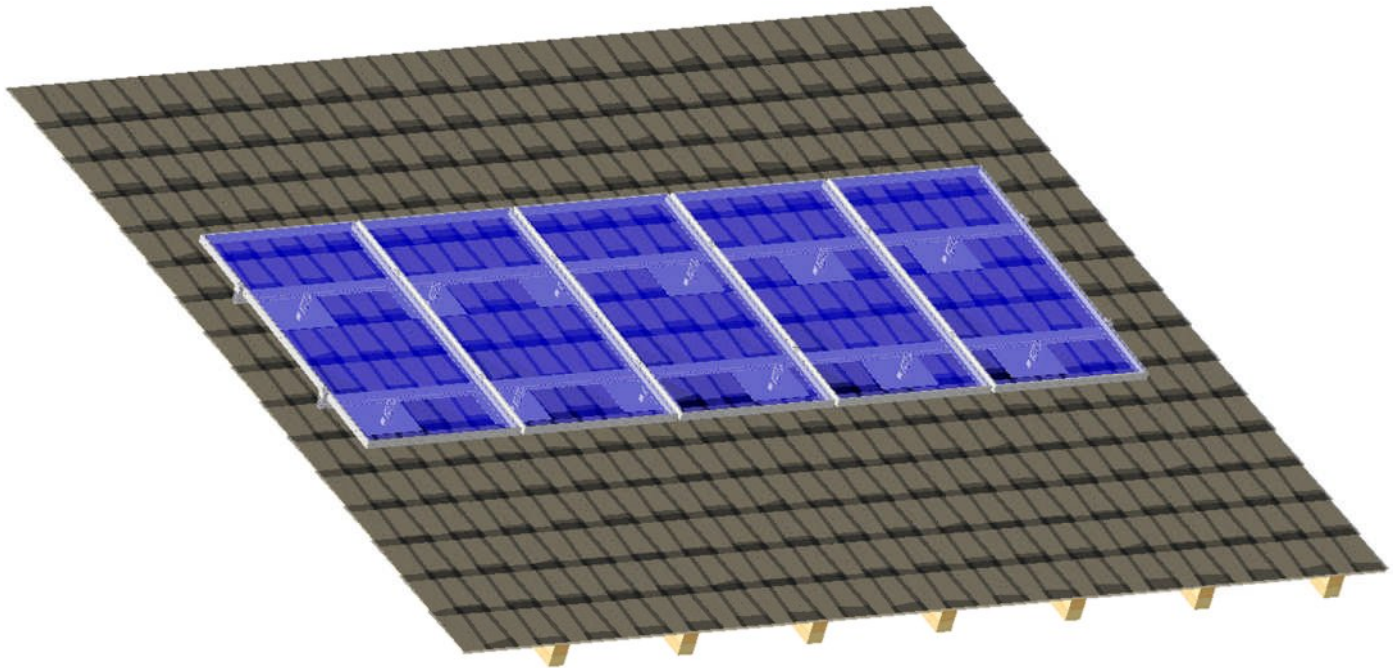


Assembly Instructions

Pitched Roof Application

***for framed PV-Modules**

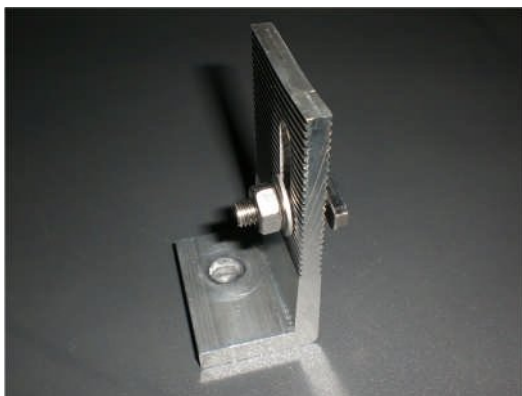


Needed tools and materials

- ▶ Open Ended Wrenches (10, 13)
- ▶ Metric Allen Wrenches or Driver sizes: M (5, 8)
- ▶ Cordless screwdriver
- ▶ Approved flashing system or standoff device for the attachment of the system on the roof
- ▶ Stainless steel screws, bolts and hardware shall be used for attaching to S:FLEX rails and materials to prevent galvanic corrosion. Where different metals are used in combination, insulation shall be used to break all contact between metals.

We want to point out that our mounting instructions reflect the state of technology and our experience on how to install our systems on site. Due to the fact that each roof has individual characteristics, we highly recommend commissioning a professional assessment before beginning the installation. In particular it is necessary to take into account static requirements. During the installation of the system, bear in mind the compliance with the corresponding norms and legislation referring to the prevention of accidents (see also page 15).

S:FLEX's pitched roof systems are designed from the Angle Bracket up and must be attached to an approved and properly installed standoff or flashing system of the installer's choice.



1.1

Angle Brackets must have hardware installed before installation can begin. To do this, insert one of the T-Bolts provided and loosely fasten with a nut and washer. See Figure 1.1



1.2

Approved flashing or standoff devices are to be properly installed along the desired plane for the installation of the mounting rails. The rails that will be mounted on these will serve as the structure to which the solar modules are mounted.

Angle brackets can now be fastened to an approved and properly installed flashing or standoff device such as the Quick Mount PV™ version shown here.

See Figure 1.3

(Torque: Dependent on size of hardware)

Mounting Rail Attachment:



Mounting rails can now be attached to the angle brackets. To do this, simply insert the T-Bolt on the angle bracket into the C-Channel on the side of the mounting rail. Turn the T-Bolt clockwise until it stops (approximately $\frac{1}{4}$ turn).

See Figure 2.1

(Torque: 8 ft. lbs)

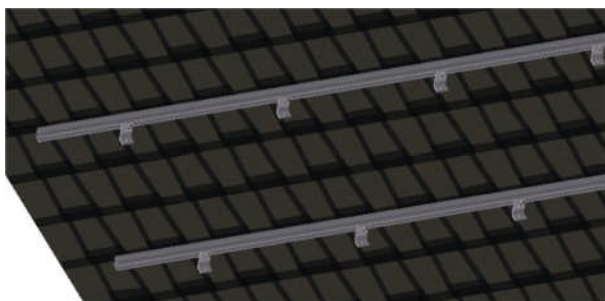
2.1 Note: *The serrated edges allow the rail to be adjusted vertically on the angle bracket to desired height.*



2.2

To ensure that T-Bolt is properly aligned make sure that the line on the back of the T-Bolt is perpendicular to the rail and is pointing straight up and down.

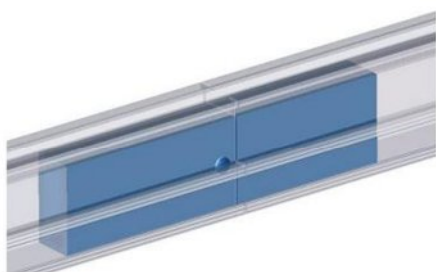
See Figure 2.2



2.3

Continue fastening all angle brackets on mounting rails until the system is completely attached to the roof.

See next step if a rails need to be joined together.



2.4

Additional mounting rails can be attached using a splice. To install, simply insert the splice into the end of the rail that will need to be joined until the rivet on the middle of the splice stops the insertion. Then slide the opposing rail over the exposed end of the splice and push together. Do not attempt to through bolt splice. $\frac{1}{2}$ " gap or separation between rails is required for thermal expansion.

See Figure 2.4

**Note: There must be attachment points to the roof of any rails that are spliced together.*

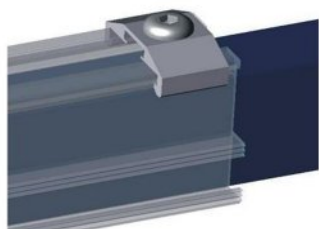
Telescope and Anti Slip Hardware Installation (optional):



3.1

Optional:

To best adapt the length of the mounting rails to the module dimensions, use the pre-assembled telescopic shaft from S:FLEX. To install, slide the shaft onto the mounting rail and fasten it to the roof hooks. Adjust the length (max. 23 inches). See Figure 3.1

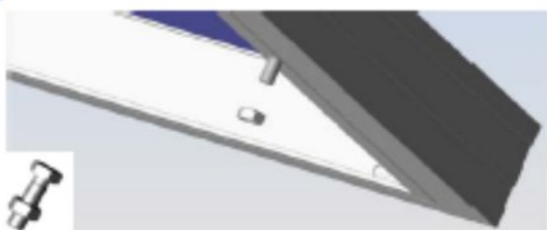


3.2

Now, slide the locking clip onto the mounting rail and tighten the screw.

See Figure 3.2

(Torque: 8 ft. lbs.)

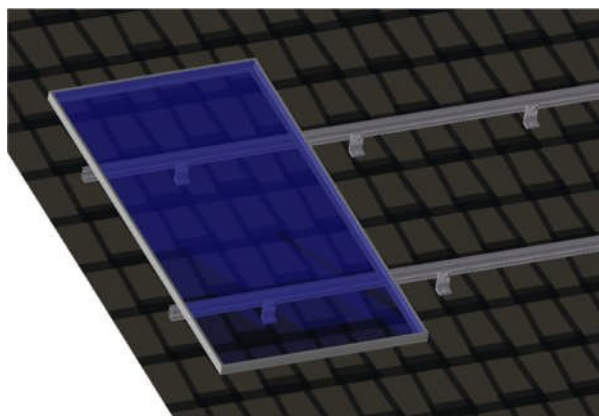


3.3

Optional:

Before they are mounted, the modules are equipped with anti-slip protection. This is done by attaching $\frac{1}{4}$ x $\frac{3}{4}$ in. SS bolts (with the shank downward) with $\frac{1}{4}$ in. nuts in the lower mounting holes of the module. When mounting large modules (e.g. ASE250), $\frac{5}{16}$ x $\frac{3}{4}$ in. SS bolts are used.

See Figure 3.3

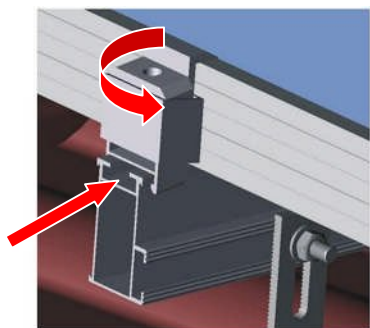


3.4

To install the first module, place the anti-slip screw (optional) on the top side of the top mounting rail. This will allow the module to rest on the mounting rails without the need to hold them in place.

See Figure 3.4

Module Installation:

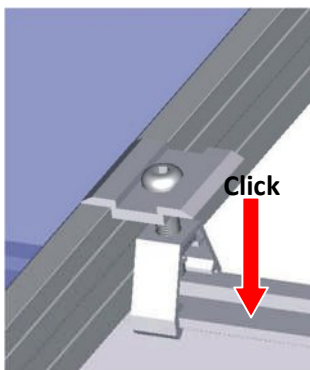


4.1

To clamp module to mounting rails, slide end clamps onto end of mounting rails. Push the module end clamp against the edge of the module frame. Module end clamps are height adjustable by simply turning the screw within the clamp clockwise to expand and counterclockwise to tighten.

See Figure 4.1

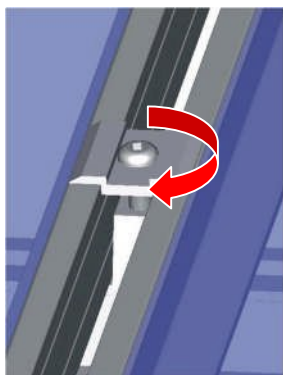
(Torque: 8 ft. lbs.)



4.2

Now click the mid clamp onto the mounting rail and slide it onto the module. Ensure that the mid clamp clicks onto both sides of the mounting rail.

See Figure 4.2

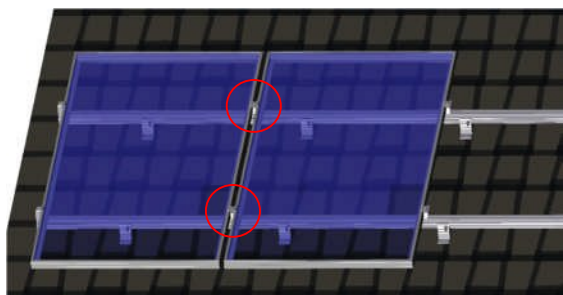


4.3

Now, slide the next module under the mid clamp, adjust it to the module frame height and tighten the screws clockwise.

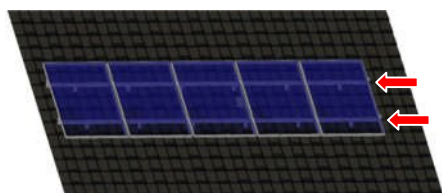
See Figure 4.3

(Torque: 8 ft. lbs.)



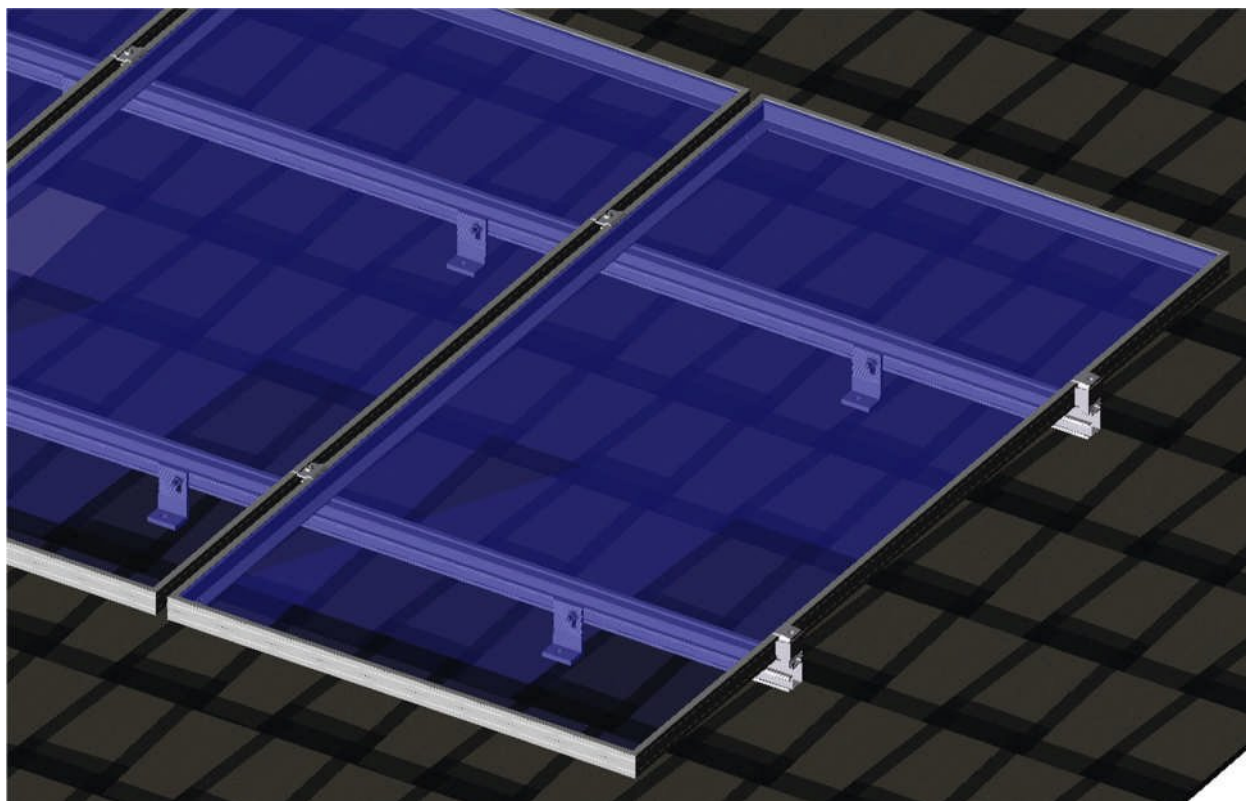
4.4

Modules are now fixed to mounting rails. Continue the same process with the rest of the modules in the row.

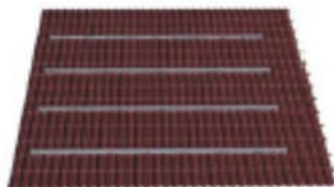


4.5

Once all modules are mounted, an end clamp is also attached to the end of the mounting rail as illustrated in Figure 4.1 above.

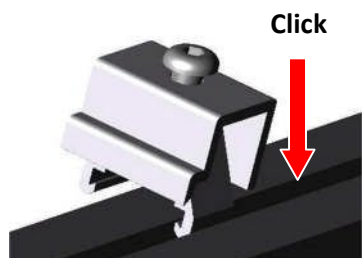


Assembling System Using Cross Rails:



5.1

Follow the assembly sequence for the horizontal, substructure rail described in sections 1.0 to 3.2.



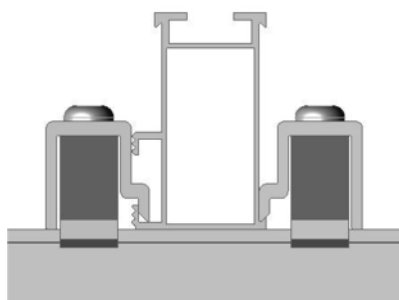
5.2

Mount the vertical mounting rails onto the horizontal substrate rails for each row of modules using the cross adapters.

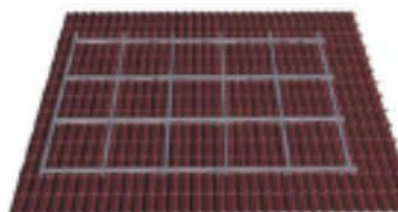
Click the cross adapters onto the base rails and slide attachment lip into channel on base rail. Fasten the clamp screws by turning clockwise.

See Figures 5.2 & 5.3

(Torque: 8 ft. Lbs)



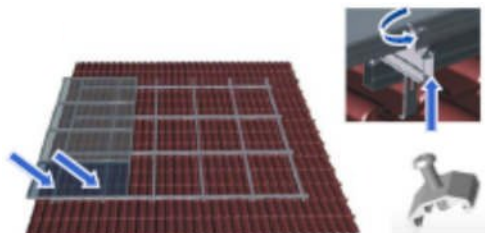
5.3



Use the correct number of cross adapters for the mounting rails. Number of clamps per intersection point:

► ST/AK 13/60 = 2 cross adapters

To set up several mounting rails in a row, follow the procedure described under section 5.1-5.3.



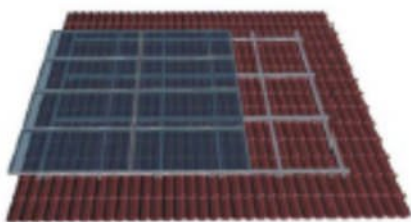
5.4

Slide the end clamp onto the vertical mounting rails as shown in section 4.1.

Afterwards, slide a locking clip onto the end of each vertical mounting rail and fasten it by tightening the screw clockwise.

See Figure 5.4

(Torque: 8 ft. lbs.)

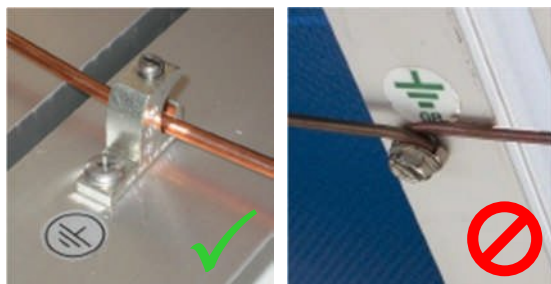


5.5

Slide the first module into the end clamp. Then, adjust the end clamp to the module frame height as illustrated in section 4.1.

Additional modules are mounted as described in sections 4.2 to 4.5.

Grounding:



Left: Correct application with Lay-in Lug.
Right: Wrong application – potential for corrosion and loss of electrical contact in the future. Direct contact between dissimilar metals should be avoided. **6.1**

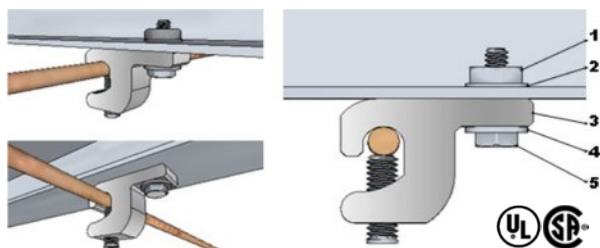
For safety reasons, ground the module frame, array and mounting rails before wiring the circuit in a manner that is in accordance with NEC requirements for grounding solar electrical systems. When grounding, use material that is certified according to UL 1703. In addition, grounding hardware must be compatible with other materials to avoid corrosion due to the use of dissimilar metals – see figure 6.1. Grounding should only be performed by a qualified electrician. Wiring shall be in accordance with the NEC and grounding method shall also be in accordance with the NEC, article 250 and any relevant local code and/or ordinance. Grounding method of the frame of arrays and mounting rails shall comply with NEC, article 250.

It is critical that the grounding system be designed so that maintenance and/or repair work on one module in the circuit will not interrupt the grounding of any of the other modules or mounting systems. Each mounting rail has to be grounded with appropriate grounding hardware. Each module has usually designated grounding holes in the frame for use with appropriate grounding hardware.

Component	Description
Grounding Lug	Lay-In Lug – IlSCO GBL-4DBT
Bolt	#6 32, SS
Serrated Washer	M5, SS
Washer	ID 9/64", OD 3/8", SS
Nut	#6-32, SS

Table 1: Recommended Grounding Components

S:FLEX recommends using a UL listed lay-in ground lug such as IlSCO GBL-4DBT or equivalent, and stainless steel hardware (bolt, washer, serrated washer and nut). A tooth washer (serrated washer) should be used between the grounding lug and the module frame because it is critical that the grounding hardware break through the anodizing layer and establish electrical connection with the aluminum frame. Grounding hardware for outdoor use should be stainless steel. See Table 1 for a list of recommended components. The assembly must be at a torque between 15 in-lbs to 20 in-lbs for #6-32 bolts.



1 – Nut
 2 – Serrated Washer
 3 – Ground Lug
 4 – Washer
 5 – Bolt

6.2

S:FLEX recommends that the ground lug be secured using a bolt, washer, serrated washer and nut assembly. The assembly shall incorporate some type of locking mechanism (lock washer, lock nut, etc.) to maintain tension between the bolt and the assembly. The grounding assembly should be designed to prevent components from wiggling loose, which can jeopardize the integrity of the grounding system. See Figure 6.2 for an example of acceptable means of equipment grounding. Refer to NEC article 690 on grounding PV arrays for specific requirements.

The equipment grounding conductor must be sized according to the NEC and shall be of copper, copper alloy or other material acceptable for use as an electrical conductor. Only the stainless steel set screw of the lay-in ground lug provided by the supplier of the grounding material should be used to securely attach the copper equipment grounding conductor. Any UL approved PV grounding method and components are also acceptable for the US and Canada.



6.3

Long rails for roof mount installations are sometimes constructed from two shorter rail sections with a mechanical splice. It is then necessary to also make an electrical splice. When installing the electrical splice on spliced rails that require provisions for thermal expansion, install the electrical splice with some slack. Flexible Braids (e.g. from Blackburn), Bonding Jumpers (from Wiley) or two Lay-in Lugs on each side of the splice with a bent copper wire will suffice as an appropriate grounding hardware – see figure 6.3.



6.4

PLEASE BE AWARE: Figure 6.4 shows an aluminum Lay-in Lug which closely resembles the tin plated copper Lay-in Lug that is appropriate for use in PV applications. Unlike the direct burial lug, however, the aluminum lug is not rated for outdoor use and does not include a stainless steel set screw. Corrosion and the loss of electrical contact will be the result.

PLEASE BE AWARE: A closely resembling aluminum Lay-in Lug will lead to corrosion and loss of electrical contact. A tin plated copper Lay-in Lug with stainless steel screws has to be used.

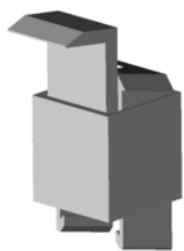
Rail Span Chart:

Table 1 - MAXIMUM SPAN FOR S:FLEX ST-AK 13/60 RAIL ^{a, b, c, d, e, f, g, h, i, k, l}

WIND EXPOSURE	WIND SPEED (3-SEC GUST)	SNOW LOAD (POUND PER SQUARE FEET)						Note
		0 psf	10 psf	20 psf	30 psf	40 psf	50 psf	
CATEGORY B	85 MPH	7' - 10"	7' - 0"	6' - 1"	5' - 5"	4' - 9"	3' - 11"	
	90 MPH	7' - 6"	6' - 10"	5' - 11"	5' - 4"	4' - 8"	3' - 11"	
	95 MPH	7' - 2"	6' - 8"	5' - 10"	5' - 2"	4' - 6"	3' - 11"	
	100 MPH	6' - 10"	6' - 5"	5' - 8"	5' - 1"	4' - 5"	3' - 9"	
	110 MPH	6' - 3"	6' - 1"	5' - 5"	4' - 10"	4' - 1"	3' - 7"	
	120 MPH	5' - 10"	5' - 9"	5' - 2"	4' - 6"	3' - 10"	3' - 5"	
	130 MPH	5' - 5"	5' - 5"	4' - 11"	4' - 2"	3' - 7"	3' - 2"	
	140 MPH	5' - 1"	5' - 1"	4' - 6"	3' - 10"	3' - 5"	3' - 0"	
	150 MPH	5' - 8"	5' - 8"	5' - 5"	5' - 1"	4' - 6"	4' - 1"	See note j below for this row
CATEGORY C	85 MPH	6' - 11"	6' - 5"	5' - 9"	5' - 2"	4' - 5"	3' - 10"	
	90 MPH	6' - 7"	6' - 4"	5' - 7"	5' - 0"	4' - 3"	3' - 8"	
	95 MPH	6' - 4"	6' - 1"	5' - 5"	4' - 10"	4' - 1"	3' - 7"	
	100 MPH	6' - 0"	5' - 11"	5' - 3"	4' - 8"	4' - 0"	3' - 6"	
	110 MPH	5' - 6"	5' - 6"	5' - 0"	4' - 3"	3' - 8"	3' - 3"	
	120 MPH	5' - 1"	5' - 1"	4' - 6"	3' - 11"	3' - 5"	3' - 0"	
	130 MPH	5' - 8"	5' - 8"	5' - 5"	5' - 1"	4' - 6"	4' - 1"	See note j below for this row
	140 MPH	5' - 3"	5' - 3"	5' - 2"	4' - 8"	4' - 2"	3' - 9"	See note j below for this row
	150 MPH	4' - 10"	4' - 10"	4' - 10"	4' - 4"	3' - 10"	3' - 6"	See note j below for this row

- a. This table does not include roof capacity check or standoff connection check. Installer to check lag screw pull-out capacity or roof connection and roof joist capacity. The standoff spacing might be less than what listed in the table above based on roof capacity or pull-out value.
- b. Maximum building mean roof height is 24 feet.
- c. Maximum roof slope is 45 degrees.
- d. ST-AK 13/60 rails are installed parallel to roof and perpendicular to roof joists.
- e. Maximum solar module length dimension is 77" and 40" wide.
- f. Roof wind zone 1 and zone 2. Zone 3 as long as no more than 25% of the panel extends into zone 3.
- g. The width of zones 2 and 3 from roof edges is 3' - 6" for the least horizontal building dimension of 35 ft.
- h. Maximum end cantilever span is 35 percent of adjacent interior end span.
- i. No rail splices permitted within the middle 1/2 of the span.
- j. Provide (3) ST-AK 13/60 rails at (0.35 x Module Length) on center. Installer to check with module manufacturer for additional panel supports when wind speed is more than 110 mile per hour or snow load exceeds 45 pound per square feet.
- k. Rails installed in two-span continuous condition minimum.
- l. Installation is away from topographic effects ($K_{zt} = 1.0$).

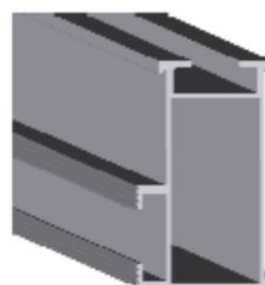
Key Components:



C-Si End-Clamp



C-Si Mid-Clamp



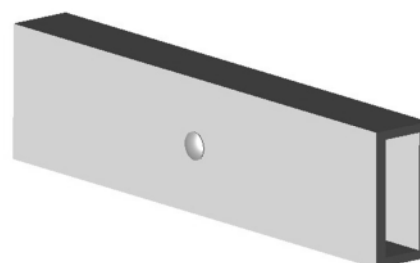
ST-AK 13/60



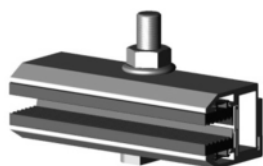
Cross Adapter



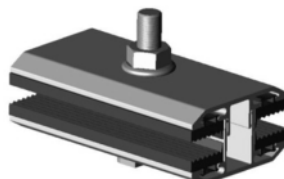
Angle Bracket



ST-AK 13/60 Splice



Thin Film End-Clamp



Thin Film Mid-Clamp

10 Year Limited Product Warranty



S:FLEX USA (“Seller”), warrants to the original buyer (“Buyer”) of product(s) that it manufactures (“Product”) at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, from the earlier of (i) the date the installation of the Product is completed, or (ii) 30 days after the purchase of the Product by the original Buyer (the “Warranty”).

The Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance with Seller’s written installation instructions and design specifications therein, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Seller IN WRITING, or if the Product is installed in an environment for which it was not designed. This Warranty shall be VOID if Buyer does not pay all invoices promptly as due in accordance with all purchase orders, invoices, or other any other contract document. Seller shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Buyer under any circumstances. This Warranty is expressly subject to Seller’s Standard Terms and Conditions, which are incorporated herein by reference. SELLER MAKES NO WARRANTY THAT THE GOODS WILL BE MERCHANTABLE OR FIT FOR ANY PARTICULAR PURPOSE. SELLER MAKES NO WARRANTY EXPRESSED OR IMPLIED EXCEPT SUCH AS IS EXPRESSLY SET FORTH HEREIN.

Unless otherwise agreed in writing by the Parties, the Warranty shall be for a period of ten (10) years. However, for specified components generally, or for a particular type of use of a component, the term of the Warranty may be shorter as expressly specified or provided for by Seller’s individually-generated plans for the pertinent project. If a shorter Warranty is specified as to any component, or if an exchange of a component is scheduled within a shorter period, the Warranty period shall be restricted to such specified shorter period.

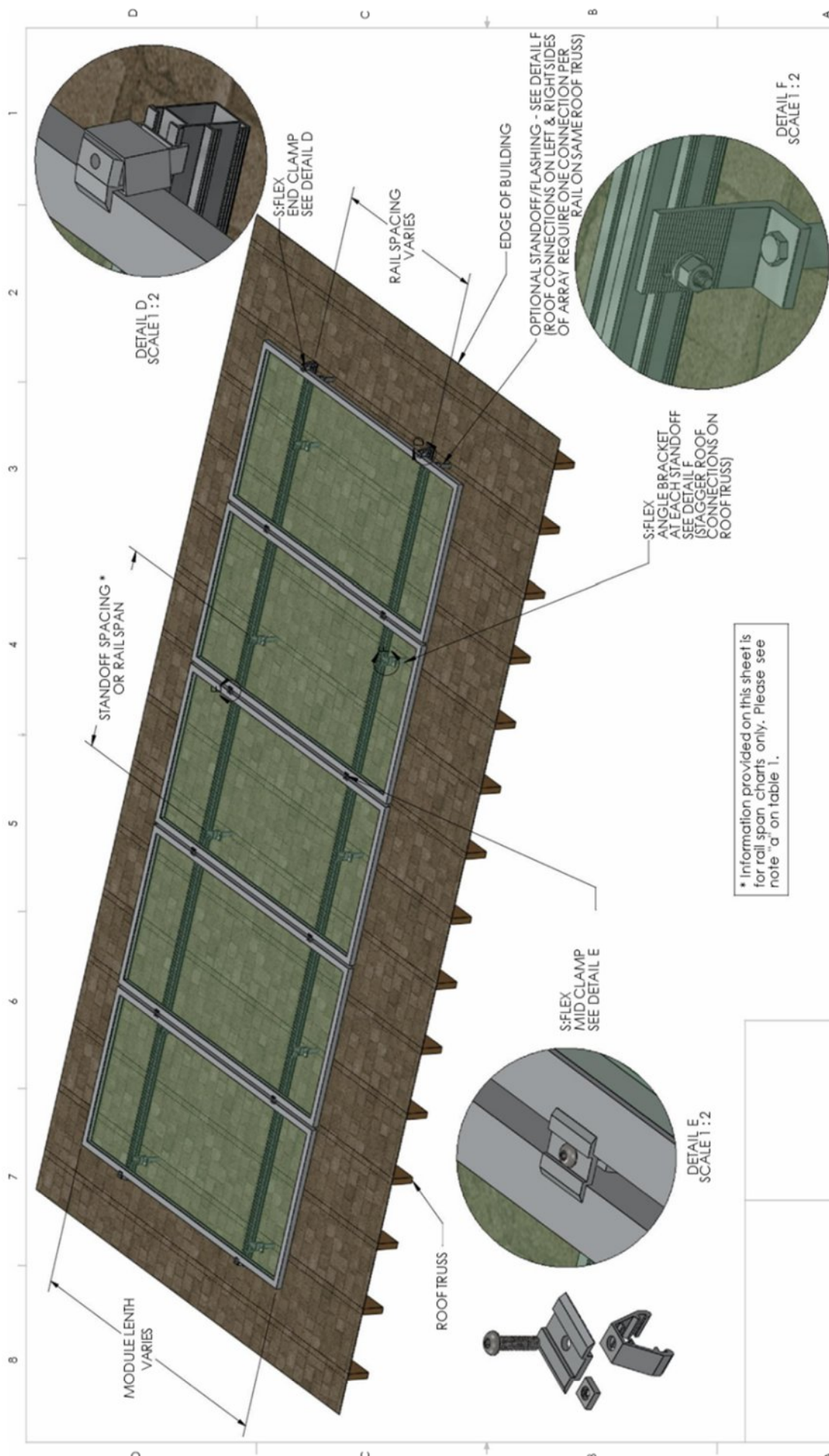
If, despite proper installation and handling and normal use, any structural component fails to perform as designed within the Warranty period, Seller shall promptly, after notice, exchange such component. The Warranty is limited to additional delivery and assembly of the defective component upon notification of the damage within the Warranty period.

The obligation to perform under the Warranty shall not apply if the pertinent damage arose in connection with defective installation or handling of the system of which it is a part or in connection with exceptional stress, unless the damage is documented as not having been caused thereby rather was caused by a design or manufacturing defect. With regard to installation and handling, the technical product descriptions and installation instructions regarding the goods supplied by Seller shall apply, as shall generally recognized standards and principles of building and construction work, together with, as appropriate, the plans, specifications and instructions prepared by Seller for Buyer for the particular project.

No claims shall exist if the damage is covered or coverable by insurance against storm and similar natural events. The Warranty extends only to claims of Buyer. Third parties shall have no rights or benefits under the Warranty. This Warranty is non-assignable and non-transferrable, without the written consent of Seller.

If within the specified Warranty period the Product are reasonably proven to be defective, then Seller shall repair or replace the defective Product, or any part thereof, in Seller’s sole discretion. Such repair or replacement shall completely satisfy and discharge all of Seller’s liability with respect to this limited Warranty. Under no circumstances shall Seller be liable for special, indirect or consequential damages arising out of or related to use by Buyer of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Seller’s limited Warranty covers only its Product, and not any related items.



* Information provided on this sheet is for roll span charts only. Please see note "a" on table 1.

PROJECT NAME:		DATE:		DATE:		DATE:		DATE:		DATE:	
DRAWING NAME: Roof Mount Assembly		DWN CHECKED		DRE 2/2/11		REV		REV		REV	
SIZE: B		DO NOT SCALE DRAWING		SHEET 1 OF 1		MATERIAL: ALUMINUM 6063-T5 (HULL FINISH)					
CHECKED BY: PJK		DESIGNED BY: JIL		DATE: 02.08.2011							

S:FLEX
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Greenwood Village, CO 80111

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Website: www.sflex.com

The designs are based on the following codes:

- 2005 International Building Code
- 2009 International Building Code
- American Society of Civil Engineers 7-05
- 2010 Aluminum Design Manual
- American Institute of Steel Construction Manual Thirteen Edition
- American Concrete Institute ACI 318R-05

