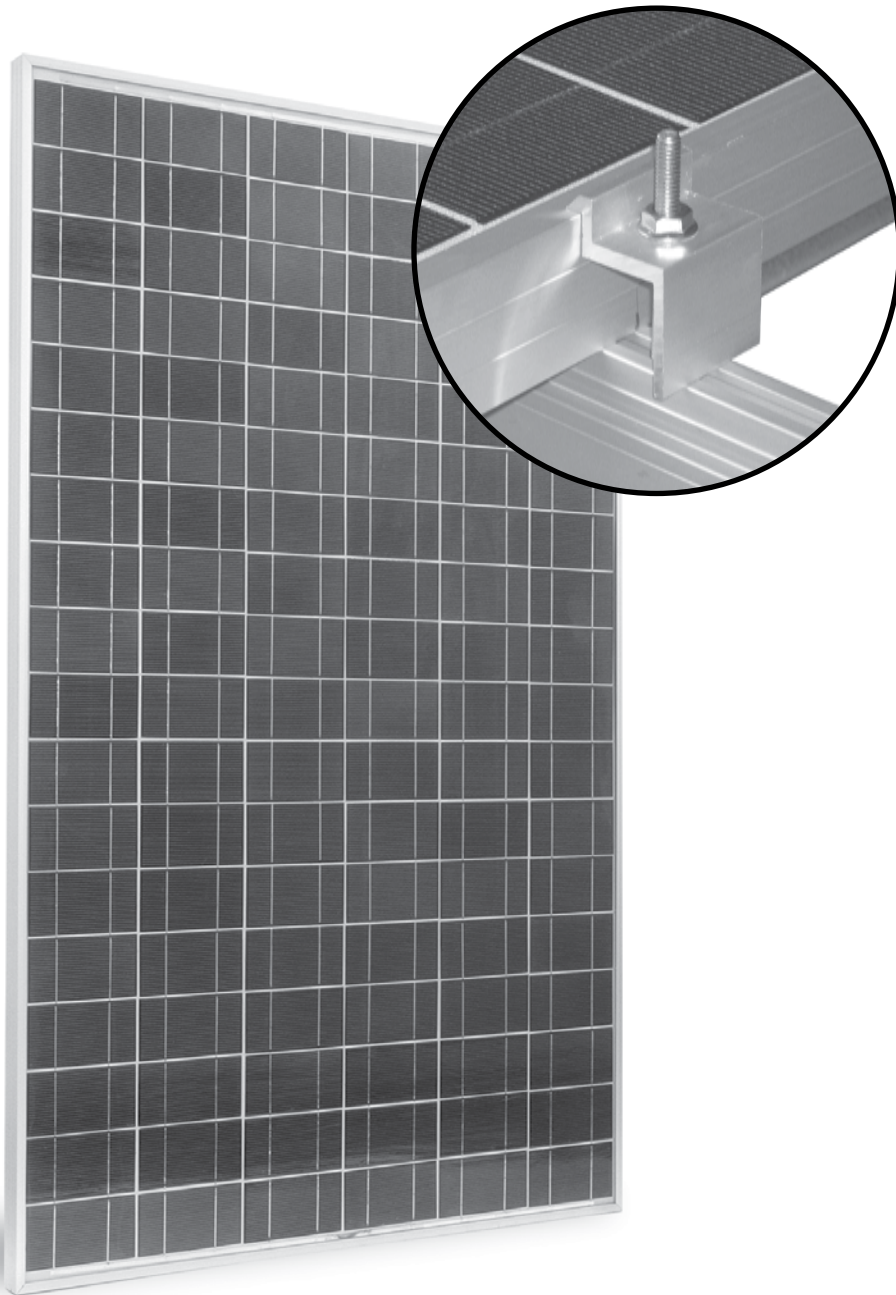


SPRUCE LINE™ photovoltaic modules

Mounting Design Guide



ELECTRICAL EQUIPMENT — CHECK WITH YOUR INSTALLER

Evergreen Solar Spruce Line photovoltaic (PV, solar electric) modules are designed to produce DC electrical energy from light. This manual contains important installation information with which you should be familiar before using Evergreen Solar modules.



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Due to continuous innovation, research and product development, the guidelines in this Mounting Design Guide are subject to change without notice. No rights can be derived from the Mounting Design Guide and Evergreen Solar assumes no liability whatsoever connected to or resulting from the use of any information contained herein.

Introduction

This guide is designed to make using Evergreen Solar panels as easy as possible by providing a comprehensive range of installation options.

It is also designed to give you clear instructions on how to install Evergreen Solar panels to ensure compliance with all major certification and regulatory requirements as well as Evergreen Solar warranty requirements.

All guidelines in this document apply to Spruce Line™ products manufactured by Evergreen Solar. They do not apply to any other products manufactured by Evergreen Solar or any product manufactured by another company. Spruce Line products not installed according these guidelines will void the warranty.

Three major methods of mounting Spruce Line solar panels are described in this guide:

Method A: Support rails or support points located symmetrically under the module

Method B: Independent support points located asymmetrically under the module

Method C: One support beam located under the center of the module

Each method has several permissible configurations, which are all described in detail. Each configuration has a maximum combined wind and snow loading associated with it that is guaranteed by Evergreen Solar. Modules can be mounted in either a horizontal or vertical orientation providing one of the approved mounting methods is used.

The mounting system vendors' installation instructions must always be strictly followed and in cases where the mounting system vendor either:

- a) Does not allow a particular configuration which is permissible according to this guide, or
- b) Does not allow wind or snow loads as high as described in this guide,

Then the mounting vendors' installation instructions must take precedence over these guidelines. In any cases of doubt the mounting vendors' installation instructions should always take precedence.

In addition, you should always consult with your local authorities for stricter regulations which may apply in your particular area or to the particular structure you are attaching Evergreen Solar panels to.

For additional information please read the Safety, Installation and Operation Manual provided by Evergreen Solar and available upon request.

We wish you every success in using Evergreen Solar product.

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Mounting Method A

Support rails or support points located symmetrically under the module

Configuration Options

Two symmetrical mounting configurations are permissible: end mounting and offset mounting. End mounting (Figure 1) uses two support rails installed under the outer edges of the module frame (on the short sides) that run flush along the entire module width.

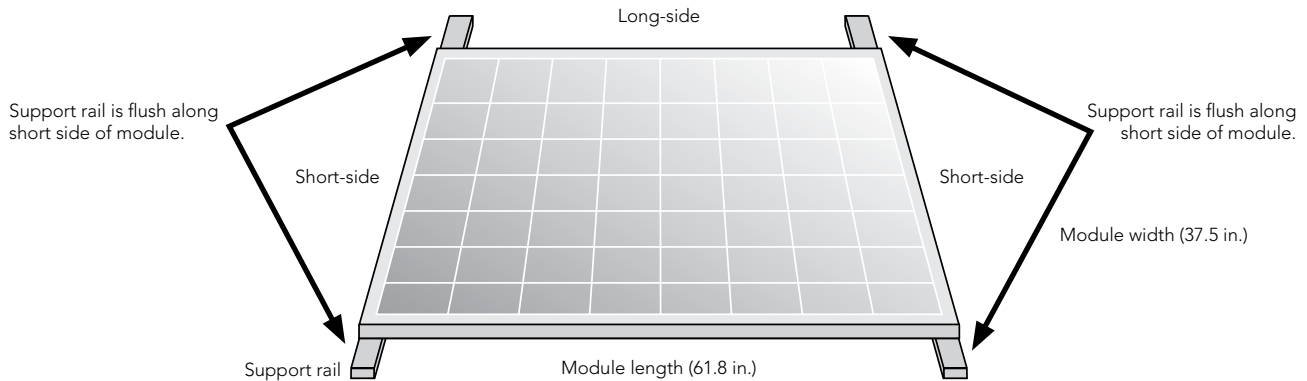


Figure 1: End Mounting

Offset mounting (Figure 2) uses two support rails installed under the main span of the module and extending across the entire module width.

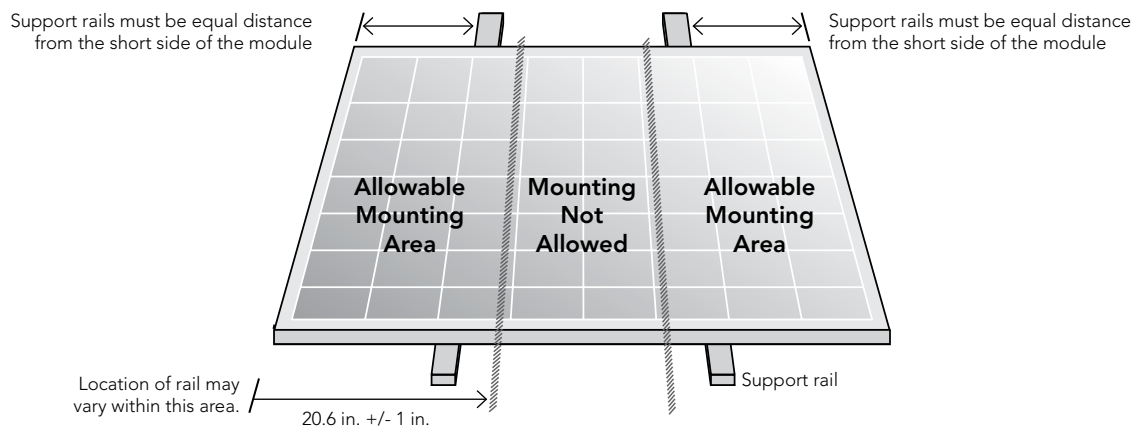


Figure 2: Offset Mounting

For offset mounting, both rails must be located inside the allowable mounting areas indicated in Figure 2 (i.e. within 20.6 in. of each short-side edge of the module). One rail must lie under each half of the module and both rails must be the same distance from the corresponding short-side of the module. The following sections describe each mounting configuration in more detail.

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End Mounting

The end mounting method is guaranteed to a maximum combined wind and snow load of **60 lbs/ft²**. Two end mounting options are permissible as detailed below:

Option #1 – Rigid Rail Supports

Rigid rails spanning the entire module width must support the short-sides of the module. The rail area directly in contact with the module frame must be at least $\frac{3}{4}$ in. wide. Topside clamps must be used to secure the module in place and must overlap at least $\frac{1}{8}$ in. of the frame top surface. Three different topside clamp configurations may be used as follows:

Clamp Arrangement #1a

The short sides of the module may be clamped along the entire frame top surface as shown in Figure 3.

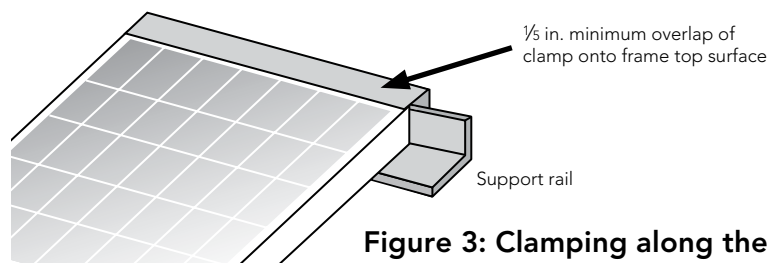


Figure 3: Clamping along the complete length of the module short-side

Clamp Arrangement #1b

The short sides of the module may be clamped at the corners using a top-side clamp shared by adjacent modules. Since Evergreen Solar recommends a minimum $\frac{1}{4}$ in. gap between modules, the clamp should be at least $2\frac{1}{4}$ in. long to ensure each module frame is clamped by at least 1 in.

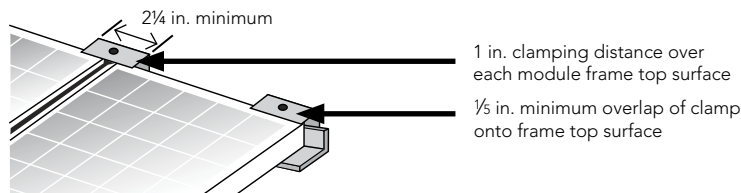


Figure 4: Clamping adjacent module frames

Clamp Arrangement #1c

The short sides of the module may be clamped by two top-side clamps which are not shared by adjacent modules. Each clamp must be at least 1 in. long and the entire clamp must be positioned within 3 in. from the nearest module corner.

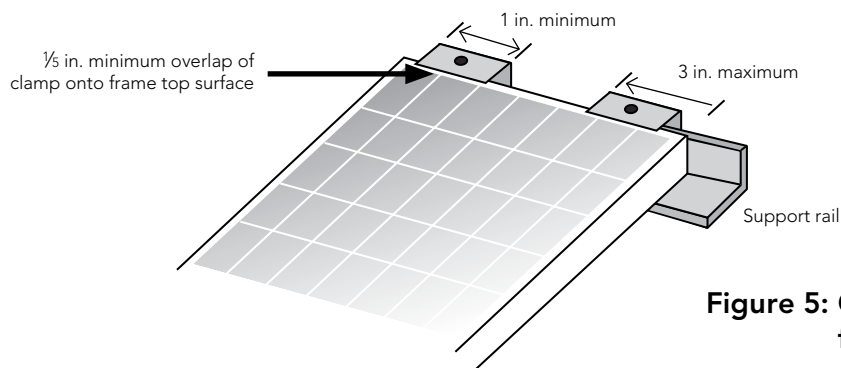


Figure 5: Clamping each module frame individually

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Option #2 – Clamp-Based Supports Only

The short sides of the module may also be supported and clamped at each corner without using support rails in direct contact with the frame. Each corner clamp must be at least 1 in. long and clamp both the top and bottom surfaces of the frame over a distance of at least 1 in. The entire clamp must be positioned within 1¾ to 3 in. of the module corner.

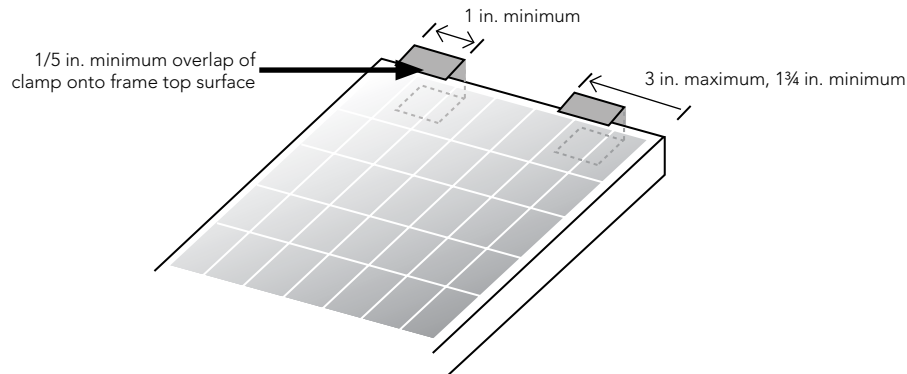


Figure 6: Clamping each module without rails in direct contact with the module

Offset Mounting:

For the offset mounting configuration the first mounting rail – installed on either the left or right side of the module – must be installed within the allowable mounting area (i.e. within 20.6 in. of each short side edge). The second rail must be located at the same distance from the opposite short edge of the module.

There are 4 sections (I, II, III and IV) within the allowable mounting area that correspond to different maximum combined wind and snow loads. The location of each section is shown in Figure 7.

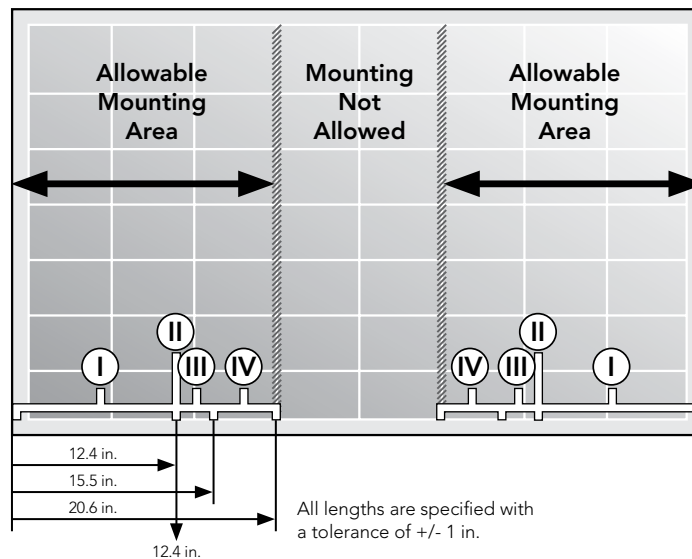


Figure 7: The location of different sections in the allowable mounting area

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Offset Mounting continued

Figure 8 illustrates the maximum permissible combined wind and snow loads for sections I, II, III and IV. Support rails at section II allow the highest maximum loading of 80 lbs/ft². Support rails located anywhere in sections I and III allow a maximum of 60 lbs/ft². Mounting rails anywhere in section IV allow a maximum of 40 lbs/ft².

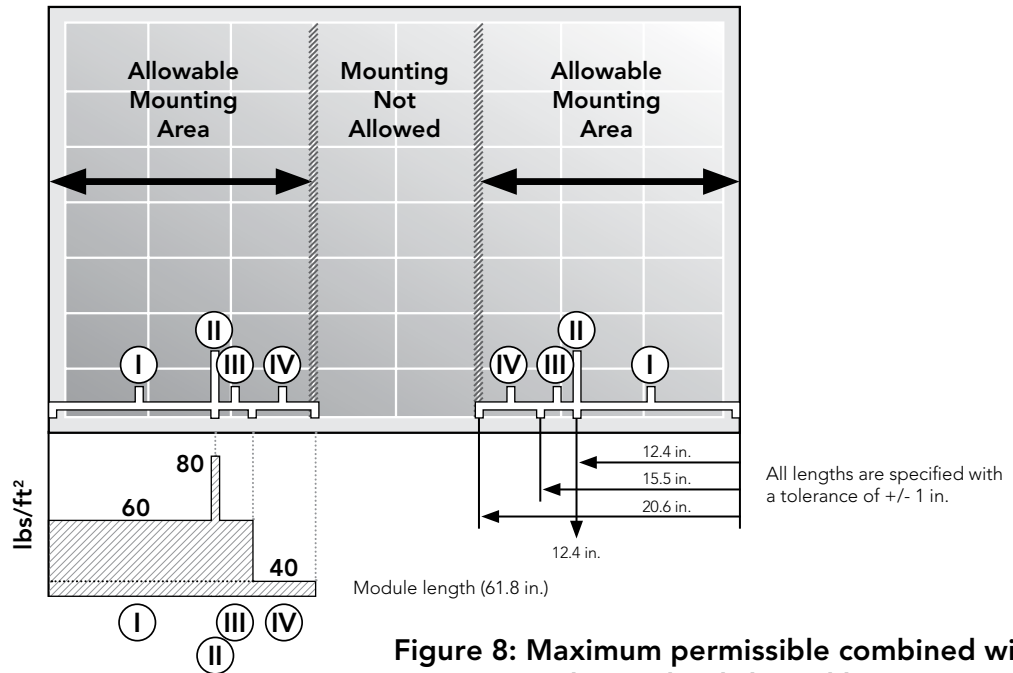


Figure 8: Maximum permissible combined wind and snow loads by rail location

For offset mounting only one clamping configuration is permissible as shown in Figure 9. At least two rigid support rails must span the entire module width and topside clamps must be used to secure the module to the rails. Clamps must be at least 1½ in. wide and the rail area supporting the module must be at least ¾ in. wide.

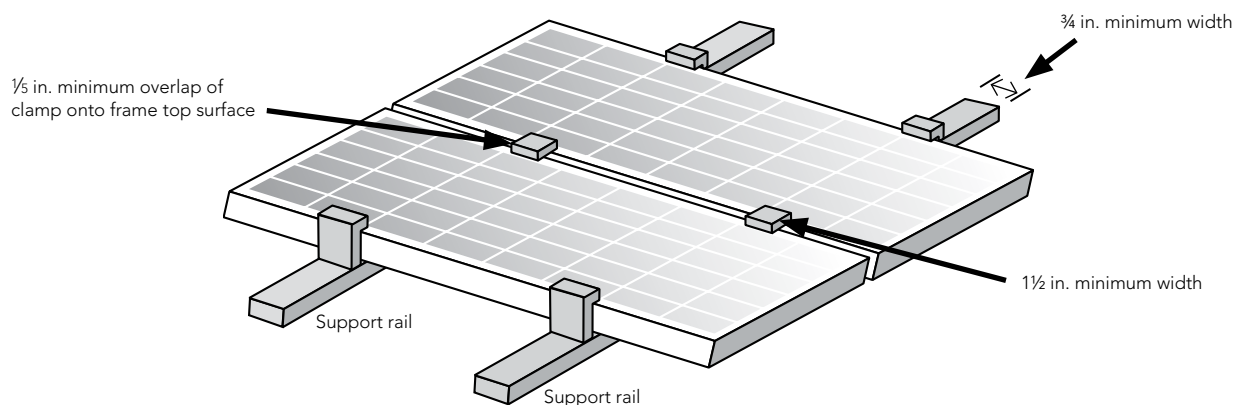


Figure 9: Permissible clamp arrangement for offset mounting

Offset Mounting using the frame holes

Mounting holes with a diameter of ¼ in. are also provided in the module frame at the 1/5 and 1/4 points. These points are located on the long-sides of the module at 12.4 in. and 16.2 in. respectively from the short-sides of the module; all four mounting holes must be used when mounting a module using the frame holes and the maximum combined wind and snow loadings for offset mounting apply at these locations.

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Mounting Method B

Independent support points located asymmetrically under the module

Mounting method B uses point supports under the module frame instead of continuous rails. The point supports can be asymmetrically located under the module as long as the guidelines detailed below are followed.

The spacing and location of the point supports is designed to allow direct mounting of modules to 24 in.-spaced roof rafters. This mounting method is guaranteed to a maximum combined wind and snow load of **60 lbs/ft²** for any configuration option.

Configuration Options

Two configuration options are permissible – one with four support points per module and one with six. Each support point must be at least 1½ in. wide (see Figure 10) and must support the entire width of the frame flange (see Figure 11). Top side clamps must be used to secure the module in place; each top-side clamp must be at least 1½ in. wide, and must overlap at least ½ in. of the frame top surface.

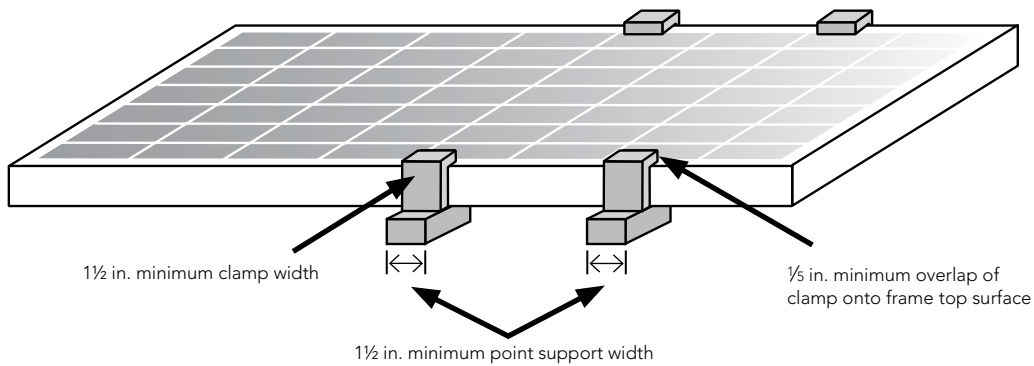


Figure 10: Point support and clamp requirements

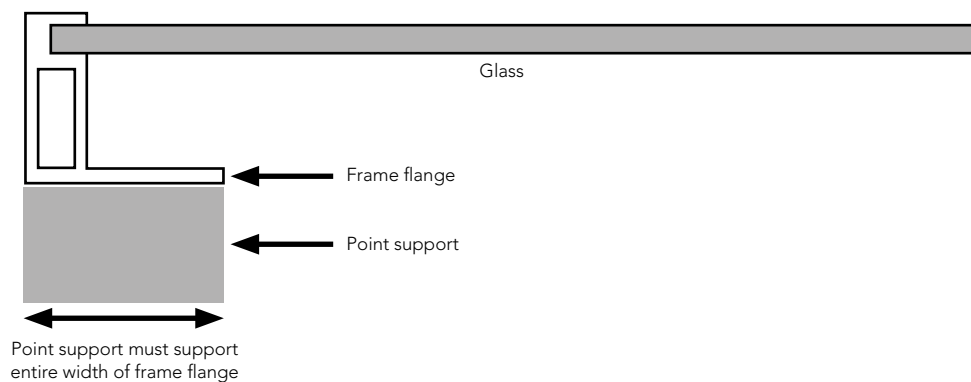


Figure 11: Location of point support in relation to the module frame

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Option #1 – Four Supports

Four supports can be used to support the module, positioned as shown in Figure 12. Two supports must be positioned under each half of the module, and supports on opposite sides of the module must be in line with each other.

The first set of supports, installed on either the left or right side of the module, must be installed between 12.3 and 25.5 in. from the short-side edge of the module. The second set of supports must be located at a distance of 24 in. (+/- 1 in.) from the first set of supports.

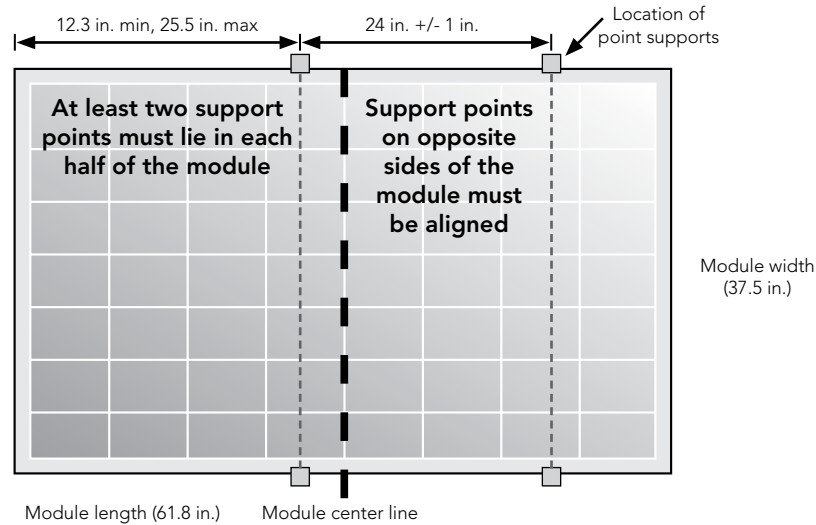


Figure 12:
Required support locations for the 4 point option

Option #2 – Six Supports

Six supports may be used to support the module, positioned as shown in Figure 13. At least two supports must be located under each half of the module, and supports on opposite sides of the module must be in line with each other.

The first set of supports, installed on either the left or right side of the module, must be installed between 0 and 12.3 in. from the short-side edge of the module. The second set of supports should be located at a distance of 24 in. (+/- 1 in.) from the first set of supports and the third set of supports should be located 24 in. (+/- 1 in.) from the second set of supports.

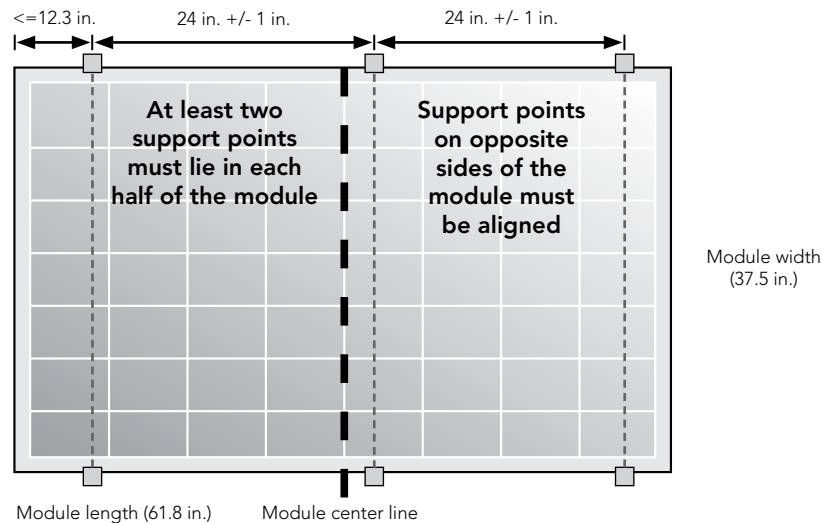


Figure 13:
Required support locations for the 6 point option

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Mounting Method C

One support beam located under the center of the module

Mounting method C uses one rigid support beam located centrally under the module. The beam must run parallel to the short-sides of the module. This mounting method is guaranteed to a maximum combined wind and snow load of **50 lbs/ft²**.

A single rigid support beam with a minimum 4 in. wide cross-section must be installed under the module center line, as shown in Figure 14. The center line of the beam must be within +/- 1 in. of the center line of the module. The support beam must span the entire module width.

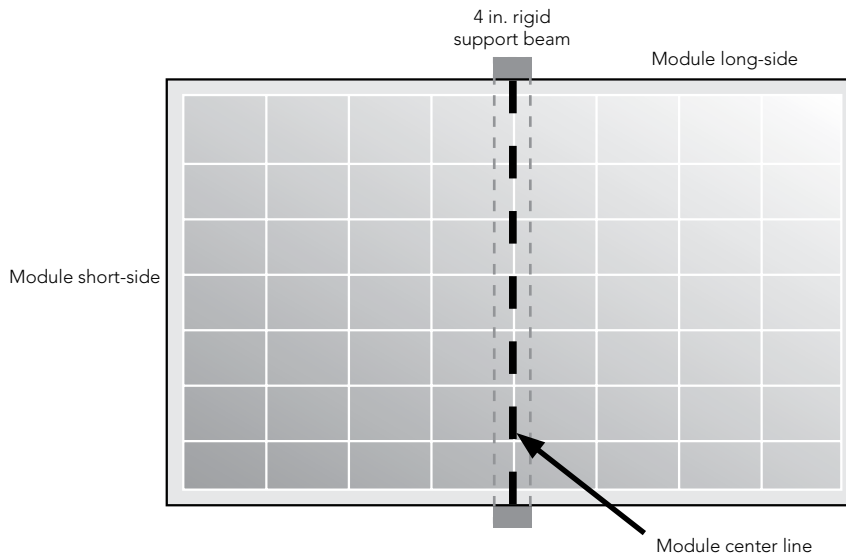


Figure 14: Required location of rigid support beam

Clamps for securing the module must span at least 4 in. of the frame length, along either the frame top surface or on the under-side along the inside of the frame flange. Top-side clamps must overlap at least $\frac{1}{5}$ in. onto the frame top surface. Rear-side clamps, if used, must clamp the entire width of the rear flange of the frame (1.1 in.).

A spacer with a minimum height of $\frac{3}{4}$ in., width of $1\frac{3}{4}$ in. and length of 4 in. must also be used between the support beam and the frame to ensure an adequate gap between the module backskin and the support beam. The spacer must support the complete width of the frame flange ($1\frac{3}{4}$ in.) as shown in Figure 15.

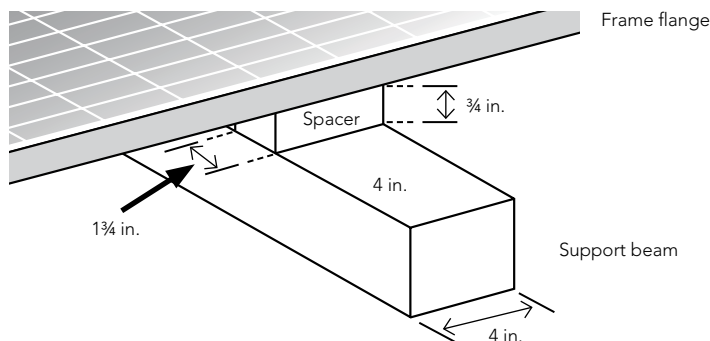


Figure 15: Spacer required between support beam and the frame flange

For additional information please contact us — see page 2 for contact information.