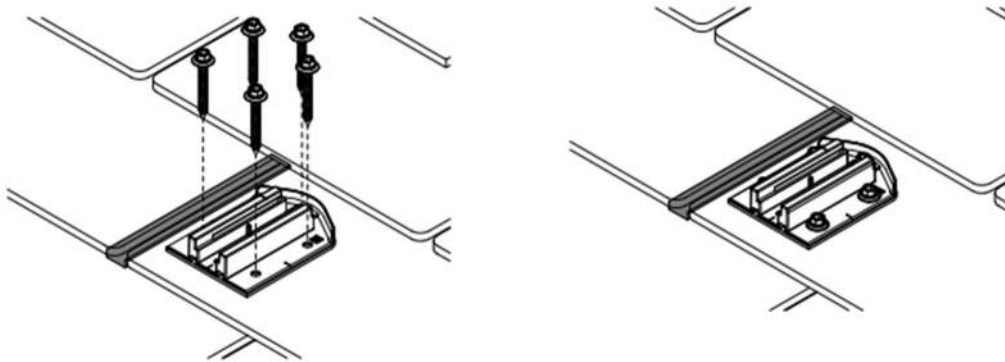
(3) Fill sealant layer by layer. Hold the nozzle in place to ensure lowest layer is filled with sealant displacing all air around the desired attachment point.



(4) After lower layer is full, move the nozzle back to fill upper layers in the same manner.



(5) Set the bracket with 5 ea. (For Roof Deck), of M6.0 x 60 mm stainless wood screw using 6 mm hex bit or 10mm socket.



Attention

When the SSB1 base is installed on the deck, 5 screws must be used. The screws are fixed into the side 4 holes and 1 ridge center hole.

Note: Each SSB1 is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

Installation on a (S/W/F) Clay Tile Roof

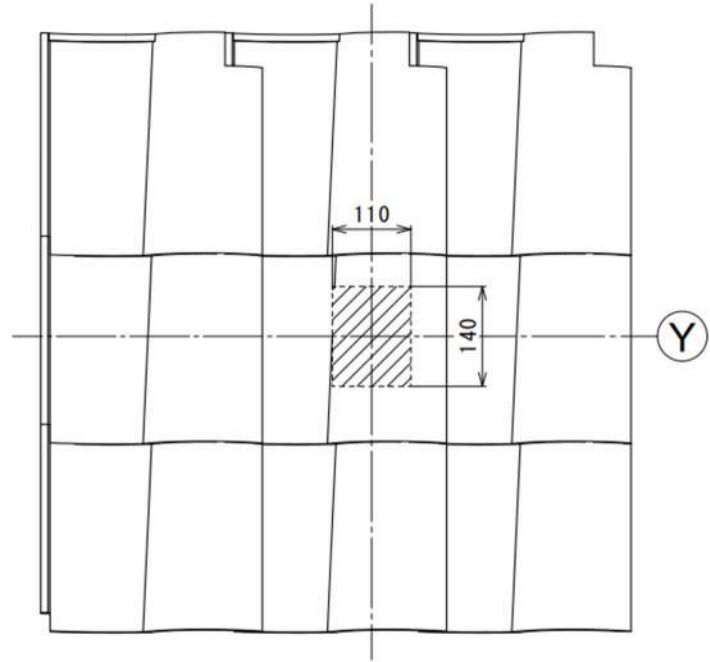
1. Requirement

- Able to install on Deck under the tile roofing.

2. Marking on the Roof

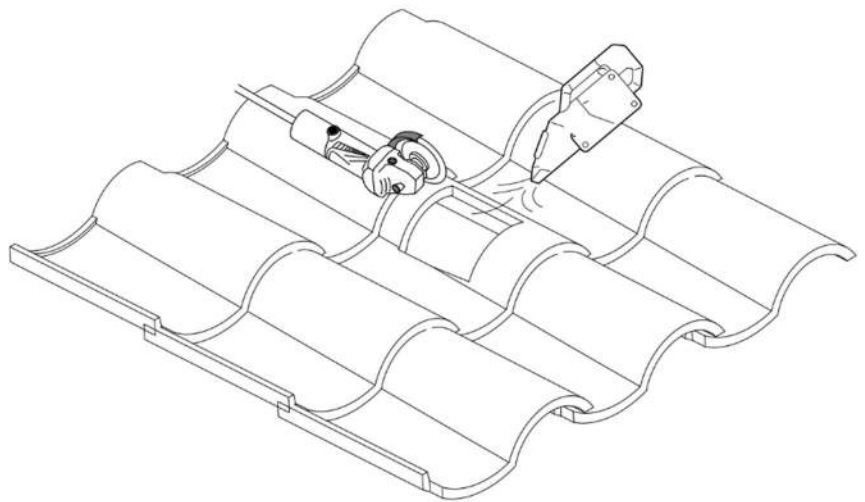
(1) Layout

1. Layout the location of the SSB1 Base.



3. Cut out the Tile for Base placement

1. Use Tile cutting tool to open a square hole on the tile.
2. Clean the surface and around the square hole. * Make sure there is no dust or debris around the hole as it may compromise the waterproof seal.





PRI ENGINEERING

Appendix A-2

Sunstack Integrity Line Installation Manual

sunstack

Integrity Line Installation Manual

2300 West Sahara Avenue, Suite 800

Las Vegas, Nevada 89102

TEL: 1-GO-SUNSTACK

www.SunstackRacking.com

Version 23 11/14/2024

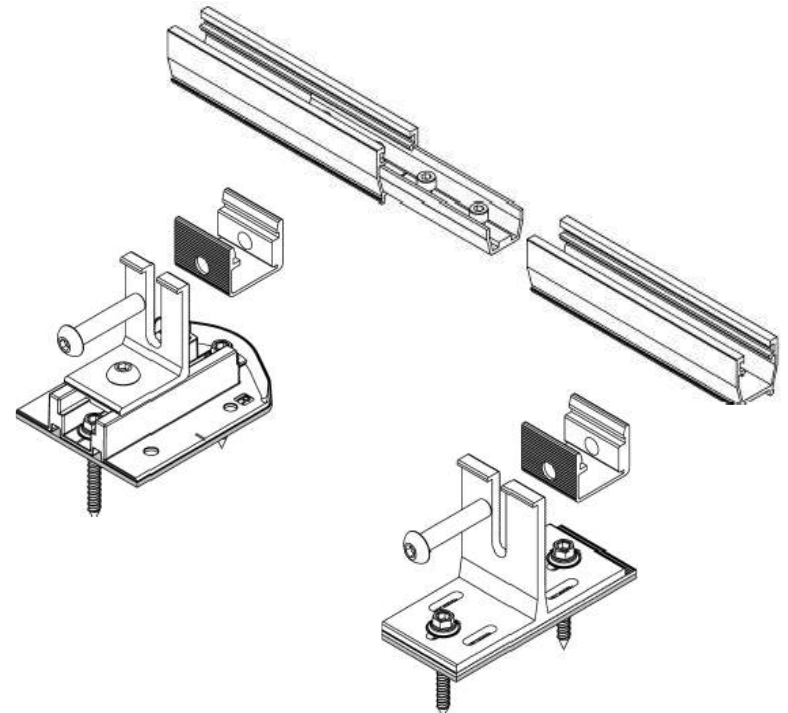
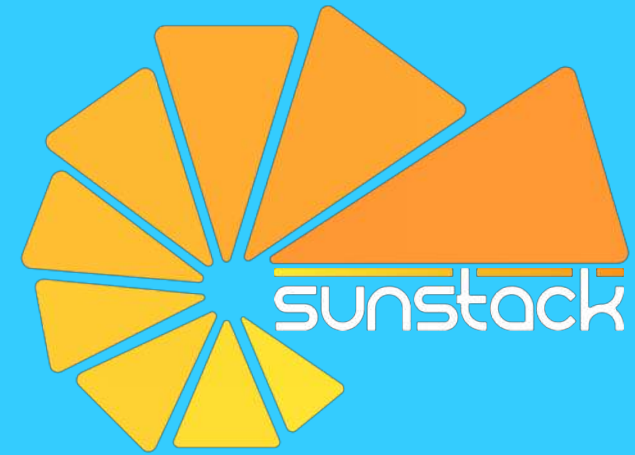


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2. Installer Responsibility Periodical Inspection
3. Installer Safety & Torque settings
4. Tools Required for Assembly & Mounting Instructions

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PART B: SSM & SSB1 Mount Installation

PART C: Rail Bracket Installation

PART D: Rail Splice Installation(Mechanical & thermal)

PART E: Rail Installation

PART F: MLPE Bracket and Grounding Wire Clamp Installation

PART G: Third Party grounding lugs Installation and bonding path diagrams

PART H: Module Installation

PART I: End Cap Installation

PART J: Final Installation View

ADDENDUM: Installation Instruction for Classic Rib Metal Roofing

ADDENDUM: Installation Instruction for Composite Slate

ADDENDUM: Installation Instruction for Tile

ADDENDUM: Thermal & Mechanical Splice diagram

PE Report Link:

Approved Module list:

For more information, visit www.sunstackracking.com

2300 West Sahara Avenue, Suite 800 Las Vegas, Nevada 89102; 1-GO-SUNSTACK

1. Certifications, Mechanical Loading and Code Compliance

System level fire classification

Integrity Rail has been classified to the system level fire section of UL 2703 The system is to be installed over a fire-resistant roof covering rated for the application for both steep and low slope roofs (type 1 & 2) Steep slope only (type 29 & 38).

System level Fire rating	Module type
Class A	Type 1, 2, 29 & 38

System level fire performance requires no additional parts to be added to the system or alternative configurations.

Mechanical loading, Maximum span and Cantilever, Maximum series fuse rating

Integrity Rail has been certified to meet international building codes when installed in accordance with the Integrity Line manual. The design load ratings are as follows: 28 PSF downward pressure, 24 PSF upward pressure, and 8.5 PSF Down slope pressure. Module orientation may be landscape or portrait. Please refer to our PE tables to confirm maximum span per installation site which is not to exceed 72 inches and the maximum cantilever is 40% which is not to exceed 28.8 inches.

Maximum fuse rating: 30 amps (20 amps if using Dynobond jumpers)

UL 2703 certification marking label

All Rail and clamps packages will have a certified labels indicating UL2703 & CSA
TIL No. A-40 compliances

Integrity Rail system



2. Installer responsibility & Periodical inspections

Introduction Installer responsibility

Please review this manual thoroughly before installing your Sunstack system. Aside from reading this manual, please review the P.E. Stamped Engineering Letters for the Sunstack Integrity Line rail system, (SSB1) & (SSM) products for your State. The Sunstack Structural Stamped letters are prepared based on a maximum 2 layers of shingles.

We recommend the installer to carefully review the instructions provided by the other manufacturers of the products being installed with the Sunstack flush mount rail system and become acquainted with OSHA's safety procedures prior to installing the PV system.

The installer is solely responsible for:

- Handling and installing the PV modules and rail system according to the manufacturer's instruction, with special attention for the suggested clamping locations on the frame.
- Complying with all applicable local or national building codes, standards and industry best practices including any code that may supersede this manual.
- Ensuring that Sunstack's and other products are appropriate for the particular installation and the installation location.
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions.
- Using only Sunstack parts and installer-supplied parts as specified by Sunstack. (Substitution of parts may void the warranty and invalidate the letters of certification.)
- Verifying the strength of any alternate mounting devices used in lieu of the anchoring screws.
- To maintain the flashing performance, avoid installation when the temperature is below 22F or above 176F.
- Ensuring safe installation of all electrical and mechanical aspects of the PV array.
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factors should be confirmed with the local building official or a licensed professional engineer.
- Sunstack requires a Thermal splice every 31 Ft., (every 2 186" Rails)
- Sunstack recommends not mechanically attaching rail sections of more than 31 feet total before a thermal splice is installed except for mechanically attaching end sections of rail – See diagram on addendum
- The SUNSTACK BASE (SSB1)& (SSM) can be installed on low slope roofs (Metal, EPDM, TPO, SBS Modified Bitumen/Torch-on, Asphalt, tar and gravel) and steep slope roofs (Asphalt shingles, Metal). For low slope roofs, make sure there is positive drainage. SS Butyl is also compatible with felt and synthetic underlayment.

Periodical Inspection

Sunstack LLC. recommends inspecting installed racking system periodically for loose components, loose fasteners and any corrosion. If found, those components are to be re-tightened, or replaced immediately. When a PV module needs to be removed from the PV array for maintenance and/or replacement, the electric bonding system may need to be temporarily restored to maintain the electrical bonding path. Please make sure the system electrical circuits and disconnects are in the open position and the entire system is powered down. Cover the fronts of modules in the array with an opaque material to stop the production of electricity. Use appropriate safety equipment such as insulated tools and insulating gloves to protect yourself.

Maintenance of the PV modules should be carried out by licensed contractors, according to the PV manufacturer's installation/maintenance instructions and Sunstack's installation instructions.

Maintenance should not be conducted under wet and/or high wind conditions.

3. Installer Safety & Torque Specifications

Installation Safety

The installation process requires working on sloped and elevated building surfaces, in outdoor weather conditions, using tools and heavy components designed for the generation of electricity.

- Use properly anchored fall protection equipment. Do not anchor fall protection equipment to roof mounts, or any other inappropriate roof structure.
- Use caution to prevent objects from falling or dropping off the roof area.
- Cordon off ground areas directly beneath the roof work area when possible.
- Always use personal protection equipment such as safety glasses, gloves, etc.
- Do not perform installation in excessively wet, windy, or inclement weather conditions.
- When working in hot weather, work crews should take care to prevent symptoms of over-heating or dehydration.
- Use proper lifting and carrying techniques when handling heavy components at the job site. If conditions are challenging for moving PV modules to the roof area, use a mechanical lift.
- Follow best practices when working around high-voltage electrical equipment.

Torque Specifications

Ilsc0 Lay-in Lug GBL-4DBT to Rail or Module Frame 2.92 ft-lbs (35 in-lbs)

Ilsc0 Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (10-14 AWG Solid Copper) 1.67 ft-lbs (20 in-lbs)

Ilsc0 Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (8 AWG Stranded Copper) 1.04 ft-lbs (25 in-lbs)

Ilsc0 Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (4-6 AWG Stranded Copper); Ground Lug SGB-4 to Grounding Electrode Conductor (4-14 AWG Solid or Stranded Copper) 1.46 ft-lbs (35 in-lbs)

Ilsc0 Ground Lug SGB-4 to Module Frame 6.25 ft-lbs (75 in-lbs)

All Dynobond bonding connectors (Max 20 amp fuse rating)

Integrity Rail Universal Clamp (120 in-lbs)

Integrity Rail Splices and Bolts (144 in-lbs) mechanical & (12 in-lbs) for one side of thermal splice

Integrity Rail Bracket (200 in-lbs)

Integrity Rail MLPE Bracket (200 in-lbs)

SSB1 Slide Plate kit for L ft (140 in-lbs)

SolarEdge Frame Mounted Bracket to Module Frame 7 ft-lbs (84 in-lbs)

MLPE Rail Attachment Kit, MLPE Frame Attachment Kit 10 ft-lbs (120 in-lbs)

Enphase Frame Mounted Bracket to Module Frame 13 ft-lbs (156 in-lbs)

4. Tools required & Mounting screw instructions

Tools Required for Assembly

Tools needed for installing the SUNSTACK Integrity Rail system

- Hex bit (6mm)
- 10mm socket
- Measuring tape
- Chalk line
- Torque Wrench or limiter socket
- String line
- straight edge

Technical Note

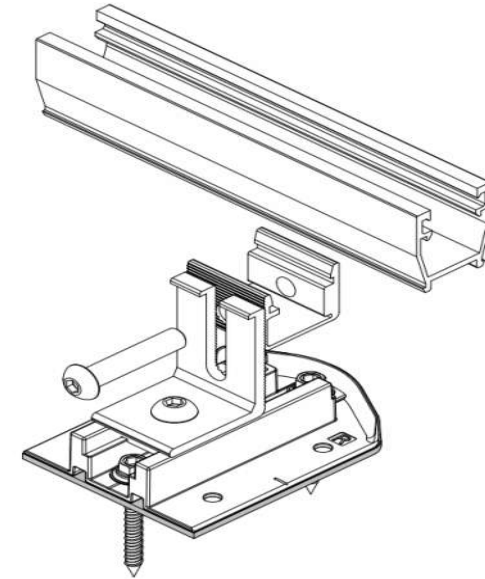
Proper torque values for a wood screw will vary depending on the rafter and/or deck characteristics, hardness, age, and moisture of the wood. Tighten the M6x60mm wood screws until the conical washer stops rotating.

Stainless hardware is soft and if dry torqued too quickly it may cause the nut and bolt to seize.

Sunstack recommends all stainless-steel threads be lubricated. This will make it easier to tighten nuts to bolts, avoid galling, and facilitate adjustments before the nut is properly torqued. Therefore, avoid the use of an impact driver.

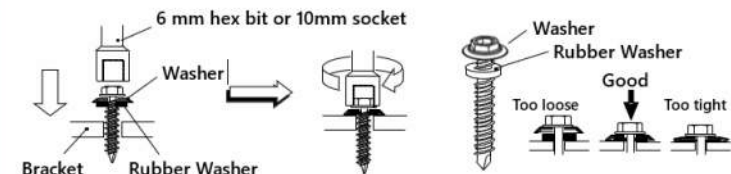
When driving the M6x60mm or M6x90mm into the wood, always keep a hand pressure on the SUNSTACK BASE (SSB1) to avoid the base being pulled away from the roof surface.

SSB1 Base with L-foot & Rail installation



IMPORTANT

Note: Proper torque values for the 6.0x60 mm screw will vary depending on the rafter and/or deck characteristics; hardness, age, and moisture of the wood etc. It should be tightened until the conical washer stops rotating.



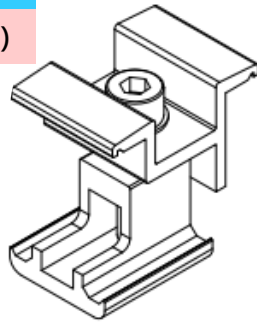
When tightening the screws please tighten all screws equally. Additionally, avoid using an impact driver as it can over torque the screws causing them to strip the threads.

Part A : Components

SUNSTACK BASE : SSB1

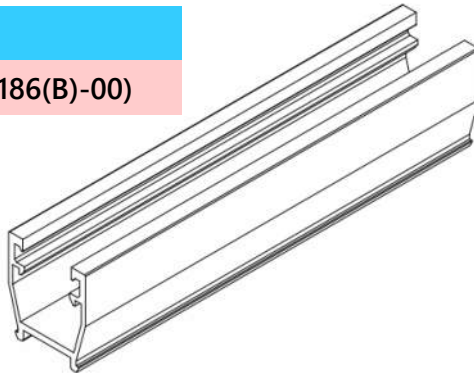
1. Integrity Rail Universal Module Clamp (30mm-40mm)

Item
A Universal Module Clamp (SS01-RCLMP-00)



2. Integrity Rail 186" – Mill & Black

Item
A Integrity Rail (SS01-R186(B)-00)



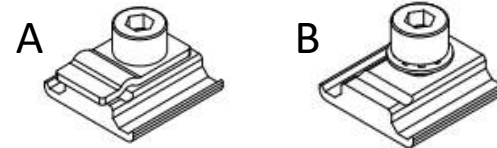
3. Integrity Rail End Cap kit

Item
A Rail End Cap (SS01-RENDCP-00)



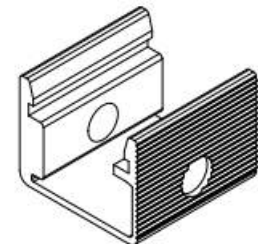
4. Integrity Rail MLPE Brackets & Ground Wire Clamp

Item
A Integrity Rail Grounding Wire Clamp (SS01-RGRND-00)
B Integrity Rail MLPE Bracket (SS01-RMLPE-00)



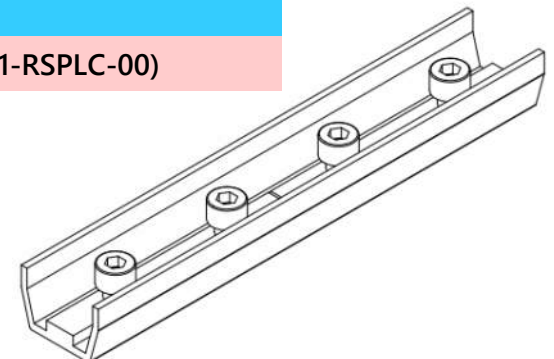
5. Integrity Rail Bracket

Item
A Rail Bracket + Bolt (SS01-RRB-00)



6. Integrity Rail Splice

Item
A Rail Splice (SS01-RSPLC-00)

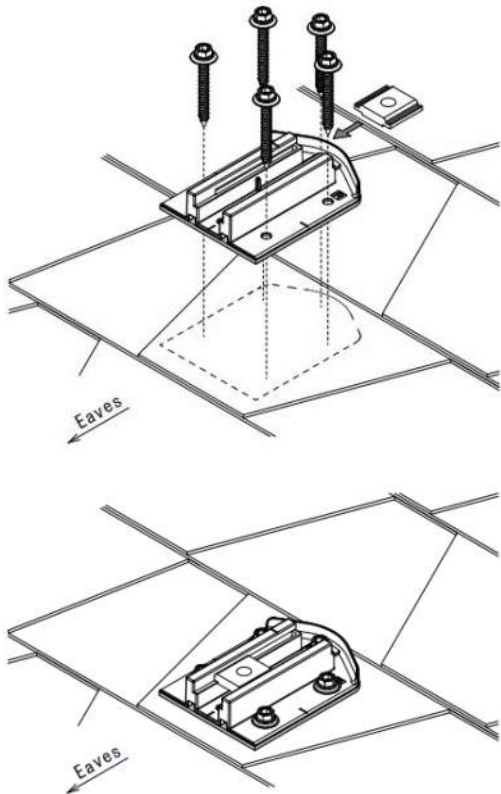


Part B : Sunstack Base (SSB1) Installation

1. Follow SSB1 Installation manual and steps to be ready for install L-foot

1. Install Base on roof

Deck Installation



Place the base at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

Set the base with 5 ea. Screws, M6.0 × 60 mm stainless wood screw using 6mm hex bit or 10mm socket.

After completing the process, make sure the base are securely fixed.

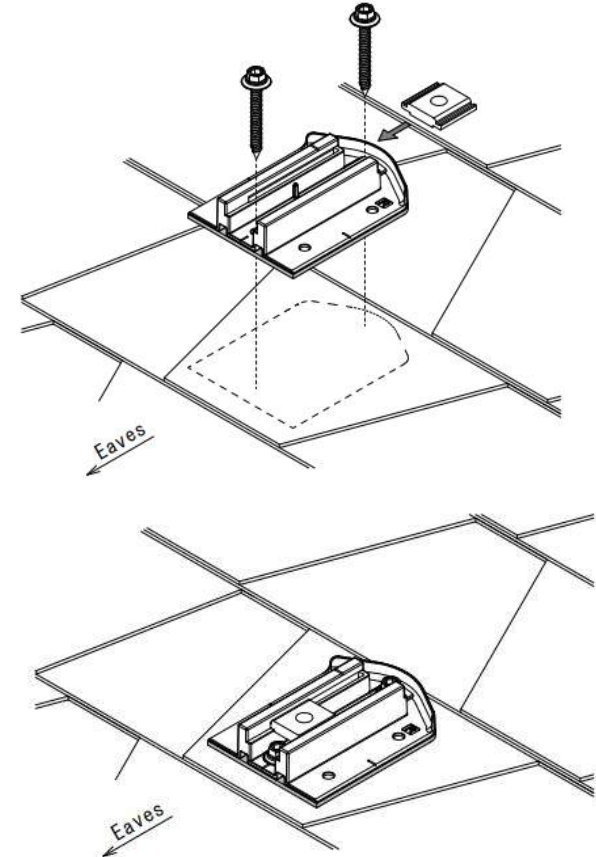
Attention

When the SSB1 base is installed on the deck, 5 screws must be used. Four screws are fixed into the sides and 1 on the center ridge side.

Note; Each SSB1 is shipped with 2 mounting screws.

See SSB1 Manual for more details

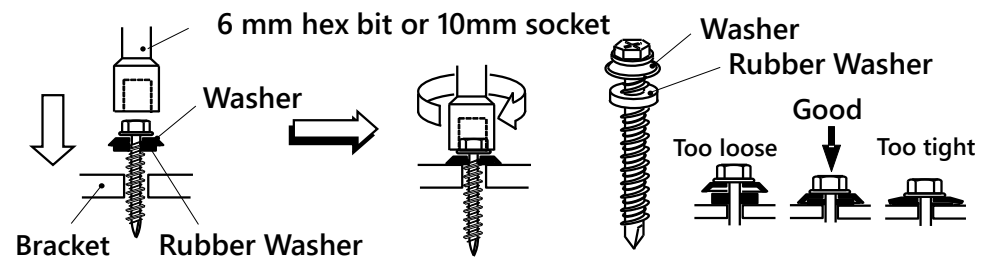
Rafter Installation



Place the base at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

Set the base with 2 ea. Screws, M6.0 × 60 mm stainless wood screw using 6mm hex bit or 10mm socket.

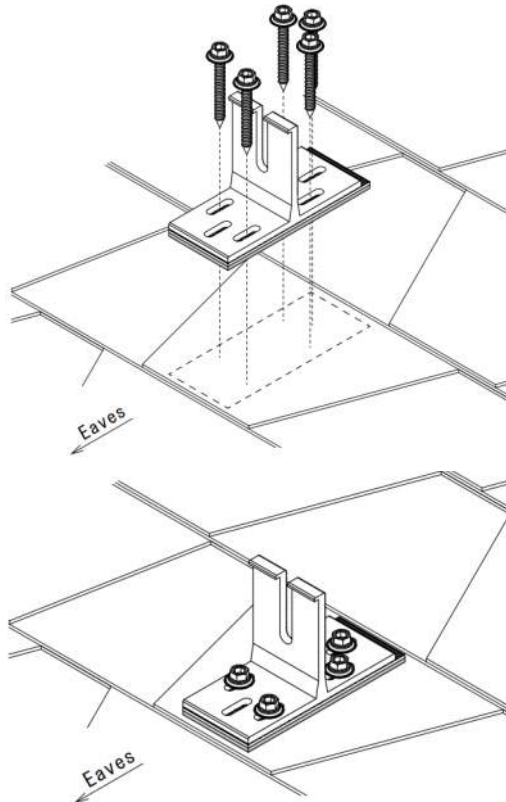
After completing the process, make sure the base are securely fixed.



Part B : Sunstack Mount (SSM) Installation

1. Install Mount on roof

Deck Installation

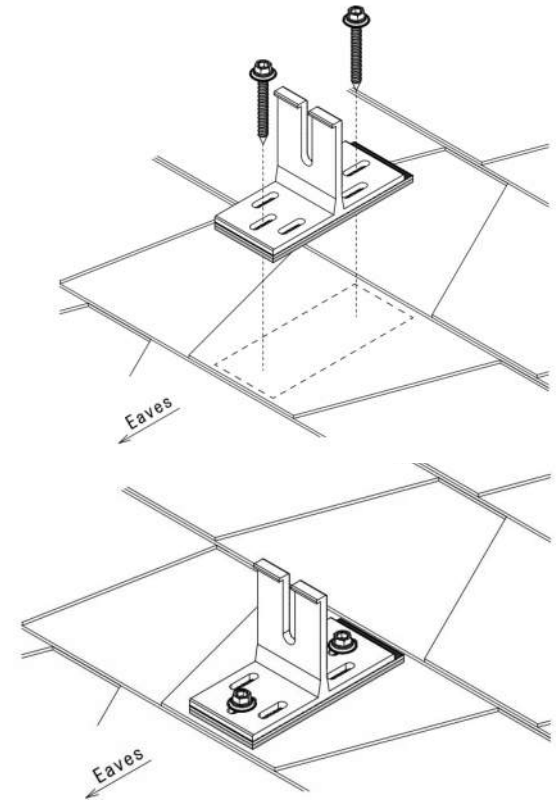


Place the mount at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

Set the mount with 5 ea. Screws, M6.0×60 mm stainless wood screw using 6mm hex bit or 10mm socket.

After completing the process, make sure the mounts are securely fixed.

Rafter Installation



Place the mount at the specified position and make sure the SS Butyl makes good contact with the roofing surface.

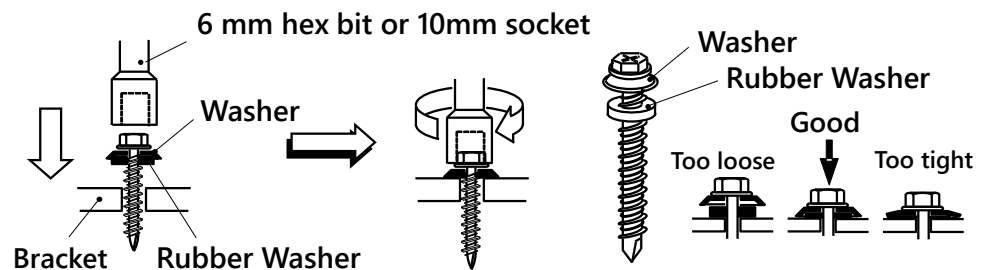
Set the mount with 2 ea. Screws, M6.0×60 mm stainless wood screw using 6mm hex bit or 10mm socket.

After completing the process, make sure the mounts are securely fixed.

Attention

When the SSM base is installed on the deck, 5 screws must be used. Four screws are fixed into the sides and 1 on the center ridge side.

Note; Each SSM is shipped with 2 or 5 mounting screws.

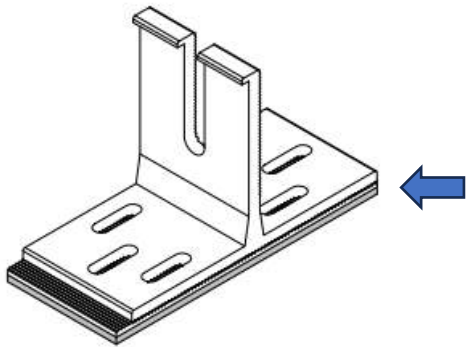


Part B : Sunstack Mount (SSM) Installation

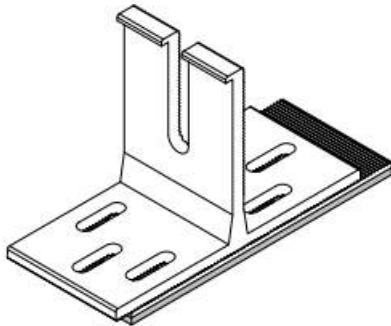
1. SSM installation

2. Using SSM adjustability

How to set on the roof



Place the SSM, which eave side are flashed with SSM and bottom plate.



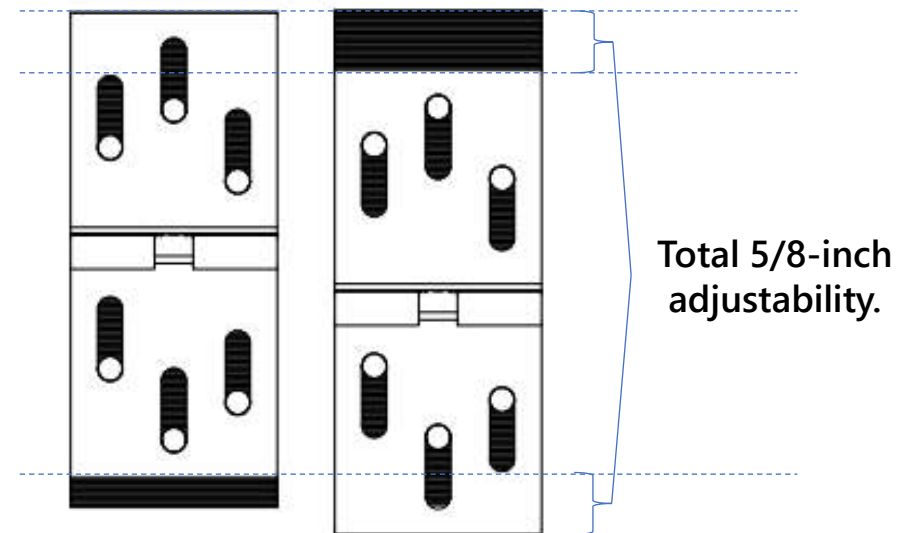
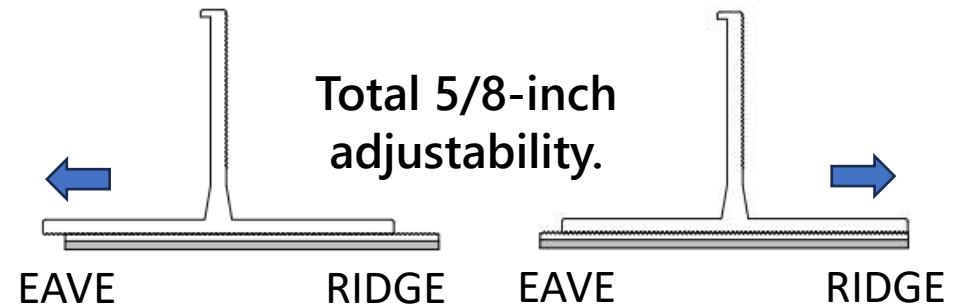
If adjustment is necessary, loosen the (WS660) screws to be able to adjust SSM to rails. Once desired alignment is achieved, reset loosened wood screws.

Attention

SSM WS660 wood screws must be re-tightened after adjustment.

Adjustability

The SSM can be adjust the location from Eave to Ridge about 5/8 inch.

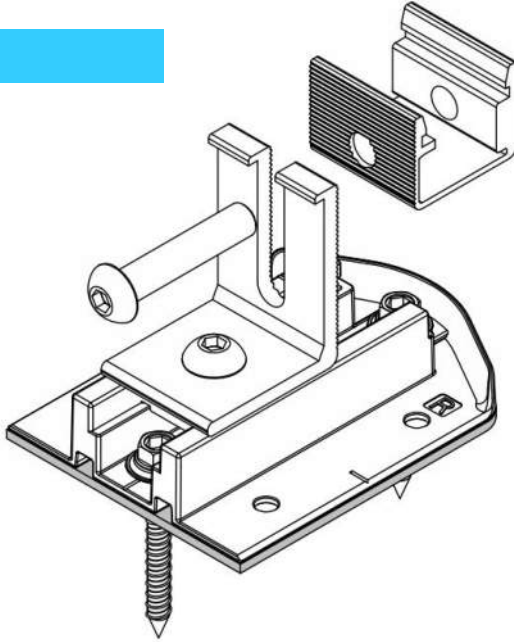


Part C : Rail Bracket Installation

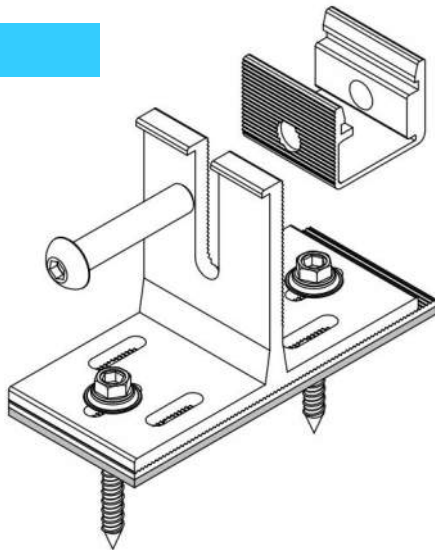
1. Install Rail Bracket

Slide in the Rail Bracket p to the L-foot or Standing channel.

SSB1 base with L-foot



SSM



ATTENTION

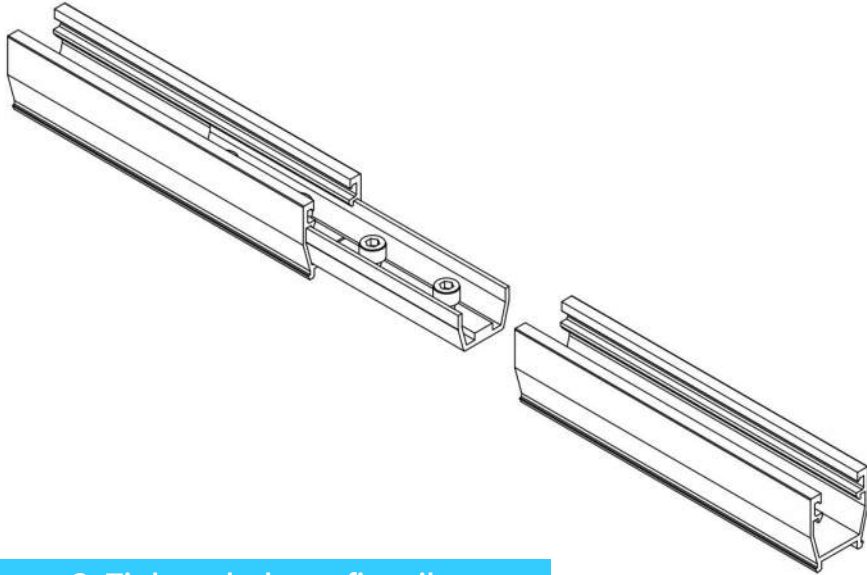
Leave the Rail Bracket loose for rail installation.

When the desired rail height is met, secure Rail Bracket, the torque value must be 22.59 Nm / 200 in-lb.

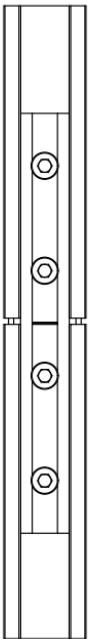
Part D: Rail splice installation- Mechanical

1. Splice Rails

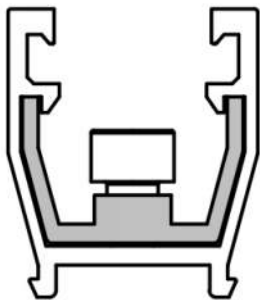
Use Splice for connecting rails together.



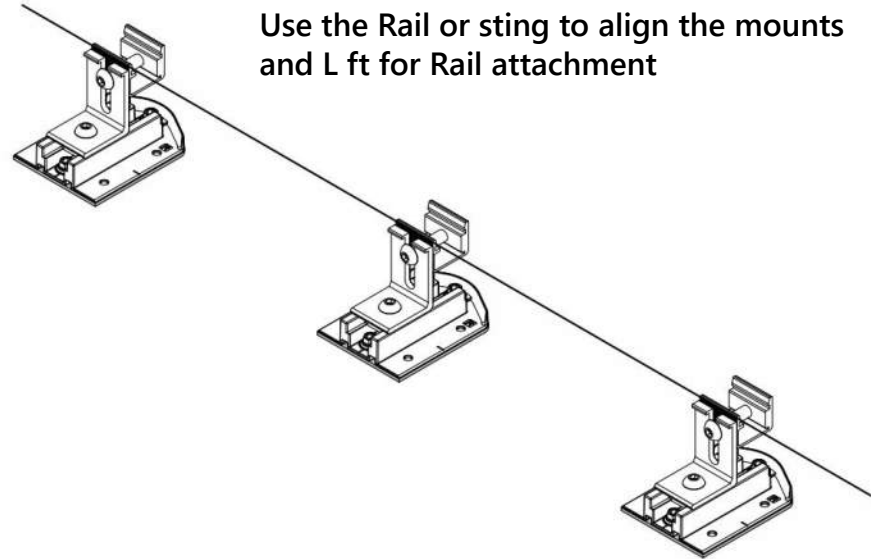
2. Tighten bolts to fix rails



Use hex bit to tighten 4 bolts to fix 2 rails together.
Use the middle line to align the splice in the middle of 2 rails.



3. Align a row of mounts



Use the Rail or sting to align the mounts and L ft for Rail attachment

Attention

Make sure the Rail heights are leveled for installing panels. Until the rail height is determined, leave the rail under clip loose for rail installation.

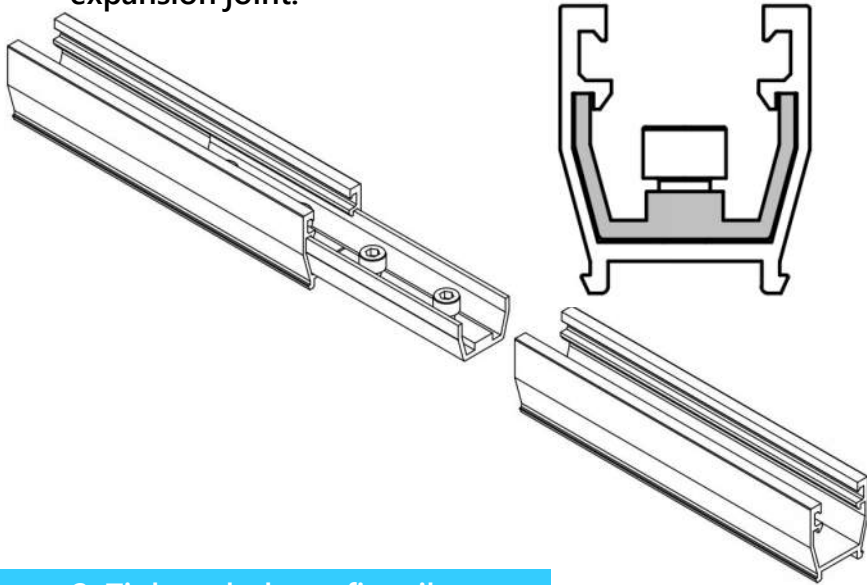
Mechanically attached rail sections are limited to 31 ft total before a Thermal Splice is needed except for end sections- please see addendum

When the Rail height is fixed, then secure Rail-under bracket, the torque value must be 22.59 Nm / 200 in-lb.

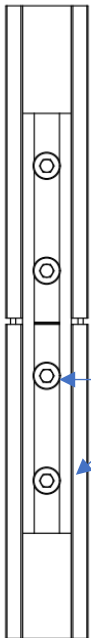
Part D: Rail splice installation- Thermal

1. Splice Rails

Use Splice for connecting rails together as a Thermal expansion joint.



2. Tighten bolts to fix rails

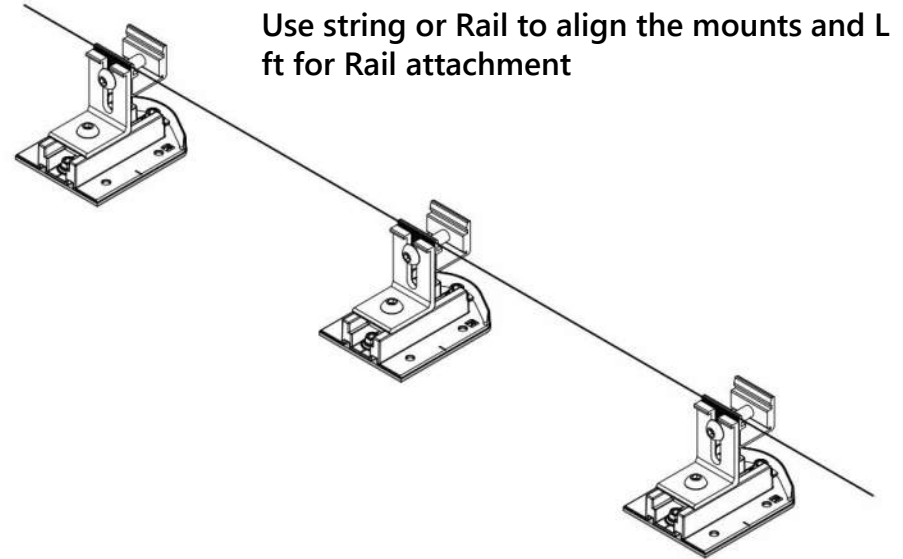


Use hex bit to tighten 2 bolts on one side to fix two rails together.

Use the middle line to align the splice in the middle of two rails leaving at least a $\frac{1}{4}$ inch gap between the rails .

Secure 2 of the 4 bolts at 12 in lbs to put positive pressure on one side of the Rail leaving it to move freely for expansion and contraction.

3. Align a row of mounts



Use string or Rail to align the mounts and L ft for Rail attachment

Attention

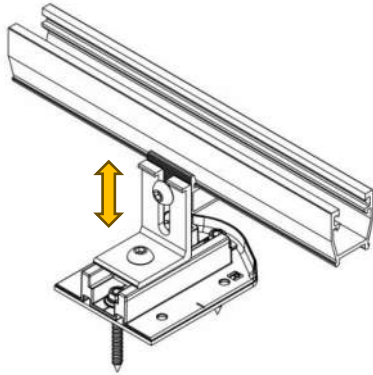
Make sure the Rail heights are leveled for installing panels. Until the rail height is determined, leave the rail under clip loose for rail installation.

When the Rail height is fixed, then secure Rail-under bracket, the torque value must be 22.59 Nm / 200 in-lb.

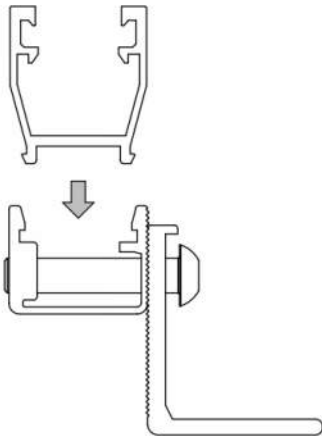
Part E : Rail installation

1. Keep Rail Bracket loose

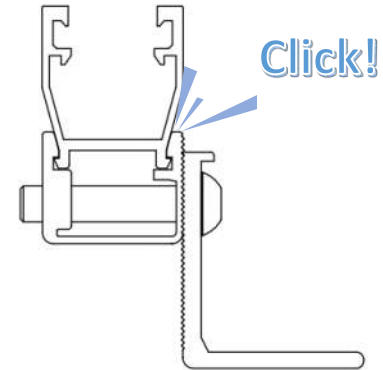
Keep loosen the Rail Bracket until rail is placed.



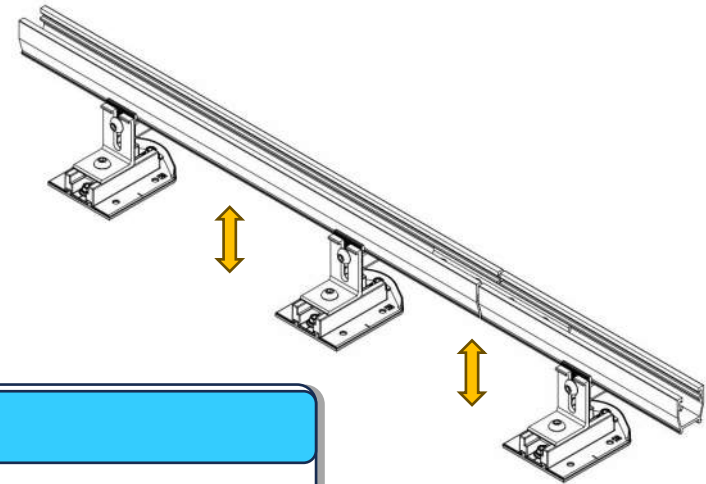
2. Place rail onto the Rail Bracket



3. Seat the rail into Rail Bracket



4. Fix Rail Bracket to rail and level



Attention

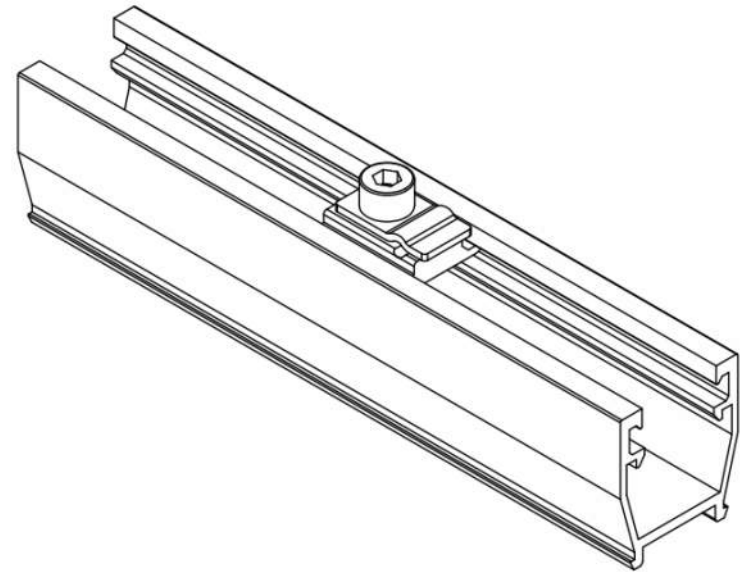
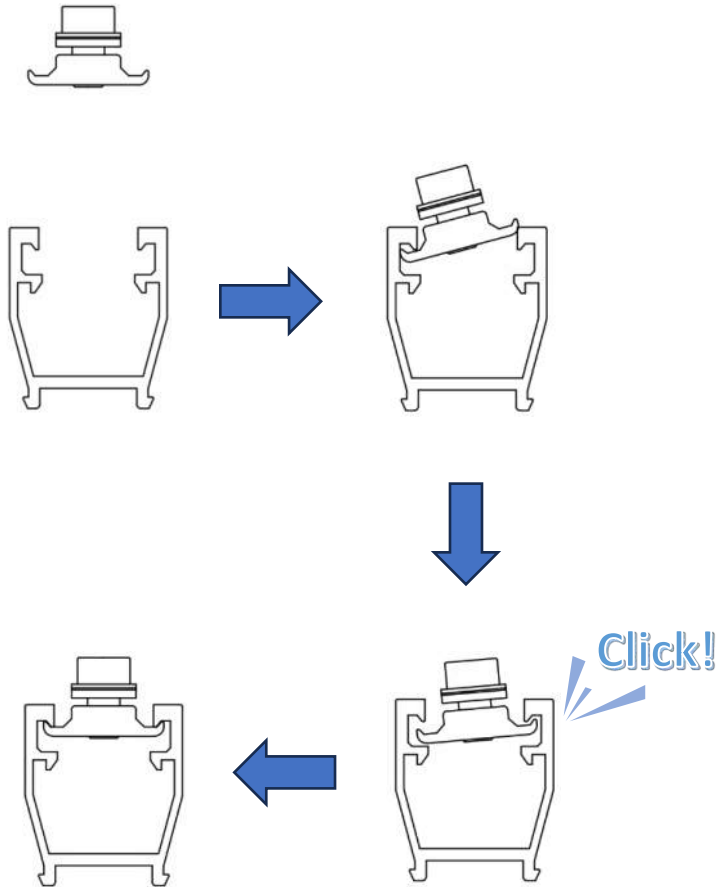
Make sure the rail heights are leveled for installing panels. Until the rail height is determined, leave the Rail Bracket loose for rail installation.

When the Rail height is fixed, then secure Rail-under clips, the torque value must be 22.59 Nm / 200 in-lb.

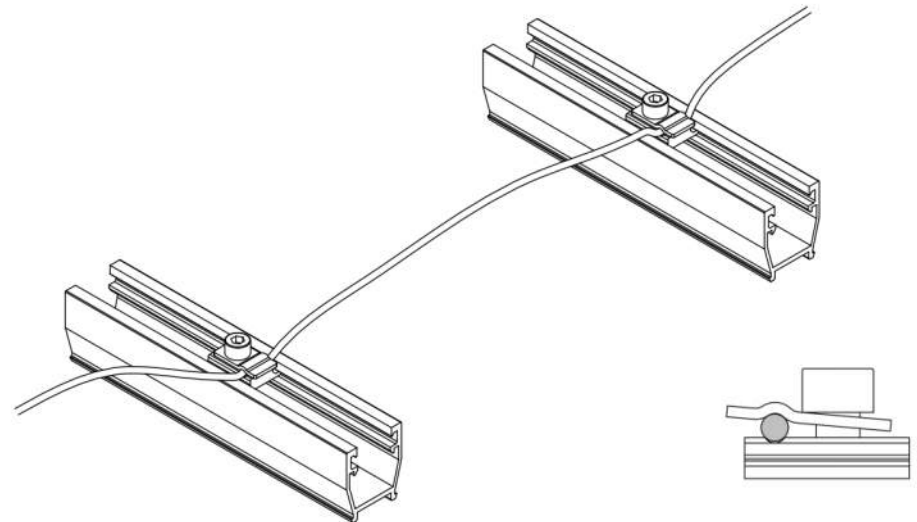
Part F : Grounding Wire Clamp Installation

1. Seat Grounding Wire Clamp

Snap in the Grounding wire clamp to the rail



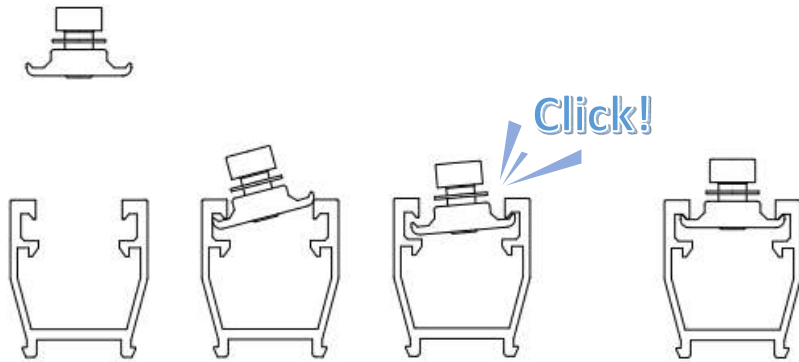
2. Tighten bolts to fix the Grounding copper wire



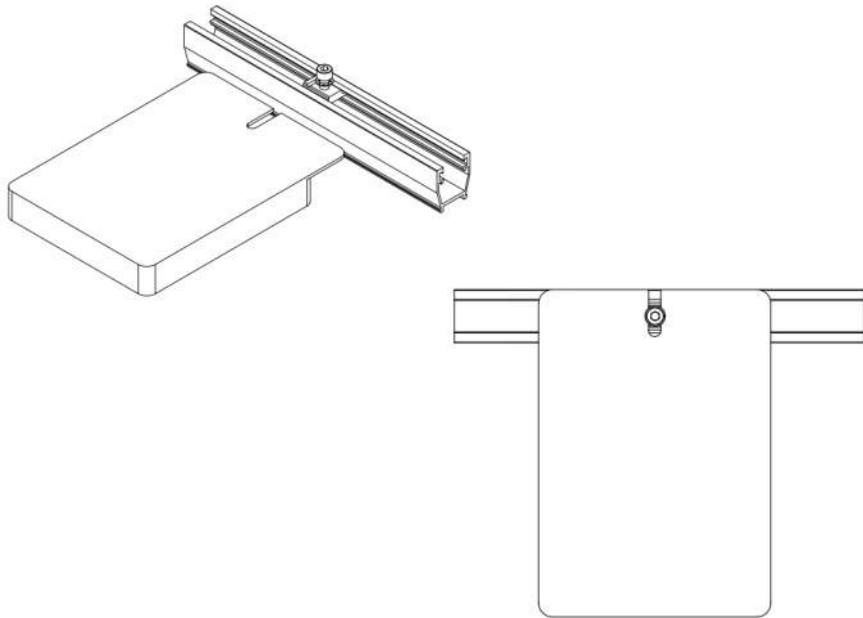
Part F : MLPE bracket installation

1. Install Microinverter clip

Snap in the microinverter clip to the rail

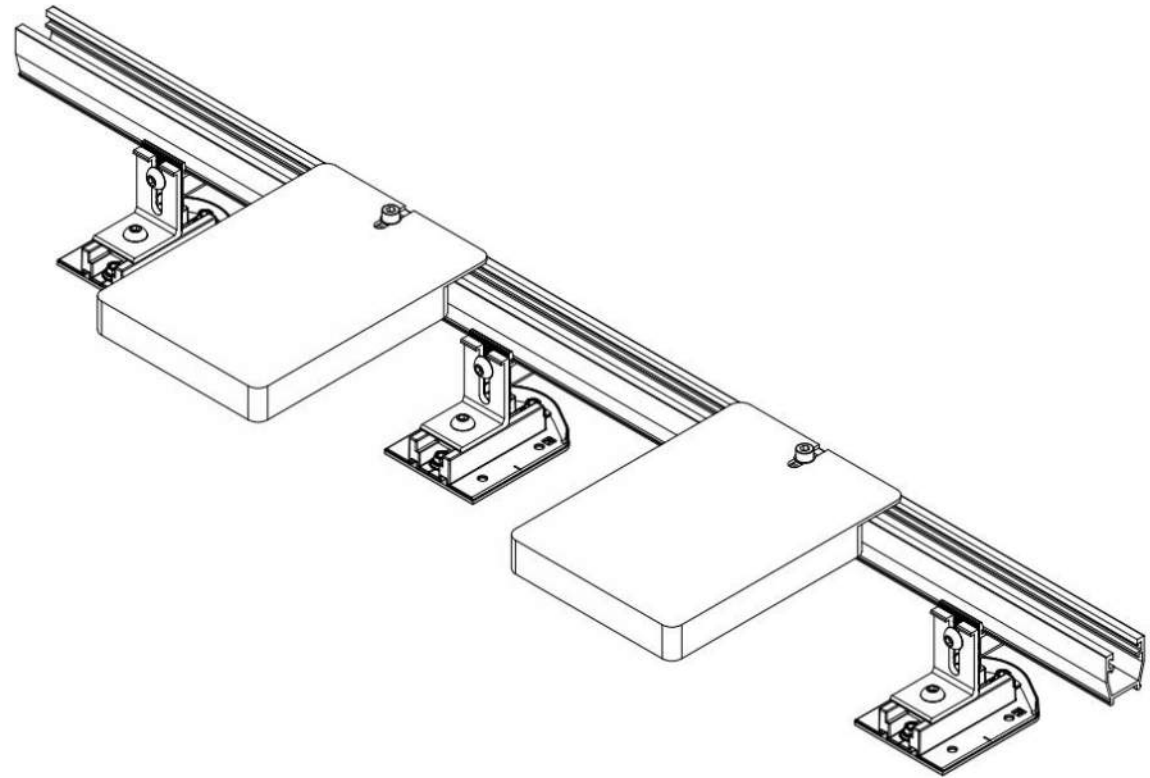


2. Tighten bolts to fix the Microinverter



3. Cable management

Use inside of rail to manage cables



Attention

Follow the instruction of Microinverter manufacture when install MLPE's.

Part G : Thrid party grounding lugs installation

1.) Approved 3rd party grounding products and torque values

IlSCO Lay-in Lug GBL-4DBT to Rail or Module Frame 2.92 ft-lbs (35 in-lbs)

IlSCO Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (10-14 AWG Solid Copper) 1.67 ft-lbs (20 in-lbs)

IlSCO Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (8 AWG Stranded Copper) 1.04 ft-lbs (25 in-lbs)

IlSCO Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (4-6 AWG Stranded Copper); Ground Lug SGB-4 to Grounding Electrode Conductor (4-14 AWG Solid or Stranded Copper) 1.46 ft-lbs (35 in-lbs)

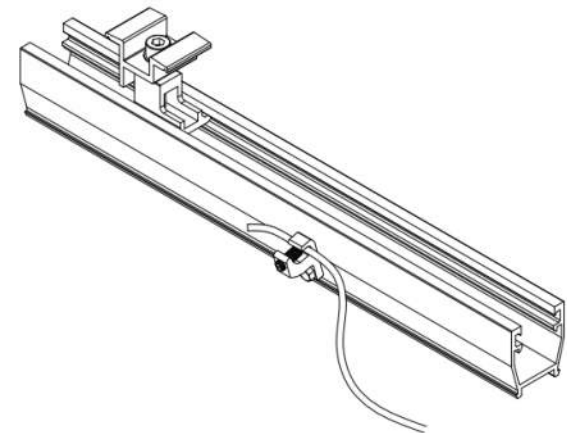
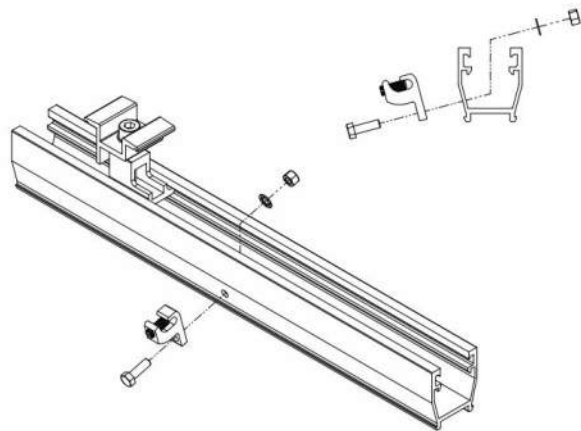
IlSCO Ground Lug SGB-4 to Module Frame 6.25 ft-lbs (75 in-lbs)

Dynobond 8",12",38",76",96"

2. Installation method

IlSCO lugs may be used with the Integrity Rail system. These lugs must be installed in accordance with the latest revision of the NEC. The IlSCO lug has a green tinted bolt the indicates it is for grounding and must be used so.

- Drill through the lower sidewall with 3/16 or 7/32 drill bit.
- Be sure to de-burr the hole and clear away any shavings
- Insert ¼ stainless steel bolt with nut and a single use bonding washer
- Place copper wire into lug and secure
- Torque the copper wire tension bolt to the specs indicated by IlSCO
- For additional details refer to IlSCO product spec sheet for the above model numbers.

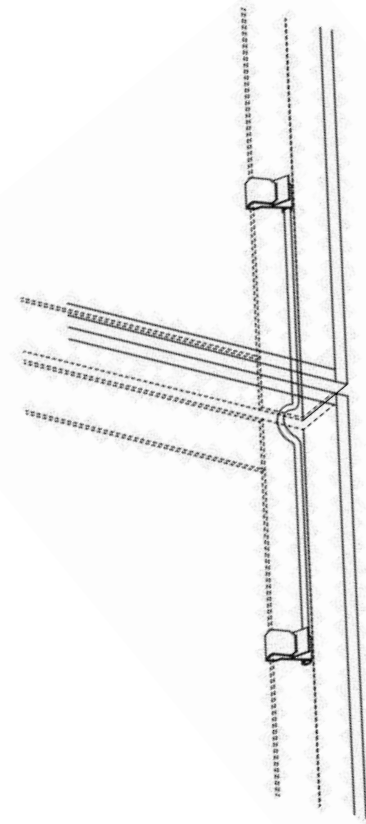
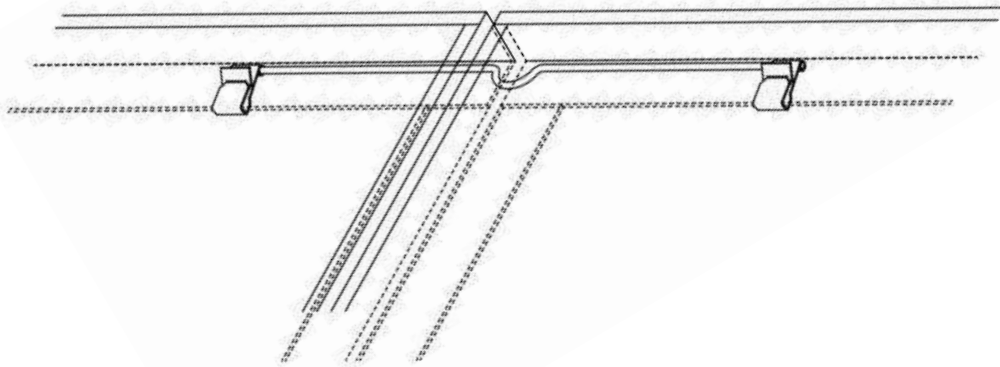


Part G: Thrid party grounding lugs installation

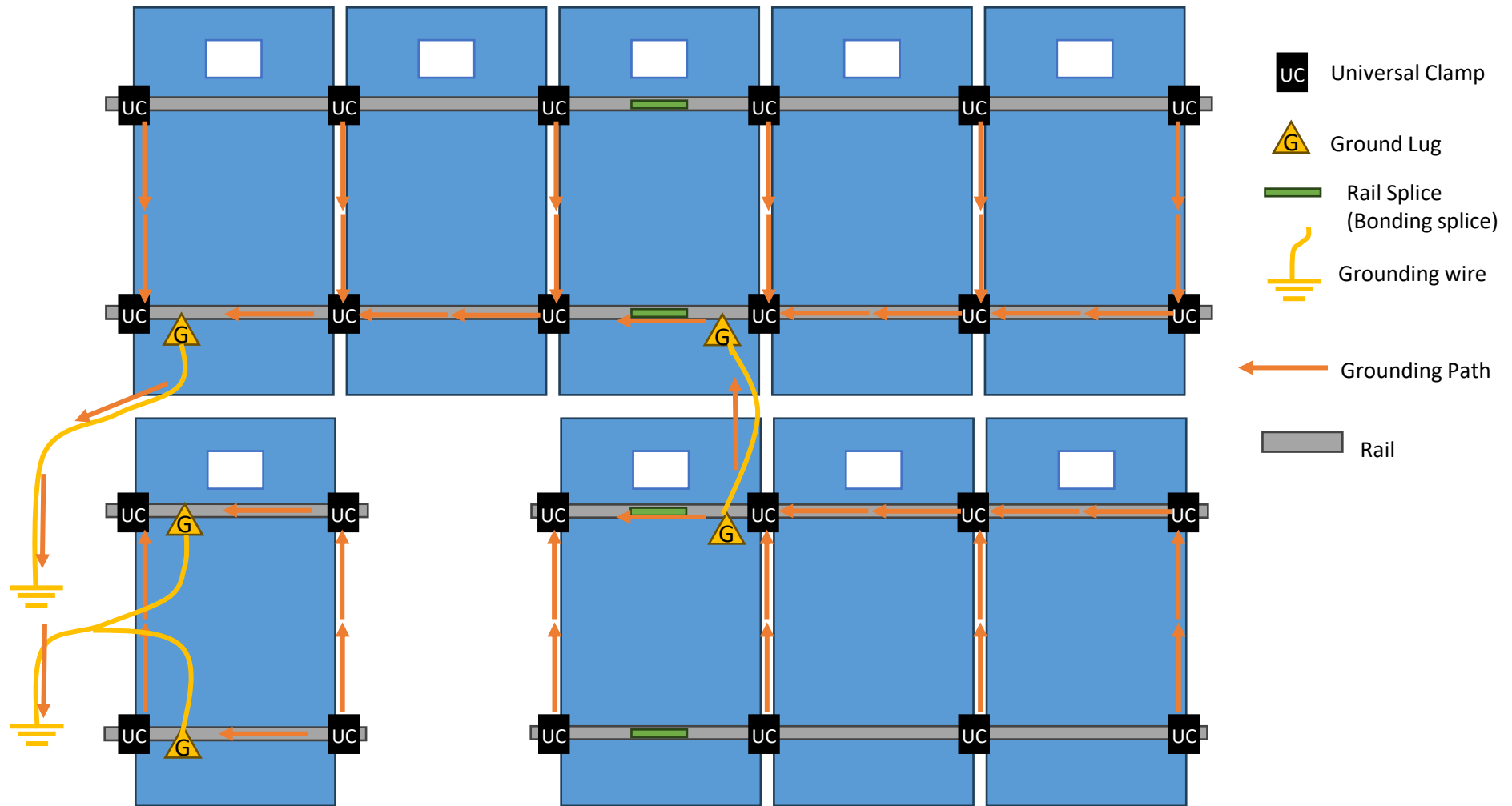
1.) Dynobond installation

Dynobond may be used to bond module to module with the Integrity Rail system. Please reference the dynobond install manual for more details, compatibility and restrictions

- Confirm module frame compatibility with dynobond product before using
- Dynobonds can be used in both landscape or portrait installations, on the short or long edges of the module frame granted the frames are the same on all four sides. Note the bonding clips are supposed to penetrate the anodized coating.
- Place the dynobond on the bottom of the lip flange of the first module and then place onto the second.
- Finally place the bend or the “s curve” in the conductor to allow for thermal expansion and contraction within the array
- Please refer to Dynobond installation manual for further installation details.

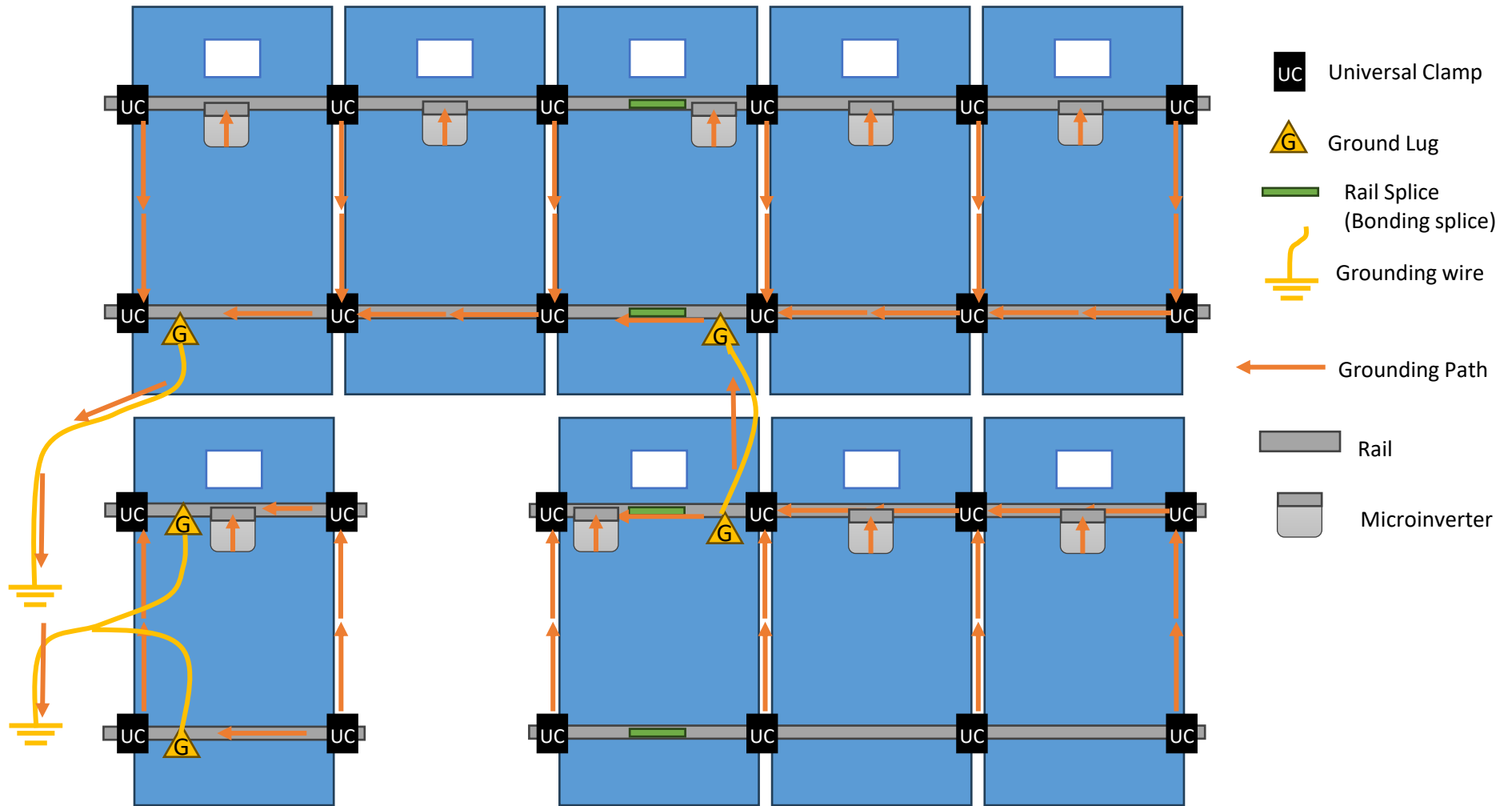


Rail bonding and grounding diagrams- Rail Grounding Path Method.

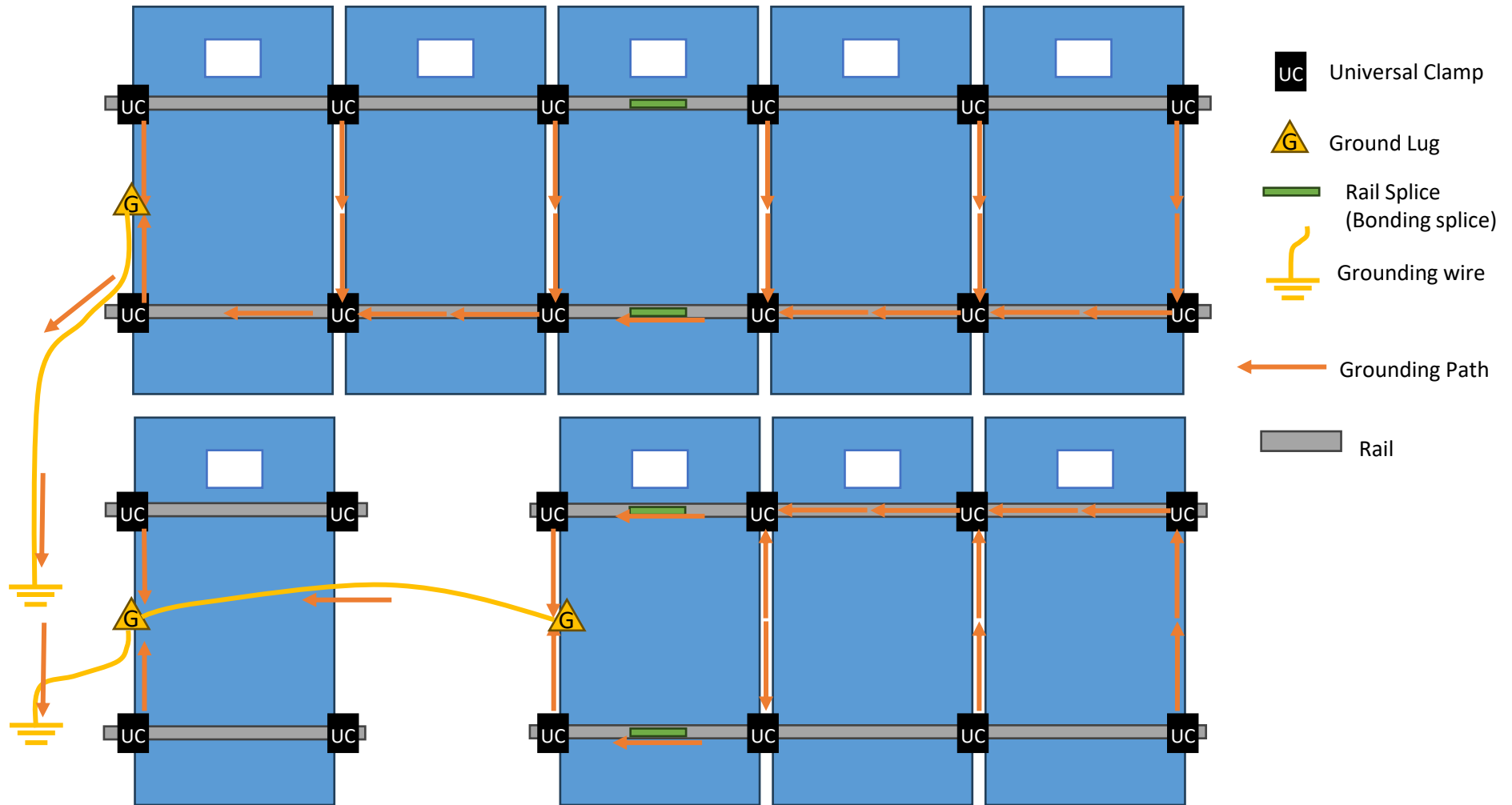


Rail bonding and grounding diagrams-

Rail Grounding Path Method with Microinverter.

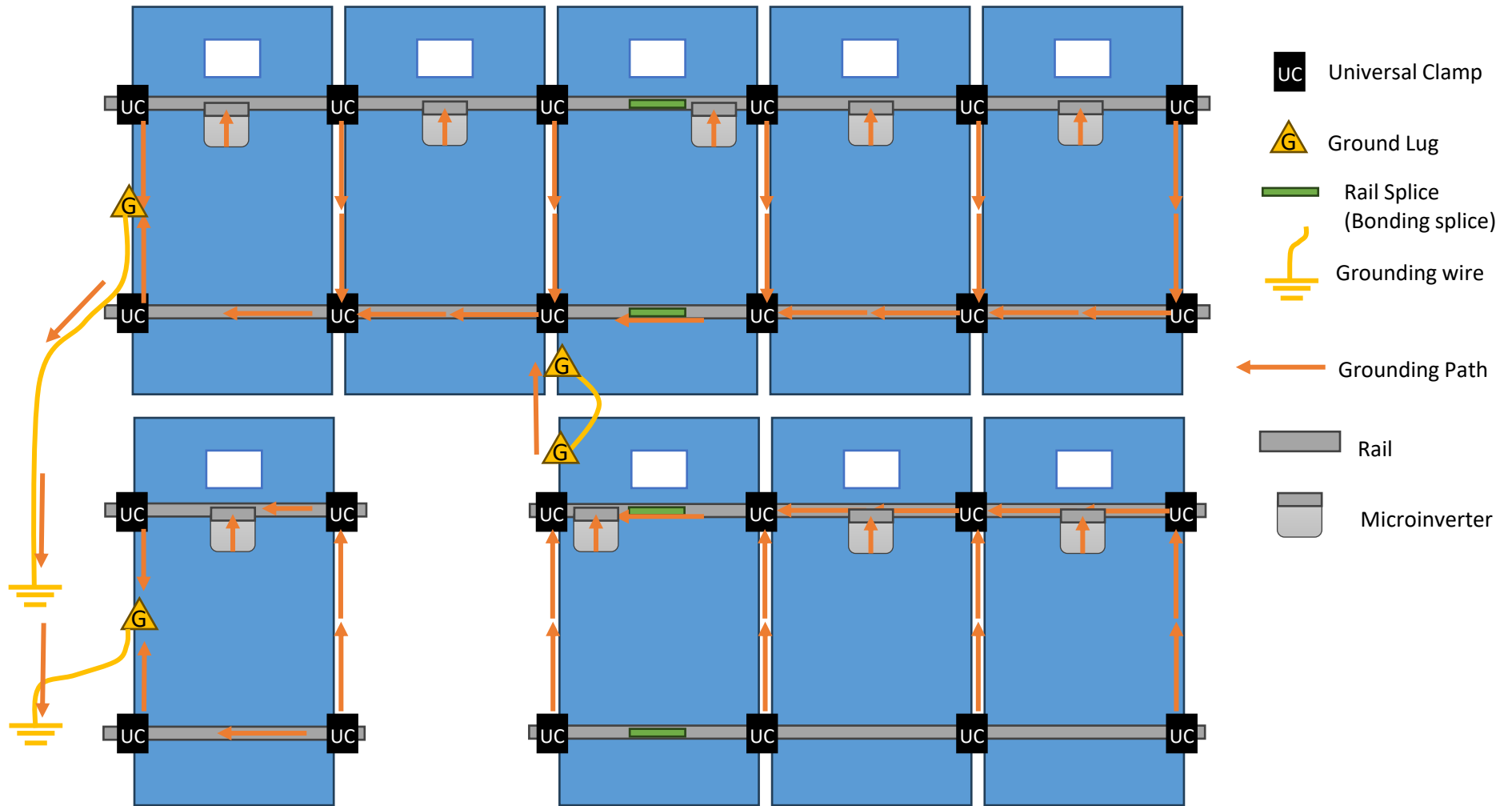


Rail bonding and grounding diagrams- Module frame Grounding Method with Microinverter.



Rail bonding and grounding diagrams-

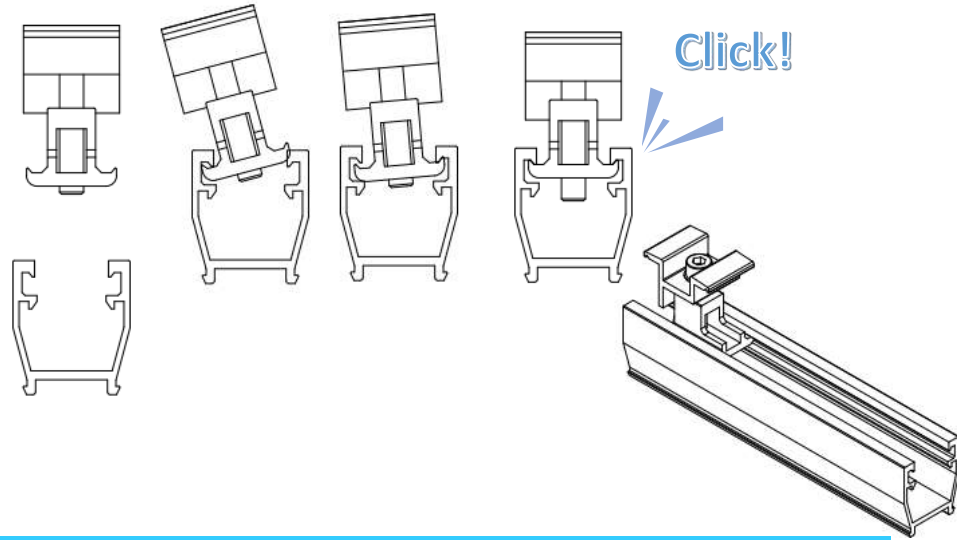
Rail Grounding Path Method with Microinverter.



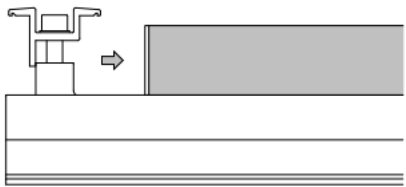
Part H: Module installation

1. Place modules onto rail, set clamps

Starting on the first row left or right side. Set end clamps in rail.

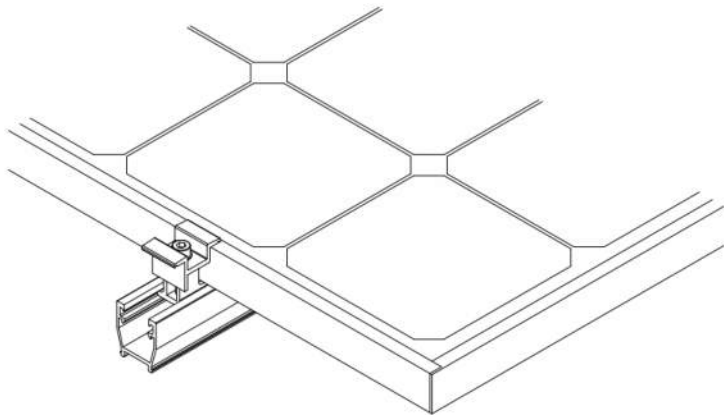


2. Once module is aligned set end clamps, must leave 1- 3/8 inch rail cantilever



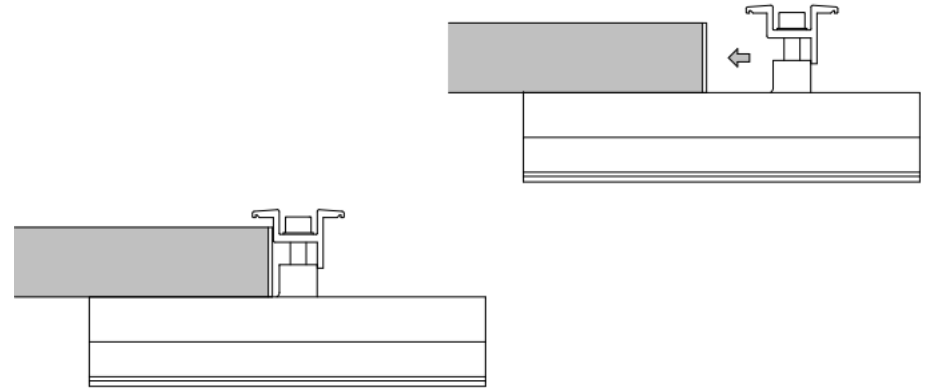
Attention

Follow the instruction of Module manufacture for clamping zone locations.

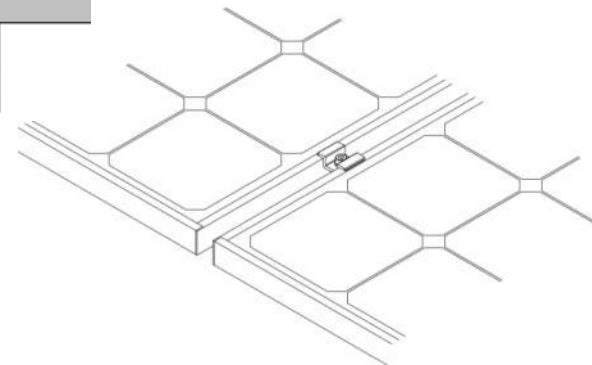
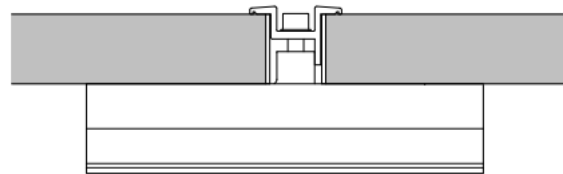
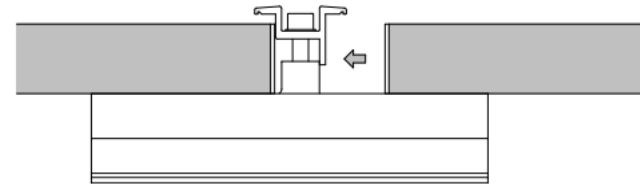


3. Set mid clamps

Slide mid clamps snug to fixed module

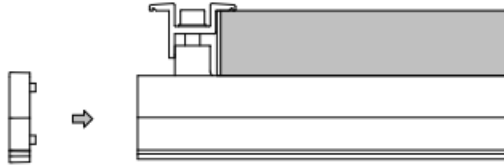


4. Set next module in place and secure



Part I : End Cap installation

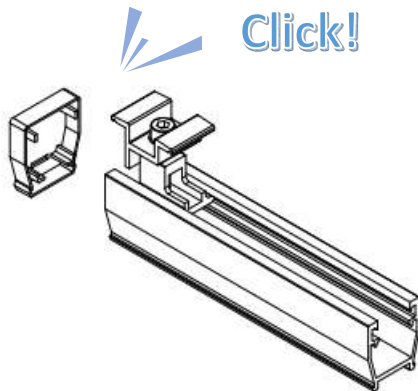
1. Place 1-piece poly end caps on clamp and rail



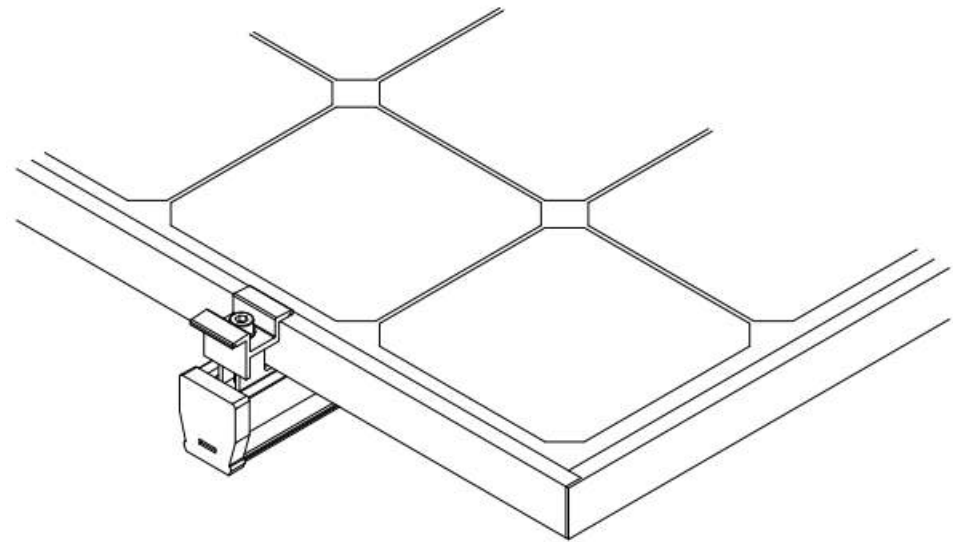
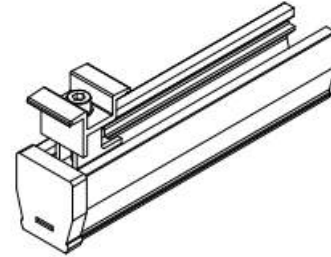
Attention

The installer must leave at least 2 inches of rail past the outer edge of the last module in the row.

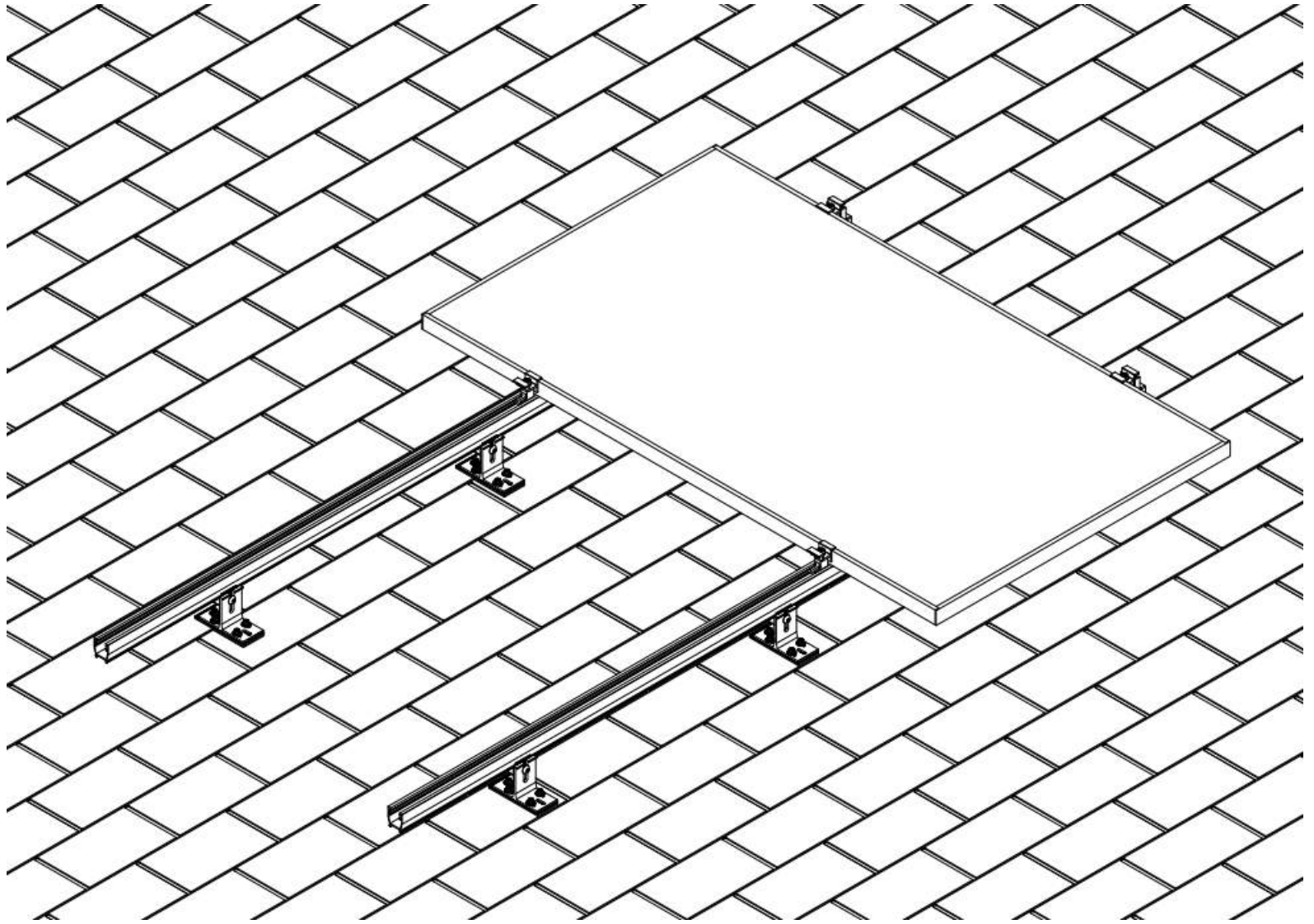
2. Snap into place



3. Final view



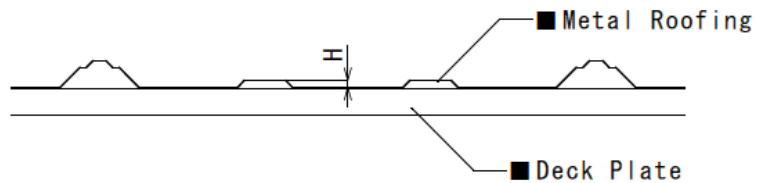
Part J : Final installation View



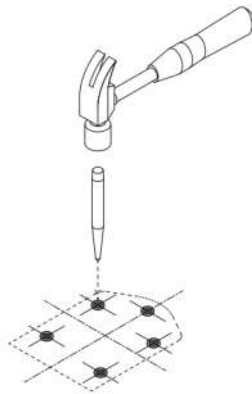
Installation on a Classic Rib Metal Roofing (SSB1)

2. Check the height of the metal rib.

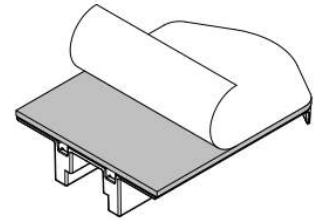
(1) The maximum height of the ribs must be 5 mm.



(2) Use Center punch as an option to make a pilot hole. You can mark on roof or use base's screw hole directly from top of the base.



(2) Peel off the protective paper from the SS Butyl.



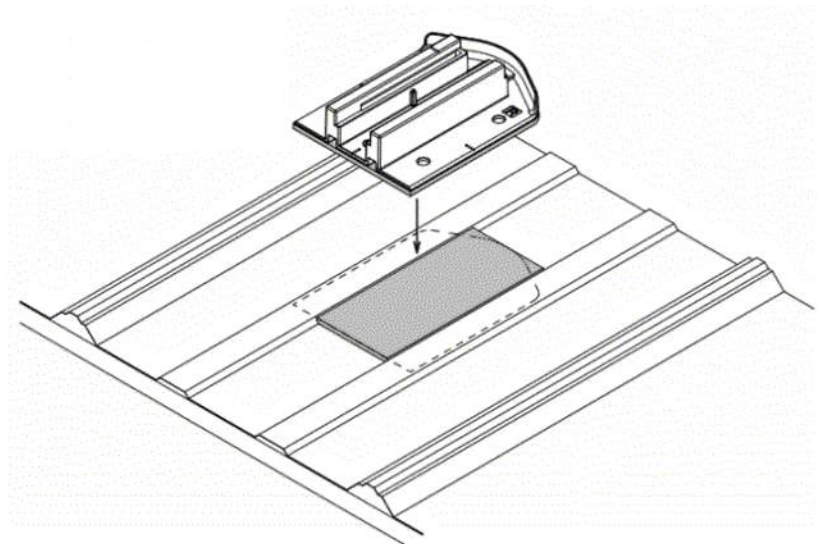
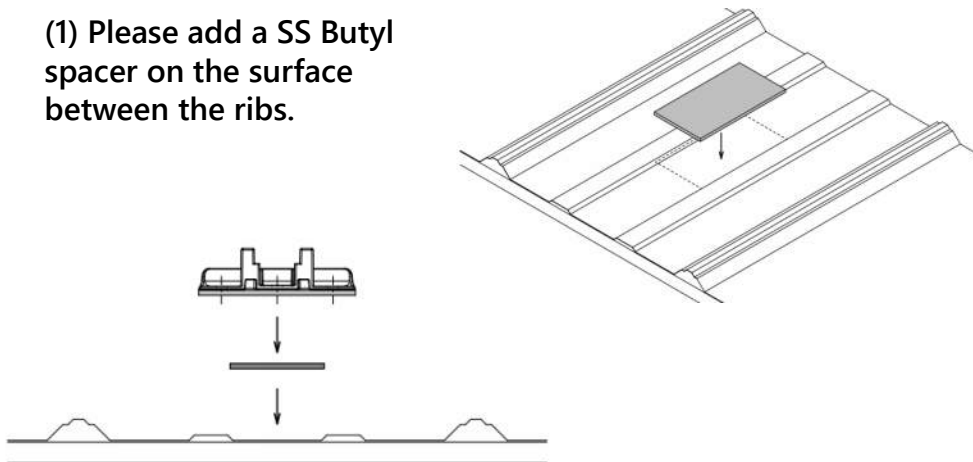
Attention

Do not leave any protective paper on the surface of the SS Butyl, it may cause an improper seal and may allow water intrusion under the bracket.

(3) Place the brackets at the specified location and make sure the SS Butyl attaches well to the roofing surface.

3. Bracket Installation

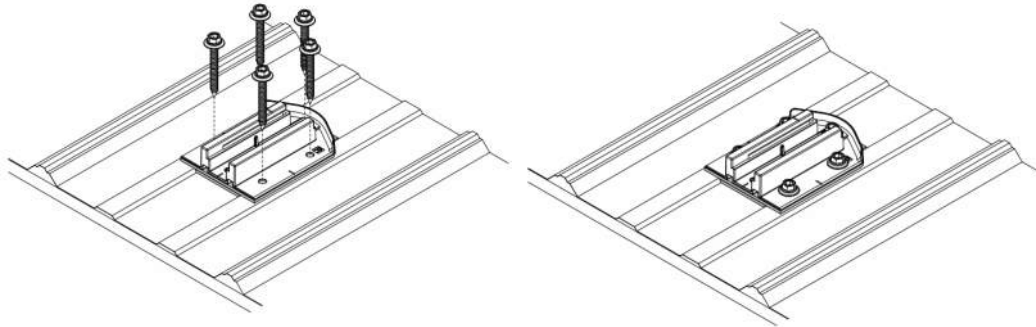
(1) Please add a SS Butyl spacer on the surface between the ribs.



Installation on a Classic Rib Metal Roofing

3. Bracket Installation (2)

(4) Set the bracket with 5 ea. (For Roof Deck), of M6.0 x 60 mm stainless wood screw using 6 mm hex bit. After completing the process, make sure the brackets are securely fixed.



Attention

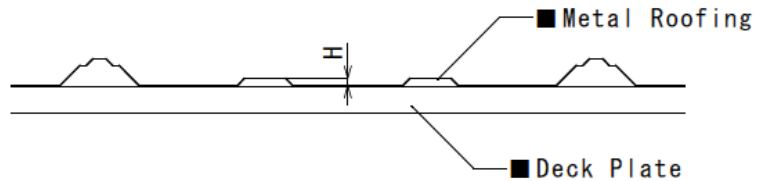
When the SSB1 base is installed on the deck, 5 screws must be used. The screws are fixed into the side 4 holes and 1 ridge center hole.

Note: Each SSB1 is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

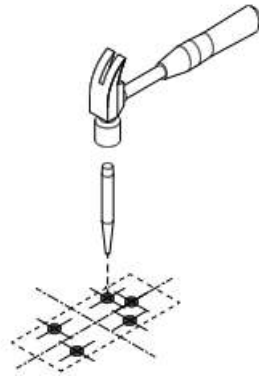
Installation on a Classic Rib Metal Roofing- (SSM)

2. Check the height of the metal rib.

(1) The maximum height of the ribs must be 5 mm.



(2) Use Center punch as an option to make a pilot hole. You can mark on roof or use base's screw hole directly from top of the base.



(2) Peel off the protective paper from the SS Butyl.



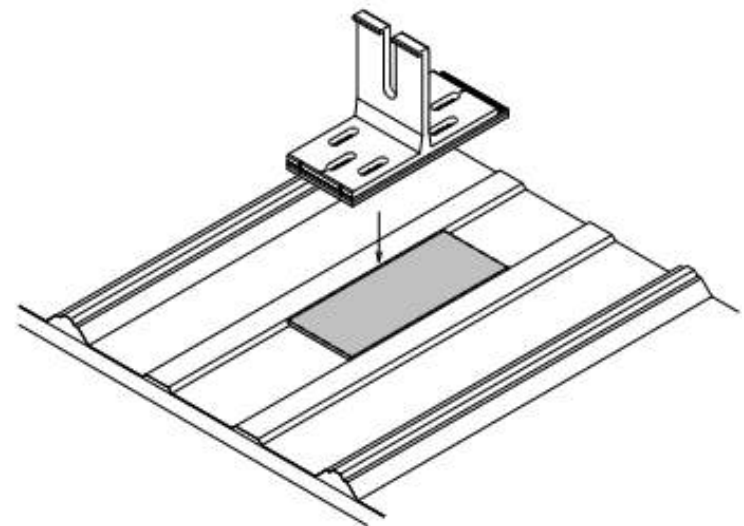
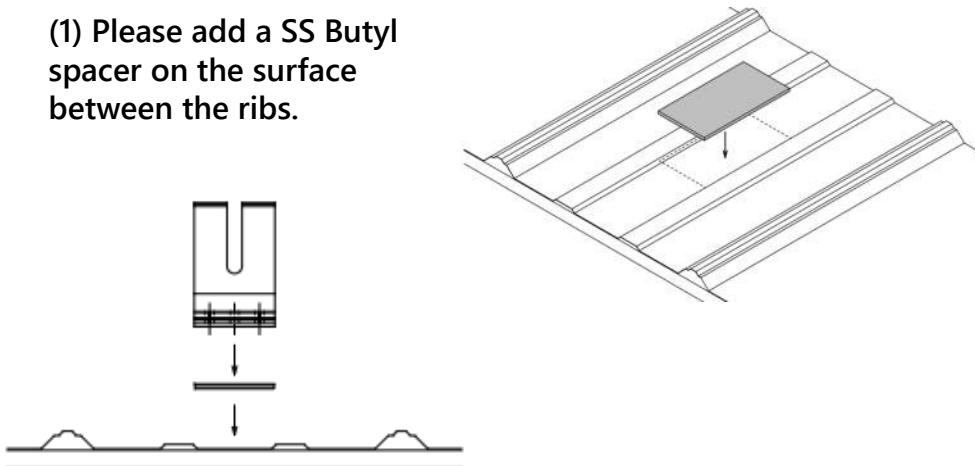
Attention

Do not leave any protective paper on the surface of the SS Butyl, it may cause an improper seal and may allow water intrusion under the bracket.

(3) Place the brackets at the specified location and make sure the SS Butyl attaches well to the roofing surface.

3. Bracket Installation

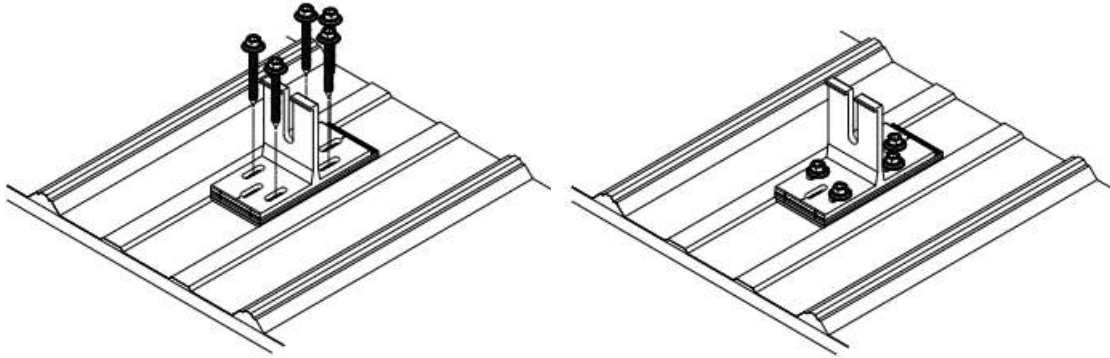
(1) Please add a SS Butyl spacer on the surface between the ribs.



Installation on a Classic Rib Metal Roofing (SSM)

3. Bracket Installation (2)

(4) Set the bracket with 5 ea. (For Roof Deck), of M6.0 x 60 mm stainless wood screw using 6 mm hex bit. After completing the process, make sure the brackets are securely fixed.



Attention

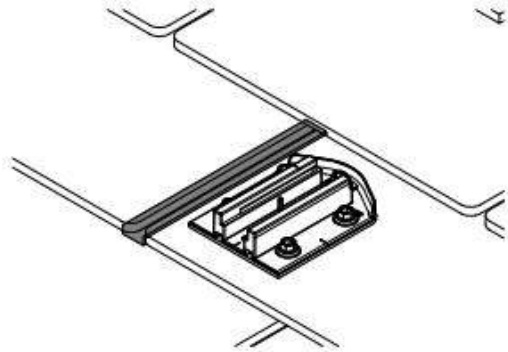
When the SSM base is installed on the deck, 5 screws must be used. The screws are fixed into the side 4 holes and 1 ridge center hole.

Note: Each SSM is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

Installation on a Composite Tile, Faux Slate & Faux Cedar (SSB1)

1. Requirement

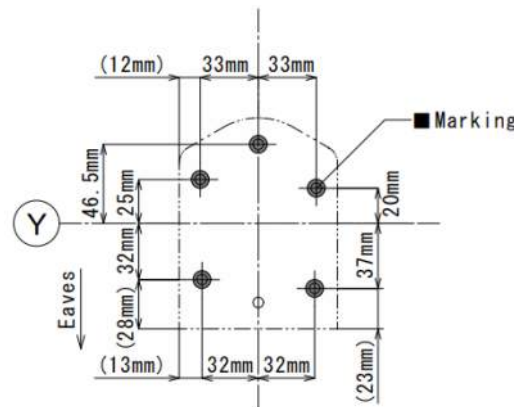
- Composite Slate compatible with SS Butyl



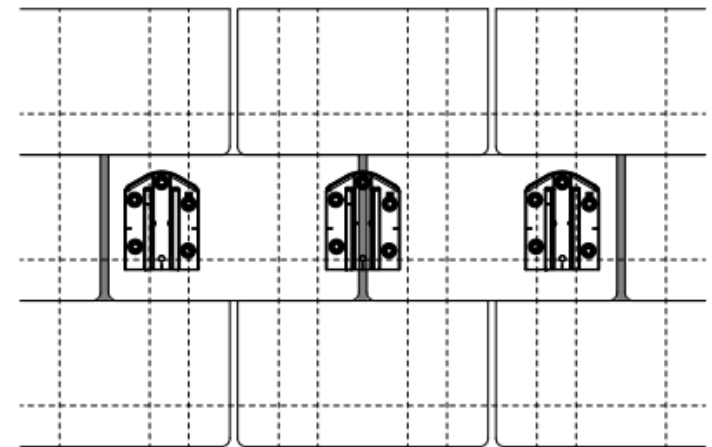
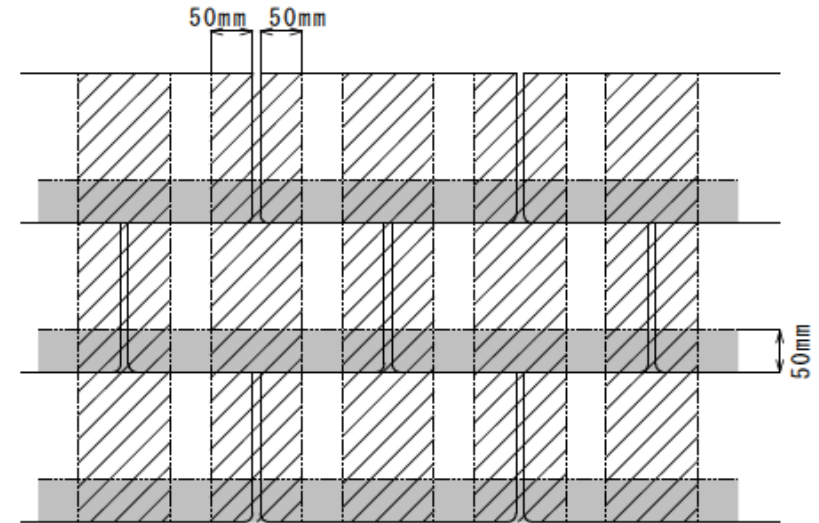
2. Marking on the Roof

(1) Layout

1. The SSB1 base must be mounted on the flat surface.
2. Mark at ± 33 mm and ± 32 mm from the intersection of the M Line and Y Line.
3. Then mark at +20, -37, -32, +25 mm from the intersection of the M Line and the Y Line.



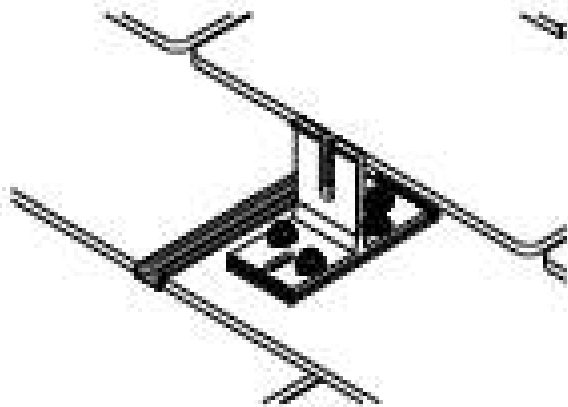
4. Do not drive the M6 x 60 screw on the butyl spacer location. Apply the butyl spacer if the base is installed in the shaded area.



Installation on a Composite Tile, Faux Slate & Faux Cedar (SSM)

1. Requirement

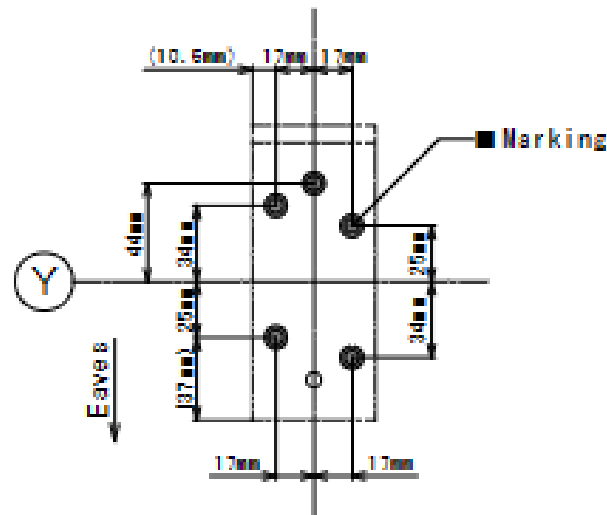
- Composite Slate compatible with SS Butyl



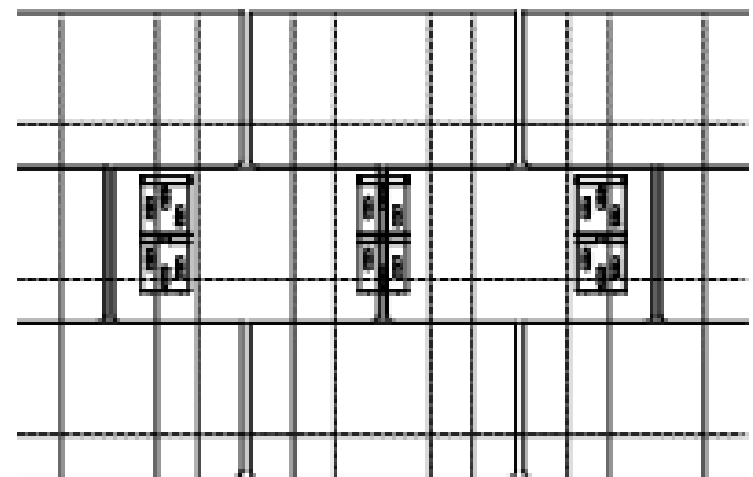
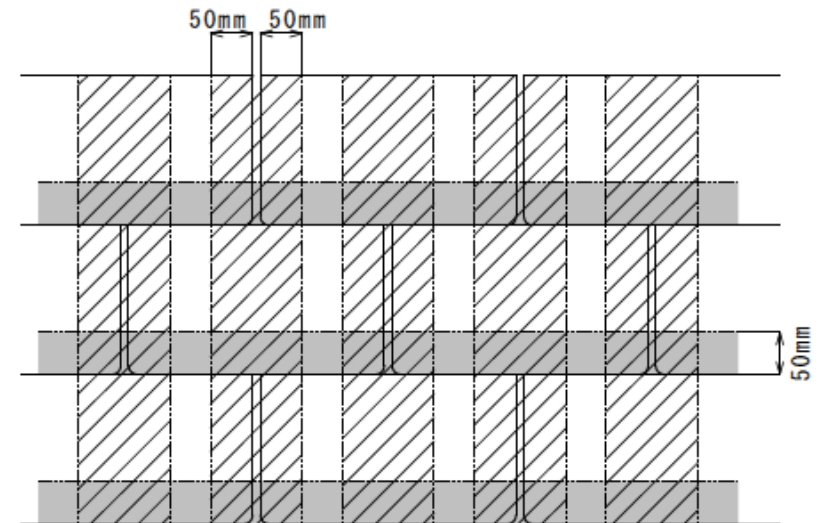
2. Marking on the Roof

(1) Layout

- The SSM base must be mounted on the flat surface.
- Mark at ± 17 mm and ± 17 mm from the intersection of the M Line and Y Line.
- Then mark at +25, -34, -25, +34 mm from the intersection of the M Line and the Y Line.



- Do not drive the M6 x 60 screw on the butyl spacer location. Apply the butyl spacer if the base is installed in the shaded area.

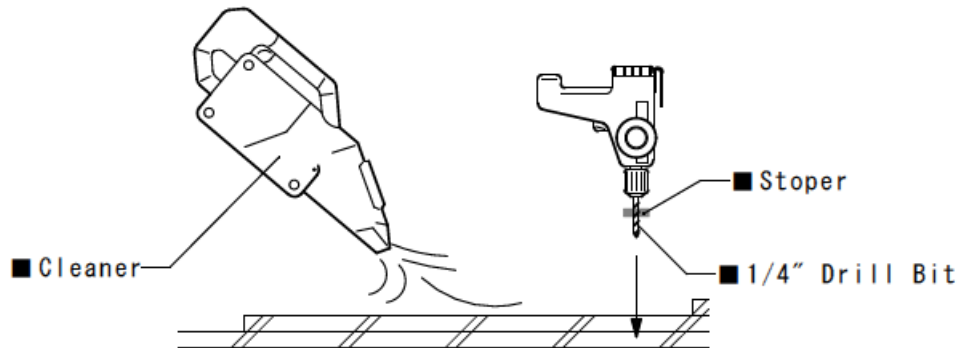


Installation on a Composite Tile SSB1

3. Bracket Installation

(1) Drill the roofing metal sheet with a 1/4 inch (6.5 mm) drill bit at the markings.

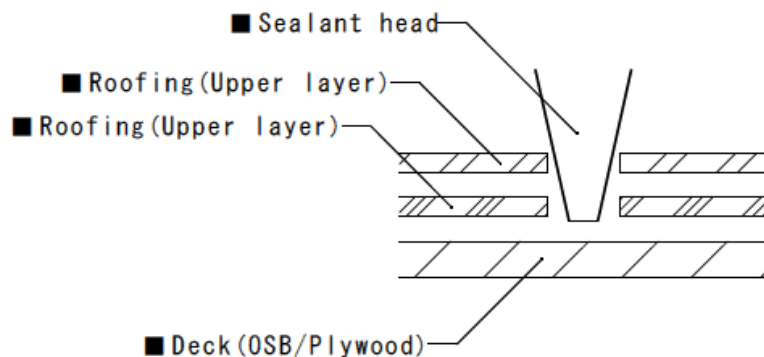
Note : Avoid drilling through the underlayment!



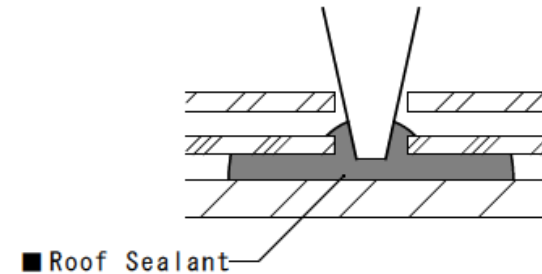
Attention

Installer must avoid drilling into the wood underneath.

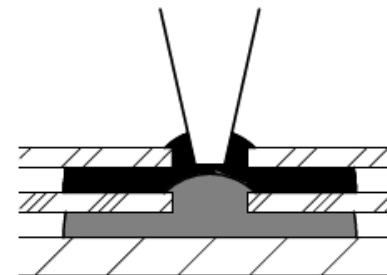
(2) Fill the cavity with a sealant listed in this Installation Manual. The sealant must be flush with the slate surface.



(3) Fill sealant layer by layer. Hold the nozzle in place to ensure lowest layer is filled with sealant displacing all air around the desired attachment point.



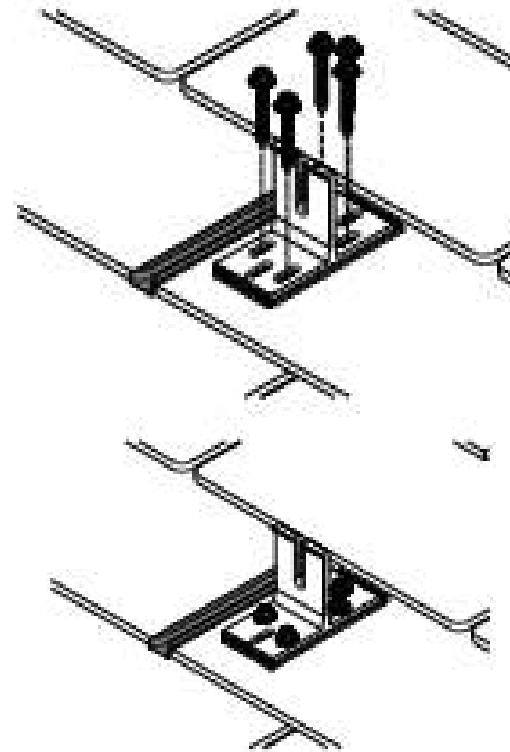
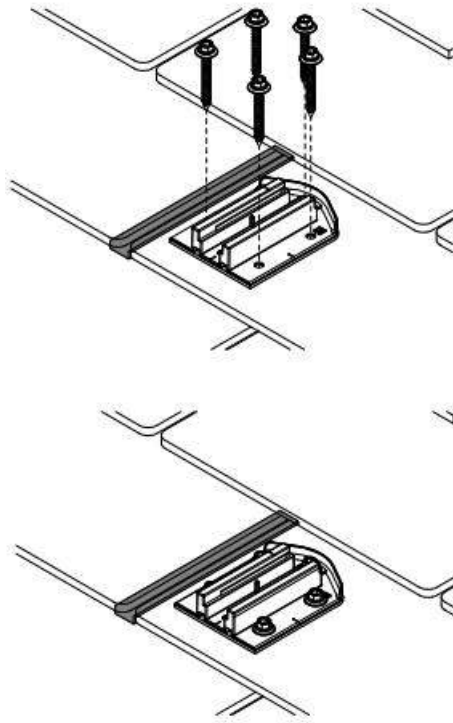
(4) After lower layer is full, move the nozzle back to fill upper layers in the same manner.



Installation on Composite Tile SSB1 & SSM

3. Bracket Installation (2)

(5) Set the bracket with 5 ea. (For Roof Deck), of M6.0 x 60 mm stainless wood screw using 6 mm hex bit or 10mm socket.



Attention

When the SSB1 & SSM base is installed on the deck, 5 screws must be used. The screws are fixed into the side 4 holes and 1 ridge center hole.

Note: Each SSB1 & SSM is shipped with 2 mounting screws. The installer must purchase additional screws when mounting it to the roof deck.

Installation on a (S/W/F) Clay Tile Roof (SSB1)

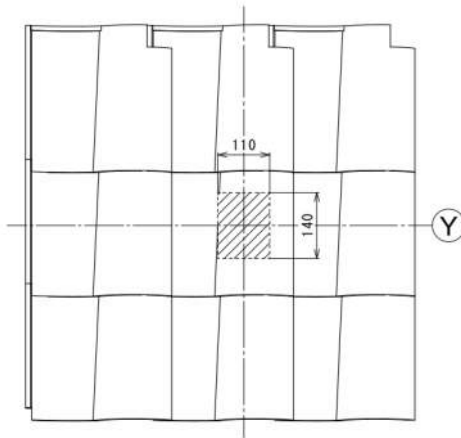
1. Requirement

- Able to install on Deck under the tile roofing.

2. Marking on the Roof

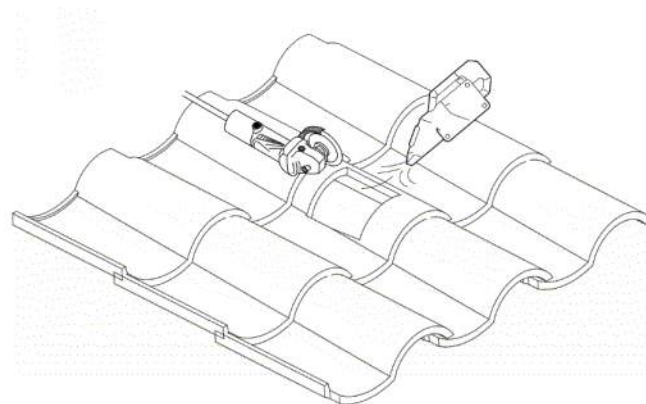
(1) Layout

1. Layout the location of the SSB1 Base.

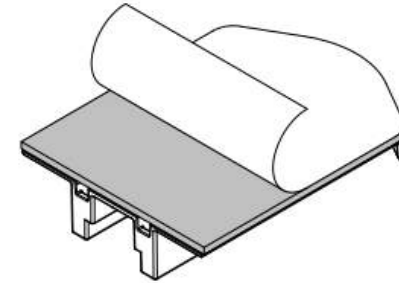


3. Cut out the Tile for Base placement

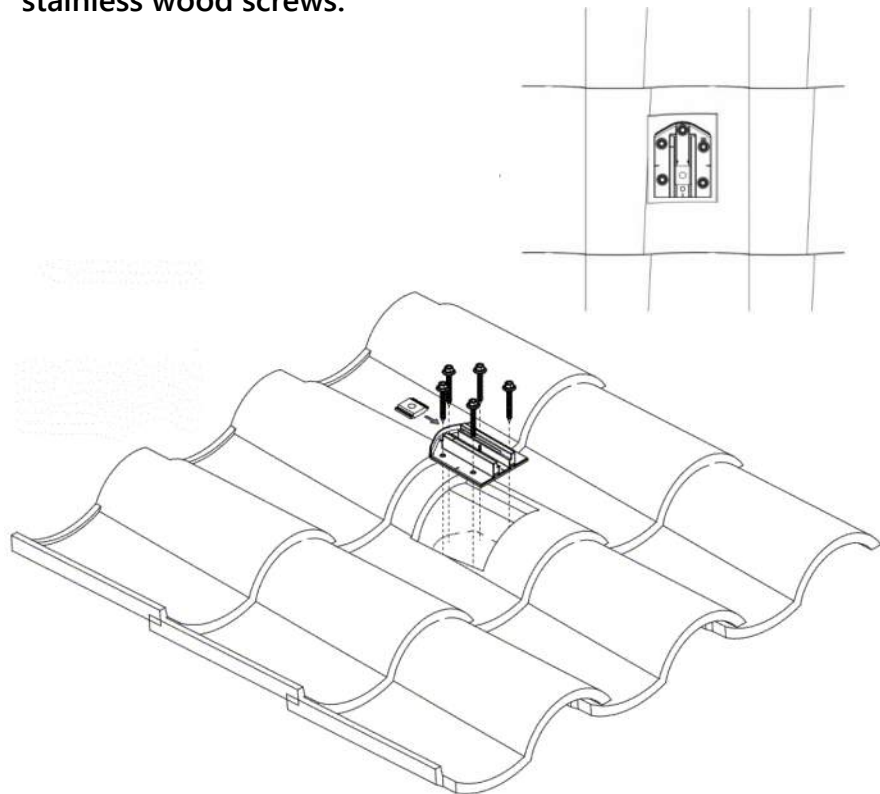
1. Use Tile cutting tool to open a square hole on the tile.
2. Clean the surface and around the square hole. * Make sure there is no dust or debris around the hole as it may compromise the waterproof seal.



3. Peel off the protective paper from the SS Butyl tape.

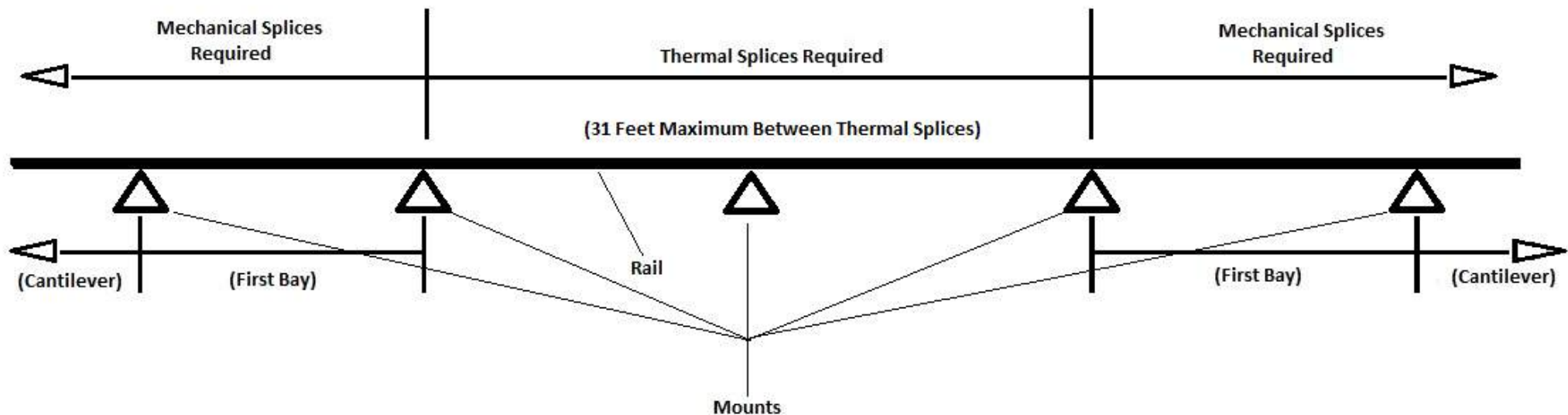


4. Place the brackets at the specified location and make sure the SS Butyl attaches well to the roofing surface. Set the bracket with 5 ea. (for Roof deck), of M6.0 × 60 mm stainless wood screws.



Mechanical and Thermal Splice Protocol.

Installers must use thermal expansion splices along the rail at intervals not to exceed 31 feet o.c. Mechanical (hard) splices are required at all cantilevers and between the first and second mounts (first bay) at either end of a rail run. Thermal splices must be installed within 28.8 inches of a mount on both sides of the thermal splice.



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Request for PE Report

Please contact to Sunstack team for PE report. Or visit our website at www.sunstackracking.com

For more information, visit www.sunstackracking.com

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Sunstack Approved Module list (page 1 of 2)

Manufacturer	Model	Manufacturer	Model
Axitec	AC- followed by 325- 370; followed by MBT/120V AC- followed by 390- 415; followed by MBT/108 followed by V AC- followed by 390-415; followed by MBT/108 followed by VB AC- followed by 360- 375; followed by MBT/120 followed by VB AC- followed by 390- 415; followed by MBTB/108 followed by V AC- followed by 360- 375; followed by MBTB/120 followed by V	Hanwha Q cells	Q.PEAK DUO XL-G10/G10.2/G10.3 Q.PEAK DUO XL-G10.d Q.PEAK DUO XL-G10.c Q.PEAK DUO XL-G9/G9.2/G9.3 Q.PEAK DUO L-G8.3/BFF Q.PEAK DUO L-G8.3 Q.PEAK DUO L-G8.2 Q.PEAK DUO L-G8.1 Q.PEAK DUO L-G8 Q.PEAK DUO L-G7.7 Q.PEAK DUO L-G7.4 Q.PEAK DUO L-G7.3 Q.PEAK DUO L-G7.2 Q.PEAK DUO L-G7.1 Q.PEAK DUO L-G7 Q.PEAK DUO L-G6.3 Q.PEAK DUO L-G6.2 Q.PEAK DUO L-G6 Q.PEAK DUO L-G5.3 Q.PEAK DUO L-G5.2 Q.PEAK DUO L-G5 Q.PLUS DUO L-G5.2 Q.PLUS DUO L-G5 Q.PEAK L G4.5 Q.PEAK L G4.2 Q.PLUS L G4.2 Q.TRON M-G2+ Q.TRON BLK M-G2+ Q.PEAK DUO BLK ML-G10+/TS Q.PEAK DUO BLK-G10+/HL Q.PEAK DUO ML-G10/G10+ Q.PEAK DUO BLK ML-G10/G10+ Q.PEAK DUO BLK ML- G10+/t Q.PEAK DUO BLK-G10/G10+ Q.PEAK DUO G10/G10+
Aptos	DNA-108-BF10-xxxW where xxx can be 400-410W DNA-120-BF10-xxxW where xxx can be 440-450W DNA-144-BF10-xxxW-DG where xxx can be 540-550W DNA-108-MF10-xxxW where xxx can be 400-410W DNA-120-MF10-xxxW where xxx can be 440-450W		
Canadian Solar	CS6.1-54TM-xxxH where xxx can be 445w to 470w CS6.2-48TM-xxxH where xxx can be 440w to 470w CS6W-xxxTB-AG where xxx can be 565w to 600w		
JA Solar	JAM54D40xxx/MB where the xxx can be 420w to 445w JAM72D40xxx/MB where xxx can be 580 to 600w		
Jinko Solar	JKM420-440N-54HL4-B JKM420-440N-54HL4-B-F3-US		
Hyundai	HiN-TxxxNF(BK) where xxx can be 430w to 440w HiN-TxxxNJ where xxx can be 625w to 645w		
Hyperion	See module listed with Runergy on next page		

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Sunstack Approved Module list

Manufacturer	Model	Manufacturer	Model
Longi	LR4-60HPB-350M LR5-54HPH LR5-54HPB LR5-66HPH	Solar For America	S4A followed by 385, 390, 395, 400, 405 or 410; followed by -108MH10; followed by S or B; followed by B, W or TT. S4A followed by 425, 430, 435 or 440; followed by -108TH10 or -108TH16; followed by S or B; followed by B, W or TT.
Meyer Burger	Meyer Burger Black Meyer Burger White		
Mission	MSExxxSX9Z where xxx can be 425 to 445w MSExxxHT0B where xxx can be 400w to 410w MSExxxSX9R where xxx can be 390w to 400w	Silfab	SIL-XXXQM SIL-XXXHM
NE Solar	NESE xxx-72THB-M10 where xxx can be 575w to 595w NESE xxx-72MHB-M10 where xxx can be 540 to 560w	Talesun	TM7G54M/xxxW (405 to 425w) TM7G54M-16BB (425 to 455w) TM7G60M (460-480w) TM7G72M (560-580w)
Panasonic	EVPVxxxHK2 where xxx can be 420w to 430w EVPVxxxPK where xxx can be 360w to 370w EVPVxxxHK where xxx can be 400-410w	Thornova	TS-BB54 (400-415W) Black TS-BBT54 (400-415w) Black TS-BB72 (545-565w) Black TS-BBT72 (580-600w) Black TS-BBT54 (485-505W)-G11 Black TS-BG60 (445-465w) TS-BG72 (545-565w) TS-BGT72 (580-600w) TS-BGT%\$ (485-505W)-G11
REC	RECxxxAA Pure Black RECxxxAA Pure RECxxxAA Pure 2 RECxxxAA Pure-R RECxxxAA Pure-RX RECxxxNP3 RECxxxNP3 Black REC Twin Peak 4 REC Twin Peak 4 Black	Trina	TSM-NE09RH.05 (420-455w) TSM-NEG19RC.20 (590-620w) TSM-NE09RC.05 (410-435w) TSM-NE19RC.05 (410-435w) TSM-NE19RC (595-620w)
Runergy/Hyperion	HY-DH144N8 (565-585) HY-DH108N8 425 to 440w HY-DH108N8B 425 to 440w HY-DH108P8 390 to 415w HY-DH108P8B 390 to 415w HY-DH144N8 570 to 590w HY-DH156N8 625 to 640w HY-DH108N8 390 to 410 w HY-DH108P8 (390-410)B	VSUN	VSUNxxxN-108BMH where xxx can be 390w to 405w VSUNxxxN-108BMH-DG where xxx can be 415w to 430w VSUNxxxH-132BMH where xxx can be 525w to 540w VSUNxxxN-132BMHR where xxx can be 610w to 625w VSUNxxxN-132BMHR-DG where xxx can be 605w to 625w VSUNxxxN-144BMH where xxx can be 560w 575w VSUNxxxN—144BMH where xxx can be 575 to 600 w VSUNxxxN-1444BMH-DG where xxx can be 535w to 550w
SEG	SEG-xxx-BMD-HV where xxx can be 400w to 415w SEG-xxx-BMD-BG where xxx can be 405 to 415w SEG-xxx-BTD-BG where xxx can be 420w to 435w	Znshine	ZXM7-UHLDD144 (565-595w) ZXM7-SHLDD144 (525-550w)
Serius PV	ELNSM54M-HC-BF-xxx where xxx can be 405w to 415w ELNSM54M-HC-xxxW where xxx can be 400w to 414w		

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Disclaimer

This manual describes proper installation procedures and provides necessary standards required for product reliability. Warranty details are available on our website. www.sunstackracking.com 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.

For more information, visit www.sunstackracking.com

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PRI ENGINEERING

Appendix B

Component Capacity



PRI ENGINEERING

Appendix B-1

Sunstack SSB1 Anchor Capacity

The factored capacity (compression, shear and tension) for SSB1 mount base in the following materials can be seen in **Table B-1**:

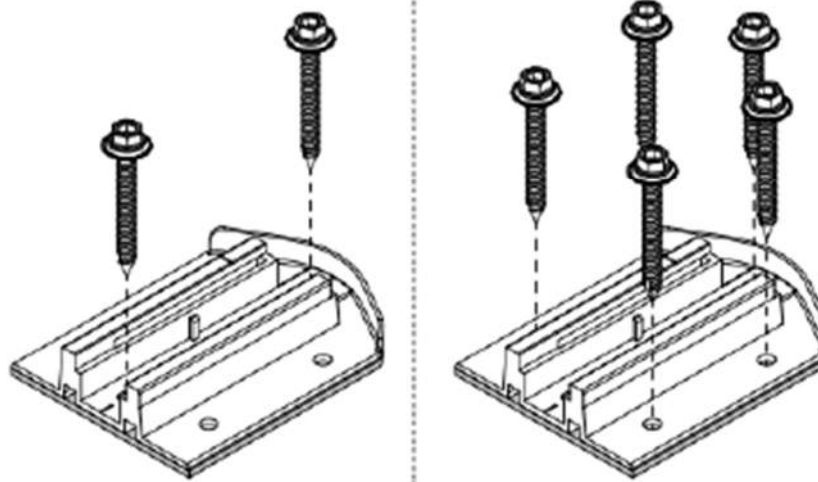
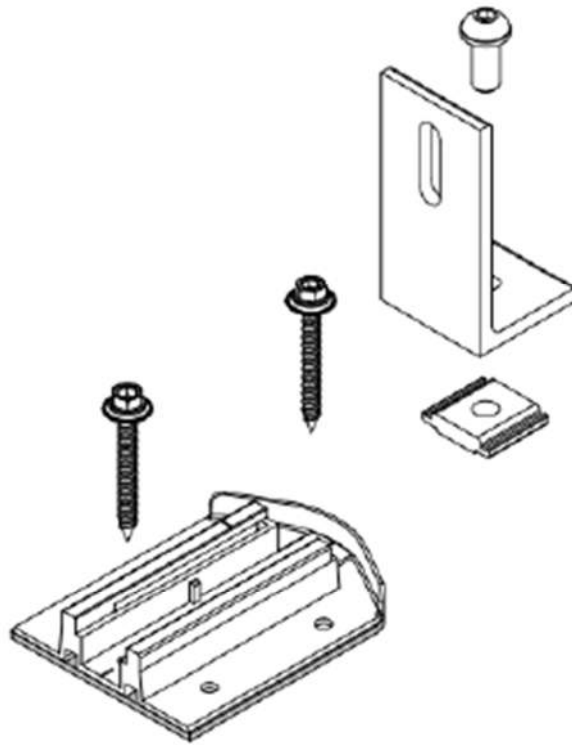
- 5/8" thick sheathing over a 2"x4" SPF #2 rafter, with a specific gravity of 0.42
- 5/8" thick plywood (only)
- 15/32" thick plywood (only)
- 7/16" thick OSB

Table B-1: Factored Capacity per Material

Material	Compression (Downward) (kN)	Tension (Uplift) (kN)	Shear (Lateral) (kN)
Rafter	-	2.66	5.18
5/8" Plywood	3.22	1.59	2.40
15/32" Plywood	2.42	1.19	2.67
7/16" OSB	1.69	0.95	1.82

The following should be considered for anchorage in wood rafter / roof truss top chords with a specific gravity G, of 0.42 or greater:

- The minimum size rafter/truss top chord is 2"x4".
- The listed specific gravity is per NDS Table 12.3.3A
- For Rafter installations the wood screw is intended to be anchored into a timber roof joist or truss with a minimum penetration of 28.58 mm (1.125 inches), with a minimum edge distance of $1.5D = 9 \text{ mm}$ (0.35 inches) which is approximately the middle 1/2 rafter/top chord width and minimum end distance of 63.5 mm (2.5 inches) laterally loaded parallel to grain downslope.
- Rafter compression loads are limited by the roof framing and shall be evaluated for each roof installation by a qualified professional and is outside the scope of this letter.



Sunstack SSB1 Mount Base (L-Foot by others) – Multi Views.



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Appendix B-2

**Sunstack Integrity Rail Supported by SSB1
Capacity**

The factored capacity (compression, shear and tension) for Sunstack Integrity Rack on SSB1 Mount System on the following materials can be seen in **Table B-2**:

- 5/8" thick sheathing over a 2"x4" SPF #2 rafter, with a specific gravity of 0.42
- 5/8" thick plywood (only)
- 15/32" thick plywood (only)
- 7/16" thick OSB

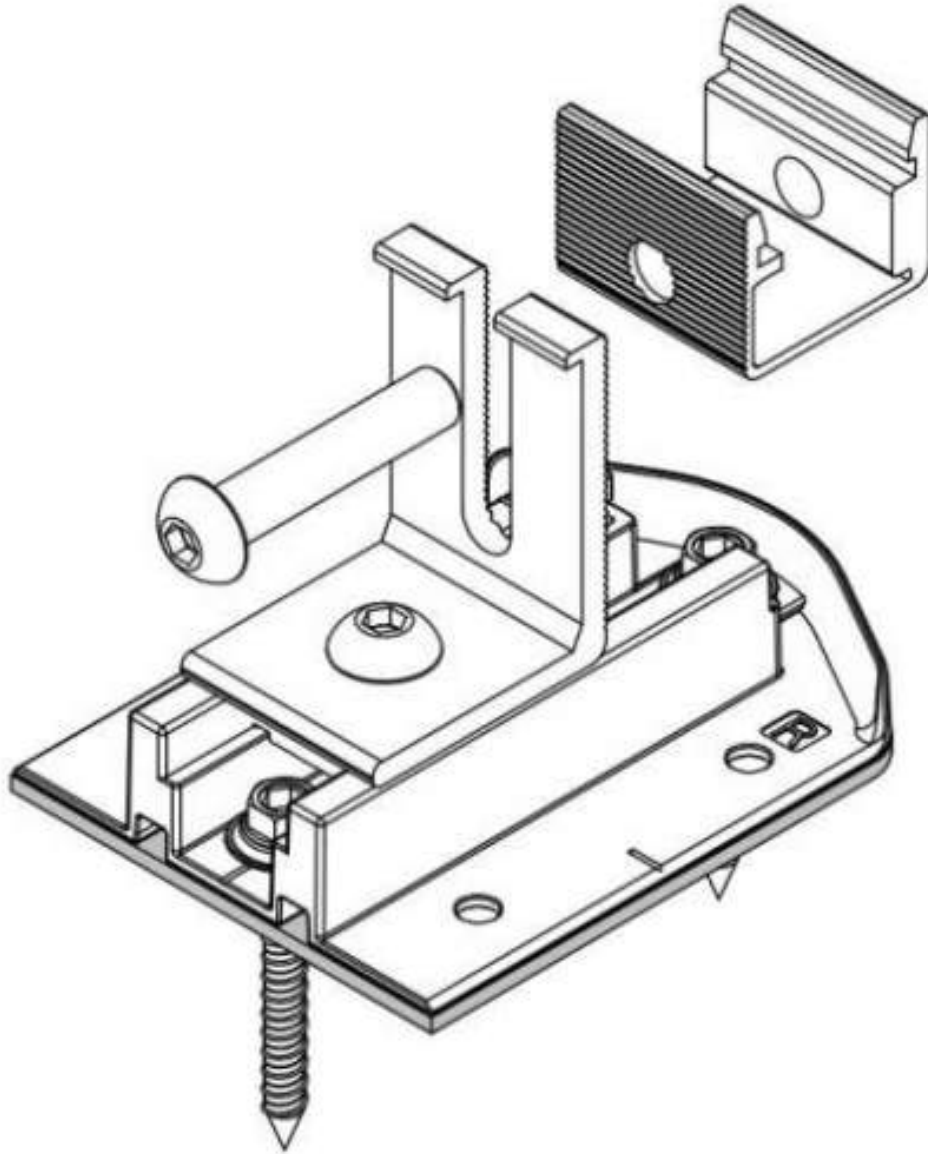
Table B-2: Factored Capacity per Material

Material	Compression (Downward) (kN)	Tension (Uplift) (kN)	Shear (Lateral) (kN)
Rafter	6.41	1.86	1.05
5/8" Plywood	3.22	1.59	1.05
15/32" Plywood	2.42	1.19	1.05
7/16" OSB	1.69	0.95	0.86

The above values include considerations for the Universal Clamp and Rail Adapter to rail, bolt to Integrity L-Foot, and Integrity L-Foot factored capacities based on IBT test results using the average values multiplied by the resistance factor determined by the ADM Appendix 1 Testing Methods or the lowest tested value multiplied by the ADM resistance factor for rupture or yielding depending on the applicable failure mode.

The following should be considered for anchorage in wood rafter / roof truss top chords with a specific gravity G, of 0.42 or greater:

- The minimum size rafter/truss top chord is 2"x4".
- The listed specific gravity is per NDS Table 12.3.3A
- For Rafter installations the wood screw is intended to be anchored into a timber roof joist or truss with a minimum penetration of 28.58 mm (1.125 inches), with a minimum edge distance of $1.5D = 9 \text{ mm}$ (0.35 inches) which is approximately the middle 1/2 rafter/top chord width and minimum end distance of 63.5 mm (2.5 inches) laterally loaded parallel to grain downslope.
- Rafter compression loads are limited by the roof framing and shall be evaluated for each roof installation by a qualified professional and is outside the scope of this letter.



Sunstack SSB1 Mount System



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Appendix B-3

**Sunstack Integrity Rail Supported by SSM
Capacity**

The factored capacity (compression, shear and tension) for Sunstack Integrity Rack on SSM Mount System on the following materials can be seen in **Table B-3**:

- 15/32" thick sheathing over a 2"x4" SPF #2 rafter, with a specific gravity of 0.42
- 15/32" thick plywood (only)
- 7/16" thick OSB

Table B-3: Factored Capacity per Material

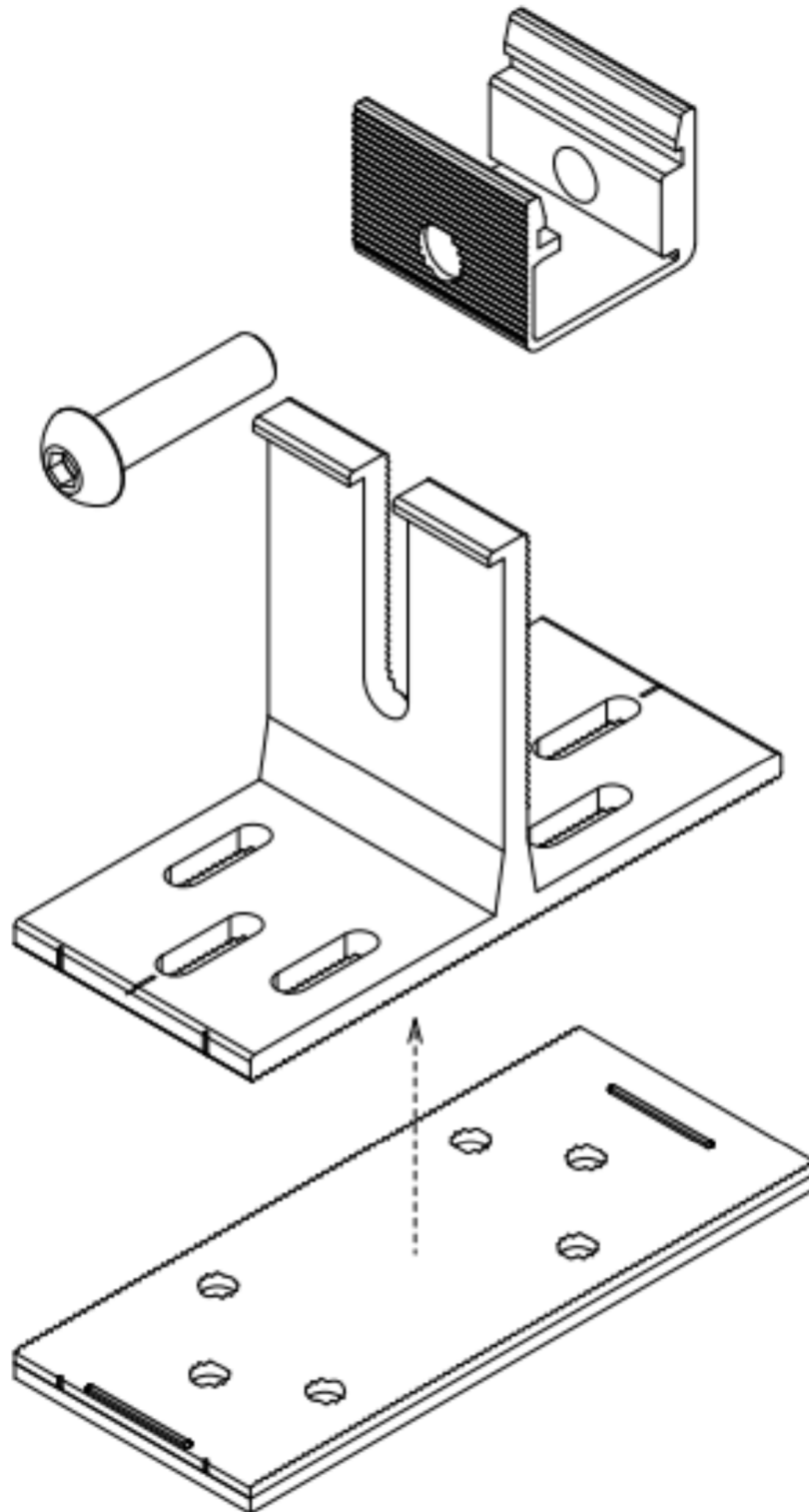
Material	Compression (Downward) (kN)	Tension (Uplift) (kN)	Shear (Lateral) (kN)
Rafter	7.91	2.52	1.55
15/32" Plywood	2.79	1.66	1.56
7/16" OSB	2.17	1.36	1.55

The above values include considerations for the Universal Clamp and Rail Adapter to rail, and bolt to SSM Mount factored capacities based on IBT test results using the average values multiplied by the resistance factor determined by the ADM Appendix 1 Testing Methods or the lowest tested value multiplied by the ADM resistance factor for rupture or yielding depending on the applicable failure mode.

The following should be considered for anchorage in wood rafter / roof truss top chords with a specific gravity G, of 0.42 or greater:

- The minimum size rafter/truss top chord is 2"x4".
- The listed specific gravity is per NDS Table 12.3.3A
- For Rafter installations the wood screw is intended to be anchored into a timber roof joist or truss with a minimum penetration of 28.58 mm (1.125 inches), with a minimum edge distance of $1.5D = 9 \text{ mm}$ (0.35 inches) which is approximately the middle 1/2 rafter/top chord width and minimum end distance of 63.5 mm (2.5 inches) laterally loaded parallel to grain downslope.

Rafter compression loads are limited by the roof framing and shall be evaluated for each roof installation by a qualified professional and is outside the scope of this letter.



Sunstack SSM Mount System



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Appendix C

Reference Figures as Per NBCC, 2020

4.1.6.16.**Division B****4.1.6.16. Roofs with Solar Panels**

(See Note A-4.1.6.16.)

1) Where solar panels are installed on a roof, the snow loads, S , shall be determined in accordance with Sentences (2) to (6) or with the requirements for roofs without solar panels, whichever produces the most critical effect.

2) For the purposes of this Article, solar panels shall be classified as

- a) Parallel Flush, where the panels are installed parallel to the roof surface with their upper surface less than or equal to $C_b C_w S_s / \gamma$ above the roof surface,
- b) Parallel Raised, where the panels are installed parallel to the roof surface with their upper surface greater than $C_b C_w S_s / \gamma$ above the roof surface, or
- c) Tilted, where the panels are installed at an angle to the roof surface with their highest edge greater than $C_b C_w S_s / \gamma$ above the roof surface.

3) For sloped roofs with solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that the slope factor, C_s , shall be

- a) taken as 1.0 for roof areas extending upslope from the downslope edge of a panel or array of panels at an angle of 45° from each side edge of the panel or array, and
- b) as specified in Sentences 4.1.6.2.(5) to (7) for all other roof areas.

(See Note A-4.1.6.16.(3).)

4) For sloped roofs with Parallel Flush solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that

- a) C_s shall be determined in accordance with Sentence (3),
- b) where the gap width, w_g , between the panels along the roof slope is greater than or equal to the panel width, w_p , along the roof slope, the accumulation factor, C_a , shall be taken as
 - i) 0.0 for the panels,
 - ii) 2.0 for roof areas within a distance of w_p downslope from a downslope panel edge, and
 - iii) 1.0 for all other roof areas
 (see Note A-4.1.6.16.(4)(b)), and
- c) where the gap width, w_g , between the panels along the roof slope is less than the panel width, w_p , along the roof slope, C_a shall be taken as
 - i) 0.0 for panel areas within a distance of w_g downslope from an upslope panel edge,
 - ii) 1.0 for other panel areas,
 - iii) 2.0 for roof areas in gaps between the panels, and
 - iv) 1.0 for all other roof areas
 (see Note A-4.1.6.16.(4)(c)).

5) For roofs with Parallel Raised solar panels, the snow loads, S , shall be determined in accordance with the requirements for roofs without solar panels, except that

- a) where the roof is flat, C_a shall be taken as
 - i) 1.0 for the panels,
 - ii) 1.0 for roof areas not under the panels,
 - iii) 1.0 for roof areas under the panels within a distance of $\min(2h_g, 2w_g)$ from a panel edge, where h_g is the gap height between the lower surface of the panels and the roof surface, and w_g is the gap width between the panels, and
 - iv) 0.0 for other roof areas under the panels
 (see Note A-4.1.6.16.(5)(a)), and
- b) where the roof is sloped, the snow loads, S , derived from Clause (a) shall be used, except that
 - i) C_s shall be determined in accordance with Sentence (3),

A-4.1.6.16.

Division B

A-4.1.6.16. Roofs with Solar Panels. Information on the design of roofs with solar panels can be found in the Commentary entitled Snow Loads in the “Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).”

A-4.1.6.16.(3) Snow Obstructed from Sliding by Solar Panels. Figure A-4.1.6.16.(3) shows the areas on sloped roofs with solar panels where snow is considered to be obstructed from sliding by the solar panels and the slope factor, C_s , must be taken as 1.0.

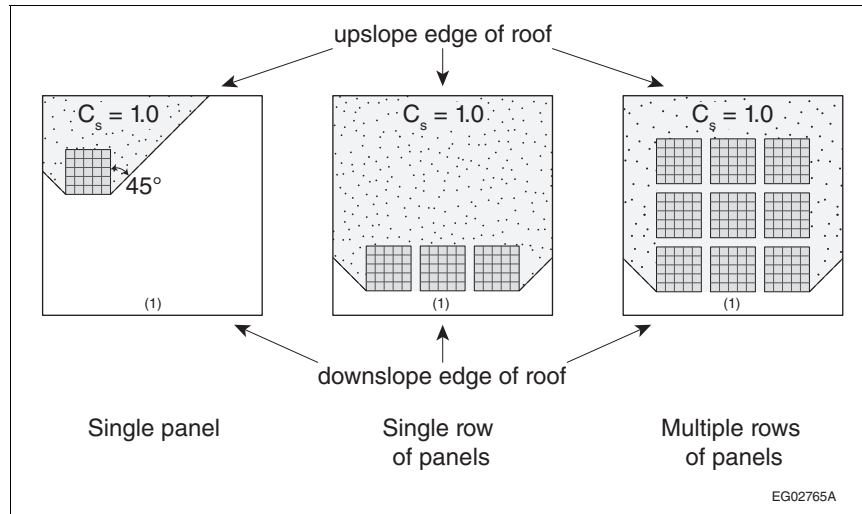


Figure A-4.1.6.16.(3)

Areas on sloped roofs with solar panels where snow is obstructed from sliding by the solar panels

Note to Figure A-4.1.6.16.(3):

(1) C_s = as specified in Sentences 4.1.6.2.(5) to (7)

A-4.1.6.16.(4)(b) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g \geq w_p$. Figure A-4.1.6.16.(4)(b) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g , between the panels is greater than or equal to the panel width, w_p .

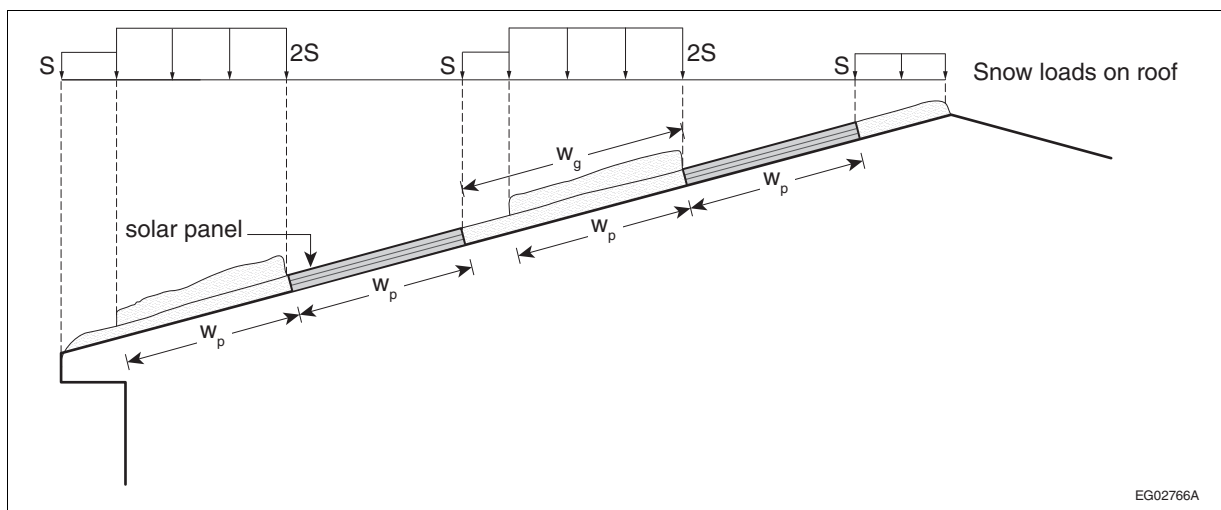


Figure A-4.1.6.16.(4)(b)

Snow loads for a sloped roof with Parallel Flush solar panels where $w_g \geq w_p$

A-4.1.6.16.(4)(c) Snow Loads for a Sloped Roof with Parallel Flush Solar Panels Where $w_g < w_p$. Figure A-4.1.6.16.(4)(c) shows the snow loads for a sloped roof with Parallel Flush solar panels where the gap width, w_g , between the panels is less than the panel width, w_p .

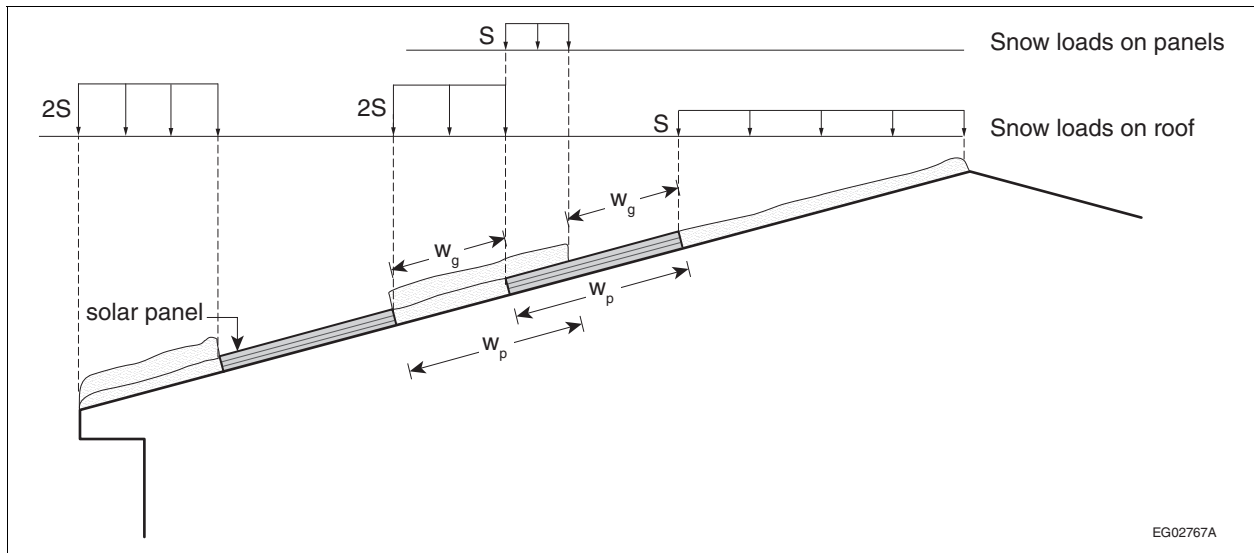


Figure A-4.1.6.16.(4)(c)

Snow loads for a sloped roof with Parallel Flush solar panels where $w_g < w_p$

A-4.1.6.16.(5)(a) Snow Loads for a Flat Roof with Parallel Raised Solar Panels. Figure A-4.1.6.16.(5)(a) shows the snow loads for a flat roof with Parallel Raised solar panels.

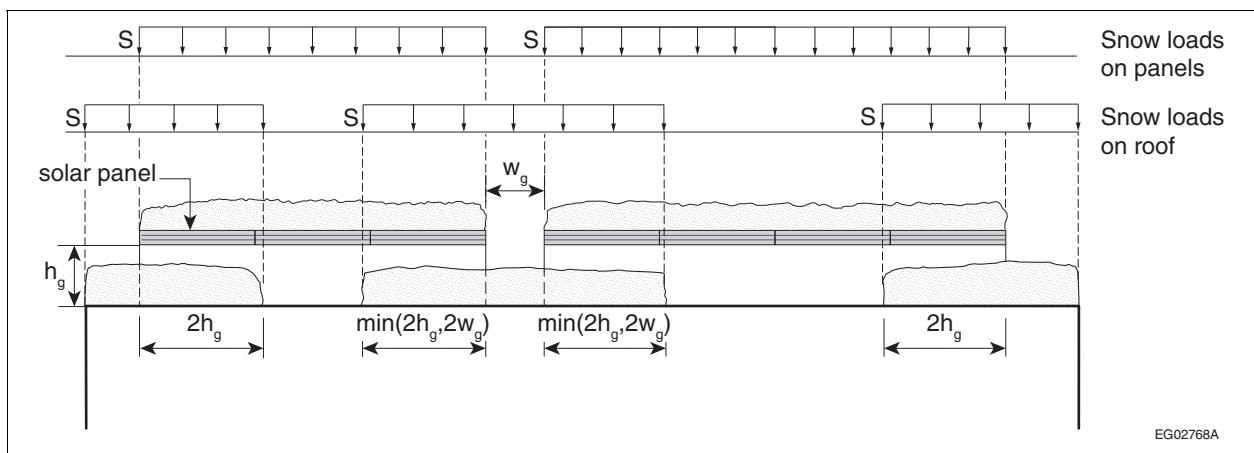


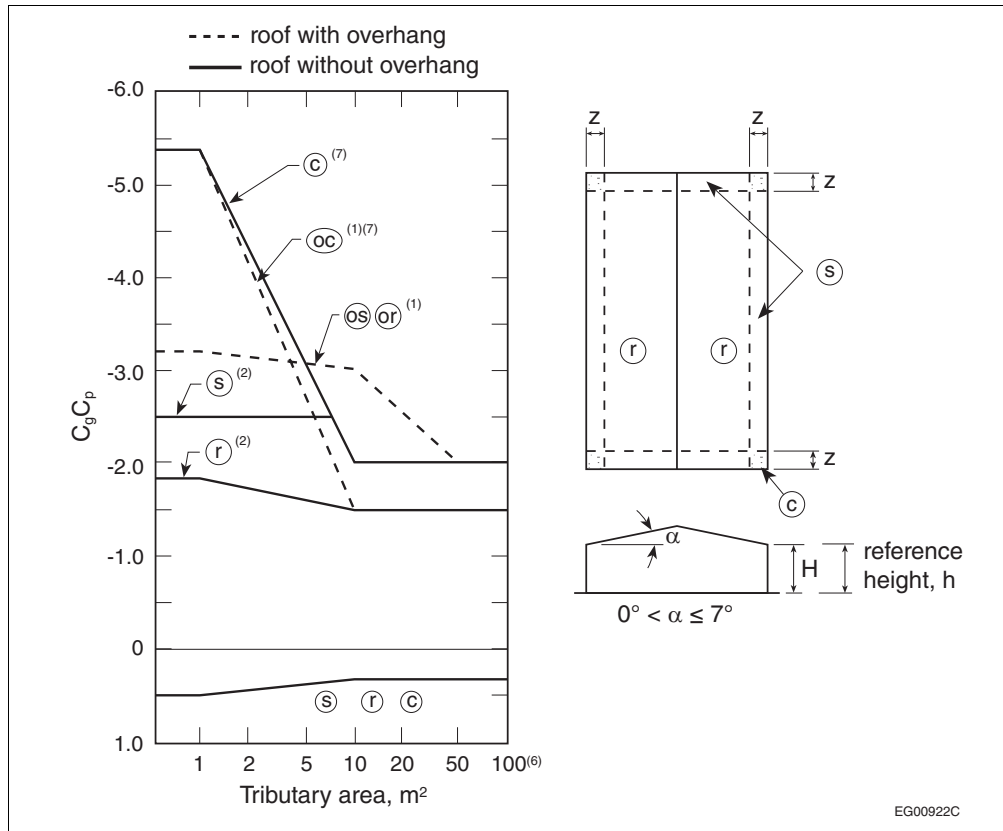
Figure A-4.1.6.16.(5)(a)

Snow loads for a flat roof with Parallel Raised solar panels

4.1.7.6.

Division B

Figure 4.1.7.6.-C
External peak values of $C_g C_p$ on roofs with a slope of 7° or less for the design of structural components and cladding
 Forming Part of Sentences 4.1.7.6.(4), (7), (8) and (9)



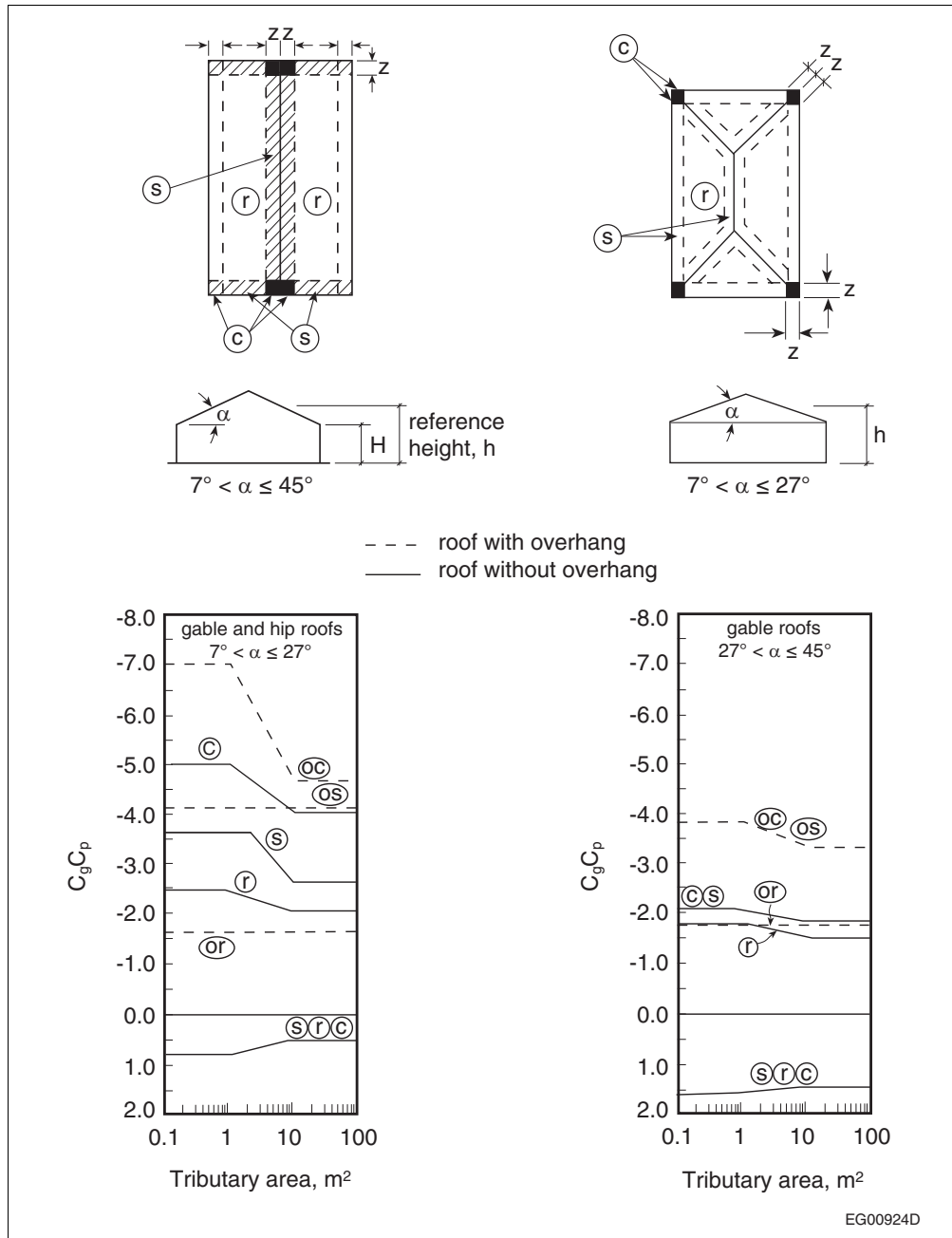
Notes to Figure 4.1.7.6.-C:

- (1) Coefficients for overhung roofs have the prefix "o" and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces. In the case of overhangs, the walls are inboard of the roof outline.
- (2) s and r apply to both roofs and upper surfaces of canopies.
- (3) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H , but not less than 4% of the least horizontal dimension or 1 m.
- (4) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
- (5) Positive coefficients denote forces toward the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
- (6) For calculating the uplift forces on tributary areas larger than $100 m^2$ on unobstructed nearly-flat roofs with low parapets, and where the centre of the tributary area is at least twice the height of the building from the nearest edge, the value of $C_g C_p$ may be reduced from -1.5 to -1.1 at $x/H = 2$ and further reduced linearly to -0.6 at $x/H = 5$, where x is the distance to the nearest edge and H is the height of the building.
- (7) For roofs having a perimeter parapet with a height of 1 m or greater, the corner coefficients $C_g C_p$ for tributary areas less than $1 m^2$ can be reduced from -5.4 to -4.4 .

4.1.7.6.

Division B

Figure 4.1.7.6.-E
External peak values of $C_g C_p$ on single-span gabled and hipped roofs with a slope greater than 7°
for the design of structural components and cladding
 Forming Part of Sentence 4.1.7.6.(6)



Notes to Figure 4.1.7.6.-E:

- (1) Coefficients for overhung roofs have the prefix "o" and refer to the same roof areas as referred to by the corresponding symbol without a prefix. They include contributions from both upper and lower surfaces.
- (2) End-zone width z is the lesser of 10% of the least horizontal dimension and 40% of height, H , but not less than 4% of the least horizontal dimension or 1 m.
- (3) Combinations of external and internal pressures must be evaluated to obtain the most severe loading.
- (4) Positive coefficients denote forces towards the surface, whereas negative coefficients denote forces away from the surface. Each structural element must be designed to withstand forces of both signs.
- (5) For hipped roofs with $7^\circ < \alpha \leq 27^\circ$, edge/ridge strips and pressure-gust coefficients for ridges of gabled roofs apply along each hip.



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Appendix D

Reference Calculations

1 Snow Load Reference Calculations

The maximum spacing (in meters) of the SSB1 Roof Mount System, Integrity Rail Supported by SSB1 Roof Mount System, and Integrity Rail Supported by SSM Roof Mount System are provided in the tables attached as **Appendix E to Appendix G**. To use these tables, the following Snow Load equation can be used to calculate the specified snow load in accordance with Sections 4.1.6.2 and 4.1.6.16 of the National Building Code of Canada (2020).

$$S = I_s[S_s(C_b C_w C_s C_a) + S_r] \times \cos \theta$$

Where:

S = Snow Load, in kPa

I_s = Importance factor of the building for snow load, as provided in the building code, (0.8 for low, 1.0 for normal, 1.15 for high, and 1.25 for post-disaster buildings).

S_s = 1-in-50-year ground snow load, in kPa, determined in accordance with Subsection 1.1.3. (Table C-2) of the NBCC

C_b = Basic roof snow load factor calculated in Section 4.1.6.2 (2), (0.8 typical for most buildings);

C_w = Wind exposure factor calculated in Sections 4.1.6.2 (3) and (4), (1.0 is conservative for all buildings)

C_s = Slope factor in Section 4.1.6.2 (5) to (7)

For roofs less than 15 degrees – $C_s = 1.0$

For roofs between 15 and 60 degrees – $C_s = (60 - \theta) / 45$

For roofs over 60 degrees – $C_s = 0$

C_a = Accumulation factor in Section 4.1.6.2 (8) taken as 1, assuming snow is retained on the modules by means of roof obstructions, roof retaining devices or other snow retaining considerations. For sloped roofs that allow snow shedding from the modules, C_a can be considered 0 in accordance with Section 4.1.6.16 (4), attached in **Appendix C** for reference.

S_r = 1-in-50-year associated rain load, in kPa, determined in accordance with Subsection 1.1.3. (Table C-2), but not greater than $S_s(C_b C_w C_s C_a)$.

θ = Angle of roof, in degrees

If the calculated specified snow load exceeds 4.0 kPa, or the calculated value aligns with a spacing value noted as a dashed line, please contact Sunstack to determine the appropriate spacing.

2 Wind Load Reference Calculations

The maximum spacing (in meters) of the SSB1 Roof Mount System, Integrity Rail Supported by SSB1 Roof Mount System, and Integrity Rail Supported by SSM Roof Mount System are provided in the tables attached as **Appendix E to Appendix G**. To use these tables, the following Wind Load equation and assumptions were made in respect to the wind loading, which must be true for the provided tables to be valid. The maximum spacing must be adjusted for conditions outside what is noted below. Please contact Sunstack to determine the appropriate spacing.

$$p = I_w q_{1/50} C_e C_t C_g C_p E \gamma$$

Where:

p = Wind Load, in kPa

I_w = Importance factor for wind load, as provided in Table 4.1.7.3 of the NBCC. A value of 1.0 for the importance of normal buildings was considered for the tables. For buildings with importance factors other than this normal importance factor, multiply the obtained $q_{1/50}$ by the corresponding importance factor (0.8 for low, 1.15 for high, and 1.25 for post-disaster buildings) and use that adjusted value in the span tables.

$q_{1/50}$ = 1-in-50-year reference velocity pressure, in kPa, determined in accordance with Subsection 1.1.3. (Table C-2) of the NBCC

C_e = Exposure factor, as provided in Section 4.1.7.3 (5) and (7) – Tables note Open and Rough terrain categories

C_t = Wind exposure factor calculated in 4.1.6.2 (3) and (4), (1.0 for buildings on flat ground)
 $C_p C_g$ = gust effect factor, as provided in Section 4.1.7.3 (8), and external pressure coefficient, as provided in Articles 4.1.7.5. and 4.1.7.6. Applicable for Gable and Hip roofs with overhangs (eaves). Monoslope, sawtooth or multi-span gables roofs maximum spans are not included in the Tables. Please contact Sunstack for assistance.

E = Edge factor, as provided in 4.1.7.13 (4), applicable to setbacks less than half of the building height from the edge of the roof. The tables consider spacing with an edge factor of 1.0. Where the setback from the edge of the roof to the solar array exceeds half the building height or if there are gaps in the array greater than 1.2 m in the same row of panels, multiply the wind load ($q_{1/50}$) by a factor of 1.5 and use that adjusted value in the span tables.

γ = Pressure equalization factor, as provided in 4.1.7.13 (3).

Corner and side zones (r, s, c) are noted in the tables, as per Figures 4.1.7.6.-C and 4.1.7.6.-E, attached as **Appendix C**.



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Appendix E

Sunstack SSB1 Mounting System



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Appendix E-1

Maximum Allowable Spacing for Anchorage in
Wood Rafter

SSB1 - Rafter, Maximum Mean Height of 6 m, Gable Roof — Portrait — Up Slope Panel Width = 2 m (78 inches)																														
Snow Load (kPa)	Exposure Factor	Velocity																												
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	
0 to 4	Open	0 to 4.8 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.30	1.22	0.61	0.30	0.91	0.61	0.30	
	Rough	Flat to 1:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	1.22	0.61		
	Open	>4.8 to 14.0 /	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.61	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	
	Rough	>1:12 to 3:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	1.22	0.91	0.61
	Open	>14.0 to 26.6 /	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.61	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	
	Rough	>3:12 to 6:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	1.22	0.91	0.61
	Open	>26.6 to 36.9 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.61	0.61	
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	
	Open	36.9 to 45.0 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.61	0.61	
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	

SSB1 - Rafter, Maximum Mean Height of 10 m, Gable Roof — Portrait — Up Slope Panel Width = 2 m (78 inches)																													
Snow Load (kPa)	Exposure Factor	Velocity																											
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c
0 to 4	Open	0 to 4.8 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	1.22	0.61	0.30	0.91	0.61	0.30	0.91	0.61	0.30
	Rough	Flat to 1:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	
	Open	>4.8 to 14.0 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30
	Rough	>1:12 to 3:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30
	Open	>14.0 to 26.6 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30
	Rough	>3:12 to 6:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30
	Open	>26.6 to 36.9 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.91	0.61	0.61	0.91	0.61
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Open	36.9 to 45.0 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.91	0.61	0.61	0.91
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22

SSB1 - Rafter, Maximum Mean Height of 6 m, Hip Roof – Portrait – Up Slope Panel Width = 2 m (78 inches)																													
Snow Load (kPa)	Exposure Factor	Velocity Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c
0 to 4	Open	0 to 4.8 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Rough	Flat to 1:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Open	>4.8 to 14.0 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.61	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30
	Rough	>1:12 to 3:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	1.22	0.91	0.61
	Open	>14.0 to 26.6 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.61	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30
	Rough	>3:12 to 6:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	1.22	0.91	0.61
	Open	>26.6 to 36.9 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.61	0.61
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Open	36.9 to 45.0 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.61	0.61
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22

SSB1 - Rafter, Maximum Mean Height of 10 m, Hip Roof — Portrait — Up Slope Panel Width = 2 m (78 inches)																												
Snow Load (kPa)	Exposure Factor	Velocity																										
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s
0 to 4	Open	0 to 4.8 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Rough	Flat to 1:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Open	>4.8 to 14.0 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30
	Rough	>1:12 to 3:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.91	0.61	0.30	0.91
	Open	>14.0 to 26.6 /	1.22	1.22	1.22	1.22	1.22	0.91	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30
	Rough	>3:12 to 6:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.91	0.61	0.91	0.61	0.91	0.61	0.30	0.91
	Open	>26.6 to 36.9 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.91	0.61	0.61
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22
	Open	36.9 to 45.0 /	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.91	0.61	0.61
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22



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Appendix E-2

**Maximum Allowable Spacing for Anchorage in
5/8" Plywood**



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Appendix E-3

Maximum Allowable Spacing for Anchorage in
15/32" Plywood



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Appendix E-4

Maximum Allowable Spacing for Anchorage in
7/16" OSB



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Appendix F

Sunstack Integrity Rail Supported by SSB1
Mounting System



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Appendix F-1

Maximum Allowable Spacing for Anchorage in
Wood Rafter



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Appendix F-2

Maximum Allowable Spacing for Anchorage in
5/8" Plywood



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Appendix F-3

Maximum Allowable Spacing for Anchorage in
15/32" Plywood



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Appendix F-4

Maximum Allowable Spacing for Anchorage in
7/16" OSB

Integrity Rail Supported by SSB1 - 7/16" OSB, Maximum Mean Height of 6 m, Gable Roof – Portrait – Up Slope Panel Width = 2 m (78 inches)																														
Snow Load (kPa)	Exposure Factor	Velocity																												
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	
0 to 0.6	Open	0 to 4.8 /	1.22	0.91	0.61	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
	Rough	Flat to 1:12	1.22	1.22	0.91	1.22	1.22	0.61	1.22	0.91	0.61	1.22	0.61	0.30	0.91	0.61	0.30	0.91	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.61	0.30	0.30	
	Open	>4.8 to 14.0 /	0.91	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	0.30	-	-	-	-	
	Rough	>1:12 to 3:12	1.22	1.22	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.61	0.30	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
	Open	>14.0 to 26.6 /	0.91	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.61	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	-	0.30	0.30	
	Rough	>3:12 to 6:12	1.22	1.22	0.61	1.22	0.91	0.61	0.91	0.61	0.30	0.30	0.61	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30
	Open	>26.6 to 36.9 /	1.22	1.22	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.61	0.30	0.30
	Open	36.9 to 45.0 /	1.22	1.22	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.30	0.30	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.61	0.30

[illegible][illegible]

Integrity Rail Supported by SSB1 - 7/16" OSB, Maximum Mean Height of 10 m, Gable Roof — Portrait — Up Slope Panel Width = 2 m (78 inches)																													
Snow Load (kPa)	Exposure Factor	Velocity																											
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c
0 to 0.6	Open	0 to 4.8 /	1.22	0.91	0.30	0.91	0.61	0.30	0.61	0.30	0.30	0.61	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-
	Rough	Flat to 1:12	1.22	1.22	0.91	1.22	0.91	0.61	1.22	0.61	0.30	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	-	0.61	0.30	-	0.30	0.30	-
	Open	>4.8 to 14.0 /	0.91	0.61	0.30	0.61	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	0.30	-	-	-	-	-	-	-	-
	Rough	>1:12 to 3:12	1.22	0.91	0.61	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	-
	Open	>14.0 to 26.6 /	0.91	0.61	0.30	0.61	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	0.30	-	-	-	-	-	-	-	-
	Rough	>3:12 to 6:12	1.22	0.91	0.61	0.91	0.61	0.30	0.61	0.61	0.30	0.61	0.30	0.30	0.61	0.30	0.30	0.61	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	-	-
	Open	>26.6 to 36.9 /	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-
	Rough	>6:12 to 9:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.30	0.30	0.30	0.30
	Open	36.9 to 45.0 /	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-
	Rough	>9:12 to 12:12	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.91	0.91	0.91	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.30	0.30	0.30	0.30	0.30	0.30

Snow Load (kPa)	Exposure Factor	Velocity																													
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1		
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c		
0.6 to 3	Open	0 to 4.8 /	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-		
	Rough	Flat to 1:12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-
	Open	>4.8 to 14.0 /	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	0.30	-	-	-	-	-	-	-	-	-
	Rough	>1:12 to 3:12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	-	-	
	Open	>14.0 to 26.6 /	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	-	-	0.30	-	-	0.30	-	-	-	-	-	-	-	-	-
	Rough	>3:12 to 6:12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	0.30	-	0.30	-	-	
	Open	>26.6 to 36.9 /	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-	
	Rough	>6:12 to 9:12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Open	36.9 to 45.0 /	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-	
Rough	>9:12 to 12:12	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	

Snow Load (kPa)	Exposure Factor	Velocity																											
		Pressure q 1/50 (kPa)	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
		Roof Angle	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c	r	s	c
3 to 4	Open	0 to 4.8 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Rough	Flat to 1:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Open	>4.8 to 14.0 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Rough	>1:12 to 3:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Open	>14.0 to 26.6 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Rough	>3:12 to 6:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Open	>26.6 to 36.9 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Rough	>6:12 to 9:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Open	36.9 to 45.0 /	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Rough	>9:12 to 12:12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	



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Appendix G

Sunstack Integrity Rail Supported by SSM
Mounting System



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Appendix G-1

Maximum Allowable Spacing for Anchorage in
Wood Rafter



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Appendix G-2

Maximum Allowable Spacing for Anchorage in
15/32" Plywood



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Appendix G-3

Maximum Allowable Spacing for Anchorage in
7/16" OSB

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