Dual Rack

PV MOUNTING SYSTEMS

Installation Guide

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i. Installer's Responsibilities

Please review this manual thoroughly before installing your DR solar racking system. This manual provides (1) supporting documentation for building permit applications relating to DR solar racking system, and (2) plan-ning and assembly instructions for DR products. When installed in accordance with this manual, DR PV Mounting system will be structurally adequate and will meet the structural requirements of the IBC 2012, ASCE 7-10 and California Building Code 2013 (collectively refereed to as "the Code"). also provides a limited warranty on DR products included at the end of this manual.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any that may supersede this manual;
- Ensuring that DR and other products are appropriate for the particular installation and the installation environment;
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure);
- Using only DR parts and installer-supplied parts as specified by DR (substitution of parts may void the warranty and invalidate the letters of certification in all DR publications);
- Ensuring that lag screws have adequate pull-out strength and shear capacities as installed;
- Verifying the strength of any alternate mounting used in lieu of the lag screws;
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing;
- Ensuring safe installation of all electrical aspects of the PV array;
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer.

Part I. Procedure to Calculate Total Design Wind Load

[1.1.] Using the Low Rise Buildings (Simplified) Method - ASCE 7-10

The procedure to determine Design Wind Load is specified by the American Society of Civil Engineers and referenced in the International Building Code 2012 and California Building Code 2013. For purposes of this document, the values, equations and procedures used in this document reference ASCE 7-10, Minimum Design Loads for Buildings and Other Structures. Please refer to ASCE 7-10 if you have any questions about the definitions or procedures presented in this manual. DR solar racking system uses Part 2, The Simplified Method, for low rise buildings to calculate the Design Wind Load for pressures on components and cladding in this document. The method described in this document is valid for flush, no tilt, DR applications on either roofs or walls. Flush is defined as panels parallel to the surface (or with no more than 3" difference between ends of assembly) with no more than 10" of space between the roof surface, and the bottom of the PV panels.

This method is not approved for open structure calculations. Applications of these procedures are subject to the following ASCE 7-10 limitations:

1. The building height must be less than 60 feet, h < 60. See note for determining 'H' in the next section. For installations on structures greater than 60 feet, contact your local design professional.

2. The building must be enclosed, not an open or partially enclosed structure, like a carport.

3. The building is regular shaped with no unusual geometrical irregularity in spatial form, like a geodesic dome.

4. The building is not in an extreme geographic location such as a narrow canyon or steep cliff.

5. The building has a flat or gable roof with a pitch less than 45 degrees or a hip roof with a pitch less than 27 degrees.

6. If your installation does not conform to these requirements please contact your local professional engineer.

If your installation is outside the United States or does not meet all of these limitations, consult a local professional engineer or your local building authority. Consult ASCE 7-10 for more clarification on the use of Part 2.

The equation for determining the Design Wind Load for components and cladding is:

$$p_{net}\,(psf) = \lambda K_{zt}\, p_{net30}$$

p_{net} *(psf) = Design Wind Load*

λ = adjustment factor for building height and exposure category

K_{zt} *= Topographic Factor = 1*

p_{net30} *(psf) = net design wind pressure for Exposure B, at height = 30 feet*

You will also need to know the following information:

Basic Wind Speed = V (mph), the largest 3 second gust of wind in the last 50 years.

H *(ft) = total roof height for flat roof buildings or mean roof height for pitched roof buildings*

Roof Pitch (degrees)

This manual will help you determine:

Effective Wind Area (sf) = minimum total continuous area of modules being installed (Step 4)

Roof Zone = the area of the roof you are installing the pv system according to Step 5.

Roof Zone Dimension = 'a' (ft) (Step 5)

Exposure Category (Step 3)

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Step 1. Determine risk category

Buildings and other structures shall be classified, based on the risk to human life, health and welfare associated with their damage or failure by nature of their occupancy or use. For the purpose of applying flood, wind, snow, ice, and earthquake provisions. See Table 1 below.

Table 1: Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads

Use or Occupancy of Buildings and Structures	Risk Category
Buildings and other structures that represent a low risk to human life in the event of failure.	I
All buildings and other structures except those listed in Risk Categories I, III, and IV.	II
· Buildings and other structures, the failure of which could pose a substantial risk to human life. · Buildings and other structures, not included in Risk Category IV, with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure. · Buildings and other structures, not included in Risk Category IV (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where their quantity exceeds a threshold quantity established by au-thority having jurisdiction and is sufficient to pose a threat to the public if released.	III
· Buildings and other structures designated as essential facilities. · Buildings and other structures, the failure of which could pose a substantial hazard to the community. · Buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous chemicals or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity exceeds a threshold quantity established by the authority having jurisdiction to be dangeours the public if released and is sufficient to pose a threat to the public if released. · Buildings and other structures required to maintain the functionality of other Risk Category IV structures.	IV

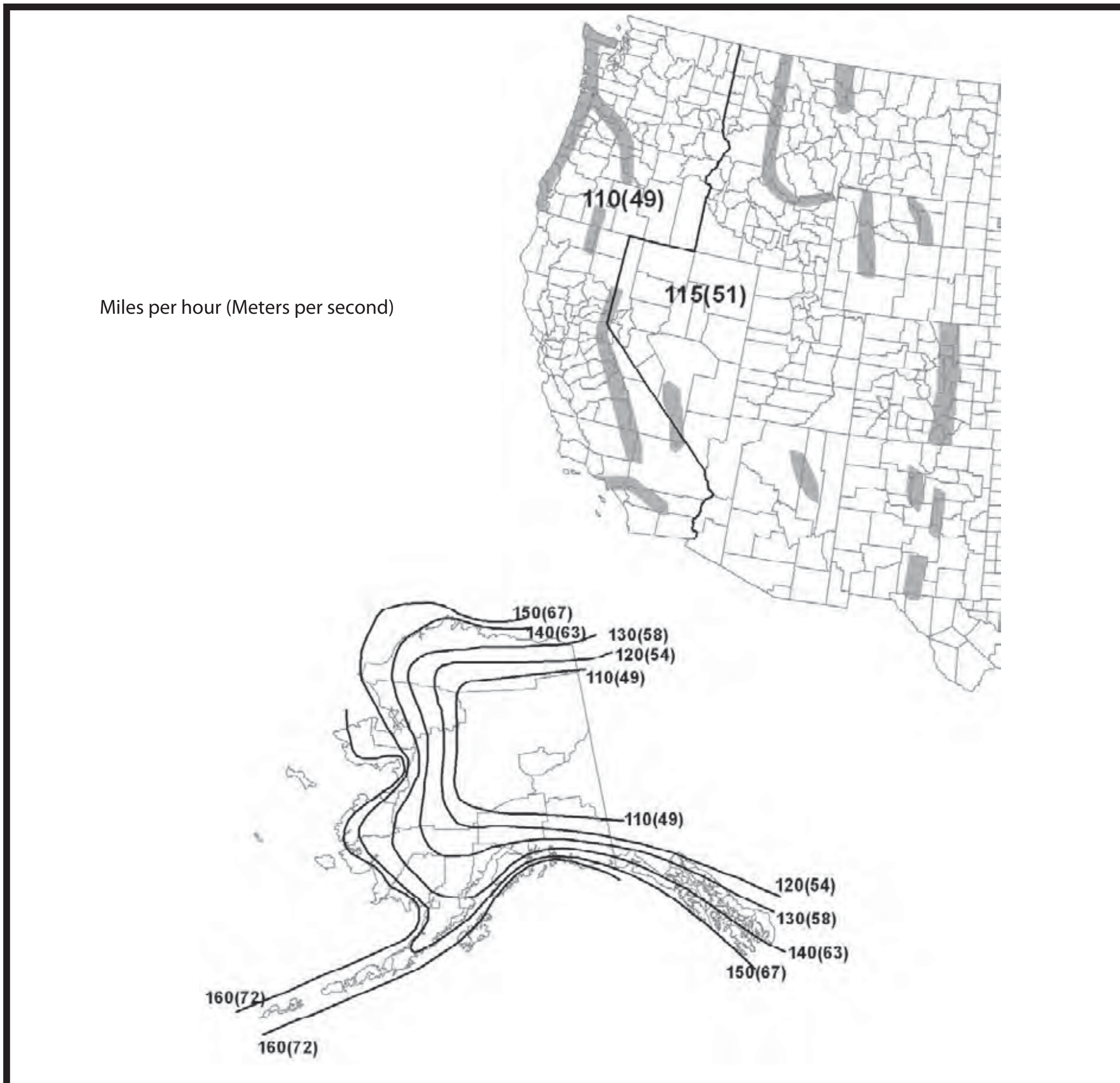
a. Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for classification to a lower Risk Category if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2 of ASCE 7-10 that a release of the substances is commensurate with the risk associated with that Risk Category.

Step 2. Determine the Basic Wind Speed, V (mph)

Determine the basic wind speed, V (mph) by consulting your local department or by locating your installation on the maps in Figures 26.5 1A through 1C, pages 6 -11. Please note that the wind speeds are dependent on the Risk (Occupancy) category determined in Step 1.

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1A Basic Wind Speeds for Risk Category II Buildings and Other Structures

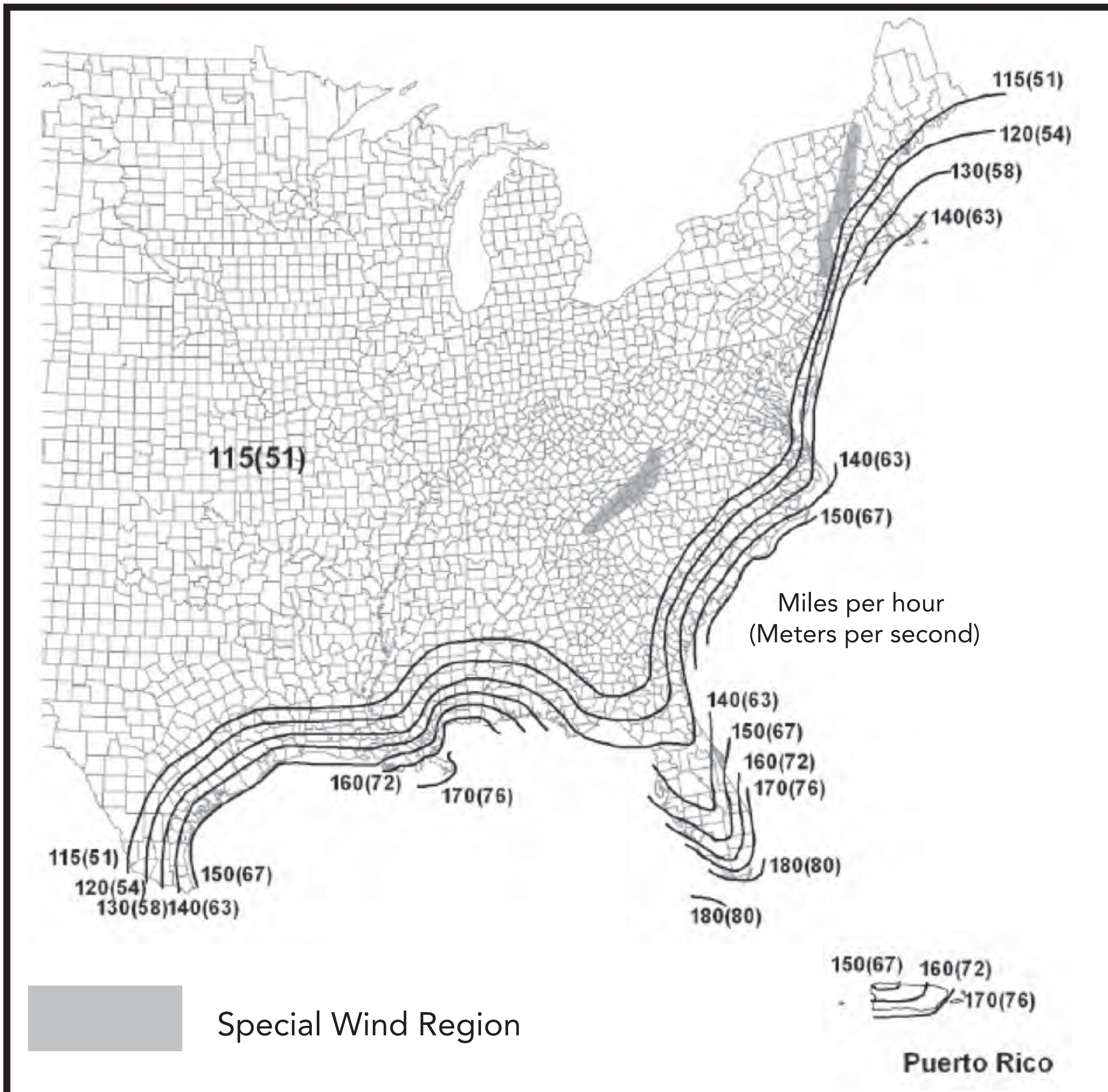


Notes:
1. Values are design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1A (Continued) Basic Wind Speeds for Risk Category II Buildings and Other Structures

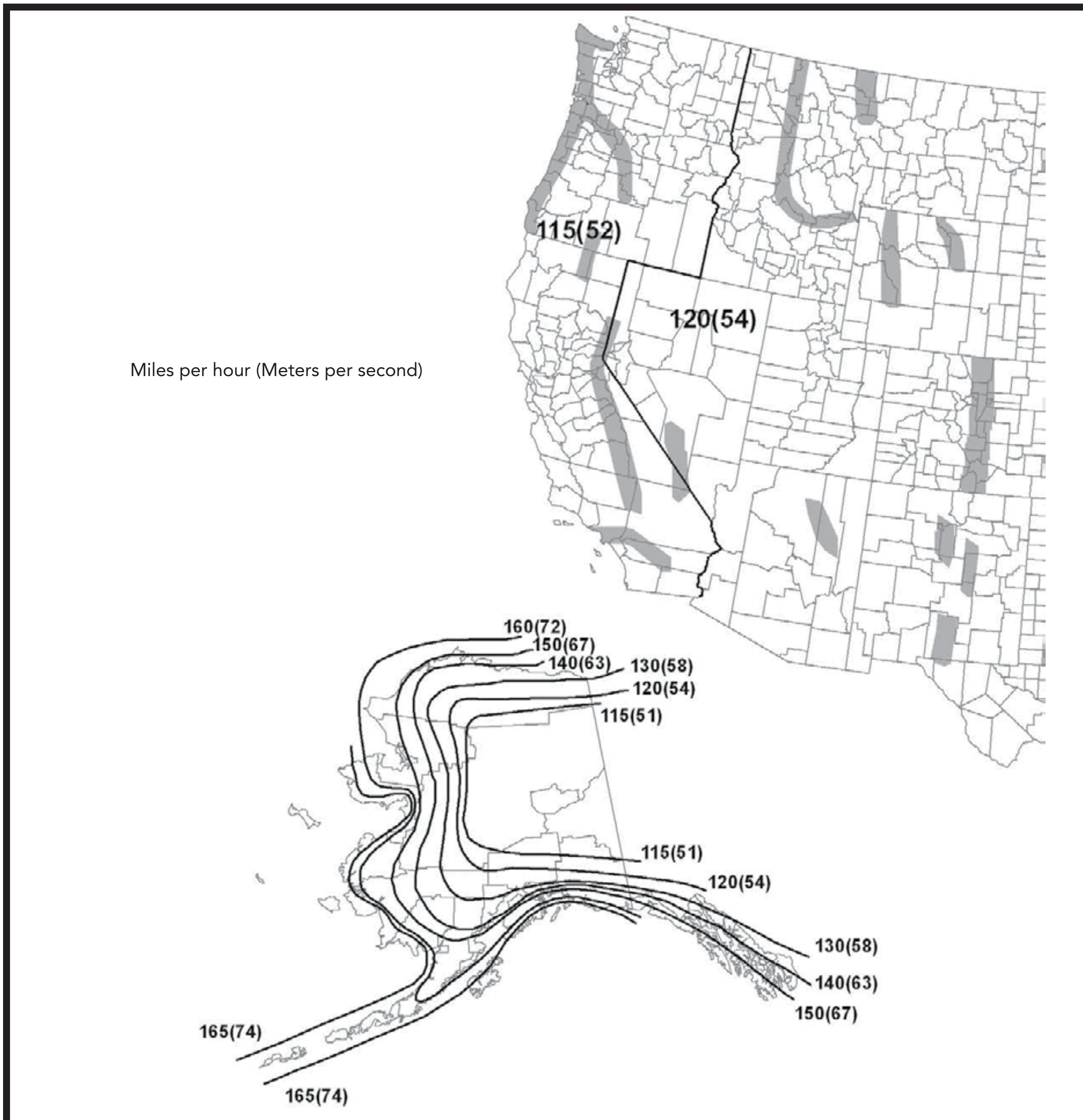


Location	Vmph	(m/s)
Guam	195	(87)
Virgin Islands	165	(74)
America Samoa	160	(72)
Hawaii-	130	(58)

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1B Basic Wind Speeds for Risk Category III and IV Buildings and Other Structures



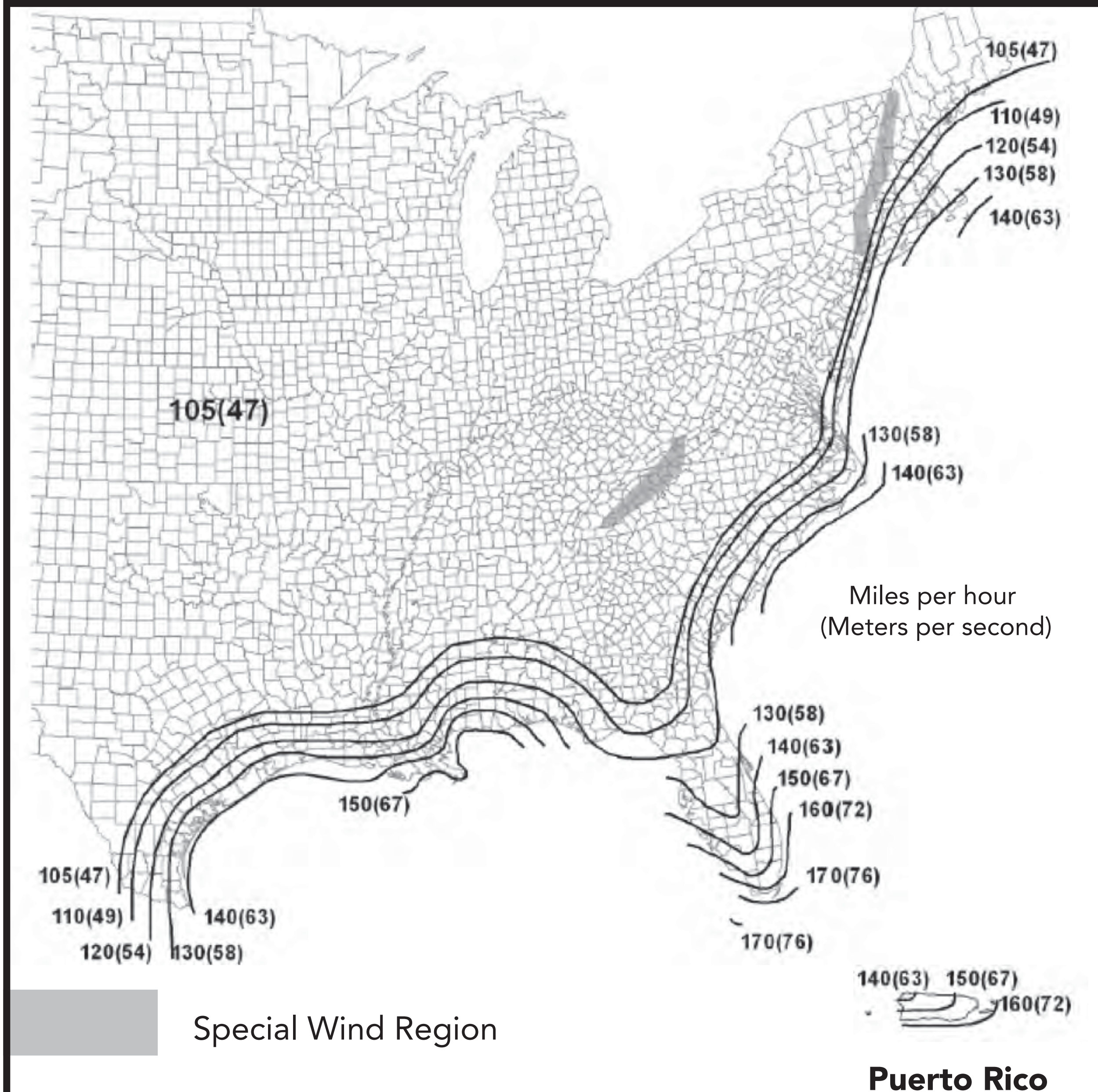
Notes:

1. Values are design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1700 years).

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1B (Continued) Basic Wind Speeds for Risk Category III and IV Buildings and Other Structures

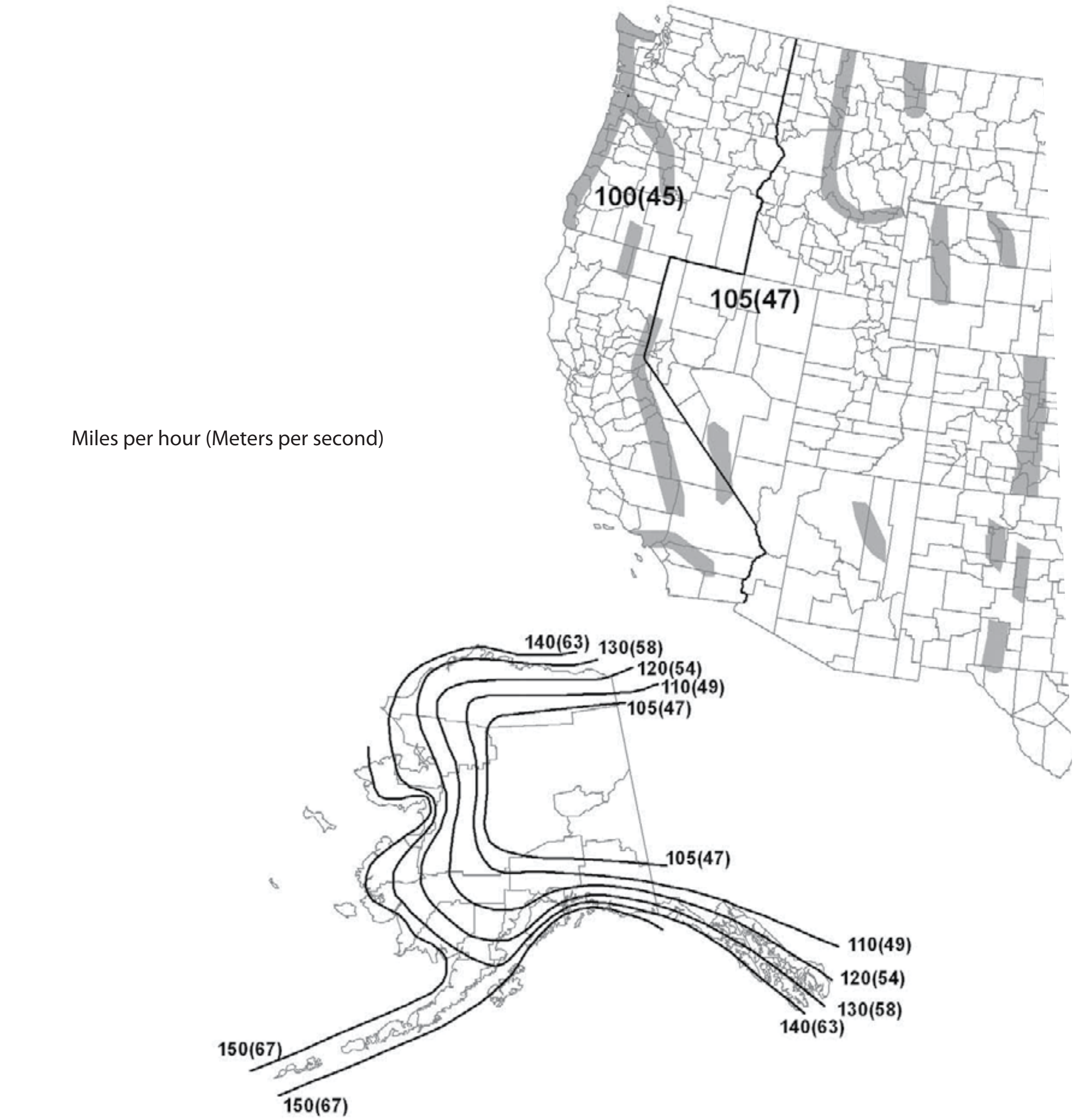


Location	Vmph	(m/s)
Guam	180	(80)
Virgin Islands	150	(67)
America Samoa	150	(67)
Hawaii-	115	(51)

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1C Basic Wind Speeds for Risk Category I Buildings and Other Structures



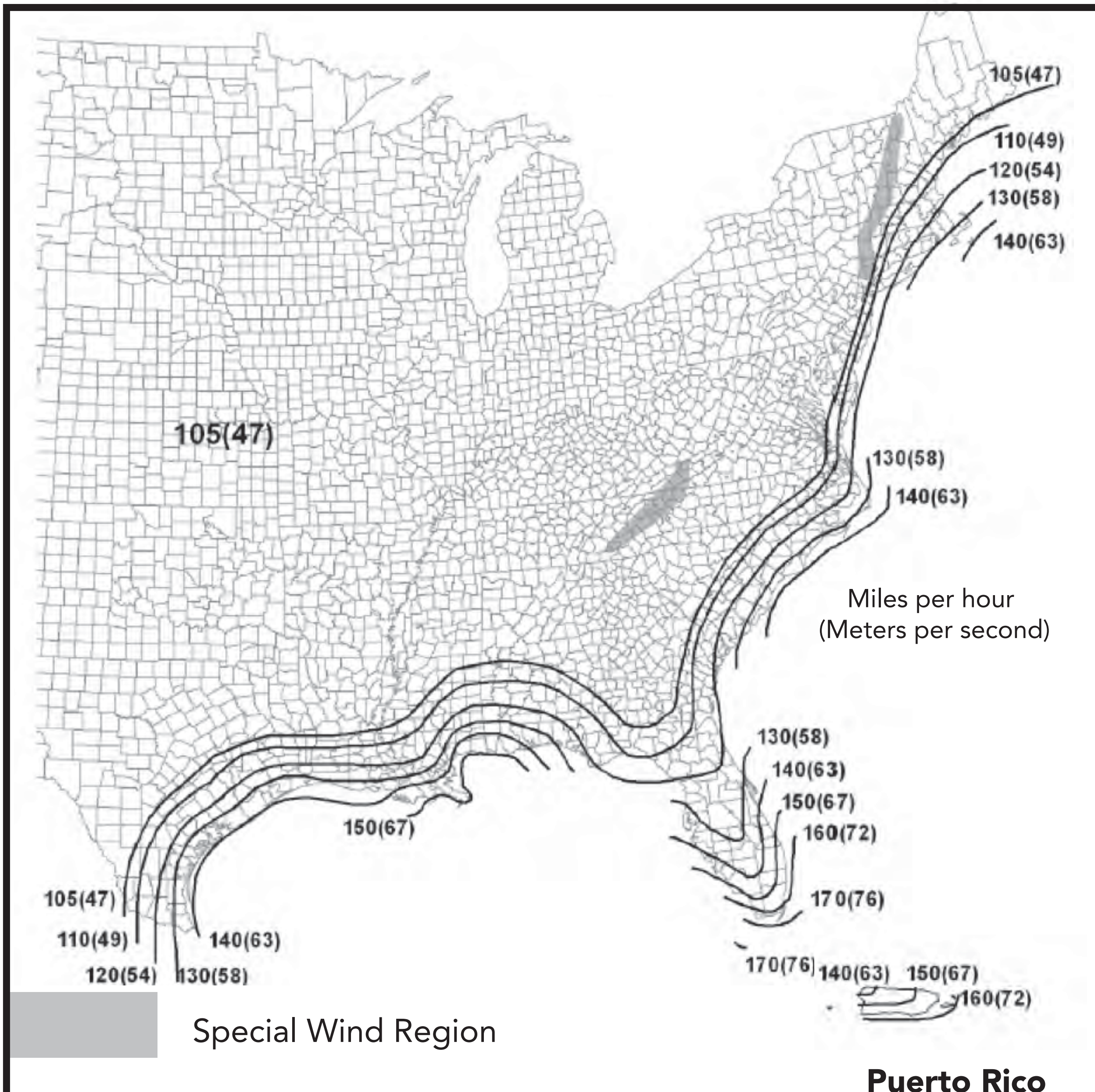
Notes:

1. Values are design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C categor
2. Linear interpolation between contours is permitte
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal are
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind condition
5. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (annual exceedance probability 0.00333, MRI = 300 years).

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

FIGURE 26.5-1C (Continued) Basic Wind Speeds for Risk Category I Buildings and Other Structures



Location	Vmph	(m/s)
Guam	180	(80)
Virgin Islands	150	(67)
America Samoa	150	(67)
Hawaii-	115	(51)

Source: ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Step 3. Determine Wind Load Parameters

Step 3a: Determine the proper Exposure Category (B, C, or D) for the project by using the following definitions for Surface Roughness Categories. ASCE 7-10 defines wind surface roughness categories as follows:

Surface Roughness B: Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C: Open terrain with scattered obstructions having heights generally less than 30 ft (9.1 m). This category includes flat open country and grasslands.

Surface Roughness D: Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats, and unbroken ice.

Step 3b: Determine the Topographic

Factor, Kzt. For the purposes of this code compliance document, the Topographic Factor, Kzt, is taken as equal to one (1) as per Section 26.8-2 or as determined by Figure 26.8-1 in ASCE 7-10. Also shown in pages 12-13.

Step 4. Determine Effective Wind Area
Determine the smallest area of continuous modules you will be installing. This is the smallest area tributary (contributing load) to a support or to a simple-span of rail. That area is the Effective Wind Area, the total area of the fewest number of modules on a run of rails. If the smallest area of continuous modules exceeds 100 sq ft, use 100 sq ft, if less round down to values available in Table 3, page 17.

Step 5. Determine the appropriate roof zone for the installation.

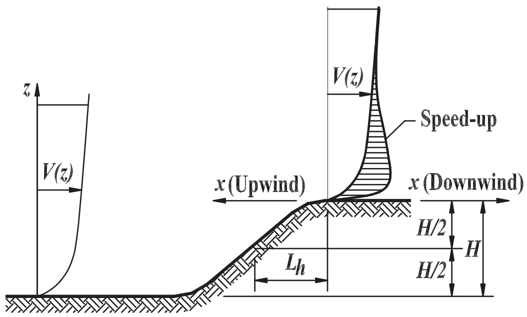
The Design Wind Load will vary based on where the installation is located on a roof. Arrays may be located in more than one roof zone.

Using Table 2, page 15, determine the Roof Zone Dimension Length, a (ft) , according to the width and height of the building on which you are installing the PV system.

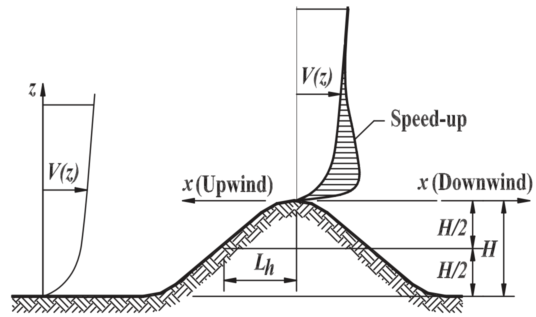
[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Figure 26.8-1 WIND LOADS: GENERAL REQUIREMENTS

Topographic Factor, K_{zt}



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

Topographic Multipliers for Exposure C

H/L_h	K_1 Multiplier: 2-D Ridge	K_1 Multiplier: 2-D Escarp.	K_1 Multiplier: 3-D Axisym. Hill	x/L_h	K_2 Multiplier: 2-D Escarp.	K_2 Multiplier: All Other Cases	z/L_h	K_3 Multiplier: 2-D Ridge	K_3 Multiplier: 2-D Escarp.	K_3 Multiplier: 3-D Axisym. Hill
0.20	0.29	0.17	0.21	0.00	1.00	1.00	0.00	1.00	1.00	1.00
0.25	0.36	0.21	0.26	0.50	0.88	0.67	0.10	0.74	0.78	0.67
0.30	0.43	0.26	0.32	1.00	0.75	0.33	0.20	0.55	0.61	0.45
0.35	0.51	0.30	0.37	1.50	0.63	0.00	0.30	0.41	0.47	0.30
0.40	0.58	0.34	0.42	2.00	0.50	0.00	0.40	0.30	0.37	0.20
0.45	0.65	0.38	0.47	2.50	0.38	0.00	0.50	0.22	0.29	0.14
0.50	0.72	0.43	0.53	3.00	0.25	0.00	0.60	0.17	0.22	0.09
				3.50	0.13	0.00	0.70	0.12	0.17	0.06
				4.00	0.00	0.00	0.80	0.09	0.14	0.04
							0.90	0.07	0.11	0.03
							1.00	0.05	0.08	0.02
							1.50	0.01	0.02	0.00
							2.00	0.00	0.00	0.00

Notes:

1. For values of H/L_h, x/L_h and z/L_h other than those shown, linear interpolation is permitted.
2. For $H/L_h > 0.5$, assume $H/L_h = 0.5$ for evaluating K_1 and substitute 2H for L_h for evaluating K_2 and K_3.
3. Multipliers are based on the assumption that wind approaches the hill or escarpment along the direction of maximum slope.
4. Notation:
   - H: Height of hill or escarpment relative to the upwind terrain, in feet (meters).
   - L_h: Distance upwind of crest to where the difference in ground elevation is half the height of hill or escarpment, in feet (meters).
   - K_1: Factor to account for shape of topographic feature and maximum speed-up effect.
   - K_2: Factor to account for reduction in speed-up with distance upwind or downwind of crest.
   - K_3: Factor to account for reduction in speed-up with height above local terrain.
   - x: Distance (upwind or downwind) from the crest to the building site, in feet (meters).
   - z: Height above ground surface at building site, in feet (meters).
   - μ: Horizontal attenuation factor.
   - γ: Height attenuation factor.

Source: ASCE-7-10 Chapter 26, page 26

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Figure 26.8-1 (cont'd) **WIND LOADS: GENERAL REQUIREMENTS**

Topographic Factor, K_{zt}

Equations:

$$K_{zt} = (1 + K_1 K_2 K_3)^2$$

K_1 determined from table below

$$K_2 = (1 - \frac{|x|}{\mu L_h})$$

$$K_3 = e^{-\gamma z/L_h}$$

Parameters for Speed-Up Over Hills and Escarpments

Hill Shape	$K_1/(H/L_h)$ Exposure B	C	D	g	m Upwind of Crest	Downwind of Crest
2-dimensional ridges (or valleys with negative H in $K_1/(H/L_h)$)	1.30	1.45	1.55	3	1.5	1.5
2-dimensional escarpments	0.75	0.85	0.95	2.5	1.5	4
3-dimensional axisym. hill	0.95	1.05	1.15	4	1.5	1.5

Source: ASCE-7-10 Chapter 26, page 253

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Table 2. Determine Roof/Wall Zone, dimension (**a**) according to building width and height

a = 10 percent of the least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of the least horizontal dimension or 3 ft of the building.

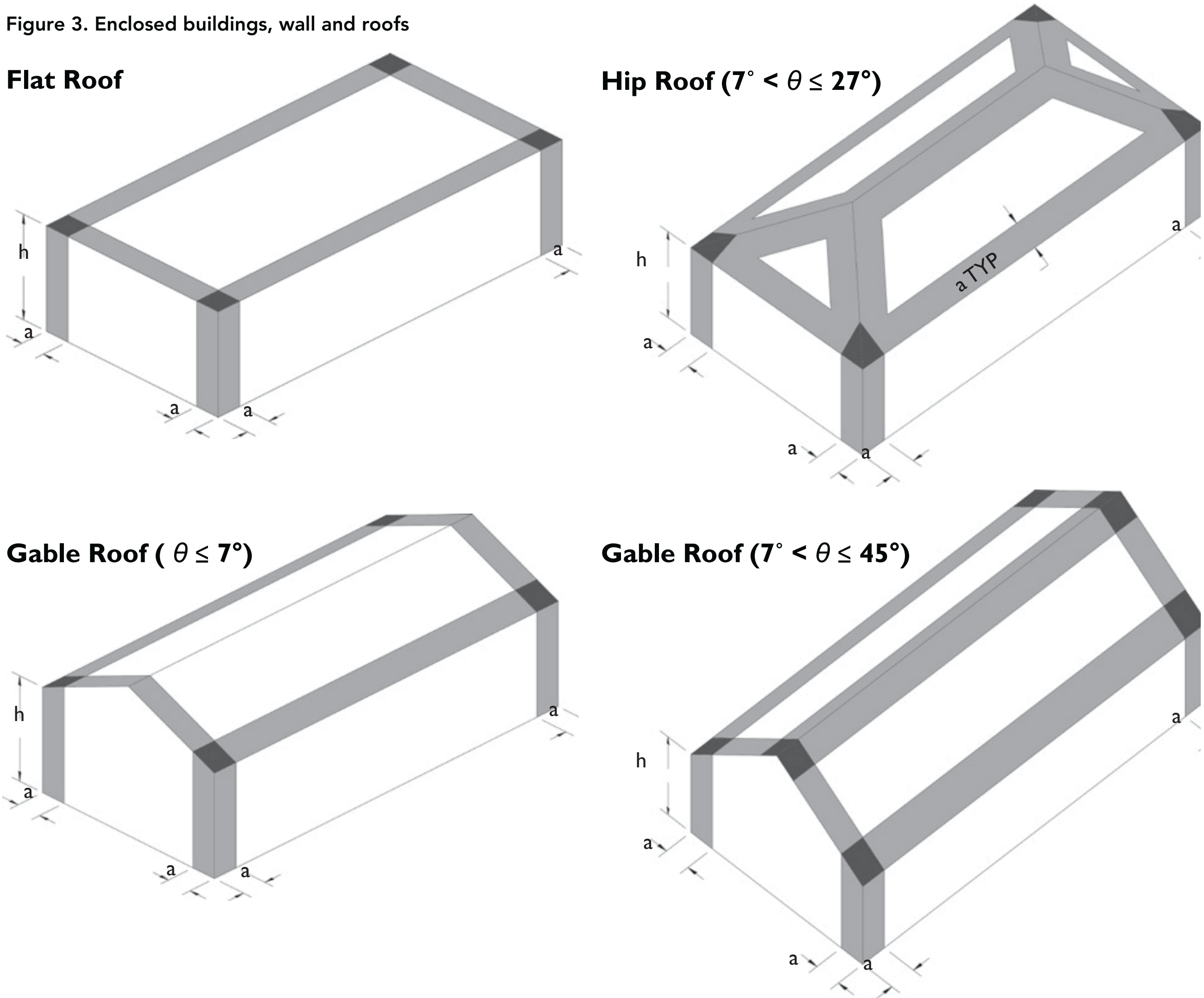
Roof Height (ft)	*Least Horizontal Dimension (ft)*																		
	10	***15***	***20***	***25***	***30***	***40***	***50***	***60***	***70***	***80***	***90***	***100***	***125***	***150***	***175***	***200***	***300***	***400***	***500***
10	3	3	3	3	3	4	4	4	4	4	4	4	5	6	7	8	12	16	20
15	3	3	3	3	3	4	5	6	6	6	6	6	6	6	7	8	12	16	20
20	3	3	3	3	3	4	5	6	7	8	8	8	8	8	8	8	12	16	20
25	3	3	3	3	3	4	5	6	7	8	9	10	10	10	10	10	12	16	20
30	3	3	3	3	3	4	5	6	7	8	9	10	12	12	12	12	12	16	20
35	3	3	3	3	3	4	5	6	7	8	9	10	12.5	14	14	14	14	16	20
40	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	16	16	16	16	20
45	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	18	18	18	20
50	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	20	20	20
60	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	24	24	24

Step 5. Determine the appropriate roof zone for the installation (continued)

Using the Roof Zone Dimension Length, 'a', determine the roof zone locations according to your roof type, gable, hip or monoslope. Determine in which roof zone your pv system is located, Zone 1, 2, or 3 according to Figure 3, page 16.

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Figure 3. Enclosed buildings, wall and roofs



Interior Zones Roofs - Zone 1/Walls - Zone 4	**End Zones** Roofs - Zone 2/Walls - Zone 5	**Corner Zones** Roofs - Zone 3

Source: ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures, Chapter 30, p. 345.

Step 6. Determine Net Design Wind Pressure, p_{net30} (psf)

Using the Effective Wind Area (Step 4), Roof Zone Location (Step 5), and Basic Wind Speed (Step 2), look up the appropriate Net Design Wind Pressure in Table 3, page 17. Use the Effective Wind Area value the table which is smaller than the value calculated in Step 2. If the installation is located on a roof overhang, use Table 4, page 18. Both down-force and uplift pressures m be considered in overall design. Refer to Section II, Step 1 for applying down-force and uplift pressures. Positive values are acting toward the surface. Negative values are acting away from the surface.

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Components and Cladding – Method 1		h ≤ 60 ft.
Figure 30.5-1 (cont'd)	Design Wind Pressures	Walls & Roofs
Enclosed Buildings		

Net Design Wind Pressure, p_{net30} (psf) *(Exposure B at h = 30 ft.)*

	Zone	Effective wind area (sf)	Basic Wind Speed V (mph) 110		115		120		130		140		150		160		180		200	
Roof 0 to 7 degrees	1	10	8.9	-21.8	9.7	-23.8	10.5	-25.9	12.4	-30.4	14.3	-35.3	16.5	-40.5	18.7	-46.1	23.7	-58.3	29.3	-72.0
	1	20	8.3	-21.2	9.1	-23.2	9.9	-25.2	11.6	-29.6	13.4	-34.4	15.4	-39.4	17.6	-44.9	22.2	-56.8	27.4	-70.1
	1	50	7.6	-20.5	8.3	-22.4	9.0	-24.4	10.6	-28.6	12.3	-33.2	14.1	-38.1	16.0	-43.3	20.3	-54.8	25.0	-67.7
	1	100	7.0	-19.9	7.7	-21.8	8.3	-23.7	9.8	-27.8	11.4	-32.3	13.0	-37.0	14.8	-42.1	18.8	-53.3	23.2	-65.9
	2	10	8.9	-36.5	9.7	-39.9	10.5	-43.5	12.4	-51.0	14.3	-59.2	16.5	-67.9	18.7	-77.3	23.7	-97.8	29.3	-120.7
	2	20	8.3	-32.6	9.1	-35.7	9.9	-38.8	11.6	-45.6	13.4	-52.9	15.4	-60.7	17.6	-69.0	22.2	-87.4	27.4	-107.9
	2	50	7.6	-27.5	8.3	-30.1	9.0	-32.7	10.6	-38.4	12.3	-44.5	14.1	-51.1	16.0	-58.2	20.3	-73.6	25.0	-90.9
	2	100	7.0	-23.6	7.7	-25.8	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	14.8	-50.0	18.8	-63.2	23.2	-78.1
	3	10	8.9	-55.0	9.7	-60.1	10.5	-65.4	12.4	-76.8	14.3	-89.0	16.5	-102.2	18.7	-116.3	23.7	-147.2	29.3	-181.7
	3	20	8.3	-45.5	9.1	-49.8	9.9	-54.2	11.6	-63.6	13.4	-73.8	15.4	-84.7	17.6	-96.3	22.2	-121.9	27.4	-150.5
	3	50	7.6	-33.1	8.3	-36.1	9.0	-39.3	10.6	-46.2	12.3	-53.5	14.1	-61.5	16.0	-69.9	20.3	-88.5	25.0	-109.3
	3	100	7.0	-23.6	7.7	-25.8	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	14.8	-50.0	18.8	-63.2	23.2	-78.1
Roof > 7 to 27 degrees	1	10	12.5	-19.9	13.7	-21.8	14.9	-23.7	17.5	-27.8	20.3	-32.3	23.3	-37.0	26.5	-42.1	33.6	-53.3	41.5	-65.9
	1	20	11.4	-19.4	12.5	-21.2	13.6	-23.0	16.0	-27.0	18.5	-31.4	21.3	-36.0	24.2	-41.0	30.6	-51.9	37.8	-64.0
	1	50	10.0	-18.6	10.9	-20.4	11.9	-22.2	13.9	-26.0	16.1	-30.2	18.5	-34.6	21.1	-39.4	26.7	-49.9	32.9	-61.6
	1	100	8.9	-18.1	9.7	-19.8	10.5	-21.5	12.4	-25.2	14.3	-29.3	16.5	-33.6	18.7	-38.2	23.7	-48.4	29.3	-59.8
	2	10	12.5	-34.7	13.7	-37.9	14.9	-41.3	17.5	-48.4	20.3	-56.2	23.3	-64.5	26.5	-73.4	33.6	-92.9	41.5	-114.6
	2	20	11.4	-31.9	12.5	-34.9	13.6	-38.0	16.0	-44.6	18.5	-51.7	21.3	-59.3	24.2	-67.5	30.6	-85.4	37.8	-105.5
	2	50	10.0	-28.2	10.9	-30.9	11.9	-33.6	13.9	-39.4	16.1	-45.7	18.5	-52.5	21.1	-59.7	26.7	-75.6	32.9	-93.3
	2	100	8.9	-25.5	9.7	-27.8	10.5	-30.3	12.4	-35.6	14.3	-41.2	16.5	-47.3	18.7	-53.9	23.7	-68.2	29.3	-84.2
	3	10	12.5	-51.3	13.7	-56.0	14.9	-61.0	17.5	-71.6	20.3	-83.1	23.3	-95.4	26.5	-108.5	33.6	-137.3	41.5	-169.5
	3	20	11.4	-47.9	12.5	-52.4	13.6	-57.1	16.0	-67.0	18.5	-77.7	21.3	-89.2	24.2	-101.4	30.6	-128.4	37.8	-158.5
	3	50	10.0	-43.5	10.9	-47.6	11.9	-51.8	13.9	-60.8	16.1	-70.5	18.5	-81.0	21.1	-92.1	26.7	-116.6	32.9	-143.9
	3	100	8.9	-40.2	9.7	-44.0	10.5	-47.9	12.4	-56.2	14.3	-65.1	16.5	-74.8	18.7	-85.1	23.7	-107.7	29.3	-132.9
Roof > 27 to 45 degrees	1	10	19.9	-21.8	21.8	-23.8	23.7	-25.9	27.8	-30.4	32.3	-35.3	37.0	-40.5	42.1	-46.1	53.3	-58.3	65.9	-72.0
	1	20	19.4	-20.7	21.2	-22.6	23.0	-24.6	27.0	-28.9	31.4	-33.5	36.0	-38.4	41.0	-43.7	51.9	-55.3	64.0	-68.3
	1	50	18.6	-19.2	20.4	-21.0	22.2	-22.8	26.0	-26.8	30.2	-31.1	34.6	-35.7	39.4	-40.6	49.9	-51.4	61.6	-63.4
	1	100	18.1	-18.1	19.8	-19.8	21.5	-21.5	25.2	-25.2	29.3	-29.3	33.6	-33.6	38.2	-38.2	48.4	-48.4	59.8	-59.8
	2	10	19.9	-25.5	21.8	-27.8	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	42.1	-53.9	53.3	-68.2	65.9	-84.2
	2	20	19.4	-24.3	21.2	-26.6	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	41.0	-51.5	51.9	-65.2	64.0	-80.5
	2	50	18.6	-22.9	20.4	-25.0	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	39.4	-48.4	49.9	-61.3	61.6	-75.6
	2	100	18.1	-21.8	19.8	-23.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	-40.5	38.2	-46.1	48.4	-58.3	59.8	-72.0
	3	10	19.9	-25.5	21.8	-27.8	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	42.1	-53.9	53.3	-68.2	65.9	-84.2
	3	20	19.4	-24.3	21.2	-26.6	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	41.0	-51.5	51.9	-65.2	64.0	-80.5
	3	50	18.6	-22.9	20.4	-25.0	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	39.4	-48.4	49.9	-61.3	61.6	-75.6
	3	100	18.1	-21.8	19.8	-23.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	-40.5	38.2	-46.1	48.4	-58.3	59.8	-72.0
Wall	4	10	21.8	-23.6	23.8	-25.8	25.9	-28.1	30.4	-33.0	35.3	-38.2	40.5	-43.9	46.1	-50.0	58.3	-63.2	72.0	-78.1
	4	20	20.8	-22.6	22.7	-24.7	24.7	-26.9	29.0	-31.6	33.7	-36.7	38.7	-42.1	44.0	-47.9	55.7	-60.6	68.7	-74.8
	4	50	19.5	-21.3	21.3	-23.3	23.2	-25.4	27.2	-29.8	31.6	-34.6	36.2	-39.7	41.2	-45.1	52.2	-57.1	64.4	-70.5
	4	100	18.5	-20.4	20.2	-22.2	22.0	-24.2	25.9	-28.4	30.0	-33.0	34.4	-37.8	39.2	-43.1	49.6	-54.5	61.2	-67.3
	4	500	16.2	-18.1	17.7	-19.8	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	34.3	-38.2	43.5	-48.4	53.7	-59.8
	5	10	21.8	-29.1	23.8	-31.9	25.9	-34.7	30.4	-40.7	35.3	-47.2	40.5	-54.2	46.1	-61.7	58.3	-78.0	72.0	-96.3
	5	20	20.8	-27.2	22.7	-29.7	24.7	-32.4	29.0	-38.0	33.7	-44.0	38.7	-50.5	44.0	-57.5	55.7	-72.8	68.7	-89.9
	5	50	19.5	-24.6	21.3	-26.9	23.2	-29.3	27.2	-34.3	31.6	-39.8	36.2	-45.7	41.2	-52.0	52.2	-65.8	64.4	-81.3
	5	100	18.5	-22.6	20.2	-24.7	22.0	-26.9	25.9	-31.6	30.0	-36.7	34.4	-42.1	39.2	-47.9	49.6	-60.6	61.2	-74.8
	5	500	16.2	-18.1	17.7	-19.8	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	34.3	-38.2	43.5	-48.4	53.7	-59.8

Note: For effective areas between the those given above the load may be interpolated, otherwise use the load associated with the lower effective area.

Table 3. p_{net30} (psf) Roof and Wall

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Roof Overhang Net Design Wind Pressure, p_{net30} (psf)

(Exposure B at h = 30 ft.)

	Zone	Effective Wind Area (sf)	Basic Wind Speed V (mph) 110	115	130	140	150	160	180	200
Roof 0 to 7 degrees	2	10	-31.4	-34.3	-43.8	-50.8	-58.3	-66.3	-84.0	-103.7
	2	20	-30.8	-33.7	-43.0	-49.9	-57.3	-65.2	-82.5	-101.8
	2	50	-30.1	-32.9	-42.0	-48.7	-55.9	-63.6	-80.5	-99.4
	2	100	-29.5	-32.3	-41.2	-47.8	-54.9	-62.4	-79.0	-97.6
	3	10	-51.6	-56.5	-72.1	-83.7	-96.0	-109.3	-138.3	-170.7
	3	20	-40.5	-44.3	-56.6	-65.7	-75.4	-85.8	-108.6	-134.0
	3	50	-25.9	-28.3	-36.1	-41.9	-48.1	-54.7	-69.3	-85.5
	3	100	-14.8	-16.1	-20.6	-23.9	-27.4	-31.2	-39.5	-48.8
Roof > 7 to 27 degrees	2	10	-40.6	-44.4	-56.7	-65.7	-75.5	-85.9	-108.7	-134.2
	2	20	-40.6	-44.4	-56.7	-65.7	-75.5	-85.9	-108.7	-134.2
	2	50	-40.6	-44.4	-56.7	-65.7	-75.5	-85.9	-108.7	-134.2
	2	100	-40.6	-44.4	-56.7	-65.7	-75.5	-85.9	-108.7	-134.2
	3	10	-68.3	-74.6	-95.3	-110.6	-126.9	-144.4	-182.8	-225.6
	3	20	-61.6	-67.3	-86.0	-99.8	-114.5	-130.3	-164.9	-203.6
	3	50	-52.8	-57.7	-73.7	-85.5	-98.1	-111.7	-141.3	-174.5
	3	100	-46.1	-50.4	-64.4	-74.7	-85.8	-97.6	-123.5	-152.4
Roof > 27 to 45 degrees	2	10	-36.9	-40.3	-51.5	-59.8	-68.6	-78.1	-98.8	-122.0
	2	20	-35.8	-39.1	-50.0	-58.0	-66.5	-75.7	-95.8	-118.3
	2	50	-34.3	-37.5	-47.9	-55.6	-63.8	-72.6	-91.9	-113.4
	2	100	-33.2	-36.3	-46.4	-53.8	-61.7	-70.2	-88.9	-109.8
	3	10	-36.9	-40.3	-51.5	-59.8	-68.6	-78.1	-98.8	-122.0
	3	20	-35.8	-39.1	-50.0	-58.0	-66.5	-75.7	-95.8	-118.3
	3	50	-34.3	-37.5	-47.9	-55.6	-63.8	-72.6	-91.9	-113.4
	3	100	-33.2	-36.3	-46.4	-53.8	-61.7	-70.2	-88.9	-109.8

Table 4. p_{net30} (psf) Roof Overhang

Step 7. Determine adjustment factor for height and exposure category, I

Using the Exposure Category (Step 3) and the roof height, h (ft), look up the adjustment factor for height and exposure (λ) in Table 5, page 19.

[1.2.] Procedure to Calculate Total Design Wind Load per ASCE 7-10

Table 5. Adjustment Factor (λ) for Roof Height & Exposure Category

Mean roof height (ft)	Exposure B	Exposure C	Exposure D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Step 8. Calculate the adjusted wind pressures, p_{net}, (psf)

Multiply the Net Design Wind Pressure, p_{net30} by the adjustment factor for height and exposure, l, the Topographic Factor, K_{zt}.

Where
l = adjustment factor for building height and exposure (Step 7)
K_{zt} = For the purposes of this code compliance document, the Topographic Factor, K_{zt}, is taken as equal to one (1) as per Section 26.8-2 or as determined by Figure 26.8-1 in ASCE 7-10.
P_{net30} = net design wind pressure for Exposure B, at h = 30 ft (Step 6)

The adjusted wind pressures will be used to select the appropriate SWH rail, rail span and attachment spacing.

Use both the positive (downforce) and the negative (uplift) results from this calculation.

Part II. Procedure to Select Rail Span and Foot Spacing

[2.1.] Using Standard Beam Calculations & Structural Engineering Methodology ASCE 7-10

The procedure to determine the DR rail span uses standard beam calculations and structural engineering methodology. The beam calculations are based on a simply supported beam conservatively, ignoring the reductions allowed for supports of continuous beams over multiple supports. Please refer to **Part I** for more information on beam calculations, equations and assumptions. If beams are installed perpendicular to the eaves on a roof steeper than a 4/12 pitch in an area with a ground snow load greater than 30psf, then additional analysis is required for side loading on the roof attachment and beam.

In using this document, obtaining correct results is dependent upon the following:

1. Obtain the *Snow Load* for your area from your local building official.

2. Obtain the Design Wind Load, pnet. See **Part I**
(Procedure to Determine the Design Wind Load) for more information on calculating the *Design Wind Load*.

3. ***Please Note:*** The terms 'rail span' and 'footing spacing' are interchangeable in this document. See **Figure 4** for illustrations.

4. To use **Table 7** the *Dead Load* for your specific installation must be less than 5 psf, including modules and DR racking systems.

If the Dead Load is greater than 5 psf, see your DR distributor, a local structural engineer or contact DR The following procedure will guide you in selecting a DR rail for a flush mount installation. It will also help determine the design loading imposed by the DR PV Mounting Assembly that the building structure must be capable of supporting.

Step 1. Determine the Total Design Load

The Total Design Load, P (psf) is determined using ASCE 7-10 2.4.1 (ASD Method equations 3, 5, 6a and 7) by adding the Snow Load, S (psf), Design Wind Load, Pnet (Psf) Step 8 page 19 and the Dead Load (psf). Both Uplift and Downforce Wind Loads calculated in Step 8, Page 18 of section 1.2. must be investigated. Use Table 6 to calculate the Total Design Load for the load cases. Use the maximum absolute value of the three downforce cases and the uplift case for sizing the rail. Use the uplift case only for sizing lag bolts pull out capacities. Use the following equations or Table 6, below.

$P\ (psf) = 1.0D + 1.0S^{1}$ (downforce case 1)
$P\ (psf) = 1.0D + 0.6\ p_{net}$ (downforce case 2)
$P\ (psf) = 1.0D + 0.75S^{1} + 0.75(0.6p_{net})$ (downforce case 3)
$P\ (psf) = 0.6D + 0.6\ p_{net}$ (uplift)
D = Dead Load (psf)
S = Snow Load (psf)
p_{net} = Design Wind Load (psf) (Positive for downforce,negative for uplift)

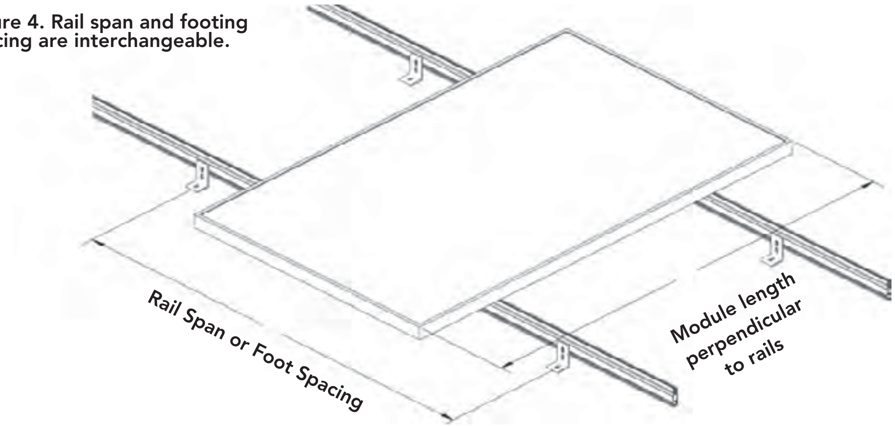
Table 6. ASCE 7-10 Load Combinations

Description	Variable	Downforce Case 1	Downforce Case 2	Downforce Case 3	Uplift	units
Dead Load	D	1.0 x	1.0 x	1.0 x	0.6 x	psf
Snow Load	S	1.0 x + ______		0.75 x + ______		psf
Design Wind Load	Pnet		0.6 x + ______	0.75 x + ______	0.6 x -	psf
Total Design Load	P					psf

Note: Table to be filled out or attached for evaluation.

[2.1.] Using Standard Beam Calculations & Structural Engineering Methodology ASCE 7-10

Figure 4. Rail span and footing spacing are interchangeable.



Note: Modules must be centered symmetrically on the rails (+/- 2*), as shown.

Step 2: Determine the Distributed Load on the rail, w (plf)

Determine the Distributed Load, w (plf), by multiplying the module length, B (ft), by the *Total Design Load, P (psf)* and dividing by two. Use the maximum absolute value of the three downforce cases and the Uplift Case. We assume each module is supported by two rails.

$$w = PB/2$$

w = Distributed Load (pounds per linear foot, plf)

B = Module Length Perpendicular to Rails (ft)

P = Total Design Pressure (pounds per square foot, psf)

Step 3: Determine Rail Span/ L-bracket Spacing

Using the *distributed load, w*, from Part II, Step 2, look up the *allowable spans, L*, for DR Standard rail in Table 7. The L-bracket DR Series Rail Span Table uses a single L-bracket connection to the roof, wall or stand-off. Please refer to the **Part III** for more installation

Table 7 . L-Foot DR Rail Span
ST- SWH STANDARD RAIL

Span (ft)	*Distributed Load (pounds/linear foot)*															
	20	25	30	40	50	60	80	100	120	140	160	180	200	220	240	260
2	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
2.5	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST			
3	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST					
3.5	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST						
4	ST	ST	ST	ST	ST	ST	ST	ST	ST							
4.5	ST	ST	ST	ST	ST	ST	ST	ST								
5	ST	ST	ST	ST	ST	ST	ST	ST								
5.5	ST	ST	ST	ST	ST	ST	ST									
6	ST	ST	ST	ST	ST	ST	ST									
6.5	ST	ST	ST	ST	ST	ST	ST									
7	ST	ST	ST	ST	ST	ST										
7.5	ST	ST	ST	ST	ST	ST										
8	ST	ST	ST	ST	ST	ST										
8.5	ST	ST	ST	ST	ST											
9	ST	ST	ST	ST												
9.5	ST	ST	ST	ST												
10	ST	ST	ST													
10.5	ST	ST	ST													
11	ST	ST														
11.5	ST															
12	ST															

[2.1.] Using Standard Beam Calculations & Structural Engineering Methodology ASCE 7-10

Step 4: Select Rail Type

Selecting a span and rail type affects the price of your installation. Longer spans produce fewer wall or roof penetrations. However, longer spans create higher point load forces on the building structure. A point load force is the amount of force transferred to the building structure at each connection.

It is the installer's responsibility to verify that the building structure is strong enough to support the point load forces.

Step 5: Determine the Downforce Point Load, R (lbs), at each connection based on rail span

When designing the DR Flush Mount Installation, you must consider the downforce Point Load, R (lbs) on the roof structure.

The *Downforce*, *Point Load, R (lbs)*, is determined by multiplying the *Total Design Load, P (psf),* **(Step 1)** by the *Rail Span, L (ft)* **(Step 3)** and the *Module Length Perpendicular to the Rails, B* (ft) divided by two.

$$R\ (lbs) = PLB/2$$

R = Point Load (lbs)

P = Total Design Load (psf)

L = Rail Span (ft)

B = Module Length Perpendicular to Rails (ft)

It is the installer's responsibility to verify that the building structure is strong enough to support the maximum point loads calculated according to **Step 5**.

Table 8. Downforce Point Load Calculation

Total Design Load (downforce) (max of case 1, 2 or 3):	P		psf	Step 1
Module length perpendicular to rails:	B	x	ft	
Rail Span:	L	x	ft	Step 3
		/2		
Downforce Point Load:	R		lbs	

[2.1.] Using Standard Beam Calculations & Structural Engineering Methodology ASCE 7-10

Step 6: Determine the Uplift Point Load, R (lbs), at each connection based on rail span

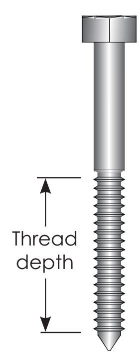
You must also consider the Uplift Point Load, R (lbs), to determine the required lag bolt attachment to the roof (building) structure.

Table 9. Uplift Point Load Calculation

Total Design Load (uplift):	P		psf	Step 1
Module length perpendicular to rails	B	x	ft	
Rail Span:	L	x	ft	Step 3
		/2		
Uplift Point Load:	R		lbs	

Table 10. Lag pull-out (withdrawal) capacities (lbs) in typical roof lumber (ASD)

	Specific gravity	*Lag screw specifications* 5/16″ shaft,* per inch thread depth
Douglas Fir, Larch	**0.50**	**266**
Douglas Fir, South	**0.46**	**235**
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	**0.46**	**235**
Hem, Fir, Redwood (close grain)	**0.43**	**212**
Hem, Fir (North)	**0.46**	**235**
Southern Pine	**0.55**	**307**
Spruce, Pine, Fir	**0.42**	**205**
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and MEL)	**0.50**	**266**



Sources: American Wood Council, NDS 2005, Table 11.2A, 11.3.2A.

Notes: (1) Thread must be embedded in the side grain of a rafter or other structural member integral with the building structure.
(2) Lag bolts must be located in the middle third of the structural member.
(3) These values are not valid for wet service.
(4) This table does not include shear capacities. If necessary, contact a local engineer to specifiy lag bolt size with regard to shear forces.
(5) Install lag bolts with head and washer flush to surface (no gap). Do not over-torque.
(6) Withdrawal design values for lag screw connections shall be multiplied by applicable adjustment factors if necessary. See Table 10.3.1 in the American Wood Council NDS for Wood Construction.

**Use flat washers with lag screws.*

Use Table 6 to select a lag bolt size and embedment depth to satisfy your Uplift Point Load Force, R (lbs), requirements. Divide the uplift pointload by the withdrawal capacity, this results in inches of 5/16 lagbolt embedded thread depth needed to counteract the uplift force. If other than lag bolt is used (as with a concrete or steel), consult fastener mfr documentation.

It is the installer's responsibility to verify that the substructure and attachment method is strong enough to support the maximum point loads calculated according to step 5 and step 6.

Dual Rack Product List

1. Rail - Supports PV modules. Use two per row of modules. Aluminum extrusion, silver or black.

2. Rail Splice - Joins and aligns rail sections into single length of rail. It can form either a rigid or thermal expansion joint, 8 inches long, pre-drilled. Aluminum extrusion, silver or black.

3. Grounding Mid Clamp - Supports PV modules. Use two per row of modules. Aluminum extrusion, silver or black.

4. End Clamps - Top mounting clamp different sizes available in silver or black.

5. Cable Clip - To simplify wire management, designed to prevent damages to wires insulation.

6. Grounding Lug - DR-GB5-P7
A grounding lay-in lug that can be used for grounding rails or modules.

7. Dual Jack (Standoff) - Use Standoffs to increase the height of the array above the roof or to allow for the use of flashing. Use one per L-foot. Comes with 5/16" x 3.5" lag bolt, 3/8" x 1.5" flat washer and 3/8" x 1.5" rubber gasket, in mill finish or painted black.

8. Dual Jack Base - Can be used as an alternative method for attaching the Dual Jack "standoff" to the roof, Suitable for roofs with multiple layers.

9. Flashing - Comes in 12.0" x 12.0" and 9.0" x 12.5" sizes (Clear/Black color) designed to be used on composition/asphalt shingle roofs.

10. Dual Jack Connector - Use to combine two Dual-Jacks to create a variety of tilt angles with no cutting needed.

12. L foot - Use to secure rails to standoffs. 3.3" x 2.1" silver or black, extruded aluminum. Refer to span tables for spacing.

13. S Tile hook - Use to mount rails on Spanish tile roofs.

14. Adjustable S Tile hook - Use to mount rails on Spanish tile roofs. Adjustable upper arm enables variety of height to fit different sizes of Spanish tiles.

15. Flat Tile hook - Use to mount rails on flat tile roof.

16. Tile Strut - Use as an alternative to tile hooks.

17. Dual Flash L-kit - Replaces Standoff and L-foot and attaches to the roof using a 5/16" x 5" lag bolts. Comes with flashing, in silver or black.

18. Lite Flash L-kit - Replaces Standoff and L foot and attaches to the roof using a 5/16" x 5" lag bolts. Comes with flashing, in silver or black.

19. Extension Leg kit - Used whenever a tilt or reverse tilt is needed.

20. Hangar Bolt - Designed for corrugated roof or comp-shingle roofs with flashing. Comes complete with rubber seal.

[3.2] Installing Dual Rack with top mounting clamps

This section covers Dual Rack racking assembly in which where the installer has elected to use top mounting clamps to secure modules to the rails. It details the procedure for flush mounting Dual Rack system to a pitched roof.

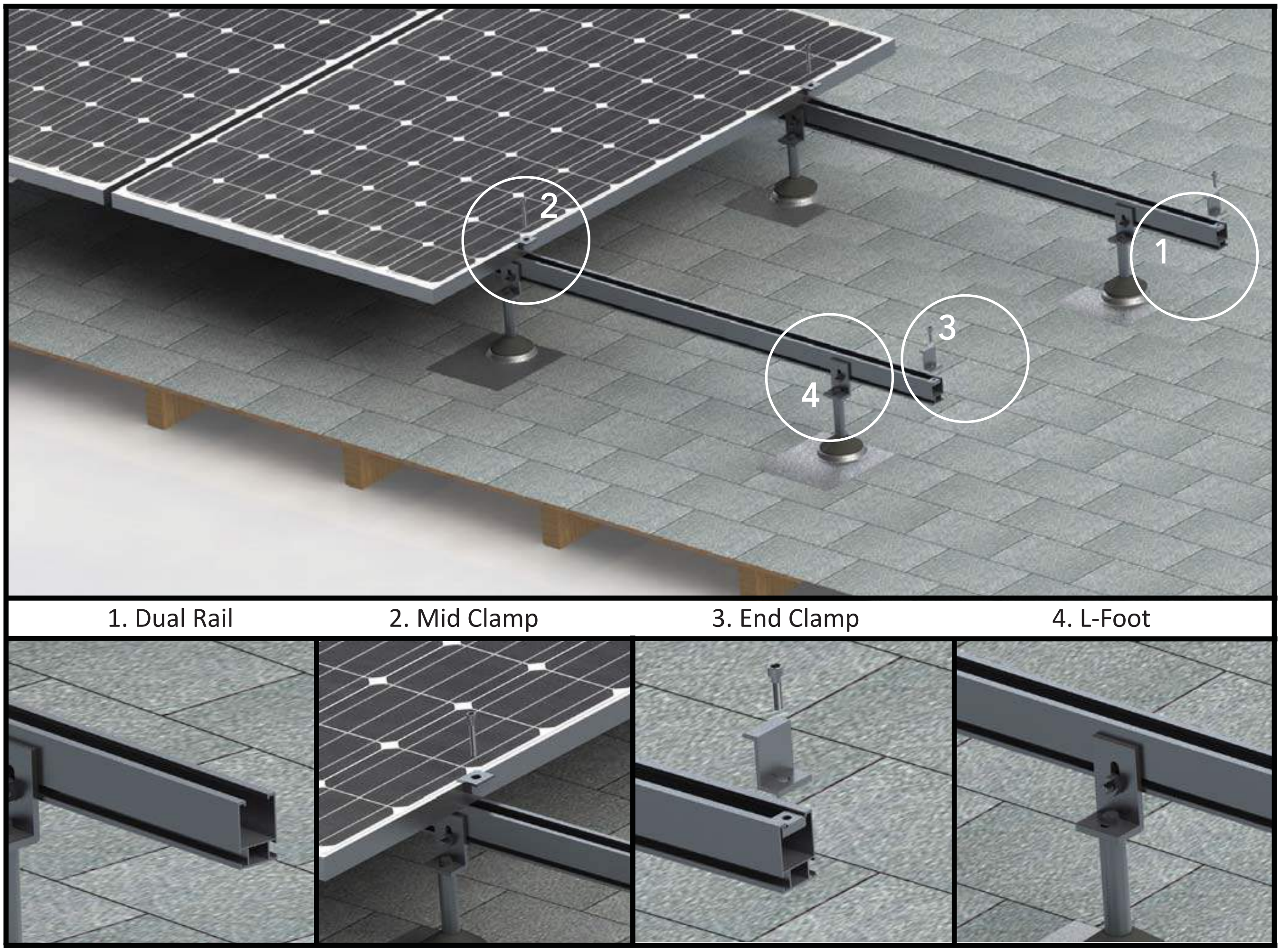


Figure 5. Exploded view of a flush mount installation with L-Foot

TABLE 12. Wrenches and Torque

	Wrench Size	Recommended Torque (ft-lbs)
M8	17/64	10* ⚠
3/8" hardware	9/16"	14

To secure the M8 or 3/8" hardware you have an option:

* Using a serrated nut.
* Using a serrated nut and serrated washer.
* Regular nut and regular washer (don't forget star washer where necessary.

⚠ *All Top down clamps must be installed with anti-seize to prevent galling and provide uniformity Top down clamp load. Dual Rack recommends Silver Grade LocTite Anti-Seize Item numbers: 38181, 80209,76732,76759,76764, 80206, and 76775, or equivalent. M8 - 20 hardware used in conjunction with Top down clamps must be installed to 10 ft-lbs of torque. In addition, once the hardware are secured and integrity verified, it is recommended that thread lock be applied.

[3.2.1] Planning your Dual Jack installations

The Installation can be laid outwit rails parallel to the rafter or perpendicular to the rafter. Note that Dual Rack Rails make excellent straight edges for doing layouts. Center the installation area over the structural member as much as possible. Leave enough room to safely move around the array during installation. Some building codes require minimum clearance around such installations, and the user should be directed to always reference to local building codes.

The width of the installation area equals the length of one module.
The length of the installation area is equal to:
*the total width of the modules.
*plus 1 inch for each space between modules (for Mid-clamps).
*plus 3 inches (1.5 inch for each pair of end clamps).

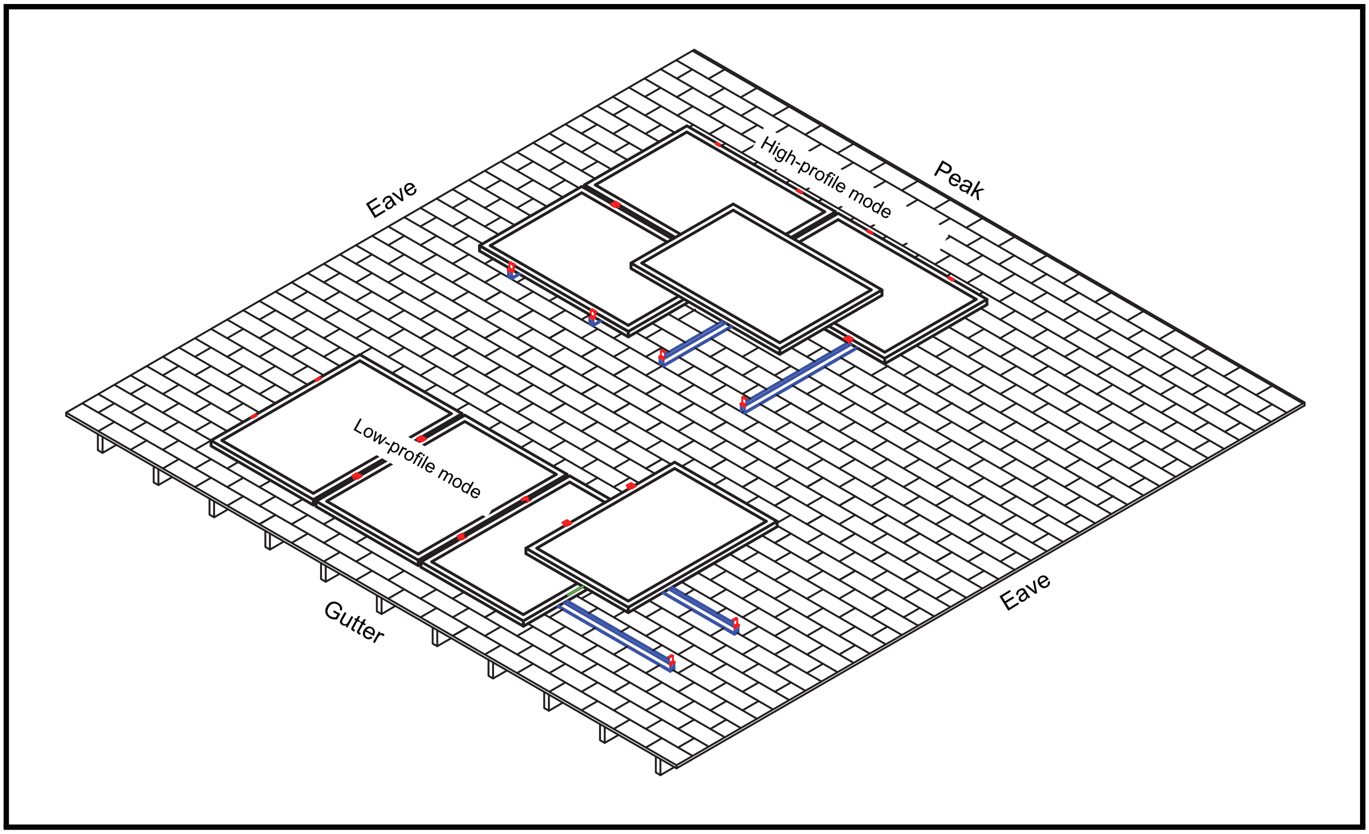
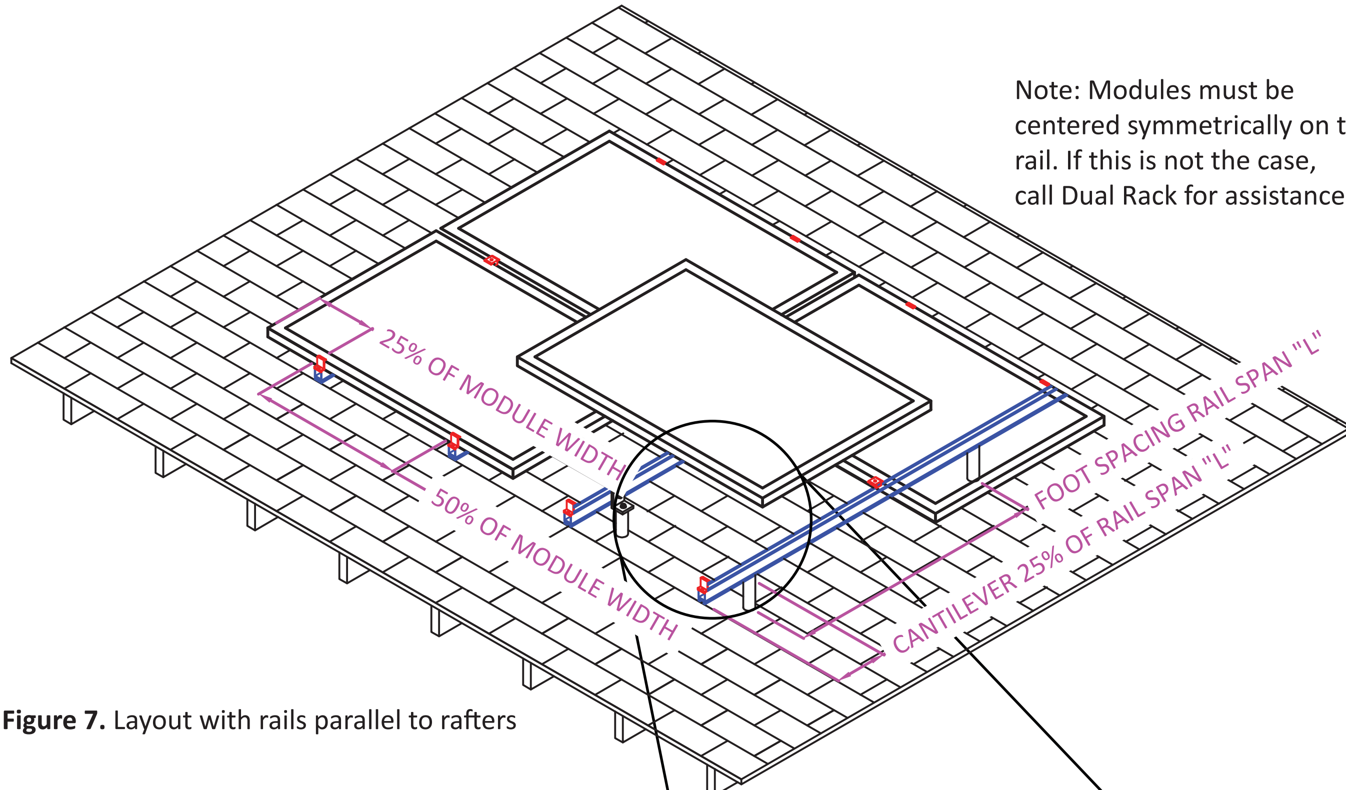


Figure 6. Rails may be placed parallel or perpendicular to rafters.

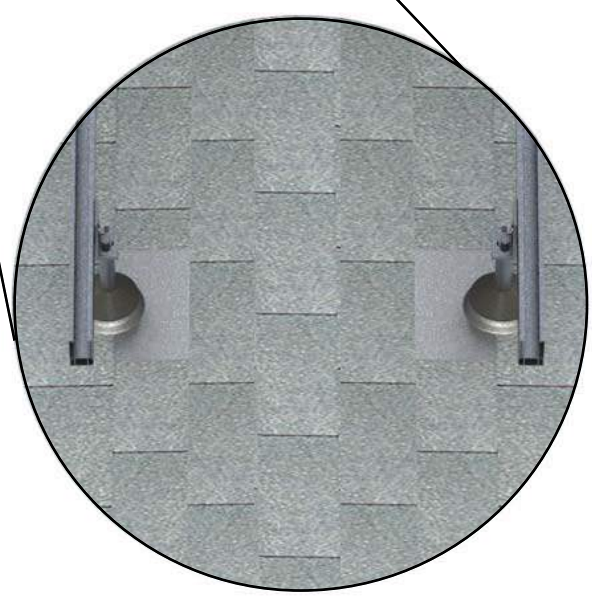
[3.2.2] Laying out Roof Attachments

Ensure that the L-Foots face as shown in **Figure 7 and 8.** For greater ventilation, the preferred method is to place the single-slotted square side of the L-Foot against the roof attachment with the long leg against the rail.



Note: Modules must be centered symmetrically on the rail. If this is not the case, call Dual Rack for assistance.

Figure 7. Layout with rails parallel to rafters



[3.2.3] Standard Rail Span Tables

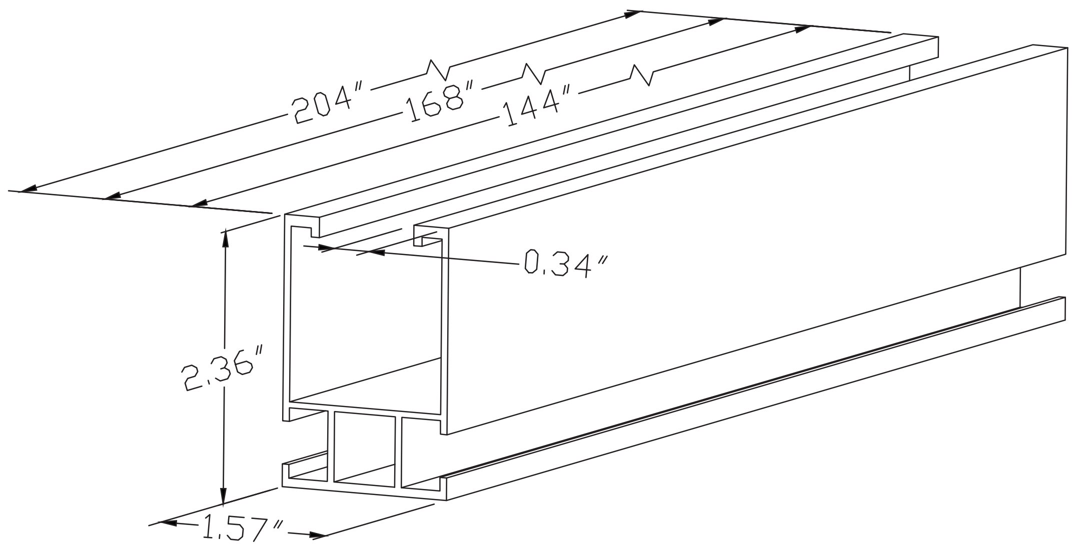


Table 1: Zone 1 Span

EXP	Wind Speed (mph)	Zone 1 Snow Load (psf) 0.0	10.0	20.0	30.0	40.0	50.0
B	110	8.0	7.0	6.0	5.0	4.5	4.0
	120	8.0	7.0	6.0	5.0	4.5	4.0
	130	8.0	7.0	6.0	5.0	4.5	4.0
	140	8.0	7.0	6.0	5.0	4.5	4.0
	150	7.5	7.0	6.0	5.0	4.5	4.0
	160	7.0	7.0	6.0	5.0	4.5	4.0
	170	7.0	7.0	6.0	5.0	4.5	4.0
	180	6.5	6.5	5.5	5.0	4.5	4.0
C	110	8.0	7.0	6.0	5.0	4.5	4.0
	120	8.0	7.0	6.0	5.0	4.5	4.0
	130	7.5	7.0	6.0	5.0	4.5	4.0
	140	7.0	7.0	6.0	5.0	4.5	4.0
	150	6.5	6.5	5.5	5.0	4.5	4.0
	160	6.0	6.0	5.5	5.0	4.5	4.0
	170	5.5	5.5	5.5	5.0	4.5	4.0
	180	5.5	5.5	5.5	5.0	4.5	4.0

a. The Table above ONLY includes Dual Rack rail capacity data. It does not include roof attachment or roof load capacity data.
b. Wind risk category II per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft.
f. Average parapet height is 0 ft.
e. Roof pitch is between 7 degrees and 27 degrees.
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” from roof.

Standard Rail Span Tables

Table 2: Zone 2 Span

EXP	Wind Speed (mph)	Zone 2 Snow Load (psf) 0.0	10.0	20.0	30.0	40.0	50.0
B	110	8.0	7.0	6.0	5.0	4.5	4.0
	120	7.0	7.0	6.0	5.0	4.5	4.0
	130	6.5	6.5	5.5	5.0	4.5	4.0
	140	6.0	6.0	5.5	5.0	4.5	4.0
	150	5.5	5.5	5.5	5.0	4.5	4.0
	160	5.5	5.5	5.5	5.0	4.5	4.0
	170	5.0	5.0	5.0	4.5	4.5	4.0
	180	4.5	4.5	4.5	4.5	4.5	4.0
C	110	6.5	6.5	5.5	5.0	4.5	4.0
	120	6.0	6.0	5.5	5.0	4.5	4.0
	130	5.5	5.5	5.5	5.0	4.5	4.0
	140	5.0	5.0	5.0	5.0	4.5	4.0
	150	5.0	5.0	5.0	4.5	4.5	4.0
	160	4.5	4.5	4.5	4.5	4.5	4.0
	170	4.0	4.0	4.0	4.0	4.0	4.0
	180	4.0	4.0	4.0	4.0	4.0	4.0

a. The Table above ONLY includes Dual Rack rail capacity data. It does not include roof attachment or roof load capacity data.
b. Wind risk category II per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft.
f. Average parapet height is 0 ft.
e. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” from roof.

Standard Rail Span Table

Table 3: Zone 3 Span

EXP	Wind Speed (mph)	Zone 3 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	6.5	6.5	5.5	5.0	4.5	4.0
	120	5.5	5.5	5.5	5.0	4.5	4.0
	130	5.0	5.0	5.0	5.0	4.5	4.0
	140	5.0	5.0	5.0	5.0	4.5	4.0
	150	4.5	4.5	4.5	4.5	4.5	4.0
	160	4.0	4.0	4.0	4.0	4.0	4.0
	170	4.0	4.0	4.0	4.0	4.0	4.0
	180	3.5	3.5	3.5	3.5	3.5	3.5
C	110	5.0	5.0	5.0	5.0	4.5	4.0
	120	5.0	5.0	5.0	5.0	4.5	4.0
	130	4.5	4.5	4.5	4.5	4.5	4.0
	140	4.0	4.0	4.0	4.0	4.0	4.0
	150	4.0	4.0	4.0	4.0	4.0	4.0
	160	3.5	3.5	3.5	3.5	3.5	3.5
	170	3.5	3.5	3.5	3.5	3.5	3.5
	180	3.0	3.0	3.0	3.0	3.0	3.0

a. The table above ONLY includes Dual Rack rail capacity check. It does not include roof attachment or roof capacity check
b. Wind risk category ll per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft
f. Average parapet height is 0 ft
e. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” to roof

[3.2.4] Lite Rail Span Tables

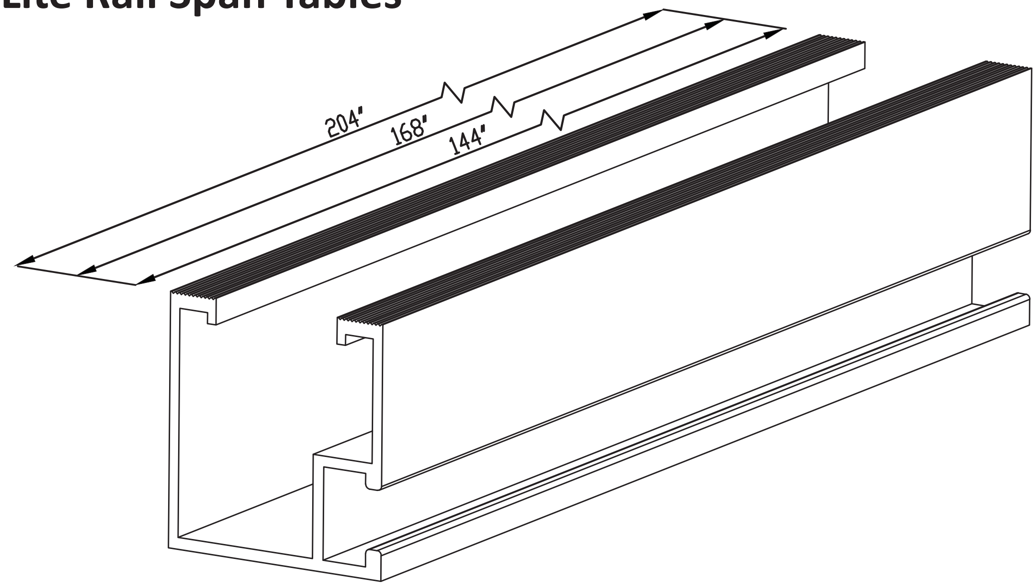


Table 1: Zone 1 Span

EXP	Wind Speed (mph)	Zone 1 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	6.5	6.0	5.5	5.0	4.5	4.0
	120	6.5	6.0	5.5	5.0	4.5	4.0
	130	6.5	6.0	5.5	5.0	4.5	4.0
	140	6.0	6.0	5.0	5.0	4.5	4.0
	150	6.0	6.0	5.0	5.0	4.5	4.0
	160	5.5	5.5	5.0	5.0	4.5	4.0
	170	5.5	5.5	5.0	4.5	4.5	4.0
	180	5.0	5.0	5.0	4.5	4.5	4.0
C	110	6.5	6.0	5.5	5.0	4.5	4.0
	120	6.0	6.0	5.5	5.0	4.5	4.0
	130	5.5	5.5	5.5	5.0	4.5	4.0
	140	5.5	5.5	5.5	5.0	4.5	4.0
	150	5.0	5.0	5.0	4.5	4.0	4.0
	160	5.0	5.0	5.0	4.5	4.0	4.0
	170	4.5	4.5	4.5	4.5	4.0	4.0
	180	4.5	4.5	4.5	4.5	4.0	4.0

a. The table above ONLY includes Dual Rack rail capacity. It does not include roof attachment or roof load capacity.
b. Wind risk category ll per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” from roof.
i. Maximum rail end cantilever lenght = 0.365 x angle bracket spacing along rail

Lite Rail Span Tables

Table 1: Zone 2 Span

EXP	Wind Speed (mph)	Zone 2 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	6.0	6.0	5.0	5.0	4.5	4.0
	120	5.5	5.5	5.0	5.0	4.5	4.0
	130	5.0	5.0	5.0	5.0	4.5	4.0
	140	5.0	5.0	5.0	5.0	4.5	4.0
	150	4.5	4.5	4.5	4.5	4.5	4.0
	160	4.5	4.5	4.5	4.5	4.5	4.0
	170	4.0	4.0	4.0	4.0	4.0	4.0
	180	4.0	4.0	4.0	4.0	4.0	4.0
C	110	5.0	5.0	5.0	5.0	4.5	4.0
	120	5.0	5.0	5.0	5.0	4.5	4.0
	130	4.5	4.5	4.5	4.5	4.5	4.0
	140	4.0	4.0	4.0	4.0	4.0	4.0
	150	4.0	4.0	4.0	4.0	4.0	4.0
	160	3.5	3.5	3.5	3.5	3.5	3.5
	170	3.5	3.5	3.5	3.5	3.5	3.5
	180	3.5	3.5	3.5	3.5	3.5	3.5

a. The table above ONLY includes Dual Rack rail capacity. It does not include roof attachment or roof load capacity.
b. Wind risk category ll per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” from roof.

Lite Rail Span Tables

Table 1: Zone 3 Span

EXP	Wind Speed (mph)	Zone 3 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	5.0	5.0	5.0	5.0	4.5	4.0
	120	4.5	4.5	4.5	4.5	4.5	4.0
	130	4.5	4.5	4.5	4.5	4.5	4.0
	140	4.0	4.0	4.0	4.0	4.0	4.0
	150	4.0	4.0	4.0	4.0	4.0	4.0
	160	3.5	3.5	3.5	3.5	3.5	3.5
	170	3.5	3.5	3.5	3.5	3.5	3.5
	180	3.0	3.0	3.0	3.0	3.0	3.0
C	110	4.5	4.5	4.5	4.5	4.5	4.0
	120	4.0	4.0	4.0	4.0	4.0	4.0
	130	3.5	3.5	3.5	3.5	3.5	3.5
	140	3.5	3.5	3.5	3.5	3.5	3.5
	150	3.0	3.0	3.0	3.0	3.0	3.0
	160	3.0	3.0	3.0	3.0	3.0	3.0
	170	3.0	3.0	3.0	3.0	3.0	3.0
	180	2.5	2.5	2.5	2.5	2.0	2.0

a. The table above ONLY includes Dual Rack rail capacity. It does not include roof attachment or roof load capacity.
b. Wind risk category ll per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30ft
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2” and 10” from roof

[3.2.5] Heavy Duty Rail Span Tables

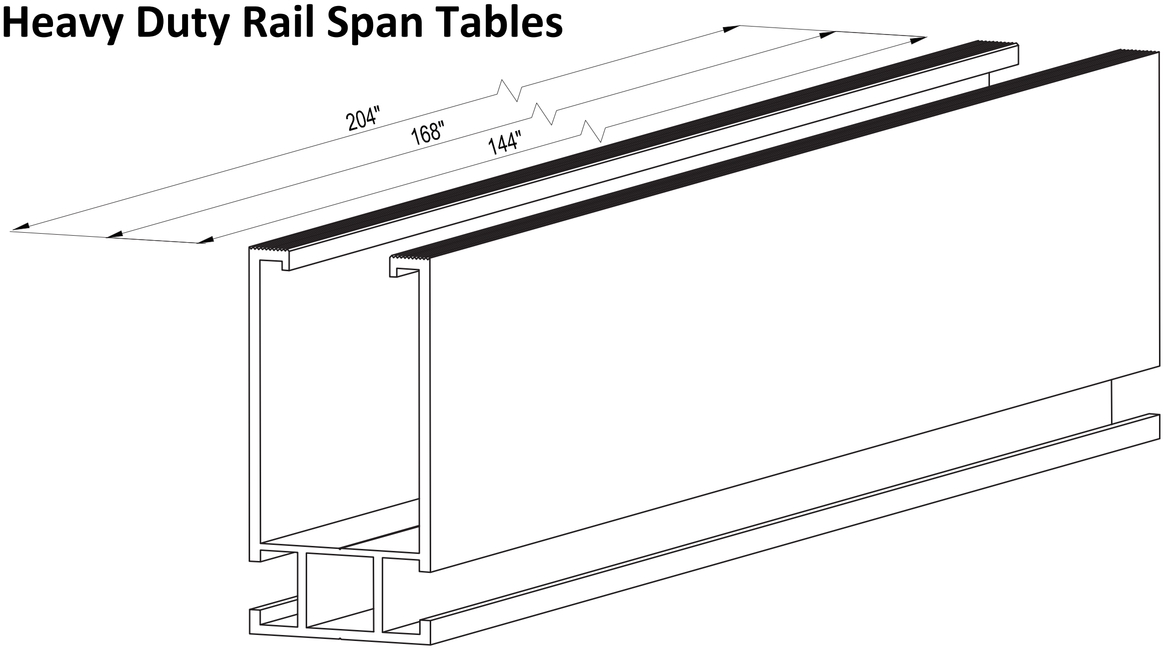


Table 1: Zone 1 Span

EXP	Wind Speed (mph)	Zone 1 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	13.5	12.5	11.0	10.0	9.0	8.0
	120	13.5	12.5	11.0	10.0	9.0	8.0
	130	13.5	12.5	11.0	10.0	9.0	8.0
	140	13.0	12.5	11.0	10.0	9.0	8.0
	150	12.0	12.0	10.5	9.5	9.0	8.0
	160	11.5	11.5	10.5	9.5	9.0	8.0
	170	10.5	10.5	10.5	9.5	8.5	8.0
	180	10.0	10.0	10.0	9.0	8.5	8.0
C	110	13.5	12.5	11.0	10.0	9.0	8.0
	120	12.5	12.5	11.0	10.0	9.0	8.0
	130	12.0	12.0	10.5	9.5	9.0	8.0
	140	11.0	11.0	10.5	9.5	8.5	8.0
	150	10.5	10.5	10.0	9.5	8.5	8.0
	160	9.5	9.5	9.5	9.0	8.5	8.0
	170	9.0	9.0	9.0	9.0	8.5	8.0
	180	8.5	8.5	8.5	8.5	8.0	7.5

a. The table above ONLY includes Dual Rack rail capacity check. It does not include roof attachment or roof capacity check
b. Wind risk category II per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30 ft.
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2" and 10" to roof
i. Maximum rail end cantilever length= 0.35 x angle bracket spacing along rail

Heavy Duty Rail Span Tables

Table 2: Zone 2 Span

EXP	Wind Speed (mph)	Zone 2 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	12.0	12.0	11.0	10.0	9.0	8.0
	120	11.0	11.0	11.0	10.0	9.0	8.0
	130	10.0	10.0	10.0	10.0	9.0	8.0
	140	9.5	9.5	9.5	9.5	9.5	8.0
	150	9.0	9.0	9.0	9.0	9.0	8.0
	160	8.5	8.5	8.5	8.5	8.5	8.0
	170	8.0	8.0	8.0	8.0	8.0	8.0
	180	7.5	7.5	7.5	7.5	7.5	7.5
C	110	10.0	10.0	10.0	10.0	9.0	8.0
	120	9.5	9.5	9.5	9.5	9.0	8.0
	130	8.5	8.5	8.5	8.5	8.5	8.0
	140	8.0	8.0	8.0	8.0	8.0	8.0
	150	7.5	7.5	7.5	7.5	7.5	7.5
	160	7.0	7.0	7.0	7.0	7.0	7.0
	170	7.0	7.0	7.0	7.0	7.0	7.0
	180	6.5	6.5	6.5	6.5	6.5	6.5

a. The table above ONLY includes Dual Rack rail capacity check. It does not include roof attachment or roof capacity check
b. Wind risk category II per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30 ft
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2" and 10" to roof
i. Maximum rail end cantilever length= 0.35 x angle bracket spacing along rail

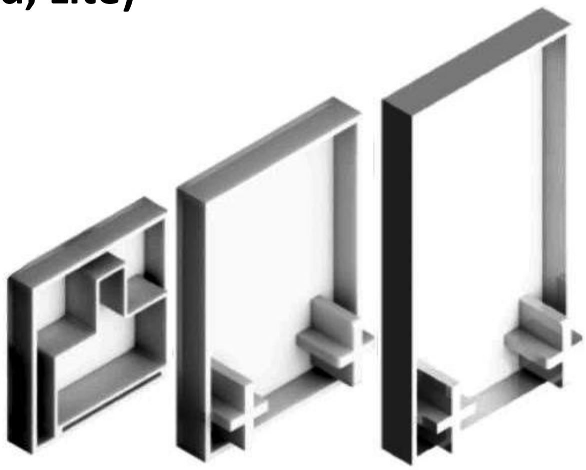
Heavy Duty Rail Span Tables

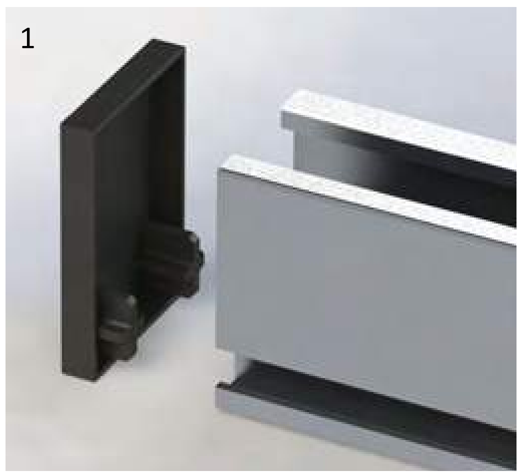
Table 3: Zone 3 Span

EXP	Wind Speed (mph)	Zone 3 Snow Load (psf)					
		0.0	10.0	20.0	30.0	40.0	50.0
B	110	10.0	10.0	10.0	10.0	9.0	8.0
	120	9.0	9.0	9.0	9.0	9.0	8.0
	130	8.5	8.5	8.5	8.5	8.5	8.0
	140	8.0	8.0	8.0	8.0	8.0	8.0
	150	7.5	7.5	7.5	7.5	7.5	7.5
	160	7.0	7.0	7.0	7.0	7.0	7.0
	170	6.5	6.5	6.5	6.5	6.5	6.5
	180	6.0	6.0	6.0	6.0	6.0	6.0
C	110	8.5	8.5	8.5	8.5	8.5	8.0
	120	7.5	7.5	7.5	7.5	7.5	7.5
	130	7.0	7.0	7.0	7.0	7.0	7.0
	140	6.5	6.5	6.5	6.5	6.5	6.5
	150	6.0	6.0	6.0	6.0	6.0	6.0
	160	6.0	6.0	6.0	6.0	6.0	6.0
	170	5.5	5.5	5.5	5.5	5.5	5.5
	180	5.0	5.0	5.0	5.0	5.0	5.0

a. The table above ONLY includes Dual Rack rail capacity check. It does not include roof attachment or roof capacity check
b. Wind risk category II per ASCE7-10
c. Topographic factor, kzt is 1.0
d. Maximum mean roof height is 30 ft
e. Average parapet height is 0 ft
f. Roof pitch is between 7 degree and 27 degree
g. Maximum solar panel weight is 50 lbs
h. Height of solar panel is between 2" and 10" to roof
i. Maximum rail end cantilever length= 0.35 x angle bracket spacing along rail

[3.2.6] RAIL END CAPS
(Heavy Duty, Standard, Lite)





1. Align the bottom teeth of the End Cap with the opening rail grooves.

2. Apply pressure to create a snug fit between the End Cap and the mounting rail.
*DualRack Rail in pictures, sold separately

[3.2.7] Laying out L-Foots

L-Foot can be used to attach the rail to the roof attachment "Standoff" Dual Rack or extension bar.

Use **Figure 7 or 8** to locate and mark the position of the roof attachment lag holes within the installation area.

If multiple rows are to be installed adjacent to one another, it is not likely that each row will be centered above the rafter. Adjust as needed, following the guidelines in **Figure 8** as closely as possible.

Note: Modules must be centered symmetrically on the rail.

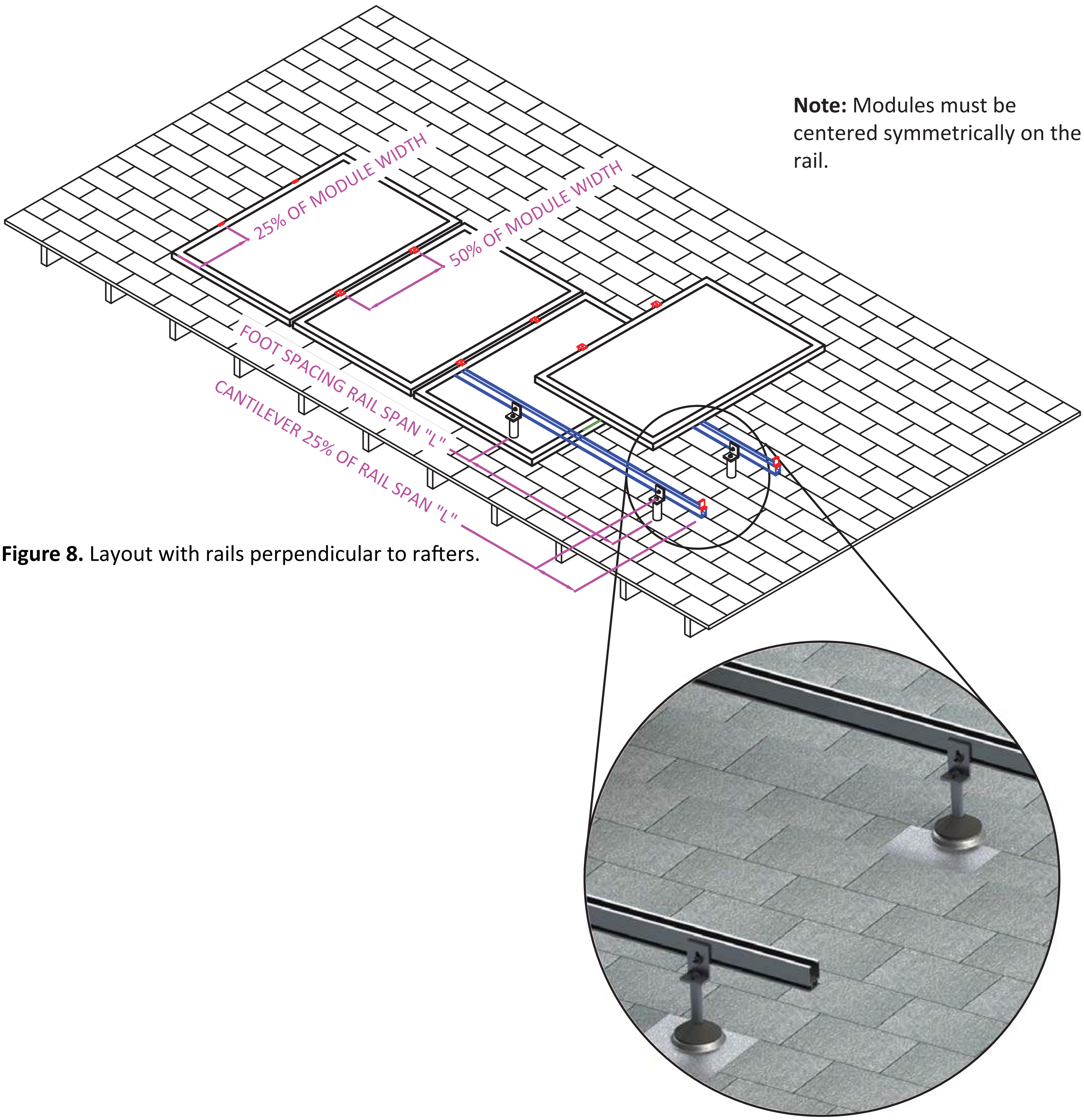
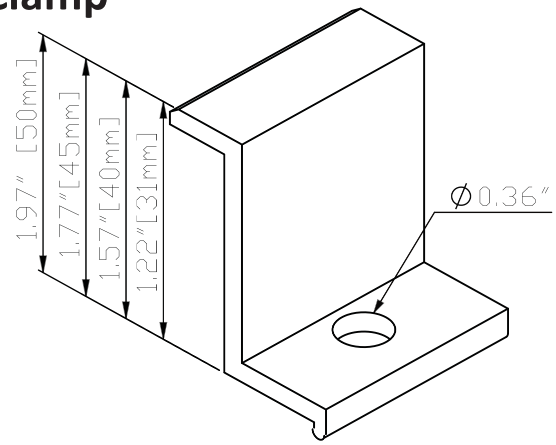
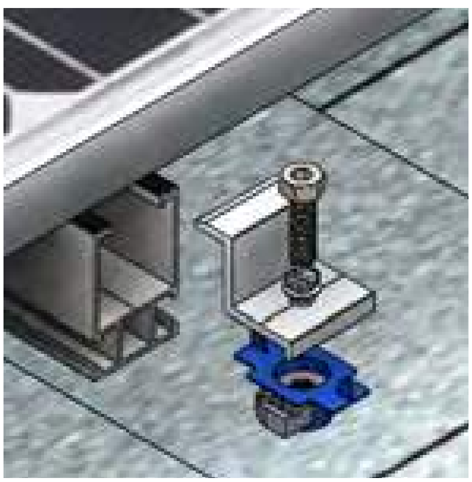


Figure 8. Layout with rails perpendicular to rafters.

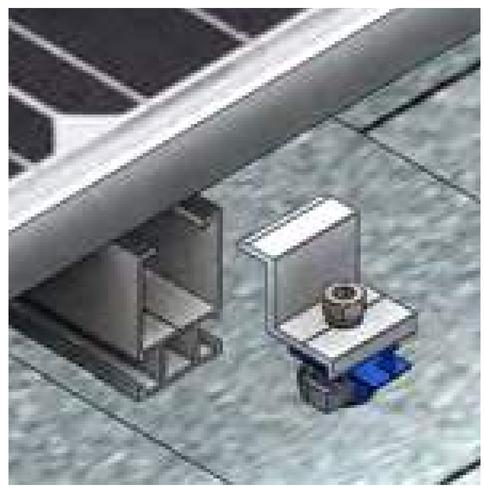
[3.3] Rail Attachments

[3.3.1] Dual Rack End Clamp

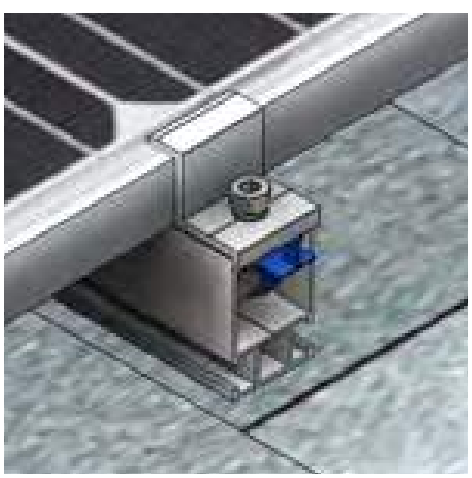




1. Insert the M8 allen bolt through the End clamp and screw the bottom to the channel strut.



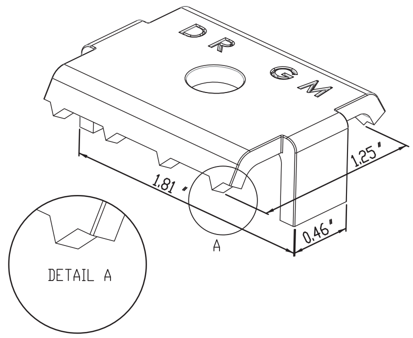
2. Lower or slide the channel strut through the Dual rail gap.



3. & 4. Screw the M8 bolt and the channel strut will align itself with the Dual rail grooves.

Recommended Torque 10 (lbs-ft)

[3.3.3] Dual Rack Grounding Mid Clamp



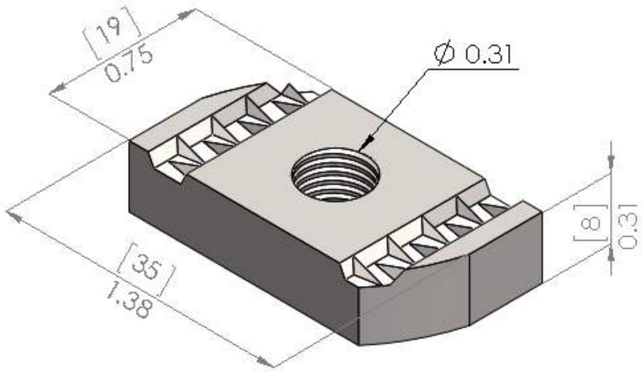
1- Insert the Grounding Mid Clamp Channel Strut in a parallel configuration into the Dual Rack Rail channel opening. The blue Channel Strut Floater will ensure that the Grounding Mid Clamp will be supported and stay in place for complete installation.

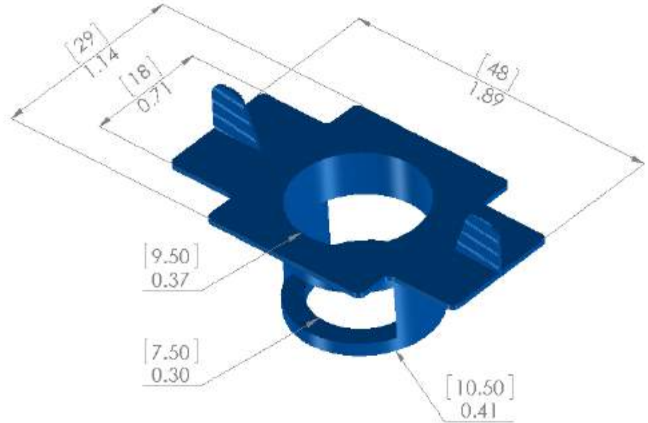
2- Lock the Channel Strut in the Dual Rack Rail channel by turning the Channel Strut Floater 180 degrees, which will ensure the grooves on the Channel Strut will line up with the lip of the Dual Rack Rail channel.

3- Verify that the Channel Strut is locked in the rail channel, using the Channel Strut Floater position (now parallel to rail channel) as a guide. Place the module(s) under the Grounding Mid Clamp, making sure the Grounding Mid Clamp teeth are in line with the module frame.

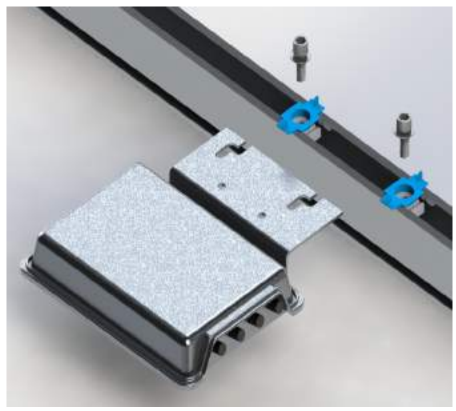
4- Make Sure the Grounding Mid Clamp teeth are "biting" center of the module frames to ensure electrical grounding continuity. Screw the M8 bolt (10 ft.-lb. torque recommended) and the Channel Strut will align itself with the Dual Rack Rail grooves.

[3.3.4] Dual Rack Channel Strut

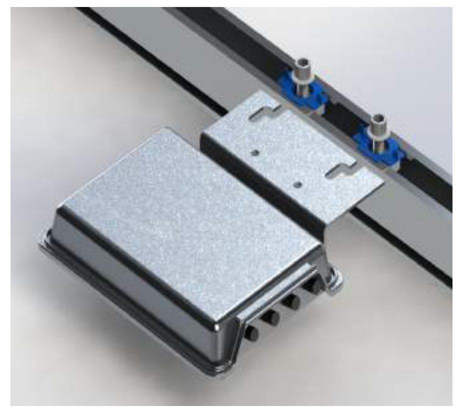




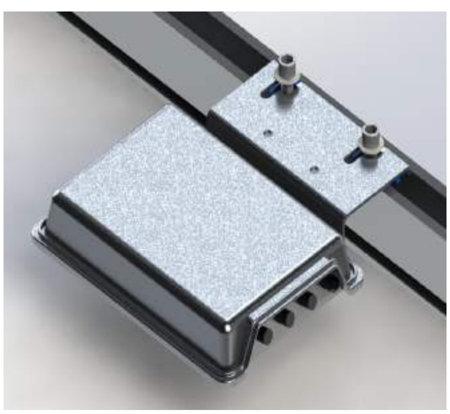
1. Insert the M8 allen bolt through the washer and screw the bottom to the channel strut.



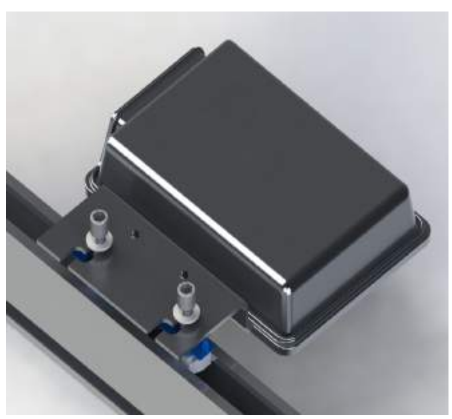
2. Lower or slide the channel strut through the Dual rail gap.



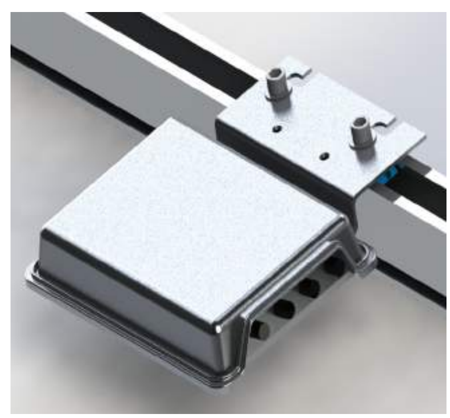
3. Place the micro inverter between the rail and the washer.



4. Screw the M8 bolt and the channel strut will align itself with the Dual rail grooves.
Recommended Torque 10 (ft. lbs.)

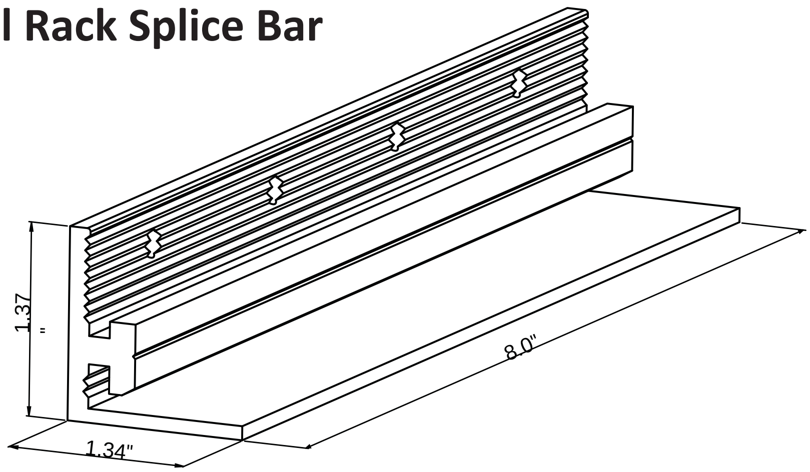


5. Screw the M8 bolt and the channel strut will align itself with the Dual rail grooves.
Recommended Torque 10 (ft. lbs.)



6. Screw the M8 bolt and the channel strut will align itself with the Dual rail grooves.
Recommended Torque 10 (ft. lbs.)

[3.3.5] Dual Rack Splice Bar

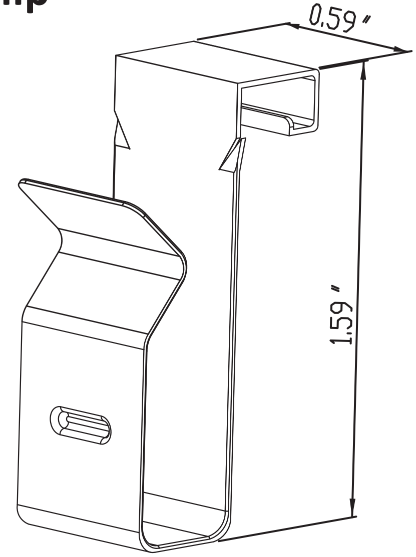


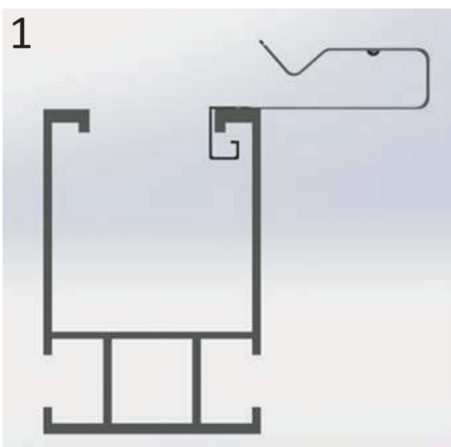
1. Slide the splice bar halfway onto the rear side of the base rails.

2. Slide the next rail section into the splice. From 1/4" to 1/16" (check with county requirement) between the rail ends. This allows the splice to act as an expansion joint.

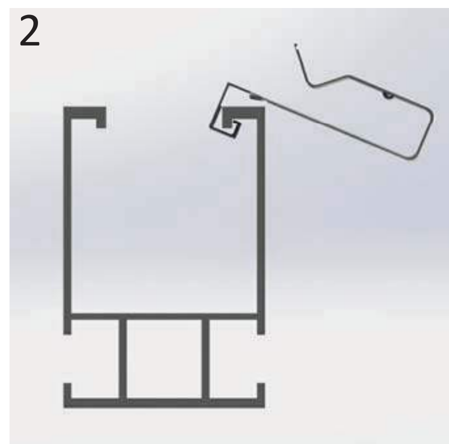
3. Tighten the first self-tapping screw all the way into the rail and tightening the rest until they just contract the rail, leaving it it just loose enough for the rail to expand and contract within the splice. For rigid joint screw all the self tapping screws all the way into the rail. The choice between thermal expansion or rigid joints depends on the installation area.

[3.3.6] Dual Rack Cable Clip

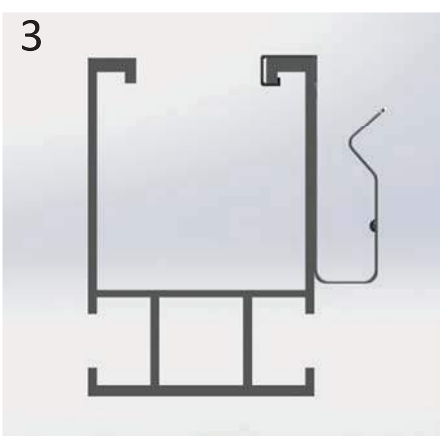




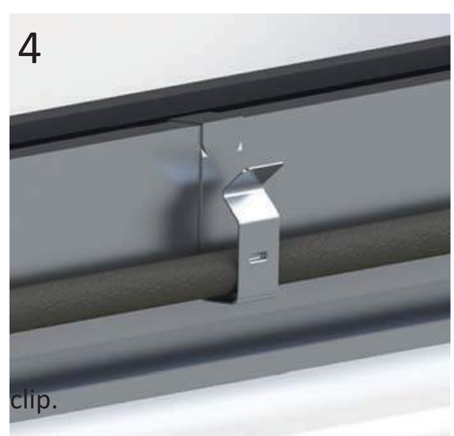
1. Place the cable clip on one of the Dual rail sides making a 90°angle.



2. Lower the cable clip towards the side of the Dual rail.



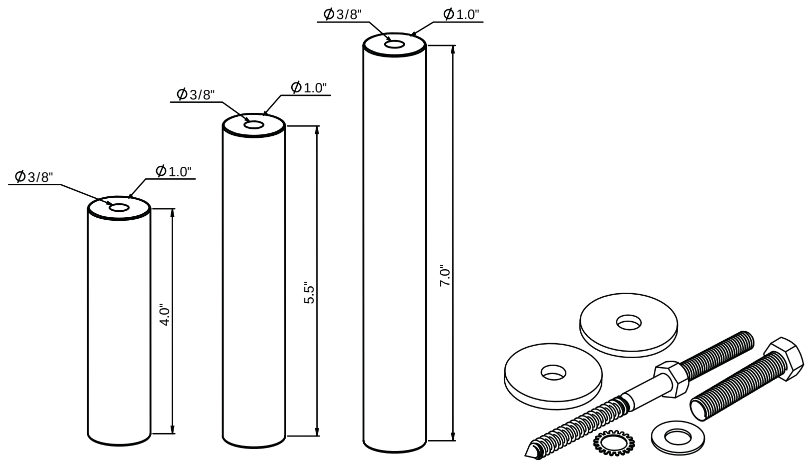
3. Make sure the cable clip is secured in place.



4. Push the cable into the cable clip.

[3.4] Dual Rack Roof Attachments

[3.4.1] Dual Jack Top Down Style with Standard Rail only



1. Drill a pilot hole using 3/16” drill bit through the roof material and into the center of the rafter at the planned location.

2. Insert the lag bolt through the 1.5” washer and 1.5” EPDM. Screw the 5/16” lag bolt into rafter, embedded min. 2.5”.

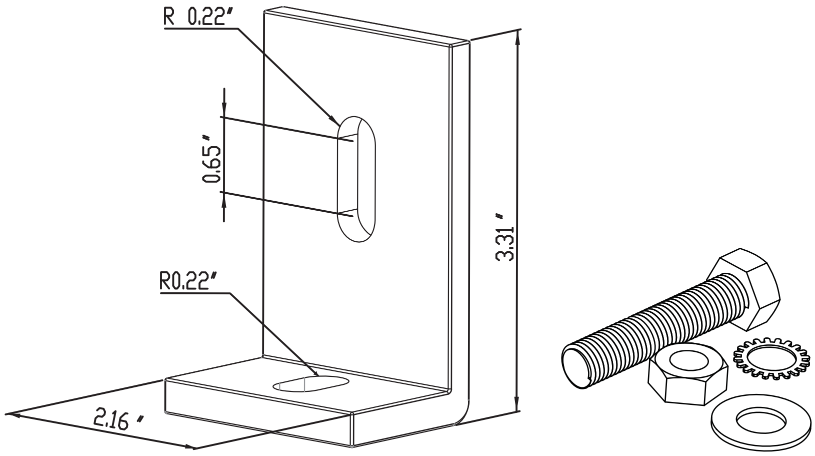
3. Screw the standoff into the lag bolt. Tightening torque is dependent on the roofing material .

4. Install the flashing over the standoff and add the EPDM collar.

5. Drill a 3/8” hole through the dual rail. Place the star washer on the rail followed by the flat washer.

6. Screw the 3/8” bolt to the standoff. Recommended Torque 14 (ft. lbs.)

[3.4.2] Dual Jack L-Foot Style



1. Drill a pilot hole using 3/16" drill bit through the roof material and into the center of the rafter at the planned location.

2. Screw the 5 /16" lag bolt into rafter, embedded minimum 2.5". Tightening torque is dependent on the roofing material.

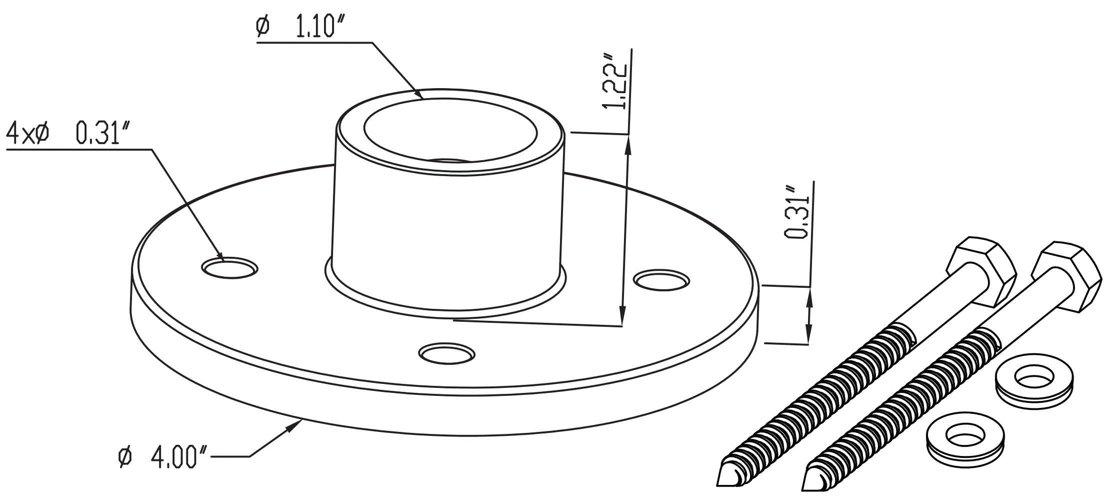
3. Install the EPDM and stainless steel washer and screw the standoff into the lag bolt.

4. Install the flashing over the standoff and add the EPDM collar. Please refer to page [3.6] for detailed flashing installation.

5. Attach the L-foot to the standoff using a 3/8" bolt, star washer and flat washer.

6. Attach the rail to the L-foot using a 3/8" bolt, star washer and nut. Recommended Torque 14 (ft. lbs.).

[3.4.3] Dual Jack Base



1. Drill two pilot holes using 3/16" drill bit through the roof material and into the center of the rafter at the planned location.

2. & 3. Screw the 5/16" lag bolt into the rafter, embedded minimum 2.5". Tightening torque is dependent on the roofing material.

4. Screw the standoff into the Dual Jack base.

5. & 6. Install the flashing over the standoff and add the EPDM collar. Please refer to page [3.6] for detailed flashing installation.

7.& 8. Attach the rail to the standoff using the top down or L-foot method. Please refer to page [3.4.1] & [3.4.2] for details regarding the rail to standoff attachment method. (Do not exeed maximum torque value or you will damage the base).

[3.4.4] Dual Flash L-Kit

1. Locate, choose, and mark centers of rafters . Select the courses of shingles where mounts will be placed and Drill a pilot hole using 3/16” drill bit through the roof materials and into the center of the rafter at the planned location.

2. Gently break seal between shingles and remove any nails. Slide flashing up under shingles, with flashing lined up with rafter center. (Marked center in step #1.)

3. Put 5/16” x 5” lag bolt through L-foot. Next, slide the EPDM washer up onto the lag bolt.

4. Secure EPDM washer onto bolt. Attach bolt and flashing to rooftop.

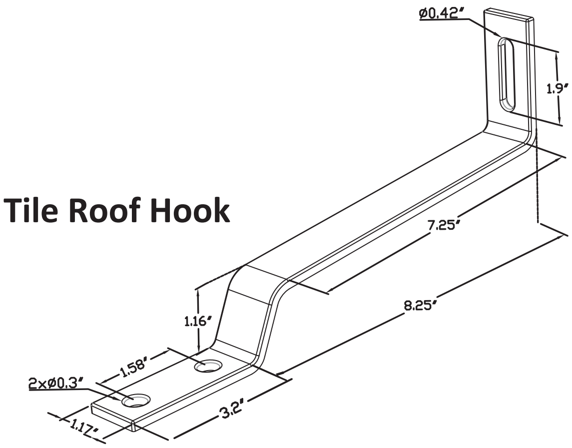
5. Screw the 5/16” lag bolt into the rafter, embedded a minimum 2.5". Tightening torque is dependent on the roofing material.

6. You are now ready to attach the rail. Slide the 3/8” bolt through the rail groove.

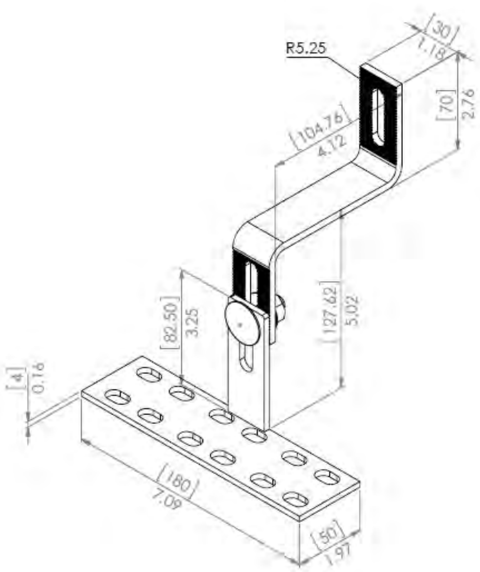
7. Attach the rail to the L-foot using 3/8” bolt, nut and star washer. The Star washer must be placed between the rail and L-Foot.

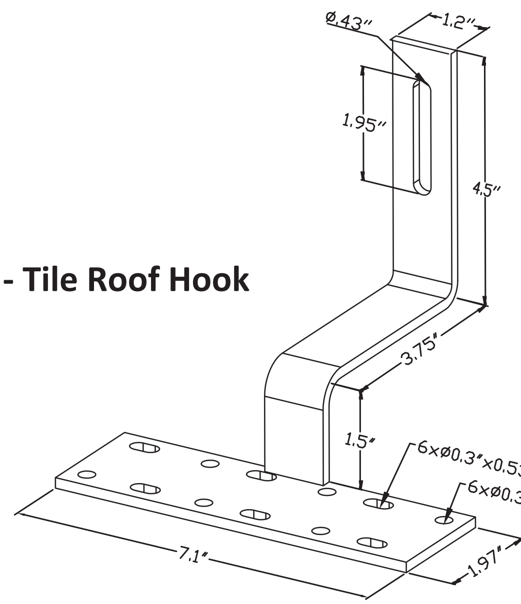
8. Recommended Torque 14 (ft. lbs).

Tile Roof Attachments



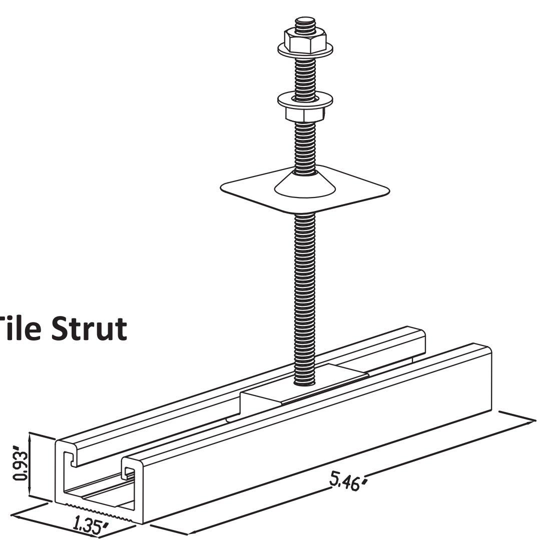
Flat Tile Roof Hook





S - Tile Roof Hook

S-TILE ROOF HOOK - ADJUSTABLE



Tile Strut

[3.4.5] Flat Tile Hook

1. Remove the roof tiles at the marked position or, if possible, simply push them up. When using 5/16” hex bolt, drill a pilot hole 1st. Take care not to warp damage the roof panel when tightening the nut.

2. Insert the two (3 /16” or 5/16”) bolts through EPDM washers and the flat hook and apply fresh compatible sealant to the base.

3. Position the roof hook above the tile.

4. Attach the roof hook to the rafter using the two (3/16” or 5/16”) hex bolts, embedded a minimum 2.5”. Tighening torque is dependent on the roofing material.

5. Slide the flat tile back in position.

6. Slide the 3/8” bolt through the rail groove.

7.Attach the rail to the tile hook using 3/8” bolts and nut. (It's recommended to place a star washer betweenthe r ail and flat tile hook).

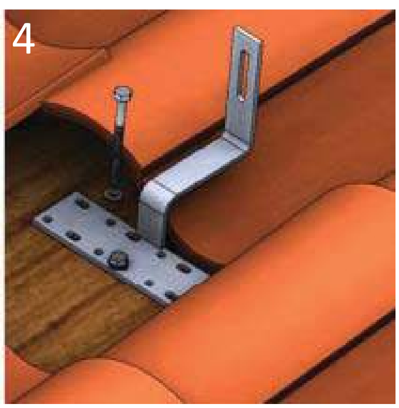
8. Secure the 3/8” bolt with the nut (Tightening torque 14 ft. lbs.).

[3.4.6] S-Tile Hook

1. Remove the roof tiles at the marked position or, if possible, simply push them up. When using 5/16” hex bolt, drill a pilot hole first. Take care not to warp or damage the roof panel when tightening the nut.

2. Insert the three (3/16”) or two (5/16”) bolts through the washer and S-Tile hook and apply fresh compatible sealant to the base.

3. Position the roof hooks to the side of the underlying interlocking tile’s valley.

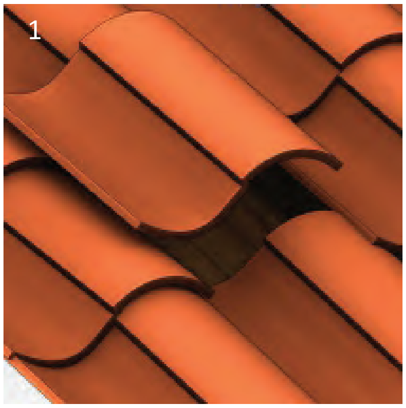


4. Attach the roof hooks to the rafter using the three (3/16”) or two (5/16”) hex bolts, embedded a minimum 2.5”.

5. Slide the 3/8” bolt through the rail groove.

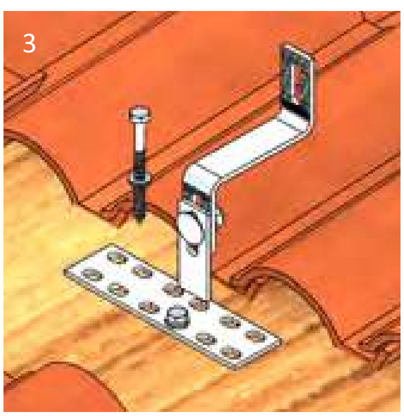
6. Attach the rail to the tile hook using 3/8” bolts and nut. (it’s recommended to place the star washer between the rail and S-tile hook.

[3.4.7] S-Tile Roof Hook Adjustable

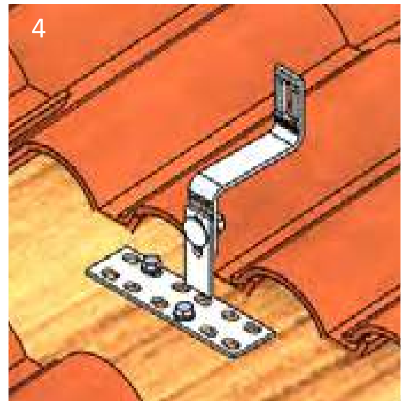


1. Remove the roof tiles at the marked position or, if possible simply push them up. When using 5/16" lag bolt drill a pilot hole 1st. Take care not to warp or damage the roof panel when tightening the nut.

2. Position the tile hook to the side of the underlying interlocking tile's valley.



3. Insert the three (3/16") or two (5/16") bolts through the washer and S-tile hook, and apply fresh compatible sealant to the base. Tightening torque is dependent on the roof material. Adjust S-Tile hook height accordingly. Tighten the M8 flange nut.



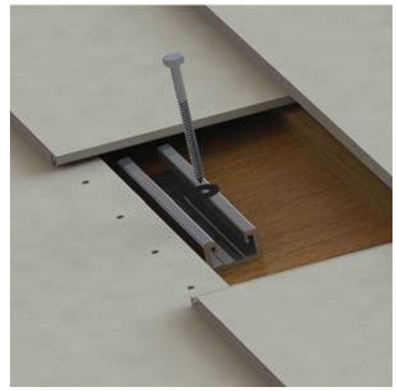
4. Attach the tile hook to the rafter using the three (3/16") or two (5/16") lag bolts, embedded a min. of 2.5"

5. Slide the 3/8" T-bolt through the rail groove.

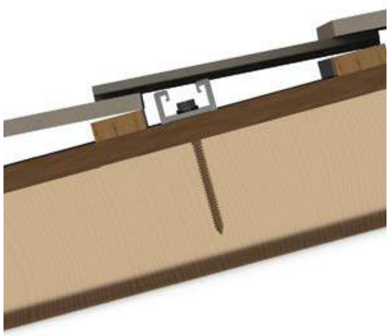
6. Attach the rail to the tile using 3/8" bolts, washer & nut. (Recommended: place star washer between the rail & S-tile adjustable hook).

[3.4.8] Tile Strut (Flat Tile Roof)

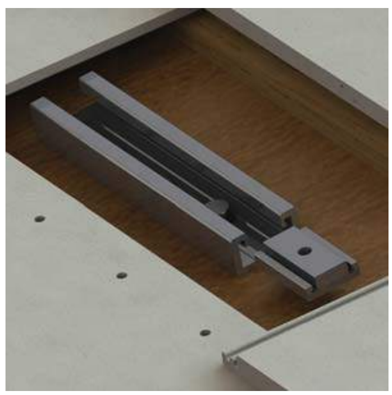
1. Remove the tile and locate the rafter.



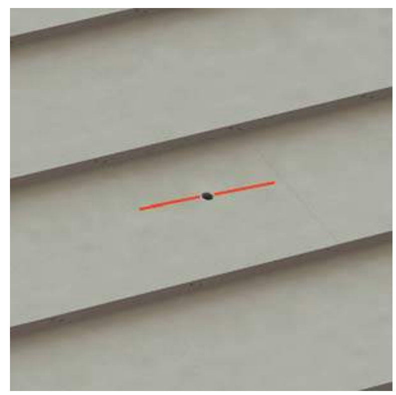
2. & 3. Insert the lag bolt through the tile strut and apply compatible sealant.



4. Screw the 5/16” lag bolt into rafter, embedded a minimum 2.5”. Tightening torque is dependent on the roof material.

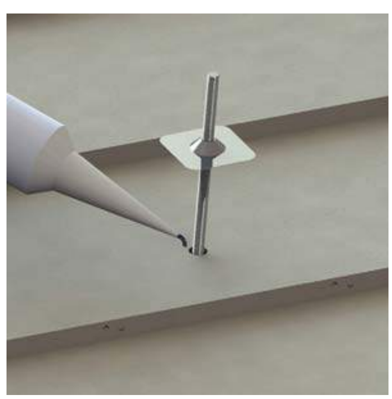


5. Slide the supplied channel nut through the tile strut.



6. Carefully drill a hole through the tile using 1/2” drill bit.

7. Use the two 3/8” nuts to engage the threaded headless bolt to the channel strut below the tile and remove the nut when done.



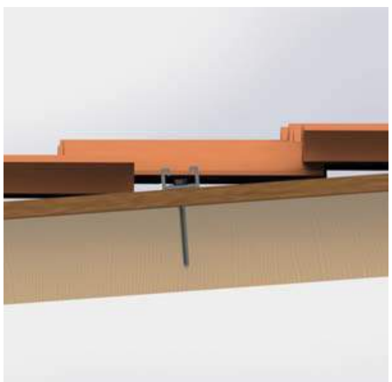
8. Apply fresh compatibale sealant to seal the tile openinig and lower the mini flashing.

9. Attach the rail to the headless threaded bolt using two 3/8” nuts. (Top down or L-foot.) Please see page [3.4.1 & 3.4.2].

[3.4.9] Tile Strut (S-Tile Roof)

1. Remove the tile and locate the rafter.

2. & 3. Insert the lag bolt through the tile strut base and apply compatible sealant.



4. Screw the 5/16” lag bolt into rafter, embedded a minimum 2.5”. Tightening torque is dependent on the roof material.

5. Slide the supplied channel nut through the tile strut base.

6. Carefully drill a hole through the tile using 1/2” drill bit.

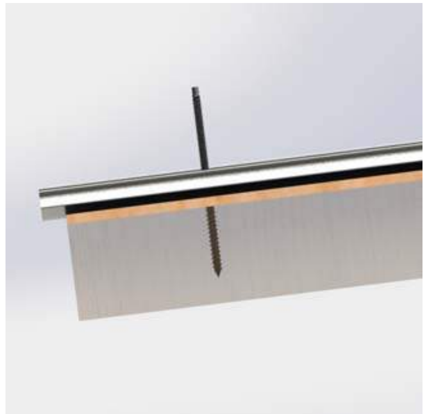
7. Use the two 3/8” nuts to engage the threaded headless bolt to the channel strut below the tile and remove the nut when done.

8. Apply fresh compatibale sealant to seal the tile openinig and lower the mini flashing.

9. Attach the rail to the headless threaded bolt using two 3/8” nuts.

[3.4.10] Hanger Bolt

1. Drill a pilot hole using 5/16” drill bit through the roof material and into the center of the rafter at the planned location.



2. Screw the hanger bolt into the rafter, embedded a min. 2.5". Tightening torque is dependent on the roof material.

3. Place the EPDM, flat washer and nut and secure the bolt. (Tightening torque dependent on the roof material).

4. Place the second bolt and lower it to the planned rail height above the roof.

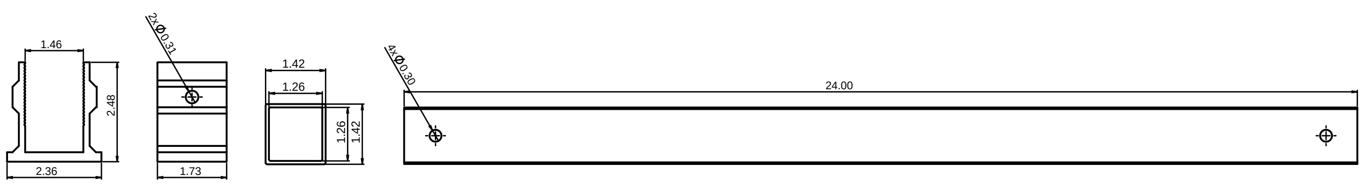
5. Drill a 3/8” hole through the rail for top down installation.

6.Attach the rail to the hanger bolt using the star washer, flat washer and 3/8” bolt.

7. For top down style see page # [3.4.1]

8. For L-foot style see page # [3.4.2].

[3.5] Dual Rack Tilt Up Kit
[3.5.1] Extension Leg Kit



[3.5.1.1] Extension Leg Kit Installation With Dual Jack

1. Attach the lower extension leg base to the Dual Jack “standoff” using the 3/8” bolt, star washer and flat washer.

2. Align the extension bar holes with the leg base holes and secure it with the M8 bolt and nut. Place one star washer between U-bracket and extensio n bar.

3. If the extension bar is longer than required, cut the extension bar and drill a hole using a 1/4” drill bit 0.8” below the cut line.

4. Slide the 3/8” bolt through the back side channel of the rail and attach to the upper leg base. Place one star washer between the rail and U-bracket

5. Move the rail to align all the upper leg bases with their corresponding extension bars.

6. Secure the upper leg base to the extension bar using the M8 bolt, nut and star washer. Place one star washer between the U-bracket and extension bar.

7. For rails on the low end of the module use an angle bracket. Place one star washer between the rail and angle bracket.

[3.5.1.2] Extension Leg Kit Installation With Dual Flash L-Kit

1. Attach the extension bar to the flash L- base using the M8 bolt, nut and star washer. Place one star washer between the extension bar and L-foot.

2. If the extension bar is longer then required, cut the extension bar and drill a holes using a 1/4” dril bit 0.8” below the cut line.

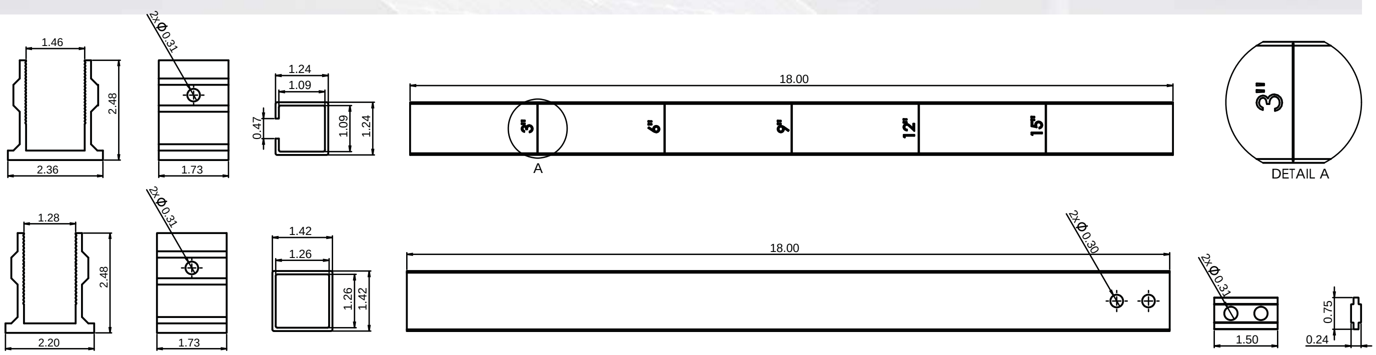
3. Slide the 3/8” bolt through the back side channel of the rail and attach to the U-bracket. Place one star washer between the rail and U-bracket.

4. Move the rail to align all the U-bracket, with their corresponding extension bars.

5. Secure the upper leg base to the extension bar using the M8 bolt, nut and star washer. Place star washer between the extension bar and U-bracket.

6. For rails on the low end of the modules use an angel bracket. Place one star washer between the rail and angel bracket.

[3.5.2] Adjustable Extension Leg Kit Installation



[3.5.2.1] Adjustable Leg Kit Installation With Dual Jack

1. Attach the lower extension leg base to the Dual Jack “standoff” using the 3/8” bolt, star washer & flat washer.

2. Align the extension bar holes with the U-bracket holes and secure it with the M8 bolt and nut.

2. If the extension bar is longer than required, slightly loosen the two M8 bolts and slide the adjustable bar up or down as necessary and retighten the two bolts.

4. Slide the 3/8” bolt through the back side channel of the rail and attach to the upper leg base. Place one star washer between the rail and U-Bracket.

5. Move the rail to align all the upper leg bases with their extension bars.

6. Secure the U-bracket to the extension bar using the M8 bolt, nut and star washer. Place star washer between the extension bar and U-Bracket.

7. For rails on the low end of the module use an angle bracket. Place one star washer between the rail and angle bracket.

[3.5.2.2] Adjustable Leg Kit Installation With Dual Flash L-Kit

1. Attach the extension bar to the flash L- base using the M8 bolt, nut and star washer. Place star washer between the extention bar and L-foot.

2. If the extension bar is longer than required, lightly loosen the two M8 bolts and slide the adjustable bar up or down as necessary and retighten the two M8 bolts.

3. Slide the 3/8" bolt through the back side channel of the rail and attach to the upper leg base. Place one star washer between the rail and upper U-bracket

6. Move the rail to align all the upper leg bases with their extension bars.

7. Secure the upper leg base to the extension bar using the M8 bolt, nut and star washer. Place star washer between extension bar and U-bracket.

6. For rails on the low end of the module use an angle bracket. Place one star washer between the rail and angle bracket.

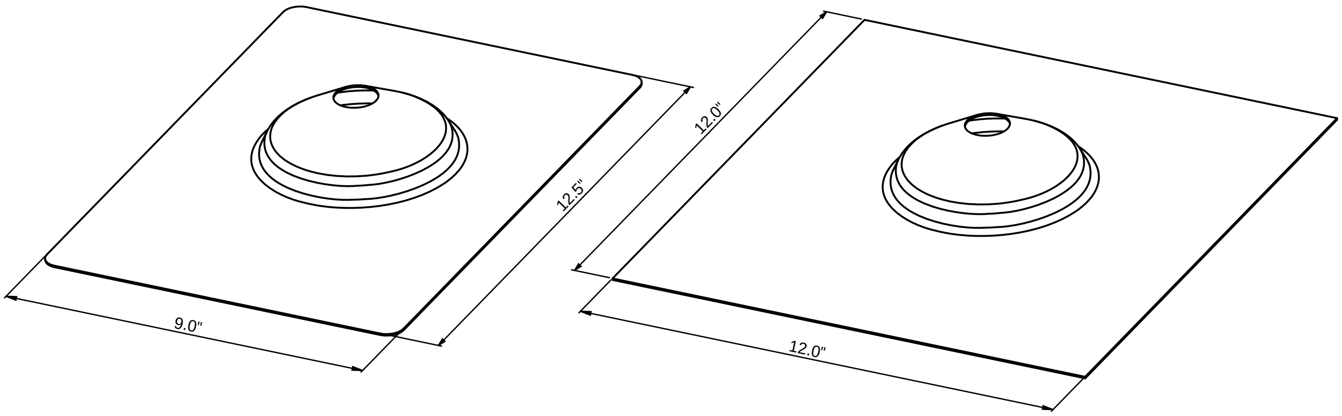
[3.5.3] Angle Bracket

1.Attach the angle bracket to the standoff and secure it using the bolt. Make sure the order of the star washer and the flat washer is as shown a above. Tightening torque (14 ft. lbs).

2. Slide the 3/8" bolt though the back side of channel of the rail and attach to the angle bracket. Place one star washer between the rail and angle bracket. (Tightening torque 14 ft.lbs).

3. Align the angle bracket hole and secure it with the bolt and star washer, as shown above. (Tightening torque 14 ft.lbs).

[3.6] Dual Rack Flashing Installation



1. After securing the Dual Jack roof attachment to the roof, cut a piece of the shingle if required.

2. Gently break seal between shingles and remove any nails.

3. Slide flashing up under shingles and recover the roof with the shingle.

4. Apply fresh compatible sealant around the Dual Jack roof attachment.(* Recommended)

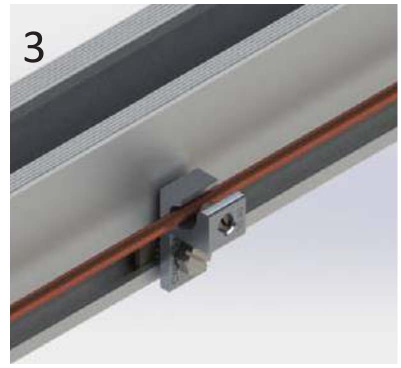
5. Press the EPDM down and hold to secure in place.

[3.7] P7 Dual Grounding Lug

Grounding Rail Option - A

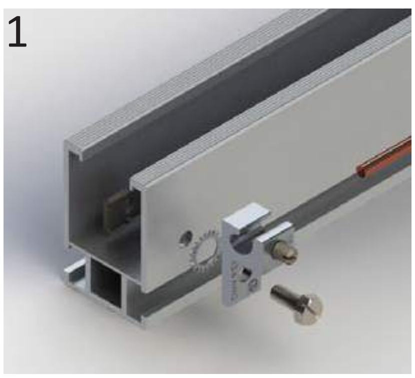
1. Slide the grounding lug through the rail groove.

2.Tighten the grounding lug to (7 ft. lbs). Make sure the back plate teeth are biting the rail.

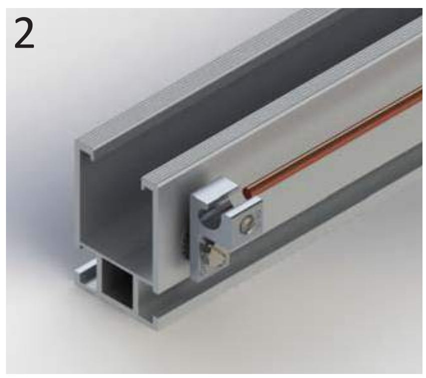


3. Push the grounding conductor (ground wire to be at minimum 10Ga)all the way to the back of the U-shaped slot and tighten the screw to (3 ft. lbs).

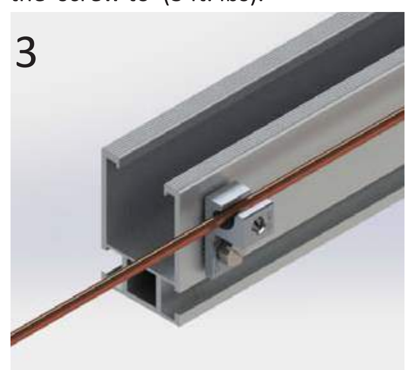
Grounding Rail Option - B



1. Drill a hole through the rail.



2. Tighten the grounding lug to (7 ft. lbs). Make sure the back plate teeth are biting the rail.

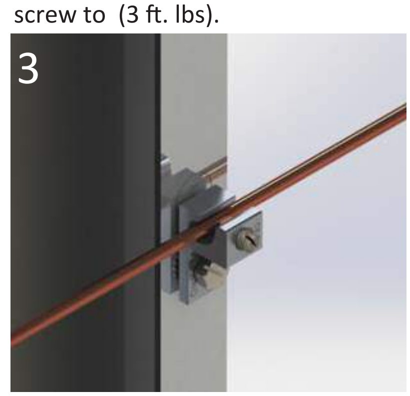


3. Push the grounding conductor (ground wire to be at minimum 10Ga)all the way to the back of the U shaped slot and tighten the screw to (3 ft. lbs).

Grounding Module

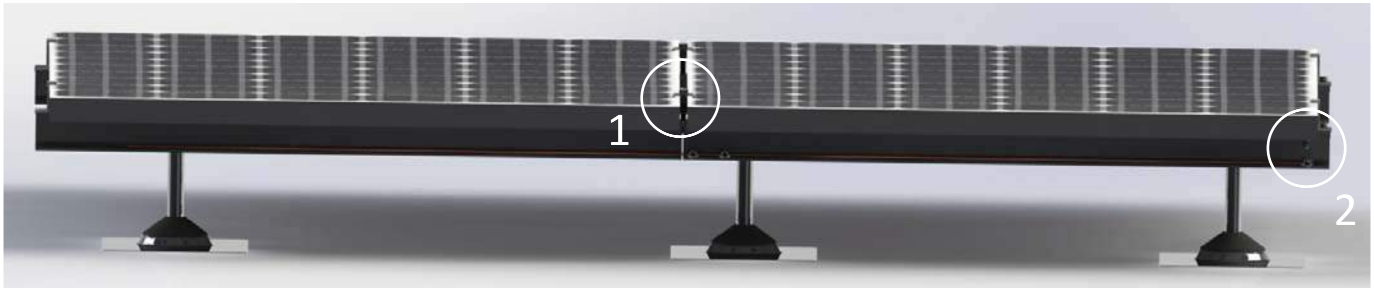
1. Slide the grounding lug through the module's grounding hole and attach to the back plate. (Tightening torque 7 ft. lbs). Make sure the back plate teeth are biting the module frame.

2. Insert the grounding conductor (ground wire to be at minimum 10Ga) and push it all the way to the back of the U shaped slot.

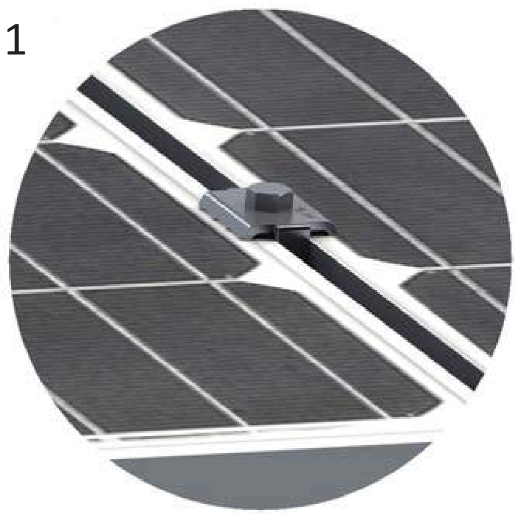


3. Tighten the screw to (3 ft. lbs).

[3.7.1] Grounding Using Grounding Mid Clam & P7 Grounding Lug

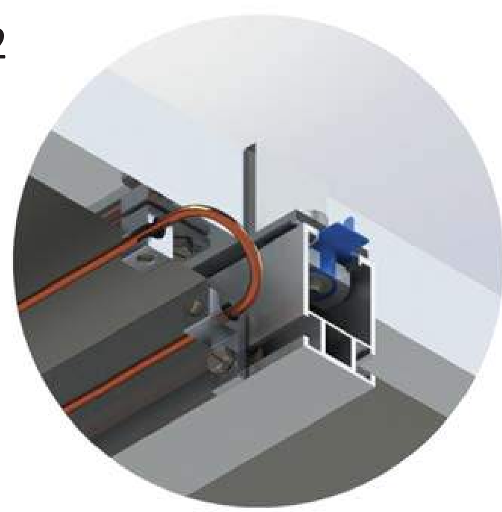


1



1. Grounding mid clamp electrically bonds the module's frames together. (Up to 44 modules per #6 bare copper wire.)

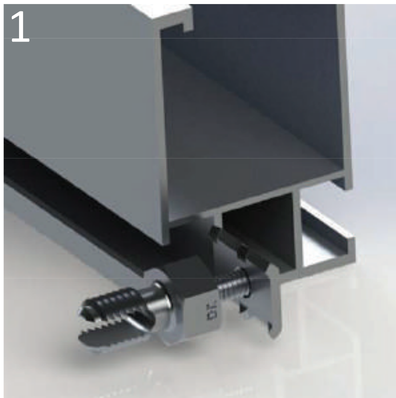
2



3. At the end of the string, bond both the last module and rail to the equipment grounding conductor, complying with electrical code.

[3.8] P6 Dual Grounding and Bonding Dual Grounding Lug Installation

Grounding Rail Option A:



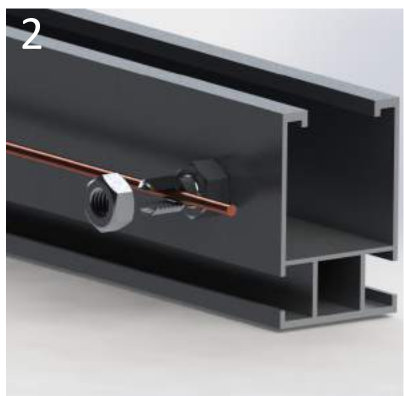
1.Slide the grounding Lug through the rail groove.

2. Tightening the grounding lug to (7 ft. lbs) make sure the back plate teeth is biting the rail.

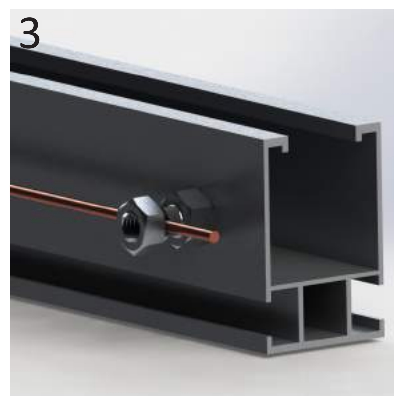
3. Push the grounding conductor (ground wire to be at minimum 10Ga) all the way to the back of the U shape bolt. Add the nut in secure to (2 ft. lbs).

Grounding Rail Option B:

1. Drill a hole through the rail.



2. Tightening the grounding lug to (7ft. lbs) make sure the back plate teeth is biting the rail.



3. Push the grounding conductor (ground wire to be at minimum 10Ga) all the way to the back of the U shape bolt. Add the nut in secure to (2 ft. lbs).

Grounding Module

1. Slide the grounding lug through the modules grounding hole and attach to the back plate. Tightening tourq (7 ft. lbs) make sure the back plate teeth is bitting the module frame.

2. Insert the grounding conductor (ground wire to be at minimum 10Ga) and push it all the way to the back of the U shape bolt.

3. Tightening the nut in secure to (2ft. lbs).

[3.9] SLIDER BRACKET & BRACE BAR

Dual Rack Slider Bracket & Brace Bar reinforces ground mount system pipe and foundation structures. Each DR Slider Bracket & Brace Bar comes with a galvanized 3” hex bolt and ⅜” SS flange nut. This combination offers the durability and flexibility to accommodate the majority of solar panel configurations. Competitive price-per-watt cost and reduced labor time from efficient installation design could provide savings of up to 10k on a 250Kw project. Available in clear and black finishes, the DR Slider Bracket works as a Cross Member Support while locking the front and back of the array support posts. This helps in all weather conditions to reduce the size and number of concrete posts.

Module frames tested for bonding and grounding

1- CanadianSolar:
CS6V-xxxM, CS6P-xxxP, CS6K-xxxM, CS5A-xxxM, CS6K-xxxMS CS6U-P, CS6U-M, CS6X-P, CS6K-MS, CS6K-M, CS6K-P, CS6P-P, CS6P-M, CS3U-P, CS3U-MS, CS3K-P, CS3K-MS, CS1K-MS, CS3K, CS3K, CS3U, CS3U-MB-AG, CS3K-MB-AG, CS3K-MB-AG, CS6K, CS6U, CS3L, CS3W, CS1H-MS, and CS1U-MS

2- Certainteed :
CTxxxMxx-01, CTxxxPxx-01, CTxxxMxx-02, CTxxxMxx-04, CTxxxHC11-04
Where “xx” denotes frame and backsheet color. "xxx" denotes power output. CT-03 Series

3- BYD:
P6K Series (35mm), MHK-36

4- C-Sun:
CSUN 350~335-72M

5- ET Solar:
ETAC Module, ET Module.

6- GCL:
40mm frame: GCL-P6/72
35mm frame: GCL-P6/72, GCL-P6/72H, GCL-M6/72, GCL-M6/72H
35mm frame (Black frame): GCL-P6/60, GCL-M6/60

7- Hansol:
TD-AN3 (40mm), TD-AN4, UB-AN1 (35mm), UD-AN1 (40mm), UB-AN1, UD-AN1

8- Jinko:

JKMxxxP-60, KMxxxPP-60, JKMxxxM-60, JKMxxxM-60B, JKMSxxxPP-60-JKMSxxxP-60, JKMSxxx-72, JKMxxxP-72, JKMSxxxP-72, JKMxxxM-72, JK07A (JKMSxxxPP-60 & JKMSxxxPP-72), JK07B (JKMSxxxPP-60), JKM xxx PP-60(Plus), JKMxxxPP-60B, JKMxxxM-60B, JKMSxxxM-60, JKMSxxxM-60-EP, JKMxxxP-72B, JKMxxxPP-72, JKMxxxPP-72B, JKMxxxPP-72(Plus), JKMSxxxPP-72, JKMxxxM-72-V, JKMxxxPP-72-V, JKMxxx-72L-V, JKMxxx-72HL-V, JKMxxxM-60L, JKMxxxM-60BL, JKMxxxM-60HL, JKMxxxM-72HL-V, JKMxxxM-72L-V

9- LG:

MONO X, MONO X 2, Mono X Plus, Mono Neon 2, Mono Neon 2 LGxxxS1C-L4, LGxxxN1C-G4
LGxxxS1C-A5, LGxxxN1C-A5, LGxxxQ1C(Q1K)-A5, LGxxxN1C(N1K)-A5, LGxxxS1C-A5, LGxxxA1C-A5, LGxxxN2T-A4, LGxxxN2T-A5, LGxxxN2W-A5 LGxxxS2W-A5, LGxxxE1C-A5, LGxxxN1C(N1K)-G4, LGxxxN2W-G4, LGxxxS2W-G4 LGxxxS1C-G4, LGxxxE1K-A5, LGxxxN1K-V5, LGxxxN1C-V5, LGxxxQ1C-V5, LGxxxN2T-J5, LGxxxN2W-V5

10- Mission Solar :

MSE series

11- NSP:

D6M and D6P

12- Panasonic:

VBHNxxxSA16/VBHNxxxSA16B, VBHNxxxSA15/VBHNxxxSA15B, VBHNxxxKA01, VBHN SA17/18/KA03/04, VBHNxxxSA17G, VBHNxxxSA17E/18E, VBHNxxxZA01, VBHNxxxZA02, VBHNxxxZA03, VBHNxxxZA04.

13- REC Solar:
PEAK Energy Series, PEAK Energy BLK2 Series, PEAK Energy 72 Series, TWINPEAK 2 SERIES, TWINPEAK 2 BLK2 SERIES, TWINPEAK SERIES

14- Renesola:
Virtus II with module ratings of 250-260 in increments of 5.
156 series with module ratings of 270-275.

15- Silfab:
SLA-M and SLG-M

16- Solaria:
PowerXT-xxxy-zz, PowerXT-xxxR-PD/BD, PowerXT-xxxR-AC, PowerXT-xxxC where: xxx is power in watts y is module size (R for residential, C for commercial) zz is other PowerXT-xxxy-zz all share the same rail profiles.

17- SunEdison/Flextronics:
F-Series / FXS, R-Series / FXS

18- Sunpower:
E20-xxx-COM, X21-xxx, X22-360-C-AC.
Evaluated with both the G3 and G5 frame
SPR-P17-xxx-COM (xxx: module power rating)

19- SunSpark:
40mm high frame profile: Mono module 60P (xxxW), Mono Module 72P (xxxW)

20- Suntech:
STP 35/40

21- Tesla/ZEP/SolarCity:
SCxxx, SCxxxB, SCxxxB1, SCxxxB2

22- Trina Solar:
TSM-xxx PA05.08, TSM-xxx PD05.10, TSM-xxx PD05.08, TSM-xxx DD05.08 TSM-xxx DD05A.05(II), TSM-xxx DD05A.05(II), TSM-DD14/PE14/PD14, TSM-DE14

23- Vikram:
Eldora Grand Ultima, Eldora Grand, Eldora Prime, Eldora Ultima, Solivo, Somera Grand, Ultima, Somera Grand, Somera Half (VSMH.72), Somera Prime, Somera Ultima

24- Yingli:
YL xxx P-29b, YLM 60, YLM 72, YGE, YGE-VG, YLM, YL xxx P-35b, YL xxx D-30b, YL xxx D-36b

25- Hanwha Q-cell:
Q.PEAK DUO-G5 315-330 , Q.PEAK DUO-G5 305-330 ,
Q.PEAK DUO L-G5. 2 380-395

26- Longi Solar:
LR6-72HV (330~350), LR6-72PH (350~370)

[4] Installer Warning and Notice

NOTICE!

Please carefully read and understand the provided installation manual before installing, wiring, or operating our product in your PV system. Failure to follow all instructions and conditions could possibly damage the product, and above all, lead to serious injury or death**. PV systems and Dual Rack Solar Racking installations must comply with the National Electrical Code and, installer is solely responsible for code and safety compliancw and all consequences.**

WARNING!

PV modules generate electricity when exposed to light and are electrically live when mounted. This DC electricity can pose danger to the installer, user, and/or property. Any contact with electrically active module terminals can result in arcing; leading to shocks, fires, burns, and/or death. Use caution around utility power lines that may be near the work area. Never work in wet or windy conditions. Lightning is a hazard to any work with metal, never work when lightning is present. Insure good earth-bonding as part of a lightning protection system.

DANGER!

Electrical shock potential of PV modules increases with higher parallel currents and series voltage connections. The PV installer must assume all inherent risk of property damage and/or personal injury related to the mishandling of PV modules during installation and maintenance. Skilled, Licensed Electricians must conduct all electrical installation procedures. All work must comply with all national, state and local installation procedures and product and safety standards. These standards include, but are not limited to, applicable National Electrical Code (NEC®) sections, UL Standards, OSHA Regulations, State or Local Fire Marshall Codes, and NFPA 70E. Installation must comply with NEC 250 (Grounding and Bonding), NEC 690 (Solar Photovoltaic Systems), CSA 22.1 (Safety Standard for Electrical Installations), Canadian Electrical Code Part 1, and all other applicable state, and local electrical code requirements. Dual Rack Solar Racking Systems must be used with UL1703 listed equipment including but not limited to; PV modules, combiners and disconnects.

DANGER!

Avoid electrical injuries by preventing the accidental or unintentional release of hazardous energy. Proper Lockout/Tag out procedures will limit this danger. All Personnel must. Use caution when working in and around PV arrays. Proper PPE worn at all times will also limit this danger. Modules produce electricity when exposed to light. To avoid electric shock and injury, completely cover the front of the module with an opaque material before making any electrical connections. Lockout / tag-out and disconnect the PV system from all electrical energy before any maintenance or cleaning. NEVER disconnect or connect modules under load. Never disconnect the earth bond to the array.

DANGER!

When installing Dual Rack Solar Racking Systems on roofs a falling hazard is present. Proper fall protection will limit this danger. Never work in wet or windy conditions. Secure tools and materials from falling, and insure personnel below exercise caution from work overhead. Follow all OSHA guidelines for working on roofs, with ladders, and insure general safety conditions exist.

DANGER!

The Installer of Dual Rack Solar Racking Systems must provide the components necessary for the final connections to the grounding electrode system. Typically the installation will incorporate a grounding electrode (ground rod), appropriately-sized copper wire, rated wire connectors, and grounding lugs which are out door rated for this purpose. Many PV installations contain more than one mounting array. Such cases call for electrically bonding each of the different arrays together. It is only necessary to connect individual racks together from one single point to another single point. Only use stainless steel hardware when connecting harnesses or jumpers to the mounting system.

Take care to prevent copper wires from directly contacting aluminum, as this will cause corrosion. The use of anti-oxidant grease is highly recommended to prevent ground wire terminal corrosion.

Use mechanically sound methods to secure groundbond wires to Dual Rack Solar Racking Systems thus ensuring electrical continuity at all times. Conductors must meet or exceed the requirements of the NEC. Always refer to your local AHJ (Authority Having Jurisdiction) when sizing conductors, fuses, inverters, and other Balance of System (BOS) components. Where common grounding hardware (nuts, bolts, star washers, spilt ring lock washers, flat washers and the like) are used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.

Mounting System Product Limited Warranty

§ 1 Limited Warranty

(1) Dual Rack Inc., hereinafter referred to as “Dual Rack”, warrants only to its original retail purchaser (“Customer”) of DualRack’s rooftop solar mounting product line, defined as products manufactured by DualRack (“Products”) and that the products listed below (each a “Product” and, collectively, the “Products”), when installed properly in the United States of America, will be free from substantial defects in material and workmanship and that Product finish will be free from visible peeling, cracking or chalking under normal atmospheric conditions (“Finish Warranty”) while the Products are installed at their original installation site and provided that the Products were installed in accordance with DualRack’s written installation instructions during the applicable warranty period identified in § 2, below, subject to the exclusions and limitations contained in this Limited Warranty statement.
The Dual Rack (“Dual Rack”) PV Mounting Systems covers only the Product, and not PV modules, electrical components and or wiring used in conjunction with the Product or any other materials not provided by Dual Rack. Goods which may be sold by Dual Rack, but which are not designed or manufactured by Dual Rack are not warranted by Dual Rack, are sold only with the warranties, if any, of the original manufacturers thereof.
(2) This Limited Warranty sets forth Dual Racks’ total and exclusive warranty obligation. Dual Rack does not assume, nor authorize any person to assume for it, any other liability in connection with the sales of its Products.

(3) This Limited Warranty does not cover any adverse effects on any Product or any Product defects which arise because:
The Product was not assembled and installed in accordance with the assembly and in-stallation instructions and the applicable technical norms and regulations;
The Product was not assembled and installed by qualified personnel with the skill set defined in the installation manual;The Product was not transported, installed, assembled, tested or operated in accordance with best prudent industry methods and practices; The Product was not used in accordance with the published technical specifications or the Product was used contrary to the intended purpose of use as specified in the installa-tion manual;
The Product was not properly stored before or during the assembly / installation phase; Interferences with or changes to the Product or its accessories were made without the express written consent of Dual Rack; Accessories which are not original Dual Rack accessories were used in connection with the Product;

The Product was not serviced by a specialist firm at least once each year; The Product was subject to extraordinary environmental conditions (e.g., excess volt-age, magnetic fields or similar circumstances); The Product was subject to a force majeure (as defined in § 4 (1), below); A heightened salt content in the ambient air or oxidation-provoking metal combinations (e.g., copper) have caused corrosion at the installation site of the Product; or The load capacity of the roof construction and/or the foundations, footers or ground has not been assured according to the accepted state-of-the-art technology and applicable technical norms and regulations.

This Limited Warranty does not cover damages or problems caused by the connection to or use of alternative materials not purchased from the Dual Rack Product List. This Limited Warranty shall also be void if A) installation of the Product is not performed in accordance with the Dual Rack Product Information, B) if the Product has been modified, repaired, or reworked in a manner not previously authorized by Dual Rack in writing, or C) the Product is installed in an environment for which it was not designed, each as determined by Dual Rack at its sole discretion.

(4) If any Product fails to operate during the applicable warranty period due to a warranted defect in workmanship or material, Dual Rack shall either, at its option and expense and as its sole and exclusive obligation, carry out a professional repair of the defective Product component in question or replace the defective component with a new or updated component. If the Product in question is no longer manufactured, then Dual Rack shall be entitled to provide a different comparable Product (different size, different color, different form and/or different performance, etc.). Any such repair or replacement does not cause the beginning of new warranty terms, nor shall the Warranty Period of this Limited Warranty be extended. Dual Rack’s total liability for all warranty claims shall not exceed the original Purchase Price of the nonconforming Product. Buyer shall bear all shipping costs related to the repair or replacement of the nonconforming product. Such repair or replacement shall be Buyer’s sole remedy and shall complete all of Dual Rack’s obligations with respect to the Product and all said warranty claims. EXCEPT FOR THE LIMITED WARRANTY EXPRESSED ABOVE, Dual Rack MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND WHATSOEVER AND HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, COURSE OF DEALING AND USAGE OF TRADE. Dual Rack SHALL NOT BE LIABLE FOR LOSS OF USE, REVENUE OR PROFIT, OR FOR DIRECT, INDIRECT, SPECIAL, PUNITIVE, LIQUIDATED, INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR FOR ANY OTHER LOSS OR COST OF A SIMILAR TYPE, OR FOR CLAIMS BY BUYER FOR DAMAGES OF BUYER’S CUSTOMERS, CLAIMS OF THIRD PARTIES OR INJURY TO PERSONS OR PROPERTY ARISING OUT OF ANY DEFECT OR NONCONFORMITY IN THE PRODUCT COVERED BY THIS WARRANTY, EVEN IF CAUSED BY THE NEGLIGENCE OF Dual Rack. ALL SUCH RELATED DAMAGES AND EXPENSES ARE HEREBY EXCLUDED. DualRack does not warrant that the Products will meet any specifications, needs, or requirements that are not expressly set forth and Dual Rack SHALL NOT IN ANY CASE BE LIABLE FOR ANY OTHER SIMILARLY INCURRED DAMAGES EVEN IF Dual Rack OR ITS REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.
(5) Performance under this Limited Warranty will not trigger the commencement of a new warranty period, nor will it extend the applicable warranty period.

§ 2 Territorial Scope/Warranty Period

This Limited Warranty applies geographically to Products sold and properly installed in the United States of America. The warranty period for all metallic Product components is ten (10) years. The warranty period for all metallic Product finish is three (3) years. The warranty period for all non-metallic Product components is one (1) year. Each warranty period commences on the the earlier of 1) the date the installation of the Products is completed, or 2) thirty (30) days after the purchase of the Products by the original Customer.

§ 3 Procedures in the Event of a Warranty Claim

If a Customer has a claim for repair or replacement under this Limited Warranty, said Customer must contact Dual Rack promptly and under no circumstances later than 30 days after the end of the applicable Limited Warranty Period to initiate the Limited Warranty claim process. If the Product exhibits defects that are covered under this Limited Warranty, contact Dual Rack Customer Service at (818) 678 -9699 or at the address or facsimile number noted below.
Please have the following information available when contacting us by phone:

Mounting System Product Limited Warranty

-Your name, address, zip code, and a telephone number where you can be contacted;
-The Product model description;
-Purchase receipt containing the date and Customer address;
-Warranty certificate of the defective Product (if available);
-The date of installation;
-The location and address of the actual installation;
-A complete listing of the observed defects and additional information which could help in ana-lyzing the defect.

The staff of Dual Rack Customer Service will inform you about any additional steps and will supply you with your own individual claim number. Please provide this number during any subsequent discussion or communications related to the processing of your claim. The following documents and information must be made available to Dual Rack upon request:
Photographs of the damaged Product(s);
System circuit diagram(s);
Any pertinent system monitoring or data capture records.

If the staff members at Dual Rack Customer Service request that you send Dual Rack purchase documentation which is more specifically defined during the discussions, then please send this information either by mail, fax or email to the following:
Dual Rack Customer Service:
2290 Agate Ct. Unit A&B, Simi valley CA 93065
Fax: 818-812-9566
Email: info@DualRack.net

Please note that Dual Rack cannot accept the delivery of any Product or Product component that it receives without prior notice by telephone.

§ 4 Warranty Limitations, Transferability, Assignability and Final Provisions

(1) This Limited Warranty does not apply if the defects or discrepancies in the condition of the Product are not material and such defects or discrepancies are insignificant with respect to the value or conforming use of the Product.

(2) The Finish Warranty does not apply to any issues caused by foreign residue deposited on the finish, or an installation in atmospheric conditions more corrosive than normal conditions. The Finish Warranty is VOID if the practices specified by AAMA 609 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed.

(3) The Warranty coverage and term is assignable by Purchaser and any subsequent owner of the Products, provided that the Products remain installed at the original installation address, and provided that any subsequent owner agrees in writing to be bound by the terms of this DualRack Limited Product Warranty document. Change in ownership of the Products or assignment of this Limited Warranty will not reset the original warranty period. Any subsequent owners to whom the Limited Warranty is assigned shall be considered a subsequent "Purchaser" for purposes of this Warranty during the period of ownership under Warranty of the Product(s). Proof of purchase is required for any warranty claim.

(4) Dual Rack is not liable for any delays or failure to provide the warranty performance listed in § 1, if that delay or failure is caused by force majeure (i.e., war, war-like conditions, terrorism, vandalism, earthquake, civil unrest, strikes, epidemics, fire, flooding, lightning strike, hail or other similar circumstances which are beyond Dual Rack's control).

(5) THE WARRANTIES STATED HEREIN ARE IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IF THE CUSTOMER IS A BUSINESS OR ENTITY, ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED. IF THE CUSTOMER IS A CONSUMER WHO PURCHASES THE PRODUCT FOR PERSONAL, FAMILY OR HOUSEHOLD PURPOSES, IN NO EVENT SHALL ANY IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXTEND BEYOND THE APPLICABLE WARRANTY PERIOD IDENTIFIED IN § 2, ABOVE.
Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

(6) The foregoing provisions state Dual Racks' entire liability, and the Customer's exclusive remedy, for any breach of warranty, express or implied. IN NO EVENT WILL DUAL RACK BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES ARISING FROM OR OUT OF THE INSTALLATION OR USE OF ANY PRODUCT, OR ANY BREACH OF WARRANTY; WITHOUT LIMITING THE FOREGOING, DUAL RACK SHALL NOT BE LIABLE FOR PERSONAL INJURY, PROPERTY DAMAGE, LOST PROFIT, LOST REVENUE, HARM TO REPUTATION, LOSS OF DATA, ADVERTISING OR MANUFACTURING COSTS, OVERHEAD COSTS, LOST CUSTOMERS, OPERATIONAL DISRUPTIONS OR DOWN-TIME RESULTING FROM THE INSTALLATION OR USE OF ANY PRODUCT OR ANY BREACH OF WARRANTY. The total scope of liability under this Limited Warranty is limited to the purchase price paid by the Customer for the individual Product.

(7) This Limited Warranty allocates risks of Product failure between Customer and Dual Rack. The Limited Warranty set forth above is in lieu of all other express warranties, both oral or written. The agents, employees, distributors and dealers of Dual Rack are not authorized to modify any aspect of this Limited Warranty nor to make additional warranties binding on Dual Rack whatsoever. Accordingly, additional statements such as dealer advertising or promotions, whether oral or written, do not constitute warranties by DualRack and cannot be relied upon as a warranty of DualRack. DualRack's product pricing incorporates this allocation of risk and the limitations of liability in this Limited Warranty.

(8) This Limited Warranty shall be governed by the internal laws of the state of California, without reference to conflict of laws principles. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Limited Warranty. Any and all disputes arising out of or relating to this Limited Warranty, any breach of warranty, the Product, or the installation or use of the Product shall be resolved through binding arbitration conducted in Simi Valley, California, U.S.A.