



The Right Way™ to attach almost anything to metal roofs!

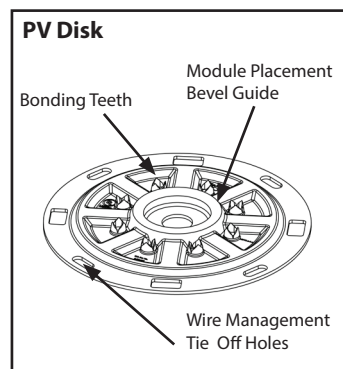
Installation Instructions

S-5!® Warning! Please use these products responsibly! Visit our website or contact your S-5! distributor for available load test results. The user and/or the installer of these parts is responsible for all necessary engineering and design for the intended use of these parts in an assembly or application. Note that a continuous ground must be followed in accordance with National Electric Code (NEC), ANSI/NFPA 70. Installation in Canada must be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1. For UL 2703 Listed assemblies (UL Listed) use with PV Modules having a maximum fuse rating of 25A or less. Prior to installation, contact the local code Authority Having Jurisdiction (AHJ) to determine the proper grounding requirements. Visit www.S-5.com for more details.

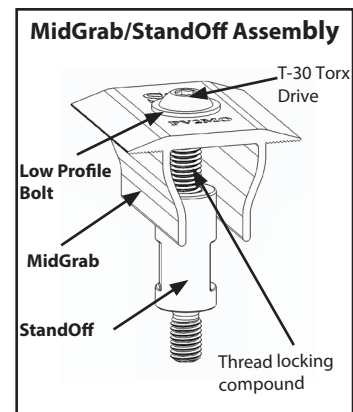
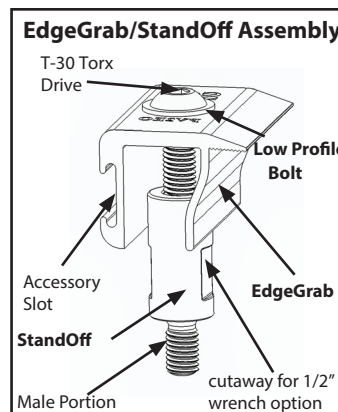
Exercise care when threading the Male Portion of the StandOff into the clamp to avoid cross-threading.

Tools Needed

- Screw Gun
- T-30 Torx Bit Tip (provided)
- Calibrated Dial Torque Wrench

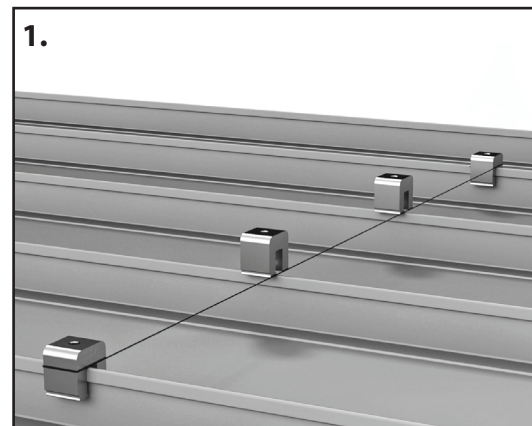


Parts



To install PV Kit 2.0 On Standing Seam

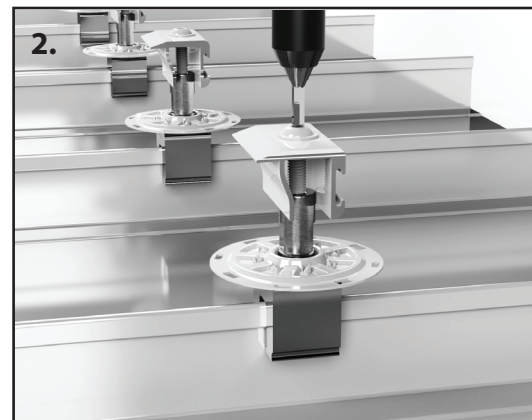
1. Install the first row of S-5! clamps, at the edge of the array: It is critical that this row is straight. Install a clamp at both ends of the row, by measuring from a reference point such as the eave of the roof. Tighten the setscrews with Screw Gun and the included Bit Tip. The setscrews will dimple the seam material but will not penetrate it. When relying on published load values, setscrew tension should be verified periodically using a calibrated torque wrench to ensure the tool is consistently achieving the proper torque range (**see Setscrew Torque Table below**). Please see installation instructions provided with clamps for specifics. Stretch a string line between the two end clamps to provide a true line to mount the remaining edge clamps (**Fig. 1**).



Specified Torque	Inch Pounds	Foot Pounds	Nm
22ga steel	160–180	13–15	18–20
All other metals and thinner gauges of steel	130–150	11–12.5	15–17

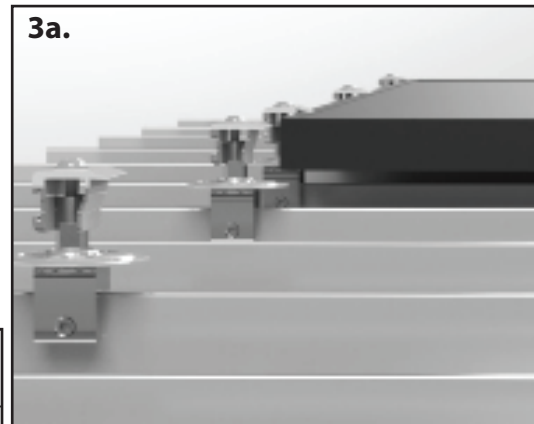
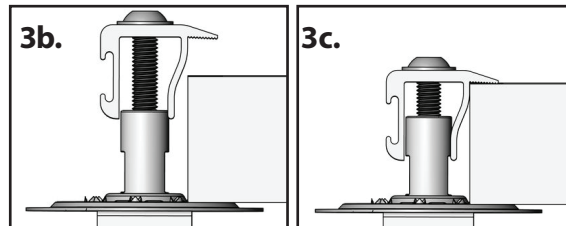
S-5! Clamp Setscrew Torque Table (torque varies depending on roof material)

2. Mount the PV Disks and the EdgeGrab/StandOff Assembly to the first row of clamps: place the PV Disk atop the clamp and thread the Male Portion of the StandOff through the disk and into the clamp. Drive the EdgeGrab/StandOff Assembly down with provided Bit Tip (**Fig. 2**) until the base of the StandOff seats the disk in place and breaks the thread locking seal between the StandOff and Low Profile Bolt. Leave the grab up, to allow space for a module frame. A 1/2" open end wrench can be used to further tighten the StandOff atop the disk if desired.

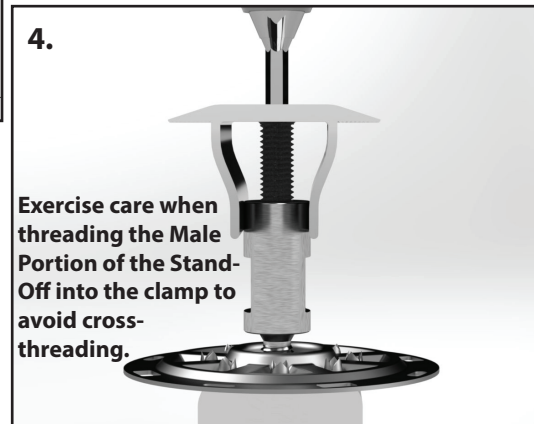


3. Install the first row of modules (Fig 3a): Place first module in the grabs pushing on the frame to seat the module against the EdgeGrabs and Module Placement Bevel Guide (**Fig 3b**). Drive the Low Profile Bolt with the provided bit to tighten the grabs (**Fig 3c**). Low Profile Bolt and Standoff should be **torqued to 120-130 in lbs (13.6-14.7 Nm)**. Check torque periodically during install to ensure the tool is achieving torque.

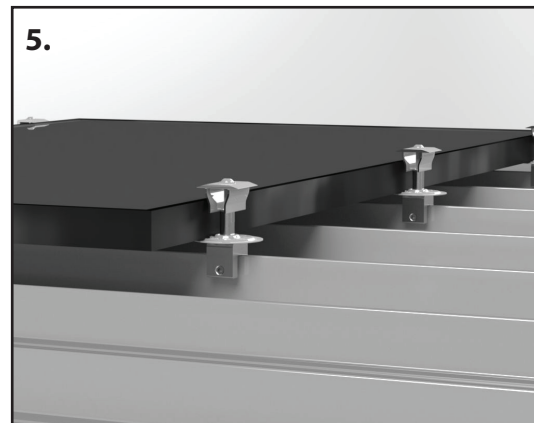
PV Kit 2.0 fits module frame thicknesses from 30 mm-46 mm.



4. Install MidGrab/StandOff Assembly & PV Disk on Clamps: the PV Disk and MidGrab/StandOff Assembly should be mounted to the clamps **before mounting the clamps to the roof**. Place the PV Disk atop the clamp and thread the male portion of the StandOff through the disk and into the clamp. Drive the MidGrab/StandOff Assembly down with the provided bit tip (**Fig 4**) in similar fashion to Step 2. Note: When using the S-5-H90 or S-5-K Grip style clamps, the clamp must be secured to the roof prior to fixing the S-5-PV Kit 2.0 EdgeGrab or MidGrab assembly to clamps. See: **Tips for Mounting with CorruBrackets, S-5-H90, or S-5 K Grip Style Clamps** at end of installation instructions.



5. Place MidGrab/StandOff/Disk & Clamp Assemblies: using the PV module as a guide, place the throat of the clamp over the seam and slide the assembly into place so that the edge of the module is seated against the wall of the MidGrab and the Module Placement Bevel Guide, similar to (**Fig 3b**). Tighten the setscrew(s) of the clamp as described in **step 1**. The grabs should be left in the partially open position to accommodate the next row of modules before final tightening.



6. Install Additional PV Modules-repeating steps 3-5: place another module in the MidGrabs that were left open in the previous step. Tighten the downslope row of grabs each time a module is placed and leave the upslope open until the next module is placed (**Fig. 6**). The final row will be finished with EdgeGrab/StandOff Assemblies. Periodically look back at the modules you've installed to double check that the MidGrabs were tightened.



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The right way to attach almost anything to metal roofs!

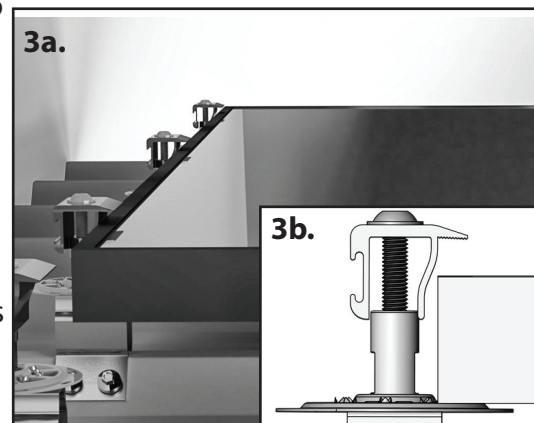
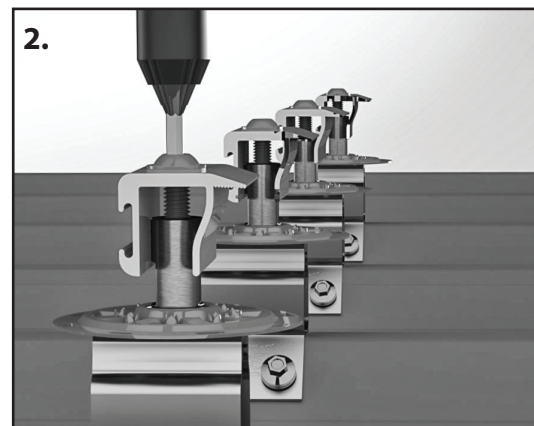
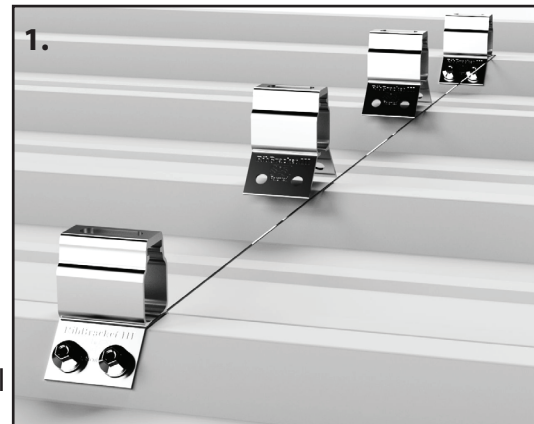
To install PV Kit 2.0 On Exposed Fastener

1. Install the first row of S-5! brackets, at the edge of the array: It is critical that this row is straight. Install a bracket at both ends of the row, by measuring from a reference point such as the eave of the roof. Stretch a string line between the brackets to provide a true line to mount the remaining edge brackets (**Fig. 1**). Secure the RibBracket directly into the crown of the roof profile by driving the included fasteners into the pre-punched holes. To achieve tested holding strength, secure the RibBracket by using all pre-punched hole locations. Drive the fastener in until it is tight and the washer is firmly seated. Be careful not to over-drive fasteners. A slight extrusion of rubber around the washer is a good visual-tightness check. Please see S-5! bracket installation instructions for specific install information.

2. Mount the PV Disks and the EdgeGrab/StandOff Assembly to the first row of brackets: place the PV Disk atop the brackets and thread the male portion of the StandOff through the disk and into the M8 nut inserted in the bracket (nut provided with brackets). Drive the EdgeGrab/StandOff assembly down with the provided bit tip (**Fig. 2**) until the base of the Stand-Off seats the disk in place and breaks the thread locking seal between the StandOff and the Low Profile Bolt. Leave the grab up, to allow space for a module frame. A 1/2" open end wrench can be used to further tighten the StandOff atop the disk if desired.

3. Install the first row of modules (Fig 3a): Place the first module in the grabs pushing on the frame to seat the module against the EdgeGrabs and Module Placement Bevel Guide (**Fig 3b**). Drive the Low Profile Bolt with the provided Torx Bit Tip to tighten the grabs (**Fig 3c On Previous Page**). Low Profile Bolt and Standoff should be **torqued to 120-130 in lbs (13.6-14.7 Nm)**. Check torque periodically during install to ensure the tool is achieving torque.

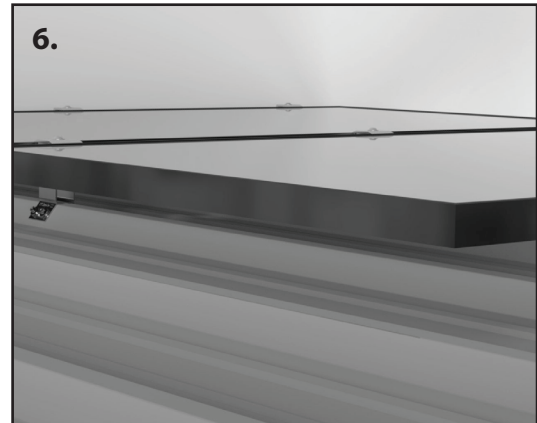
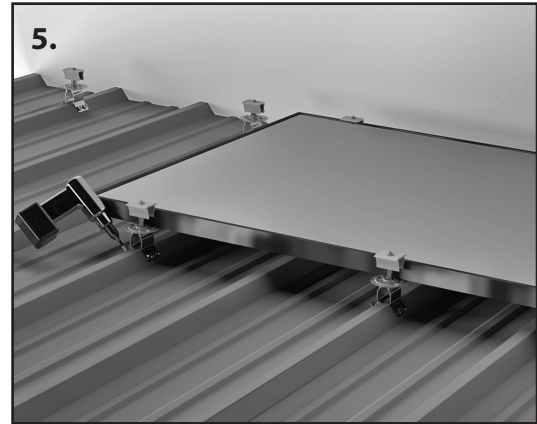
4. Install MidGrab/StandOff Assembly & PV Disk on Brackets: the PV Disk and MidGrab/StandOff Assembly should be mounted to the brackets **before mounting the brackets to the roof**. Place the PV Disk atop the brackets and thread the male portion of the StandOff through the disk and into the M8 nut inserted in the bracket (nut provided with brackets). Drive the EdgeGrab/StandOff assembly down with the provided bit tip until the base of the Stand-Off seats the disk in place (**Fig 4**) in similar fashion to Step 2. **Note:** When using CorruBrackets, the bracket must be secured to the roof **prior** to fixing the S-5-PV Kit 2.0 EdgeGrab or MidGrab assembly to bracket. See: **Tips for Mounting with CorruBrackets, S-5-H90, or S-5 K Grip Style Clamps** at end of installation instructions.



5. Place MidGrab/StandOff/Disk & Bracket Assemblies:

Using the PV module as a guide, place the bracket on the rib and move into place so that the edge of the module is seated against the wall of the MidGrab and the Module Placement Bevel Guide (**Fig. 3b**). Secure the RibBracket directly into the crown of the roof profile by driving the fasteners (included with RibBrackets) into the pre-punched holes as described in step 1 above. At this point the grabs should be left in the open position, at least partially to accommodate the next row of modules.

6. Install Additional PV Modules-repeating steps 3-5: place another module in the MidGrabs that were left open in the previous step. Tighten the downslope row of grabs each time a module is placed and leave the upslope MidGrabs open until the next module is placed (**Fig. 6**). The final row will be finished with EdgeGrab/StandOff Assemblies. Periodically look back at the modules you've installed to double check that the MidGrabs were tightened.



Tips for Mounting with CorruBrackets, S-5-H90/H90 Mini, S-5-K Grip/K grip Mini

When mounting with any S-5! CorruBracket, S-5-H90, S-5-K Grip style clamps, steps 4/5 will vary slightly. The fasteners for clamp or bracket to the roof must be installed before the PV Disk is mounted atop the clamp/bracket. The module can still be used as a spacer to place the clamps/brackets. Prepare a clamp or bracket with the full MidGrab/StandOff Assembly & PV Disk mounted atop it. Place this assembly so that the inside of the midgrab and the Module Placement Bevel Guide on the PV Disk rest against the edge of the module seating it in place as described in step 5 and shown in Fig 3b. Use a marker (do not use graphite pencil) to mark the location of the clamp or bracket on the roof. Now remove the pre-assembled clamp/bracket and PV Kit 2.0 and mount a clamp or bracket without the PV Kit, on the mark you made. After fastening the clamp or bracket in place, the MidGrab/StandOff Assembly & PV Disk can be mounted atop it. The slotted hole atop the bracket allows the kit to be slid out of the way as the module is placed, then pushed into place against the edge of the module and tightened.

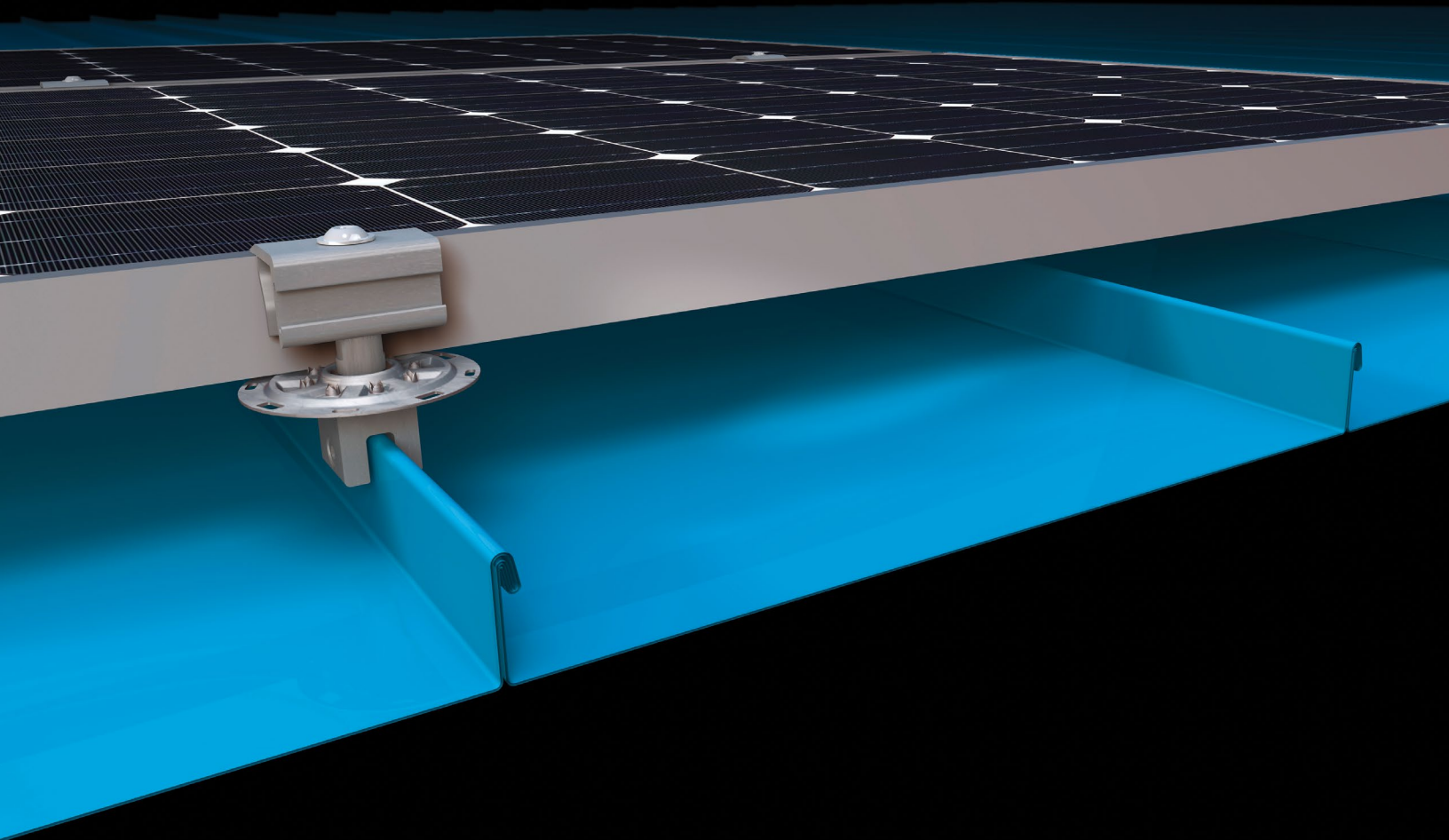
Wire Management and Bonding and Grounding

UL Listed PV wire clips should be used to attach excess wire to the underside of module frames. Clip the wires to the frame before installing the module, so that the leads are positioned correctly. Clips should be placed often enough so that the wire cannot sag and touch the roof. The home run and any other exposed wire should be encased and routed through conduit. The conduit should be intermittently attached to the roof with S-5 clamps or brackets.

Module frames within each column are bonded and have an established ground path through the PV Disk. Adjacent columns of modules should be bonded together with a jumper; a UL listed grounding lug should be attached to a module frame at the edge of the array to attach a ground wire for the array.

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PV20-V1.6-07/20



SOLAR MANUAL PVKIT™ 2.0

DESIGN

INSTALLATION

PRODUCT SPECIFICATION



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Section 1

INSTALLATION

1.2

WARNINGS

For questions regarding the installation of the S-5-PVKIT 2.0 and EdgeGrab, please contact support@S-5.com or call (888) 825-3432.

Due to the variety of attachment needs, S-5-PVKITs are sold separately from S-5! Mini clamps.

The S-5-PVKIT 2.0 fits both S-5! Standard & Mini Clamps.

- THE S-5! CLAMP IS NOT APPROVED FOR USE AS A PERSONAL FALL RESTRAINT DEVICE!
- ALWAYS PROVIDE WORKER FALL PROTECTION WHEN INSTALLING S-5! PRODUCTS. S-5! DOES NOT APPROVE PRODUCTS FOR USE IN PERSONAL FALL RESTRAINT/FALL PROTECTION APPLICATIONS. S-5! PRODUCTS MAY BE USED AS A COMPONENT IN A FALL PROTECTION SYSTEM ONLY WHEN THE SYSTEM MANUFACTURER PROVIDES APPROPRIATE APPROVALS.
- This document is an installation guide only and the photographs and drawings herein are for the purpose of illustrating components and suggested roof inspection methods. Authority Having Jurisdiction (AHJ) rules, loading scenarios, load transfers, building structures, metal roofing systems and associated components can be complex and unique to each site. S-5! recommends consulting with a qualified design professional.
- Due to the many variables involved with specific metal roofing systems, climates and other job particulars, the manufacturer cannot and does not express any opinions as to the suitability of any S-5! assembly for any specific application and assumes no liability with respect thereto.
- The information in this guide is subject to change without notification.
- For specific test data of ultimate and allowable tensile load per metal roofing system and S-5! Clamp, contact your S-5! distributor, or visit S-5!'s website http://www.s-5.com/clamps/index_99.cfm.
- When published ultimate load, and/or other raw data is used, an appropriate factor of safety (SF) must be applied.
- Screw torque should be verified during installation.
- Have a qualified licensed PE look for signs of weak building structure (roof, building structure, and foundation).
- Ensure that the installation is performed by a licensed PV installation professional.
- Ensure that installation complies with all roofing manufacturer's warranties.
- In the USA: Note that a continuous ground must be followed in accordance with National Electric Code (NEC), ANSI/NFPA 70.
- In Canada: Installation must be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.
- For UL 2703 Listed assembly's use with PV Modules having a maximum fuse rating of 15A or less.
- Contact the local code Authority Having Jurisdiction (AHJ) to determine the proper grounding requirements.
- Consult module manufacturer's installation guide for mounting methods and loading requirements.
- To avoid likelihood of galling: use anti-seize lubrication, avoid spinning nuts at high speed, and keep hardware at low temperatures during installation.
- The following suggestions assume that determination has been made that the roof to which the S-5! products will be attached is structurally adequate. S-5! recommends consulting with a qualified PE.
- Any loads imposed on the S-5! Clamps will be transferred to the panels. Panel seams must have sufficient flexural strength to carry these loads. Panels must also be adequately attached to the building structure, and the structure must be sufficient to carry these loads. The makers of S-5! Clamps make no representations with respect to these variables. S-5! recommends consulting with a qualified design professional.

1.3 PVKIT 2.0 AND CLAMP COMPONENT DWG

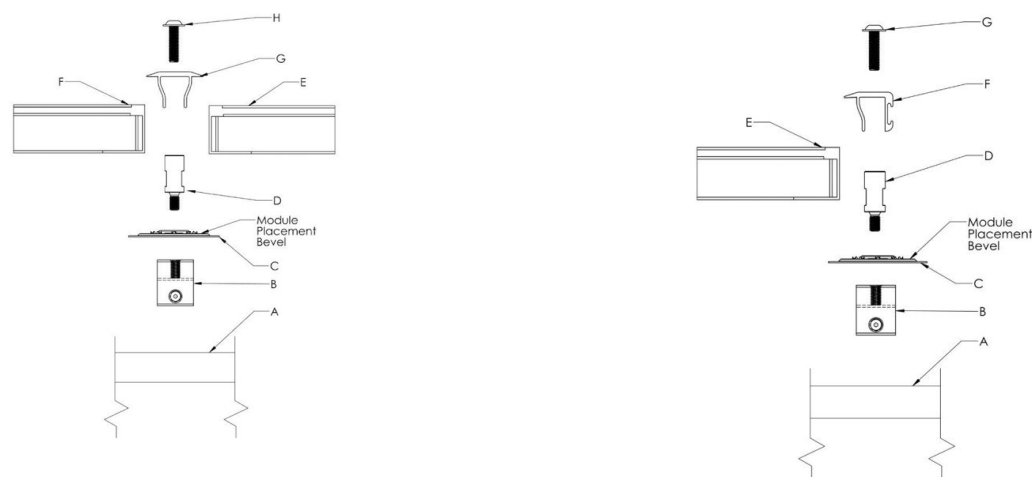


1.4 PRE-CONSTRUCTION AND LAYOUT

1.4.1 Overview

The restrictions to locating the S-5! PVKIT and clamp are: 1) the module manufacturer's allowable mounting locations or UL 2703 tested load configurations (with module producer's approval); and 2) uniformly transferring the service loads to the metal roof panels; then through the roof panels' fastening to the building structure.

The above paragraph describes the load chain experienced on any PV assembly to the roof. The "weak link" may be the flexural strength of the metal roof panel or the metal roof panel's connection to the building structure. Further information that describes a conservative design approach can be found in Section 1.4.2.2.



1.4.2 Pre-Construction

1.4.2.1 S-5-PVKIT 2.0 and EdgeGrab 2.0 Module Thickness Tolerances

To ready the project for layout and construction, the following three areas need to be examined:

1. THE MODULE: thickness, acceptable mounting locations, allowable loading.
2. THE METAL ROOF SYSTEM/PROFILE: for S-5! Mini clamp or standard clamp selection and roof attachment clip type.
3. THE LOCATION of the roof attachment clips within the seam (when relevant). (See section 1.4.2.2.4).

1. THE MODULE:

S-5! PVKIT 2.0 and clamps are designed to fit most module frame thicknesses and metal roof types. The Universal PV Grab accommodates module frame thicknesses from 32mm to 46mm, as shown in Figure 3.

It is possible to use the Universal PV Grab in array-edge scenarios (rather than the EdgeGrab). Instructions for this can be found as a 'HINT' breakout in Section 1.5.2.

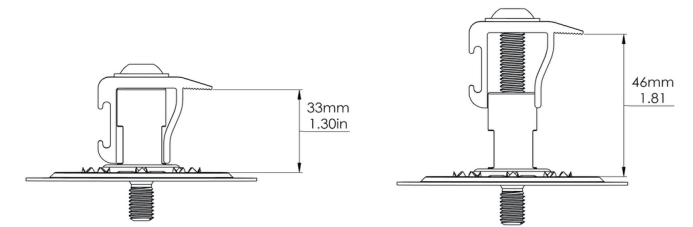
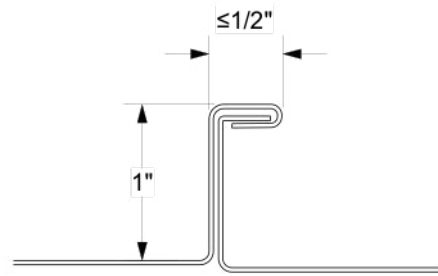


Figure 3 PV Mid Grab's Acceptable Module Thickness Range

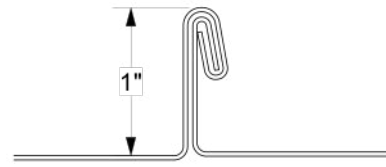
2. THE METAL ROOF SYSTEM/PROFILE:

Please see the diagrams below to choose the S-5! Mini clamp that is compatible with the metal roof profile. Verify dimensions for proper fit. For further info please see: http://www.s-5.com/clamps/index_1048.cfm.



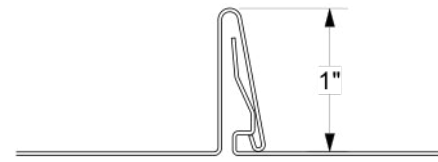
1" Single Fold

S-5-S, S-5-S Mini



1" Double Fold

S-5-E, S-5-E Mini



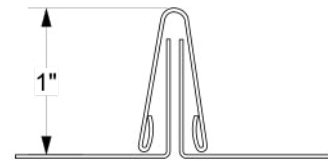
1" Snap Seam

S-5-S, S-5-S Mini



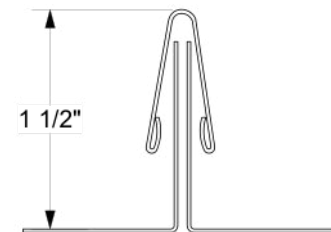
1" Nail Strip

S-5-N, S-5-N Mini



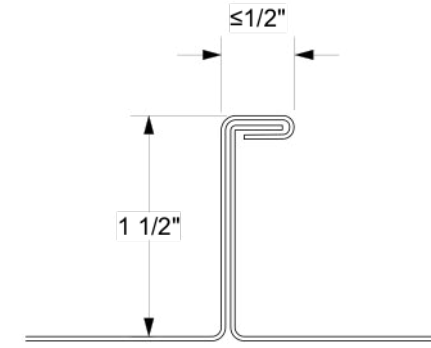
1" Batten Cap

S-5-S, S-5-S Mini



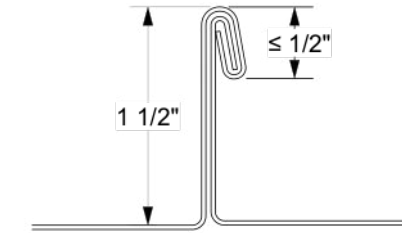
1-1/2" Batten Cap

S-5-S, S-5-S Mini



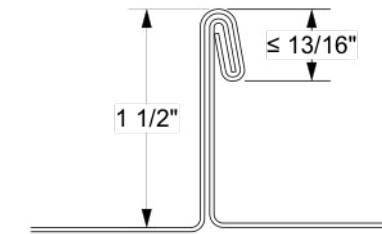
1-1/2" Single Fold

S-5-S, S-5-S Mini



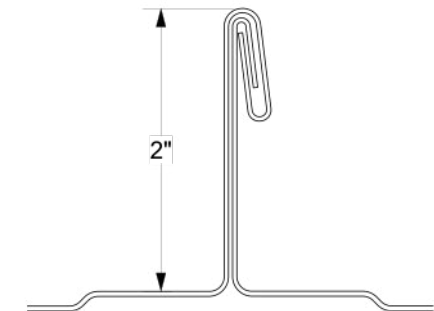
1-1/2" Double Fold

S-5-E, S-5-E Mini



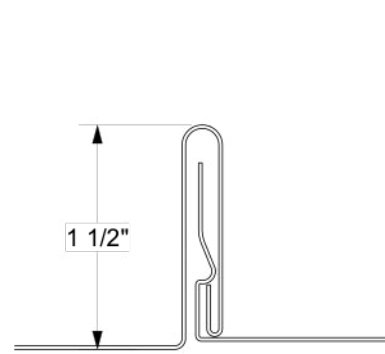
1-1/2" Double Fold

S-5-V, S-5-V Mini
S-5-U, S-5-U Mini



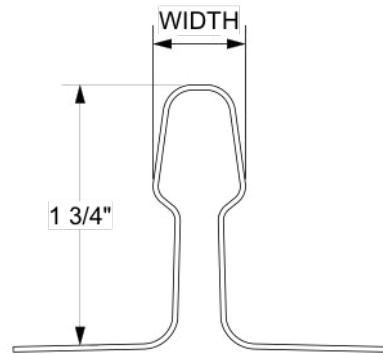
2" Double Fold

S-5-V, S-5-V Mini
S-5-U, S-5-U Mini



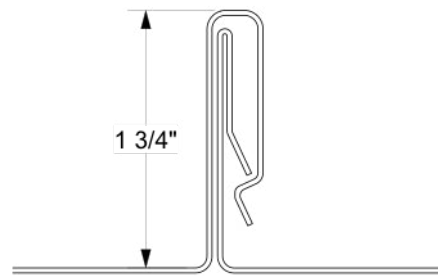
1-1/2" Snap Seam

S-5-S, S-5-S Mini



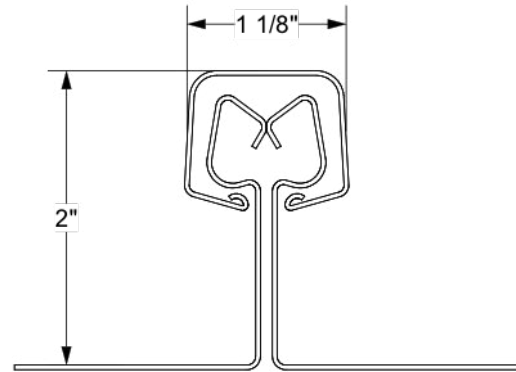
1-3/4" Bulb Seam EU

S-5-Z, S-5-Z Mini
S-5-R465, S-5-R465 Mini
Clamp choice dependent on bulb width



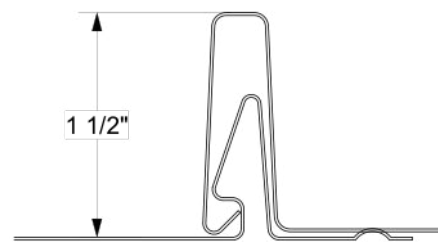
1-3/4" Snap Lock

S-5-S, S-5-S Mini



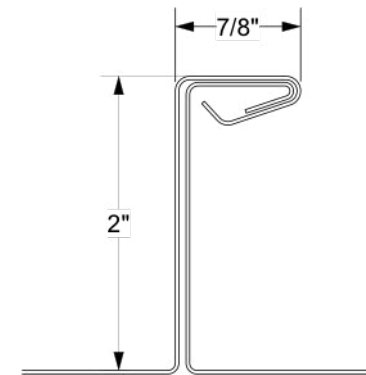
2" Bulb Seam Cap

S-5-Q, S-5-Q Mini



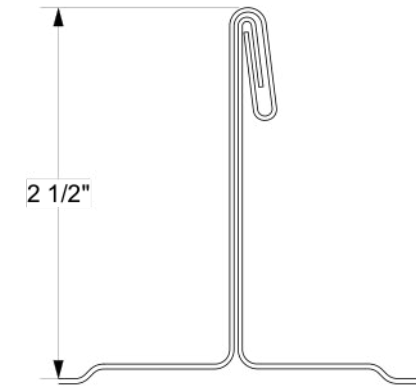
1-1/2" Nail Strip

S-5-N 1.5, S-5-N 1.5 Mini



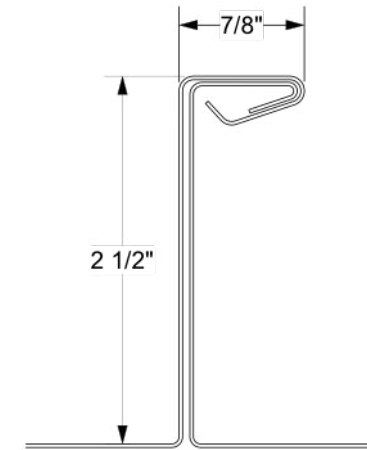
2" Single Fold

S-5-H90, S-5-H90 Mini
S-5-U, S-5-U Mini
S-5-H, S-5-H Mini



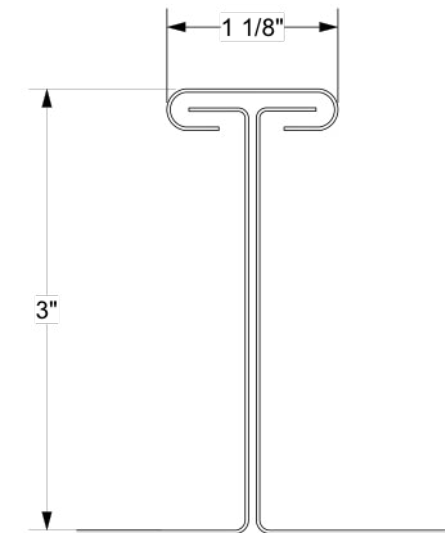
2-1/2" Double Fold

S-5-V, S-5-V Mini
S-5-U, S-5-U Mini



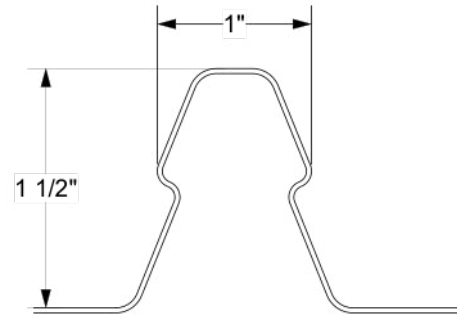
2-1/2" Single Fold

S-5-H90, S-5-H90 Mini
S-5-U, S-5-U Mini
S-5-H, S-5-H Mini



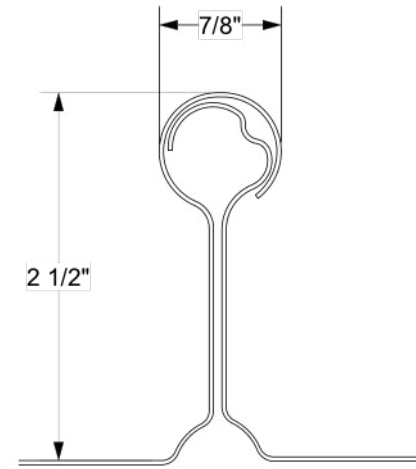
3" Batten Cap T Seam

S-5-T, S-5-T Mini



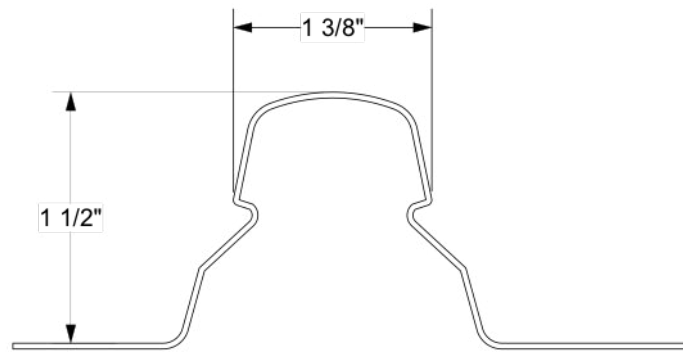
Conceal Fix Narrow

S-5-K Grip, S-5-K Grip Mini, S-5- K Grip Snow
The GX 10 insert is used on these profiles with K Grip clamps.



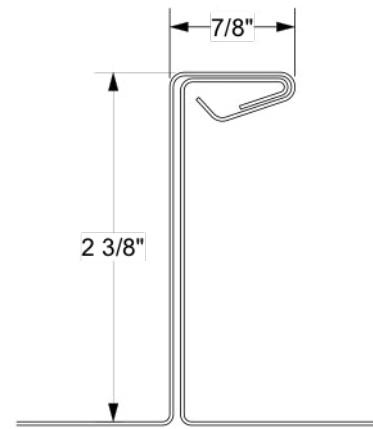
2.5" Bulb Seam

S-5-Z, S-5-Z Mini
S-5-Q, S-5-Q Mini



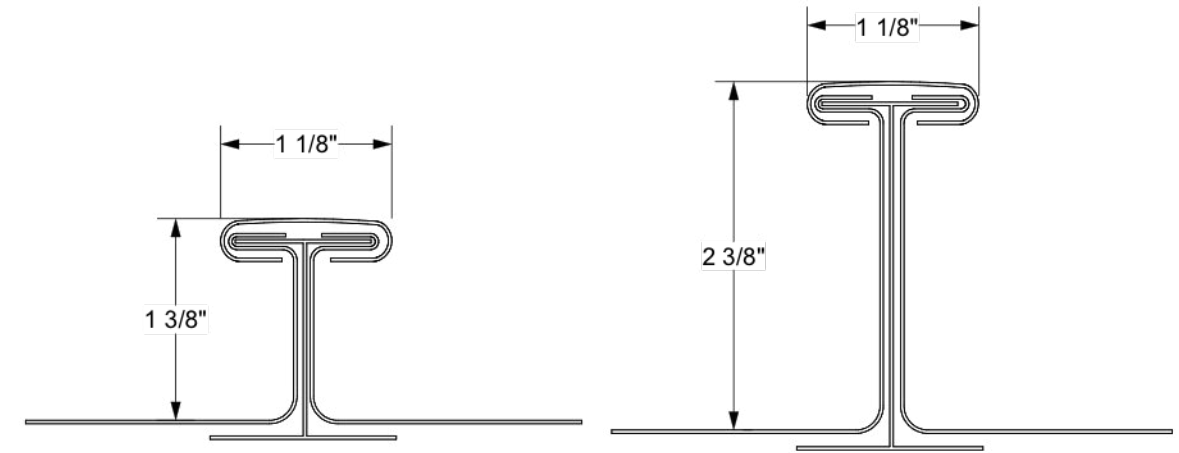
Conceal Fix Wide

S-5-K Grip, S-5-K Grip Mini, S-5- K Grip Snow
The GX 50 insert is used on these profiles with K Grip clamps.



2-3/8" Single Fold

S-5-H90, S-5-H90 Mini
S-5-U, S-5-U Mini
S-5-H, S-5-H Mini

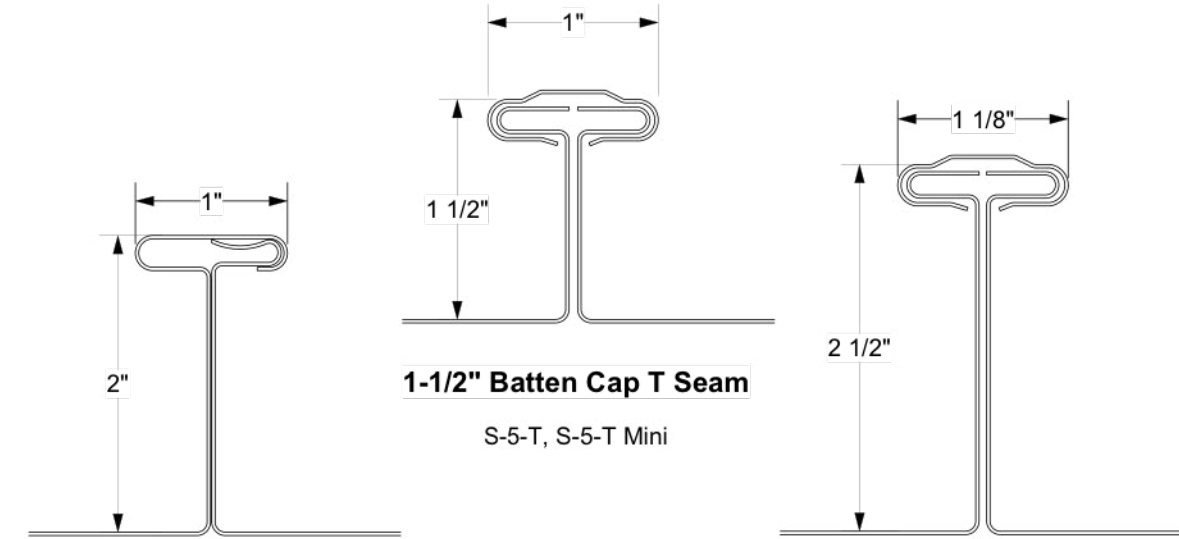


1-3/8" T Seam

S-5-T, S-5-T Mini

2-3/8" T Seam

S-5-T, S-5-T Mini



2" T Seam

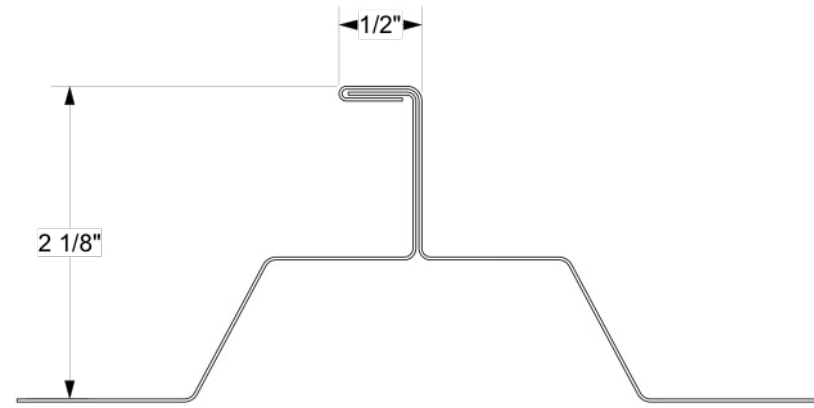
S-5-T, S-5-T Mini

1-1/2" Batten Cap T Seam

S-5-T, S-5-T Mini

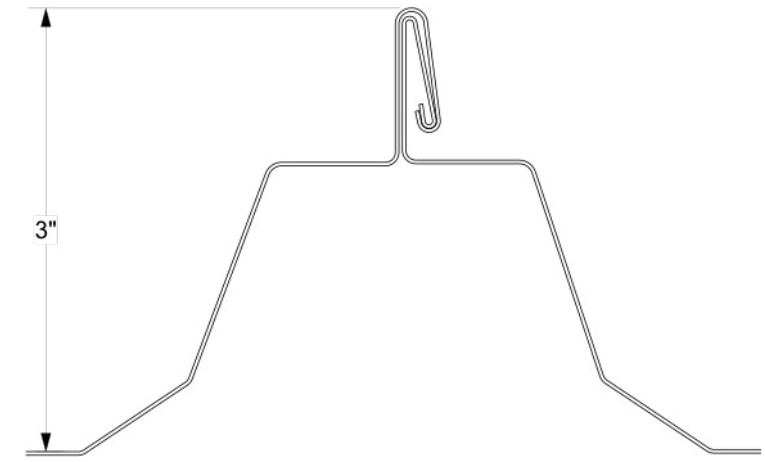
2-1/2" Batten Cap T Seam

S-5-T, S-5-T Mini



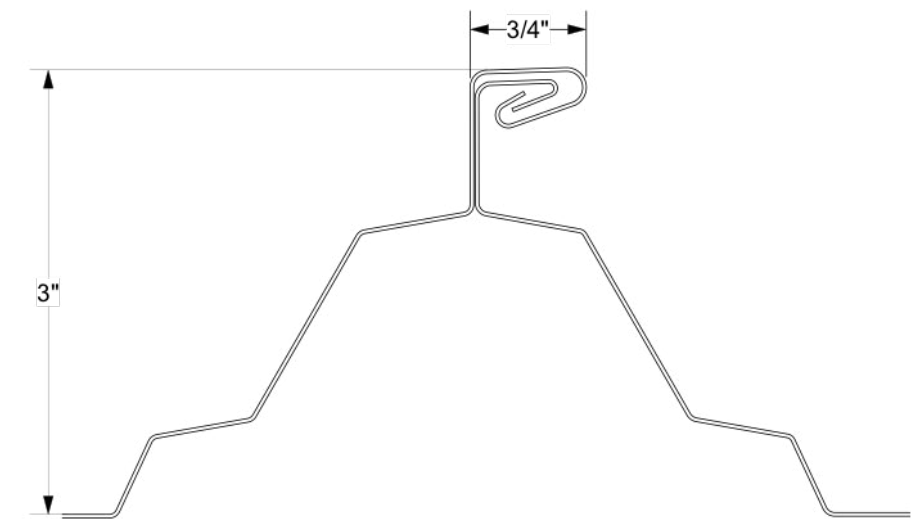
2" Trap Single Fold

S-5-S, S-5-S Mini



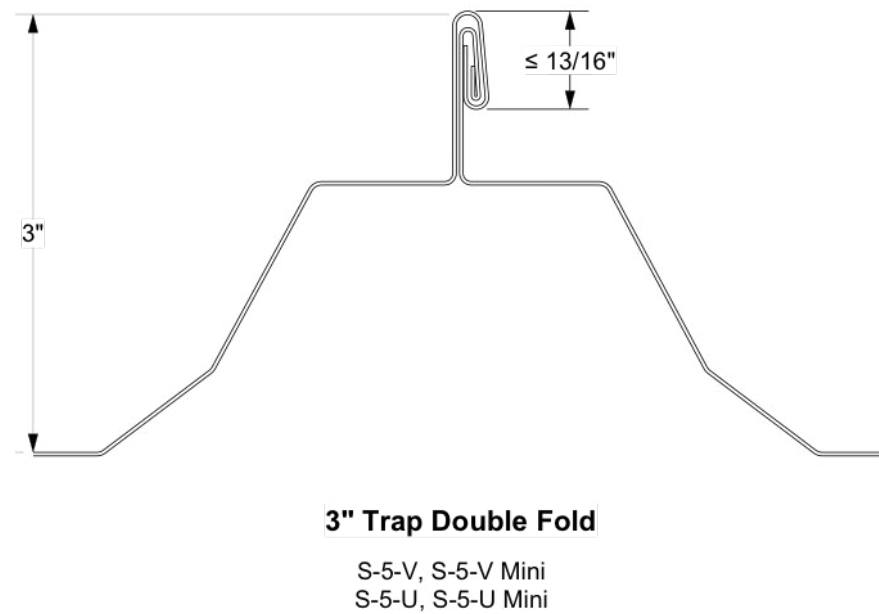
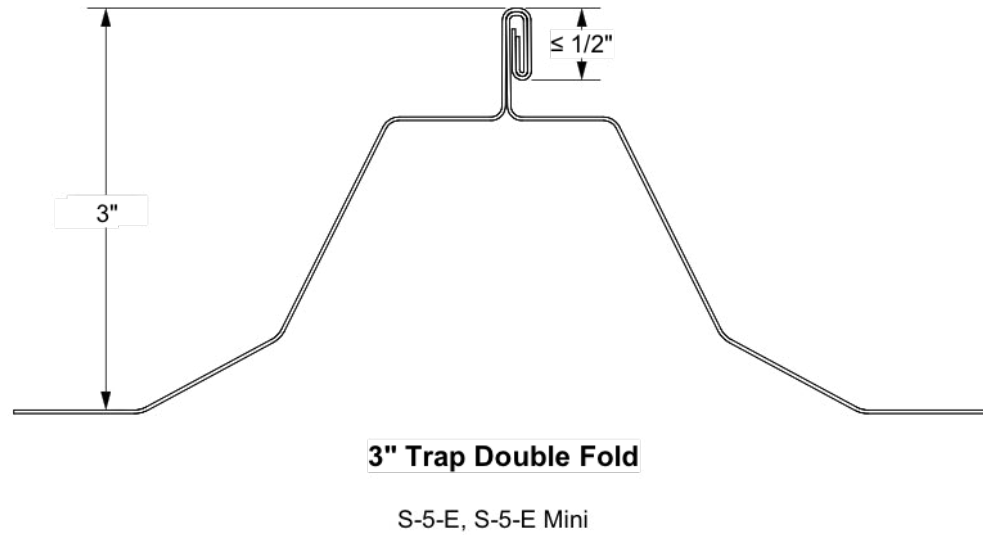
3" Trap Snap Seam

S-5-V, S-5-V Mini
S-5-U, S-5-U Mini



3" Trap Single Fold

S-5-H90, S-5-H90 Mini
S-5-U, S-5-U Mini
S-5-H, S-5-H Mini



The metal roof panels are attached to the building via concealed roof clips within the metal roof's seam areas. Acceptable clamping locations for the S-5! Mini clamps are dependent on the type of roof clip used. Once the brand of metal roof system is determined, the roof clip is implied. Use the installer, manufacturer, and/or materials invoice to confirm specifications and fitment.

1.4.2.2 S-5! Clamp Spacing Considerations

The key to frequency and spacing of attachment points for PV is to distribute loads to the metal standing seam panels in a manner that is consistent with the intended distribution of loads from the roof panels into the building structure. Often the "weak link" is not the S-5! clamp, but the standing seam metal roof clips that hold the metal panels to the building structure, or the beam strength of the roof panel seam itself. Load capacities of all the S-5! clamps have been tested and are published on the S-5! website: www.S-5.com. Here you will find testing values that are specific to the standing seam roof manufacturer, standing seam type, material type/thickness, and load orientation.

Standing seam metal roof panel attachment to a building structure is accomplished with clips hidden within the seams. The most conservative method to distribute the load into the roof panels is to determine the frequency of the roof's attachment to the structure, and then duplicate or exceed it with the attachment of the PV components to the roof. Determining panel attachment spacing in one axis is very simple: Standing seam panels' attachment will be made using concealed hold-down clips within the seam area of the panel. So, in that axis, the clip spacing is the same as the seam spacing. The location of the clips along the seam (in the other axis) can be determined by the following: a) consultation with the roof system manufacturer or installer; b) checking from the underside; or c) close examination from the topside along the seam. There will usually be a slight, but detectable, deformation of the seam at the clip location visible from the roof's topside. Many standing seam roofing systems are installed on "pre-engineered steel" buildings. The attachment spacing in that industry is typically 5'-0" and is observed by inspecting the structural purlins to which the panel clips are attached from the roof underside (i.e. the interior of the building).

If the panel clips are spaced, for instance, 5'-0" on center along the seam, then use the 5'-0" dimension as a maximum spacing for the S-5! clamps. (S-5! clamps may also be spaced at closer centers, but not wider.) When modules are direct attached (without racking) in the landscape orientation, this spacing dimension is dictated by the smallest dimension of the PV frame. Using the roof panel clip spacing as a maximum spacing template for S-5! clamps is sound practice, whether the PV modules are direct-attached or attached to a racking system, which is in turn attached to the S-5! clamp (and to the panel seams). To evenly distribute loads, it is also necessary that each seam be included in the finished assembly. Thus, every time a seam is traversed, it should be attached. Such an attachment scheme should evenly distribute wind loads into the building structure through the panels and their attachment, as was intended in the original roof construction assembly. "Skipping" seams with clamp attachment is also frequently done and may also be acceptable, but only when approved by a design professional.

Note: Wind dynamics are complex, and S-5! advises review by a qualified licensed professional who understands wind effects and metal roof design and construction.

1.4.2.2.1 Dual Component Roof Clips

In a dual component roof clip system, the top component is attached to the metal roof panel via the seam, and the bottom component is attached to the building structure. In order to accommodate differential movement presented during thermal cycling, the two roof clip components are joined with a slip joint.

When attaching to this type of standing seam metal roof, the S-5! clamp can be attached at a roof clip location or between clips. (See Figure 4).

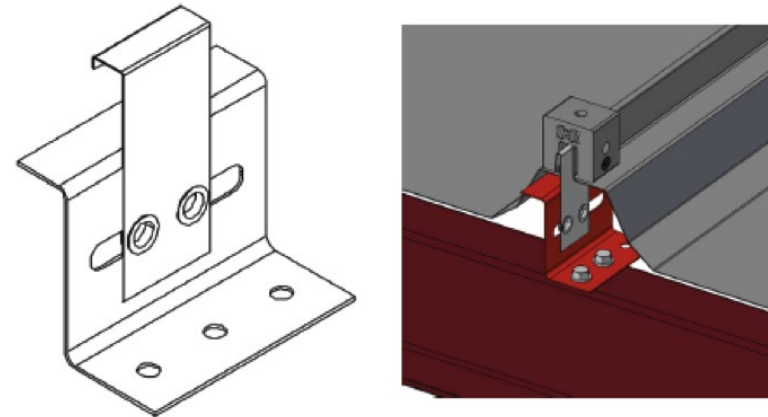


Figure 4: Dual Component Roof Clip

Note: When using a clamp on a dual component roof clip it is important the setscrew of the clamp only engages the top portion of the clip. Should the setscrew engage the lower portion please see 1.4.2.2.2 Single Component Roof Clips or Halters.

1.4.2.2.2 Single Component Roof Clips or Halters

In a single component roof clip or halter system, the metal roof panel can slide freely along the roof clip – accommodating any differential movement presented during thermal cycling.

When attaching to this type of standing seam metal roof, the S-5! clamp must be clear of the roof clip by a minimum of 2" to allow for thermal expansion/contraction movement. An exception may be permissible when the metal roof panel is 20 feet or less, or when approved by the metal roofing system manufacturer (See Figure 5).

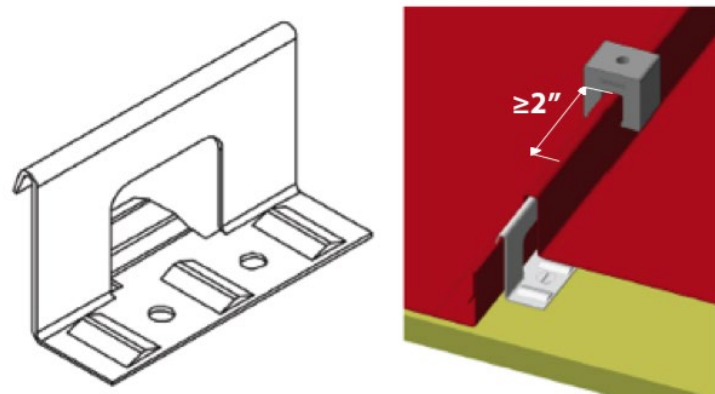


Figure 5: Single Component Roof Clip

1.4.2.2.3 Locate the Roof Clips

Locating the roof clips can be done in three ways: 1) consulting with the roofing system manufacturer or installer; 2) inspecting the underside of the roof, or 3) close examination of the top side of the roof.

When examining the clip locations from the underside, look for fasteners. As mentioned in Section 1.4.2.2, many standing seam roofing systems are installed on “pre-engineered steel” buildings. The attachment spacing in that industry is typically 5'-0" and is observed by inspecting the structural purlins to which the panel clips are attached from the roof underside (interior of the building).

When examining the clip location from the topside, look for slight deformations of the seam – these will be the clip locations. Now that the type and locations of the roof clips are known, we can better understand the allowable clamping locations for the S-5! clamps (per roof clip type).

1.4.3 Layout

The first step in designing the system layout is to map the total usable area for solar array. This can be done by drawing the total roof area and subtracting the following areas:

- Required fire setbacks and pathways. These distances can usually be found by contacting the AHJ or another qualified professional.
- Required space around any roof obstruction (e.g. skylights, etc.). These distances can usually be found by contacting the AHJ.
- Any roof zone restrictions per wind loading. A professional engineer can identify these zones.
- Any locations deemed not structurally sound or inappropriate for installation. Again, a professional engineer can identify these areas.

The next step is to map the standing seams and the roof clips, as identified in the last section. Then identify the areas on the seams that are appropriate for attaching the S-5! PVKIT/Clamp, per the previous section.

Finally, map the module placement. Keep in mind the module manufacturer’s attachment location and cantilever restrictions from Section 2.4. Modules in landscape orientation will generally allow for the most flexibility in design.

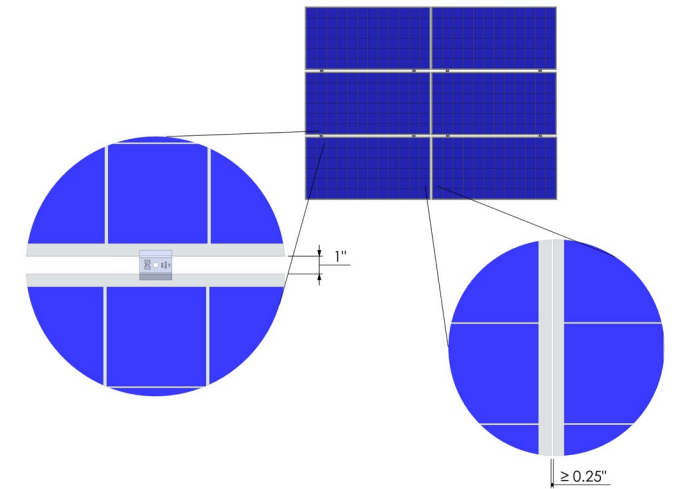


Figure 6

Gap Management

Modules in the north/south direction will have a uniform gap of 1" between each module provided by the PVKIT 2.0 MidGrab. With these module columns, it is also advised to add a 3.5" gap within a column after a maximum of 10 module sets. (For reference, please see Figure 6 and 7.)

The module gap in the east/west direction will be managed by the designer. For aesthetic reasons, the designer may choose to have a minimal gap, uniform gap, or a gap wide enough to accommodate a walk space. However, due to thermal cycling concerns, a minimal gap of 1/4" between module columns is suggested.

For more information on module gaps and pressure equalization factors please see: Wind Design for Solar Arrays / SEAOC PV2-2017. See: <https://www.seaoc.org/store/ViewProduct.aspx?id=10228815>

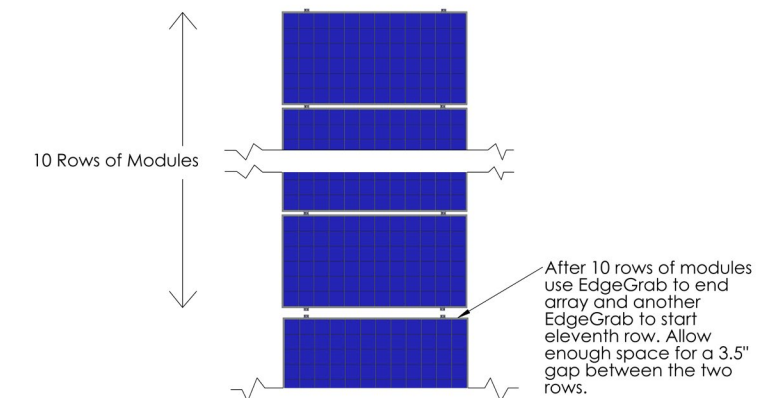


Figure 7

1.5 INSTALLATION OF PVKIT 2.0 WITH CLAMP

S-5! clamps attach to the panel seam by tightening the “bullet-nosed” stainless-steel setscrews against the seam material. The setscrews compress the seam material against the opposite wall of the clamp. They will “dimple” the seam material but will not penetrate it. Threaded holes in the clamp and the stainless-steel hardware are used to attach the S-5-PVKIT to the clamp. (Refer to section 1.3 for more component details.)

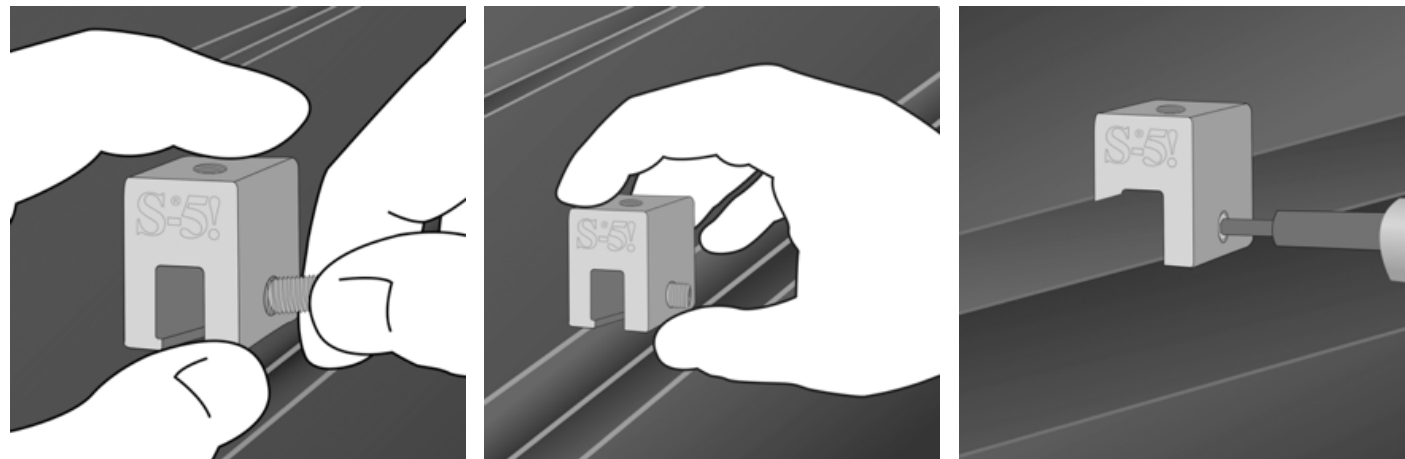
1.5.1 Mini Clamp Installation

Mini Clamp Overview:

What follows are basic installation instructions for S-5! Mini clamps. Clamp specific instructions can be found in the shipping box or by visiting: <http://www.s-5.com/gallery/index.cfm>.

Install the Clamp:

1. Partially thread the round-point setscrew into the side of the clamp manually.
2. Position clamp at desired location along seam. Ensure that the clamp setscrew will engage the proper side of the seam. (See install instructions provided with clamps.) Tighten clamp onto the seam, ensuring a snug and square fit. Clamp must be seated on the profile so that the setscrew is in the correct position to make adequate purchase of the seam.
3. Finally, tighten the setscrew on the side of the clamp to the specified torque range, per section 2.1.4.



Step 1: Preload setscrews

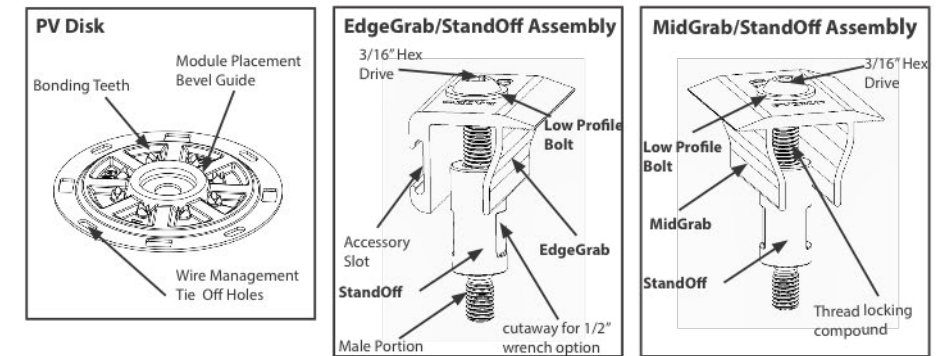
Step 2: Position on clamp seam

Step 3: Tighten to correct torque

Tools Needed

- Screw Gun
- 3/16" Hex Bit Tip (provided)
- Calibrated Dial Torque Wrench

Parts



1.5.2 PVKIT 2.0 Installation

1. Install the first row of S-5! clamps, at the edge of the array: It is critical that this row is straight. Install clamp (per section 1.5.1) at both ends of the row, by measuring from a reference point such as the eave of the roof. Tighten the setscrews with screw gun and the included hex-bit tip. The setscrews will dimple the seam material but will not penetrate it. When relying on published load values, setscrew tension should be verified periodically using a calibrated torque wrench to ensure the tool is consistently achieving the proper torque range. (See Section 2.1.4 for torque range.) Please see installation instructions provided with clamps for additional torque and tension specifics. Stretch a string line between the two end clamps to provide a true line to mount the remaining edge clamps (Fig. 1).
2. Mount the PV Disks and the EdgeGrab/StandOff Assembly to the first row of clamps: Place the PV Disk atop the clamp and thread the StandOff through the disk and into the clamp. Drive the EdgeGrab/StandOff Assembly down with provided hex-bit tip (Fig. 2) until the base of the StandOff seats the disk in place and breaks the thread-locking seal between the StandOff and low-profile bolt. Leave the grab up, to allow space for a module frame. A 1/2" open-end wrench can be used to further tighten the StandOff atop the disk if desired.
3. Install the first row of modules (Fig 3a): Place first module in the grabs pushing on the frame to seat the module against the EdgeGrabs and Module Placement Bevel Guide (Fig 3b). Drive the low-profile bolt with the same hex bit to tighten the grabs (Fig 3c). Low-profile bolt and Standoff should be torqued to 120-130 inch-pounds. (13.6-14.7 Nm). Check torque periodically with a torque wrench.

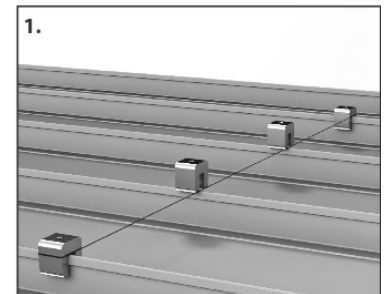


Figure 1

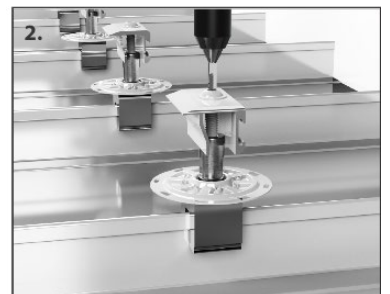


Figure 2

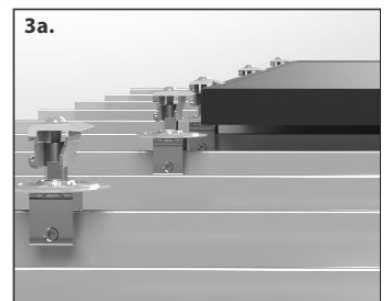
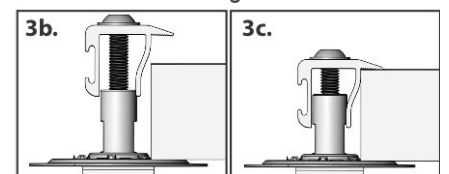


Figure 3



SOLAR MANUAL: PVKIT™ 2.0

4. Install MidGrab/StandOff Assembly & PV Disk onto clamps. The PV Disk and MidGrab/StandOff Assembly should be mounted to the clamps before mounting the clamps to the roof. Place the PV Disk atop the clamp and thread the male portion of the StandOff through the disk and into the clamp. Drive the MidGrab/StandOff Assembly down with the same bit tip (Fig 4) as was done in STEP 2. *Note: When using the S-5-H90 or S-5-K Grip style clamps, the clamp must be secured to the roof prior to fixing the S-5-PVKIT 2.0 EdgeGrab or MidGrab assembly to clamps. (See: Tips for Mounting with S-5-H90, or S-5 K Grip Style Clamps at the end of this section).*
5. Place MidGrab/StandOff/Disk & Clamp Assemblies: Using the PV module as a guide, place the throat of the clamp over the seam and slide the assembly into place so that the edge of the module is seated against the wall of the MidGrab and the Module Placement Bevel Guide, similar to (Fig 3b). Tighten the setscrew(s) of the clamp as described in STEP 1. The grabs should be left in the partially open position to accommodate the next row of modules before final tightening occurs.
6. Install Additional PV Modules-repeating STEPS 3-5: Place another module in the MidGrabs that were left open in the previous step. Tighten the downslope row of grabs each time a module is placed and leave the upslope open until the next module is placed (Fig. 6). The final row will be finished with EdgeGrab/StandOff Assemblies. Periodically look back at the modules you have already installed to double check that all MidGrabs were tightened.

Tips for Mounting with S-5-H90/H90 Mini, S-5-K Grip/K Grip Mini:

When mounting with any S-5! CorruBracket, S-5-H90, S-5-K Grip style clamps, STEPS 4/5 will vary slightly. The fasteners for clamp or bracket to the roof must be installed before the PV Disk is mounted atop the clamp/bracket. The module can still be used as a spacer to place the clamps/brackets. Prepare a clamp or bracket with the full MidGrab/StandOff Assembly & PV Disk mounted atop it. Place this assembly so that the inside of the MidGrab and the Module Placement Bevel Guide on the PV Disk rest against the edge of the module seating it in place as described in STEP 5 and as shown in Fig 3b. Use a marker (but do not use a graphite pencil) to mark the location of the clamp or bracket on the roof. (See the 'HINT' breakout in 2.1.3 Metallurgical Compatibility for further discussion). Now remove the pre-assembled clamp/bracket and PVKIT 2.0 and mount a clamp or bracket without the PVKIT, on the mark you made. After fastening the clamp or bracket in place, the MidGrab StandOff Assembly & PV Disk can be mounted atop it. The slotted hole atop the bracket allows the kit to be slid out of the way as the module is placed, then pushed into place against the edge of the module and tightened.



Figure 4

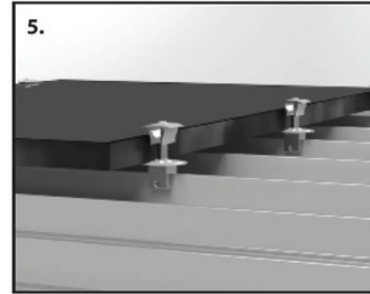


Figure 5



Figure 6

SOLAR MANUAL: PVKIT™ 2.0

1.6 REMOVAL/O&M OF PVKIT 2.0 SYSTEM & CLAMP

To remove, reverse the installation instructions found in Section 1.5.

The Stand-off has a flattened area for a wrench to fit to assist with removal.

When re-installing, it is advised to use all new parts.

This is especially true for the mounting disk (due to the integrated grounding), and the clamp if it has been removed from the seam.

1.7 TECHNICAL SUPPORT

For questions regarding the installation of the S-5-PVKIT 2.0 and EdgeGrab, please contact support@S-5.com or call (888) 825-3432.

2.1 PVKIT 2.0 COMPONENT SPECIFICATIONS & RATINGS (MATERIAL PROP, STRUCTURAL PROP, TORQUES, ETC.)

2.1.1 Clamp Specifications

Clamp	
Model Numbers:	S-5-U Mini, S-5-U, S-5-S Mini, S-5-S, S-5-T Mini, S-5-T, S-5-Z Mini, S-5-Z, S-5-N Mini, S-5-N, S-5-E Mini, S-5-V Mini, S-5-V, S-5-H90 Mini, and S-5-H90
Material:	6061-T6 Aluminum
Manufacturer Process:	AA Aluminum Standards and Data
Extrusions	ASTM B221
Aluminum Castings	ASTM B85
Finish:	Mill

Associated Hardware	
	Round Point Setscrews, 3/16 Inch Allen Key Drive
Material:	300 series stainless steel, 18-8 alloy
Dimensions:	3/8"-24 x .800" or 3/8"-24 x .500"

Associated Hardware	
	Attachment Bolts
Material:	300 series stainless steel, 18-8 alloy
Dimensions:	8mm diameter, 1.25 thread pitch, 13mm hex flange head.

2.1.2 PVKIT 2.0/EdgeGrab Component Specifications

PVKIT 2.0 & EdgeGrab	
Model Numbers:	S-5-PV MidGrab 2.0 S-5-PV EdgeGrab 2.0
Material:	6061-T6 Aluminum

Section 2 REFERENCES

Manufacturer Process:	AA Aluminum Standards and Data
Extrusions	ASTM B221
Aluminum Castings	ASTM B85
Finish:	Mill

Associated Hardware	Standoff
Material:	300 series stainless steel
Dimensions:	M8-1.25 female thread with M8-1.25 male thread
Finish:	Mill

Associated Hardware	Stainless Steel Flanged Button Head Screw
Material:	300 series stainless steel
Dimensions:	M8-1.25 x 26mm
Finish:	Mill

Associated Hardware	3" Mounting Disk
Material:	300 series stainless steel
Dimensions:	3" O.D. / 0.33 I.D. x 0.035" thick
Finish:	Mill

2.1.3 Metallurgical Compatibility

The metals/finishes below are considered NON-CORROSIVE when combined with mill finish or anodized aluminum:

- Galvanized steel (painted or unpainted)
- Aluminum (painted, bare or anodized)
- Stainless Steel
- Galvalume® Steel
- Zinalume® Steel
- Zinalume® Plus
- Acrylume®, Galvalume® Plus
- Galfan®
- Galvanneal steel
- Titanium-Zinc (VM, Rheinzink, Nedzink, Prozink)

HINT: Some examples of incompatible metals common to the trade are:

- Exposed copper wire or copper conduit in direct contact with materials such as aluminum and aluminum alloys, galvanized steel, Galvalume® or other Al-Zn roofing coatings.
- Graphite in direct contact with aluminum and aluminum alloys, Galvalume® or other Al-Zn roofing coatings. (Graphite is the primary material in the common pencil.)

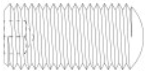

2.1.4 Torque

When relying upon published load values, setscrew tension should be periodically verified using a calibrated torque wrench between 160 and 180-inch pounds (not foot pounds) (18-20 Nm) when used on 22 ga steel, or between 130 and 150-inch pounds (15-17 Nm) on 24 ga or thinner steel and all other metals. The standing seam of a metal roof is a soft joint which involves compressible materials and/or open space. For this reason, a dial-indicating torque wrench is RECOMMENDED to verify full clamping force has been achieved (adjustable clicktype torque wrenches are NOT RECOMMENDED).

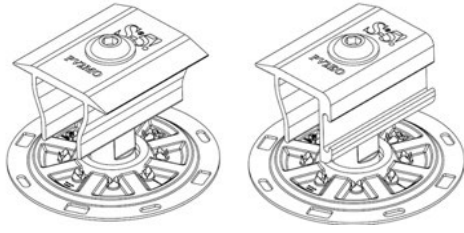
Please visit our load test table at: http://www.s-5.com/clamps/index_99.cfm to determine allowable and ultimate clamp holding strength.



ROUND POINT SETSCREW TORQUE SPECIFICATIONS

	Fastener	Torque			
		Inch Pounds		Foot Pounds	Newton Meters
	3/8-24 x 0.80" Round Point Setscrew	≤ 22ga	130-150	11-13	15-17
		≤ 22ga	160-180	13-15	18-20
	3/8-24 x 0.50" Round Point Setscrew	≤ 22ga	130-150	11-13	15-17
		≤ 22ga	160-180	13-15	18-20

S-5-PVKIT 2.0 & EDGEGRAB HARDWARE TORQUE SPECIFICATIONS

	Fastener	Torque		
		Inch Pounds	Foot Pounds	Newton Meters
	MidGrab/StandOff and EdgeGrab/StandOff Assembly	120	10-11	13.6 – 14.7

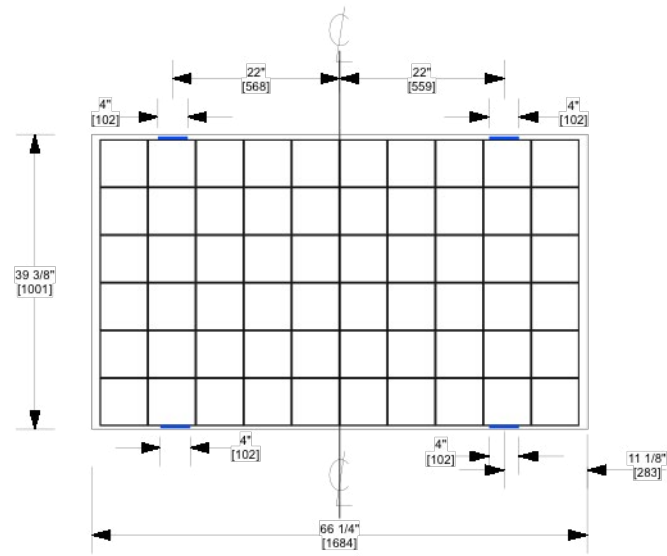
2.2 CODES AND STANDARDS

- Aluminum Standards and Data, 2003 Edition; Aluminum Association (AA) (www.aluminum.org)
- ASTM B85-03 - Standard Specification for Aluminum-Alloy Die Castings.
- ASTM B221-04a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- ASTM E527-83 (2003) - Standard Practice for Numbering Metals and Alloys
- UL 2703 Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels
- UL 1703 Standard for Flat-Plate Photovoltaic Modules and Panels
- UL 61730-1 Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction
- UL 61730-2 Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing

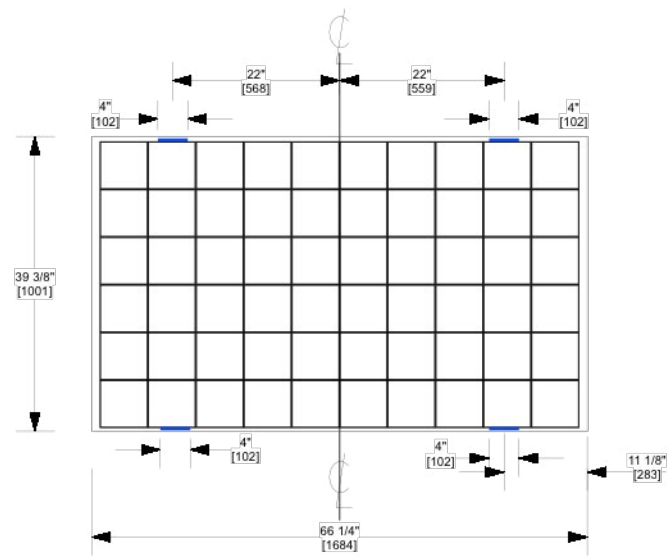
2.3 MODULE LOADING TABLE FOR PVKIT 2.0

Module Mfg	Module Model	Attachment Location	Download Pressure	Uplift	Down Slope
Hanwha Q CELLS	NRTL Listed PV Module - Q Cell model Q.PLUS BFR-G4.1, XXX, 60 cells series, black frame, where XXX is 270-280	10 7/8" From Edge	50 PSF	50 PSF	20 PSF
Hanwha Q CELLS	NRTL Listed PV module - Q Cell model Q.PRO L-G4 XXX, 72 cells series, silver frame, where XXX is 310-320	17 1/4" From Edge	50 PSF	30 PSF	20 PSF
Jinko Solar	JKMXXXPP-60, 60 CELLS SERIES, BLACK FRAME WHERE XXX IS 260-345	10 3/4" From Edge	50 PSF	50 PSF	20 PSF
Jinko Solar	JKMXXXPP-72, 72 cells series, silver frame where XXX is 260-345		50 PSF	30 PSF	20 PSF

2.3.1 Hanwha Q 60 and 72 Cell Mounting Configurations

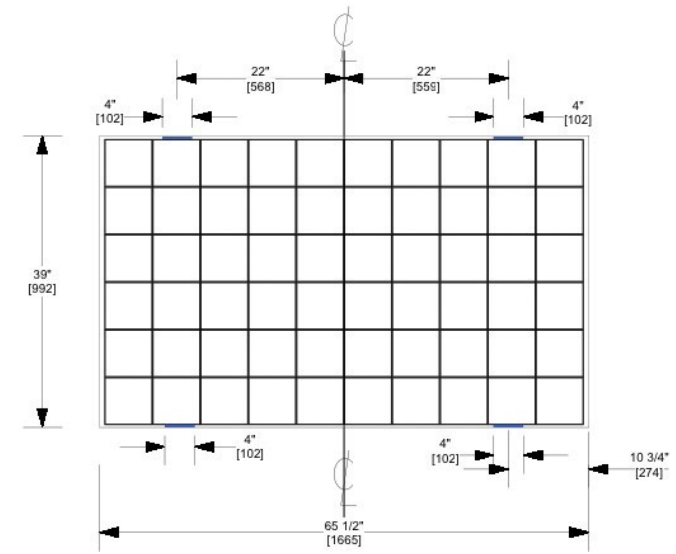


60 Cell Module

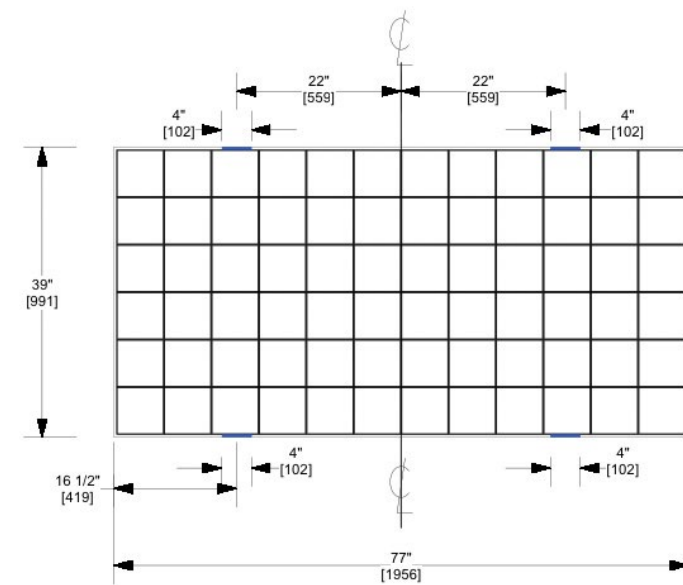


72 Cell Module

2.3.2 Jinko Solar 60 and 72 Cell Mounting Configurations



60 Cell Module



72 Cell Module

2.4 GROUNDING INFO & GROUNDING PATH FOR PVKIT 2.0

S-5! PVKIT 2.0 with the following roof clamps: S-5-U Mini, S-5-V Mini, S-5-S Mini, S-5-E Mini, S-5-T Mini, S-5-Z Mini, S-5-N Mini, S-5-U, S-5-V, S-5-S, S-5-E, S-5-T, S-5-Z, S-5-N, S-5-V, S-5-H90

UL Listed PV Modules:

Hanwha Q CELLS

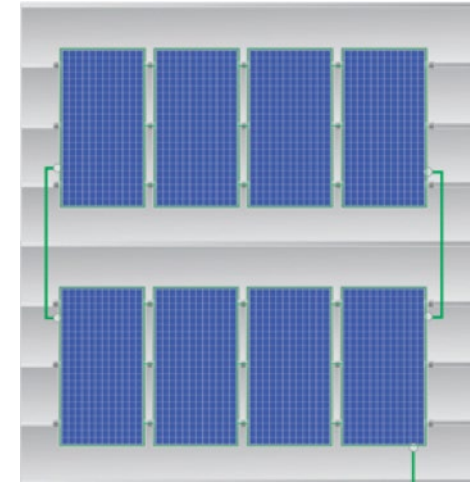
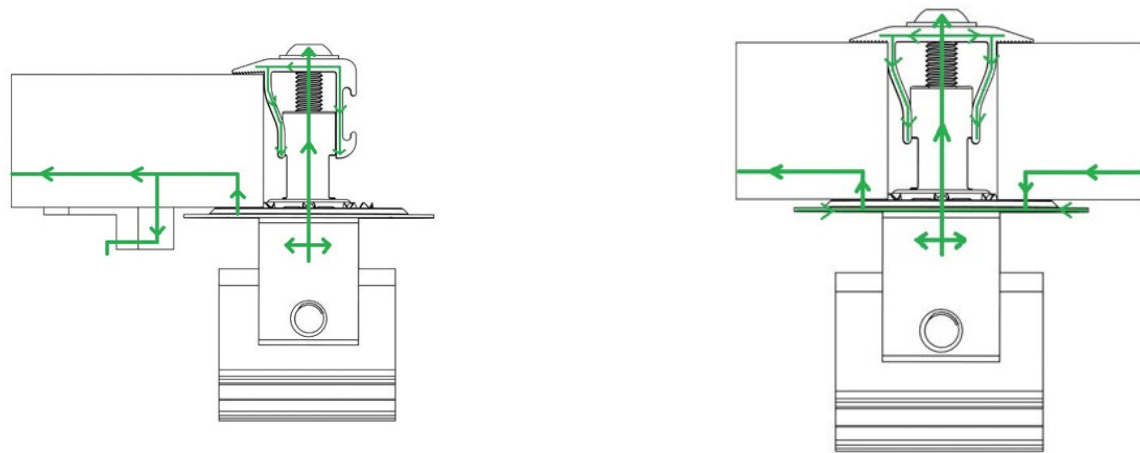
- **60 Cell Modules:** NRTL Listed PV Module - Q Cell model Q.PLUS BFR-G4.1, XXX, black frame, where XXX is 270-280.
- **72 Cell Modules:** NRTL Listed PV module - Q Cell model Q.PRO L-G4 XXX, 72 cells series, silver frame, where XXX is 310-320.

Jinko Solar:

- **60 Cell Modules:** JKMXXXPP-60, black frame where XXX is 260-345.
- **72 Cell Modules:** JKMXXXPP-72, 72 cells series, silver frame where XXX is 260-345.

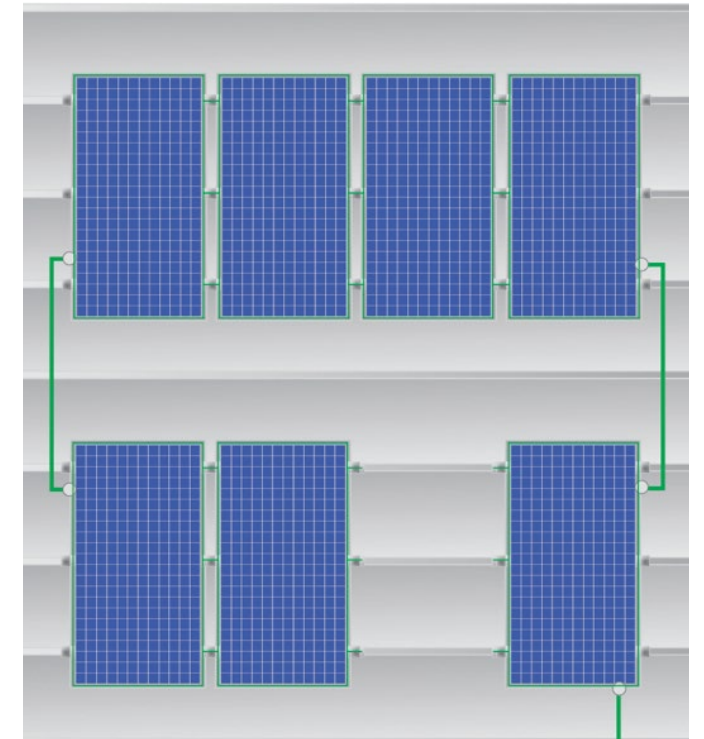
The following illustrates the system ground path with the green lines:

Please note the Mill Finish 3" Mounting Disc must be utilized to maintain a UL Listed assembly.



Important Notes:

1. Use QIMS UL 2703 Listed grounding lugs certified for frame thickness of the module being used and having a 15A fuse rating or less.
2. This ground lug must be utilized in conjunction with a ground wire to connect adjacent rows of modules. The ground lug should be secured to the PV module frame in accordance with manufacturers installation instructions.
3. In order to maintain a continuous ground path should a module be removed within a row, it is necessary to use a ground lug and ground wire at each end of the row of modules as illustrated to the right. If a ground lug and ground wire is not utilized at each end of a row of modules a temporary ground lug and ground wire must be used to connect modules at the location of the removed module.
4. The S-5-PV 3" Mounting Disc (Stainless Steel) is intended for SINGLE USE ONLY.
5. The intended ground path of black finished parts is through the Mill Finish 3" Stainless Steel Mounting Disc only. For non-separately derived systems, wire positioning must be out of reach of the black finish components.



2.5 SYSTEM FIRE CLASSIFICATION: CLASS A

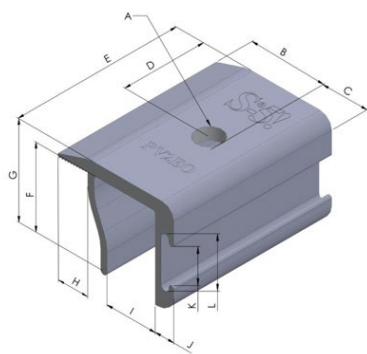
S-5! PVKIT 2.0 With the following roof clamps:

- S-5-U, S-5-U Mini
- S-5-S, S-5-S Mini
- S-5-T, S-5-T Mini
- S-5-Z, S-5-Z Mini
- S-5-N, S-5-N Mini

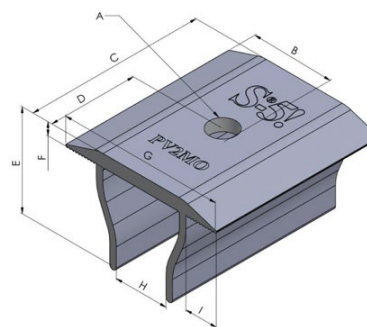
- S-5-E, S-5-E Mini
- S-5-V
- S-5-H90
- S-5! PVKIT 2.0 [BLK], including S-5! EdgeGrab [Mill] with roof clamp: S-5-Z Mini [BLK]

Evaluated for use on existing non-combustible roofs. Any UL1703 Listed module with fire classification rating: Type 1 or Type 2

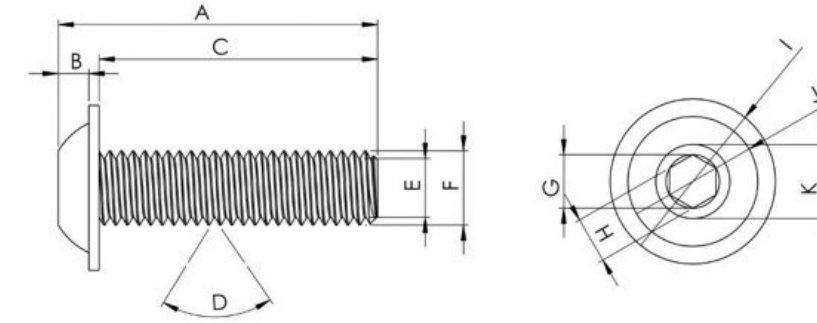
2.6 PVKIT 2.0 & BASIC CLAMP & BRACKET ENGINEERING DRAWINGS



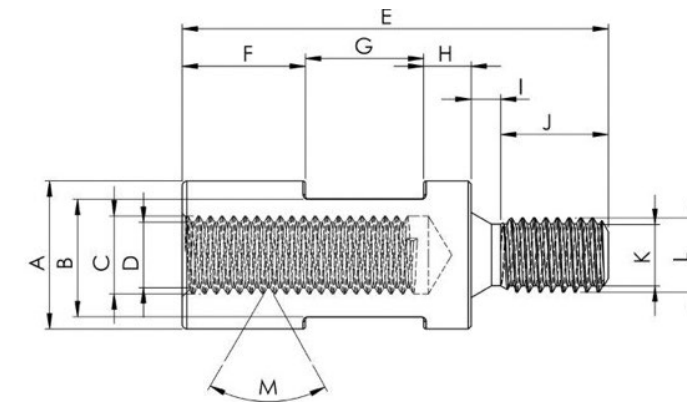
PV 2.0 EdgeGrab												
6000 Series Aluminum EdgeGrab for Module Edge/Perimeter Conditions												
UNIT	A	B	C	D	E	F	G	H	I	J	K	L
INCH	∅.32	.90	.56	1.00	2.00	1.00	1.14	.38	.61	.23	.43	.63
MM	∅8.1	22.9	14.2	25.4	50.8	25.4	28.9	9.7	15.5	5.8	10.9	16.0



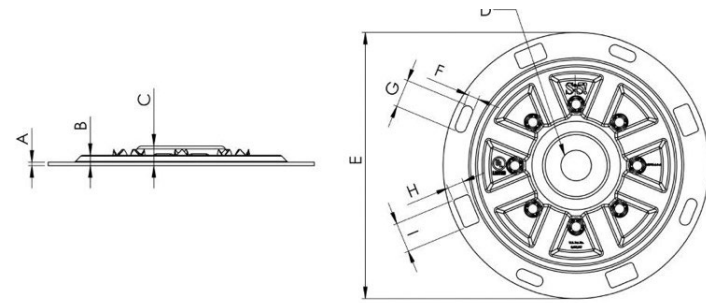
PV 2.0 MidGrab									
6000 Series Aluminum MidGrab for Module Edge/Perimeter Conditions									
UNIT	A	B	C	D	E	F	G	H	I
INCH	∅.32	.92	2.00	1.00	1.13	.15	1.85	.61	.38
MM	∅8.1	23.4	50.8	25.4	28.7	3.8	47.0	15.5	9.7



M8-1.25x26mm SS Flanged Button Head Screw											
300 Series Stainless Steel Bolt for PVKIT Assembly											
UNIT	A	B	C	D	E	F	G	H	I	J	K
INCH	1.20	.13	1.02	65.8°	∅.25	∅.31	.23	.20	∅.70	∅.55	∅.31
MM	30.4	3.3	26.0	65.8°	∅6.4	∅8.0	5.8	5.0	∅17.8	∅14.0	∅8.0



StandOff													
300 Series Stainless Steel													
UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M
INCH	∅.62	∅.50	∅.33	∅.28	1.8	.52	.50	.20	.13	.45	∅.26	∅.31	65.8°
MM	∅15.7	∅12.7	∅8.4	∅7.1	45.7	13.2	12.7	5.1	3.3	11.4	∅6.6	∅7.9	65.8°

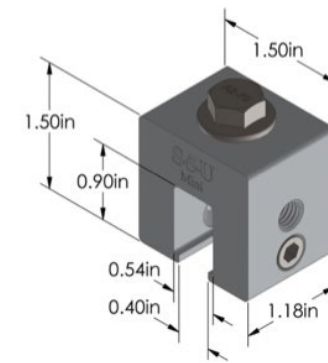


PV Disk 2.0									
300 Series Stainless Steel									
UNIT	A	B	C	D	E	F	G	H	I
INCH	.039	.12	.22	∅.34	∅2.96	.12	.31	.86	.33
MM	1.0	3.0	5.6	∅8.6	∅75.2	3.0	7.9	21.8	8.4

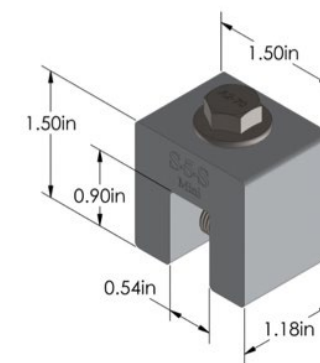
S-5-Z Standing Seam Mini [BLK]/Mill Clamp and Components

EXTERNAL THREADS - CLASS 2A						
SIZE (DIAMETER & THREAD PITCH)	SERIES DESIGNATION	MAJOR DIA. D	HEXAGON SOCKET SIZE		KEY ENGAGEMENT	
			J	T	K	L
3/8-24	UNF	0.3667 0.3739	3/16 .188	0.202	0.500	0.800

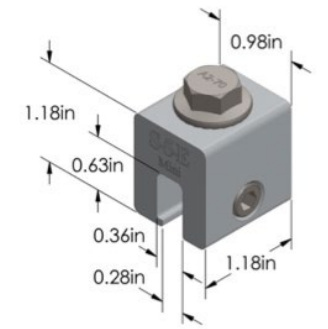
Dimensions in inch.



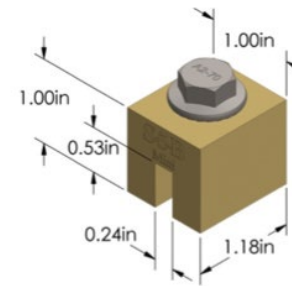
S-5-U Mini



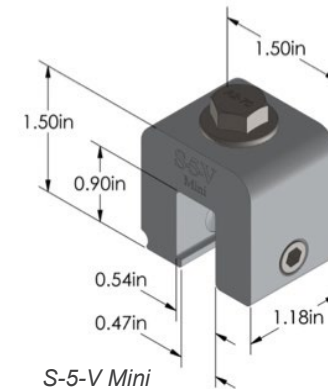
S-5-S Mini



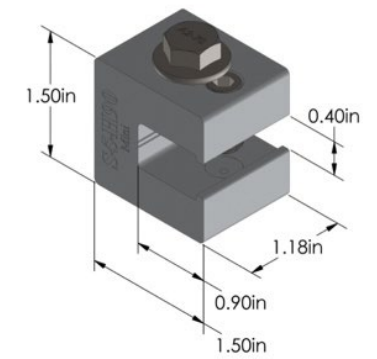
S-5-E Mini



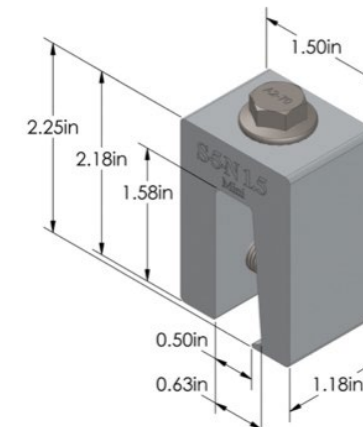
S-5-B Mini



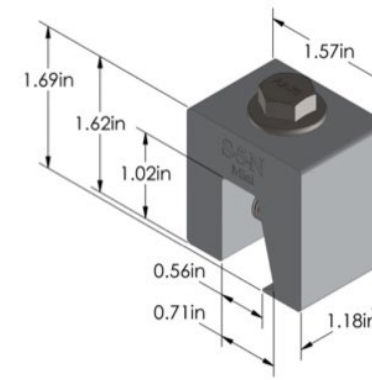
S-5-V Mini



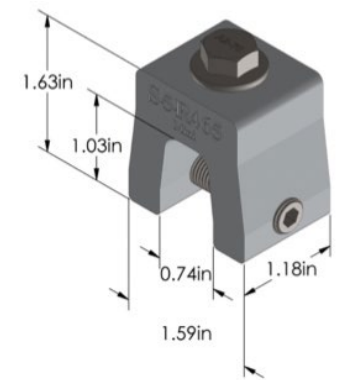
S-5-H90 Mini



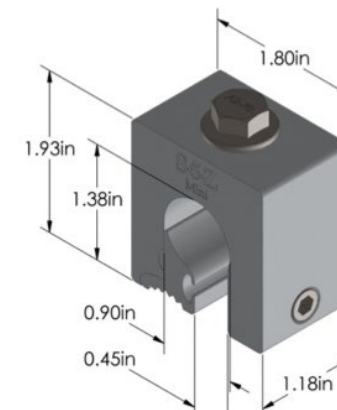
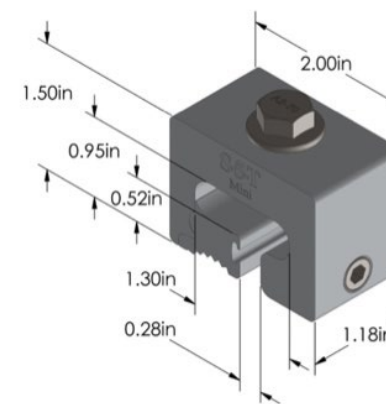
S-5-N 1.5 Mini



S-5-N Mini



S-5-R 465 Mini



2.7 WARRANTIES

Metal Roof Innovations, LTD. (MRIL) S-5! Limited Warranty

Metal Roof Innovations, Ltd (MRIL) warrants that all S-5! products manufactured by it and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized MRIL distributor to the original purchaser. As purchaser's sole remedy for breach of this warranty, MRIL will, for a period of twenty-five (25) years after the date of sale, repair or replace any part of the S-5! manufactured product which is defective. This warranty applies only when the S-5! product is properly installed, used and maintained.

This warranty does not cover, and MRIL shall not be liable for, any malfunction, damage or wear caused by faulty installation, misapplication, negligence, misuse, abuse, accident, tampering, substitution of non-S-5! component parts, or incompatibility with equipment, structures, accessories or materials not manufactured by MRIL. The purchaser acknowledges that MRIL expresses no opinions as to the suitability of S-5! products or components for any specific application or project condition.

This warranty is conditioned upon (a) the prepaid return of the products claimed to be defective to an authorized MRIL distributor for verification of the claimed defect; and (b) receipt by MRIL of claims for product repair or replacement within thirty (30) days after discovery of the defect or after the defect could have been reasonably discovered. If the claimed defect is verified, MRIL will repair or replace free of charge any defective products manufactured by MRIL. Replacement product will be returned with transportation prepaid.

Claims under this warranty must be in writing and sent to MRIL along with a copy of this limited warranty, the part or product model name or number, date and place purchased, date installed, operating conditions, and date the defect was discovered. MRIL shall have the right to examine the components, related parts, and product application, including adjacent work on the actual building site. Purchaser grants MRIL access to the site of the installation during normal business hours for this purpose.

Disclaimers and Limitations. The terms of this warranty constitute purchaser's sole and exclusive remedy and are in lieu of any other warranties (expressed or implied). MRIL MAKES NO OTHER WARRANTIES ABOUT THE PRODUCTS AND DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION. PURCHASER ASSUMES ALL RISK OF USE OF ANY OF THE PRODUCTS IN COMBINATION WITH OR AS A COMPONENT PART OF ANY PRODUCT APPLICATION. NOTWITHSTANDING THE ABOVE AND REGARDLESS OF THE CIRCUMSTANCES, MRIL'S TOTAL LIABILITY TO PURCHASER IS LIMITED TO AND SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OF THE DEFECTIVE PRODUCTS. PURCHASER WAIVES ANY AND ALL OTHER CLAIMS. IN NO EVENT SHALL MRIL BE LIABLE FOR, AND PURCHASER WAIVES ALL CLAIMS AGAINST MRIL RESPECT TO, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES, OR FOR ANY LOST PROFITS. EVERY FORM OF LIABILITY FOR DIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES IS EXPRESSLY EXCLUDED. ANY CIVIL ACTION FOR BREACH OF WARRANTY MUST BE COMMENCED WITHIN TWENTY-FIVE (25) YEARS OF THE DATE OF SALE OR WITHIN ONE YEAR AFTER THE PURCHASER DISCOVERED OR SHOULD HAVE DISCOVERED THE DEFECTIVE PRODUCT.

This warranty gives the purchaser specific legal rights. Purchaser may have other rights which vary from state to state. For a copy of warranty, please see: <https://www.s-5.com/wp-content/uploads/page/S-5-25yr-Warranty.pdf>



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