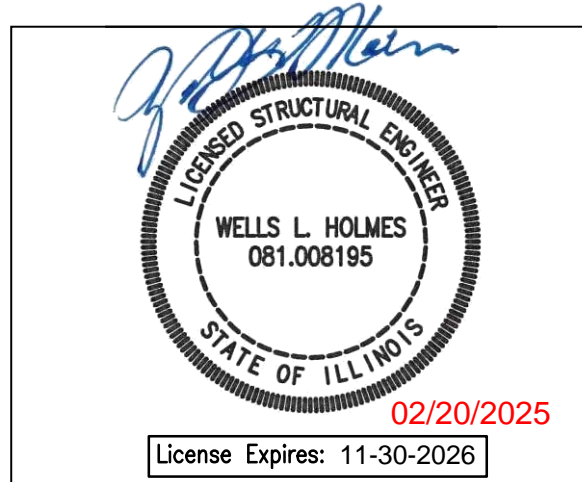




STRUCTURAL DOCUMENTATION LETTER  
for  
NANORACK PV MOUNTING SYSTEM  
ON METAL ROOFS

STATE OF ILLINOIS

PREPARED FOR:  
SUNMODO CORP



SEALED BY: WELLS HOLMES, S.E.  
PREPARED BY: MICHAEL HELKENN, P.E.  
FIRM LICENSE #: 184.005810 - COA  
PROJECT #: U2716.0365.221  
DATE: February 20, 2025

LETTER EXPIRES ON 12/31/2026 AND IS SUBJECT TO ANNUAL REVIEW AND RENEWAL

**Note:**

*The calculations presented in this package are intended for use by the client listed above. These calculations shall not be reproduced, reused, "card filed", sold to a third party, or altered in any way without the written authorization of Vector Structural Engineering, LLC and SunModo.*

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Project Number: U2716-0365-221  
April 8, 2024

SunModo Corp  
14800 NE 65<sup>th</sup> St  
Vancouver, WA 98682

**REFERENCE: NanoRack PV Mounting System – MRB Metal Roof Mount**

Per the request of SunModo, we have performed a review of the NanoRack PV Mounting system to provide guidance for typical residential installations. This review incorporates calculations and third-party load testing data to determine the number of mounts required per panel for a variety of environmental conditions. This document is applicable for the following components:

- MRB Metal Roof Mount – Part #: K50563-001
- (4) 1/4" Self-drilling Screws – Part #: B50009-006
- End Clamp Kit – Part #: K10521-BK1
- Mid Clamp Kit – Part #: K10520-001
- Module Hook Kit – Part #: K10525-001

Metal roofing panels shall be minimum 26 gauge Gr. 80 ksi or 24 gauge Gr. 50 ksi. Installations in roofing panels with less than 50 ksi tensile strength are not allowed. All components shall be installed in strict compliance with installation instructions provided by SunModo.

**Design Criteria and Assumptions:**

The following parameters, assumptions, limitations and code standards were used in the creation of this letter:

- **Building Codes:**
  - ASCE 7-10 & ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
  - International Building Code, 2015 – 2021 Editions
  - International Residential Code, 2015 – 2021 Editions
  - Aluminum Design Manual, 2015 & 2020 Editions
  - North American Specification for the Design of Cold-Formed Steel Structural Members, AISI S100-16
- **Building Assumptions and Limitations:**
  - Maximum Mean Roof Height, h: 30 ft
  - Risk Category: II
  - Roof Slope: 0 to 45 degrees
  - Enclosed and Partially Enclosed Buildings
  - Gable and Hip Roofs
  - $h/b \geq 0.8$  for Hip Roofs

(Continued on next page)



### **Design Criteria and Assumptions (continued):**

- **Environmental Assumptions and Limitations:**

- Wind Speed: 90 – 190 mph
- Ground Snow Load: 0 – 90 psf
- Exposure Category: B, C & D
- Topographic Factor,  $K_{zt}$ : 1.0
- Ground Elevation Factor,  $K_e$ : 1.0
- Wind Directionality Factor,  $K_d$ : 0.85
- Importance Factor for Snow,  $I_s$ : 1.0
- Snow Exposure Condition: Partially Exposed
- Thermal Factor,  $C_t$ : 1.2
- PV Modules are considered to be slippery and unobstructed

Design calculations for ASCE 7-16 installations are in accordance with Section 29.4.4, “Rooftop Solar Panels Parallel to the Roof Surface on Buildings of All Heights and Roof Slopes”.

Design calculations for ASCE 7-10 installations are in accordance with Chapter 30, “Wind Loads – Components and Cladding (C&C)”.

Snow load calculations are performed in accordance with ASCE 7-10/16 Chapter 7.

Each site-specific installation shall be reviewed by the Engineer of Record (EOR) to ensure the site-specific design criteria are within the scope of this letter and the criteria listed above. Vector Structural Engineering, LLC assumes no responsibility for site-specific installations we have not reviewed.



## Summary Tables and Instructions for Use:

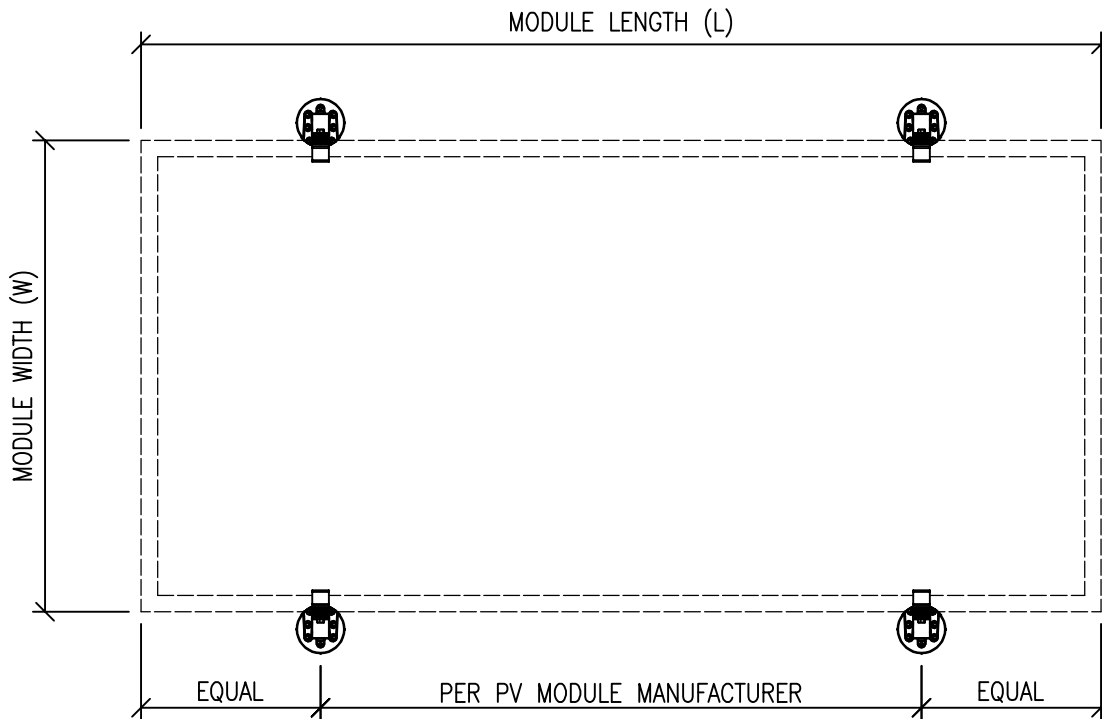
The summary tables provided in this letter list the number of NanoRack mounts required per panel to resist both upward loading (wind) and downward loading (wind, snow, dead). Installations are not allowed in conditions requiring more than 8 mounts per panel. Configurations where this is the case have been blacked out in the attached tables. See below for descriptions of the various table sections.

- **PV Module Size:** The tables provided in this letter are applicable to PV modules with surface area up to and including that listed in the header for each table. The maximum panel size covered by this letter is 90"x50" (4,500 in<sup>2</sup>).
- **Ground Snow Load,  $P_g$ :** This letter evaluates ground snow loads ranging from 0 to 90 psf, in 10 psf increments. Intermediate values of  $P_g$  (i.e. 25 psf), shall be rounded up to the next highest increment.
- **Sloped Roof Snow Load,  $P_s$ :** Ground snow loads are converted to sloped roof snow loads in accordance with ASCE 7-10/16 Chapter 7. The minimum roof slope for each range is used in the calculation of  $P_s$  for conservative purposes. **DISCLAIMER:** Certain Authorities Having Jurisdiction (AHJs) specify minimum roof snow loads that differ from the requirements of ASCE 7-10/16. In such situations, table values of  $P_s$  that comply with the AHJ requirements shall be used regardless of the site-specific ground snow load.
- **Unbalanced Snow Load:** Unbalanced roof snow loads in accordance with ASCE 7-10/16 Section 7.6 have been considered. See details below ("Roof Zones for Downward Loads") for additional information on the load combinations used.
- **Exposure Category:** Exposure categories are in accordance with ASCE 7-10/16 Section 26.7. EOR is responsible for ensuring appropriate exposure categories are selected for site-specific installations.
- **Roof Slope,  $\theta$ :** Ranges for roof slope are selected from ASCE 7-10/16 Chapter 30. This letter is valid for roof slopes up to and including 45°.
- **Exposed Panels:** Exposed vs Non-Exposed panels are defined in ASCE 7-16 Section 29.4.4 and Figure 29.4-7. EOR is responsible for evaluating each site-specific installation to determine if a PV module is to be considered Exposed or Non-Exposed.
- **Requirements for Uplift Loads:** Roof zones are defined in ASCE 7-16 Chapter 30, Figures 30.3-2A-D (Gable Roofs) and Figures 30.3-2E, G and H (Hip Roofs), as well as ASCE 7-10 Figures 30.4-2A-C. Table columns with numbered zones (1-3) list the number of mounts required per panel to resist uplift wind loading. Controlling load combination is  $0.6D + 0.6W$  per ASCE 7-10/16 Section 2.4.1.
- **Requirements for Gravity Loads:** Requirements for gravity loads are compared to the requirements for uplift loads to determine which loading condition controls. Controlling load combination is the worst case of  $1.0D + 1.0S$  (un-balanced snow),  $1.0D + 0.6W$ , and  $1.0D + 0.45W + 0.75S$  (balanced snow).

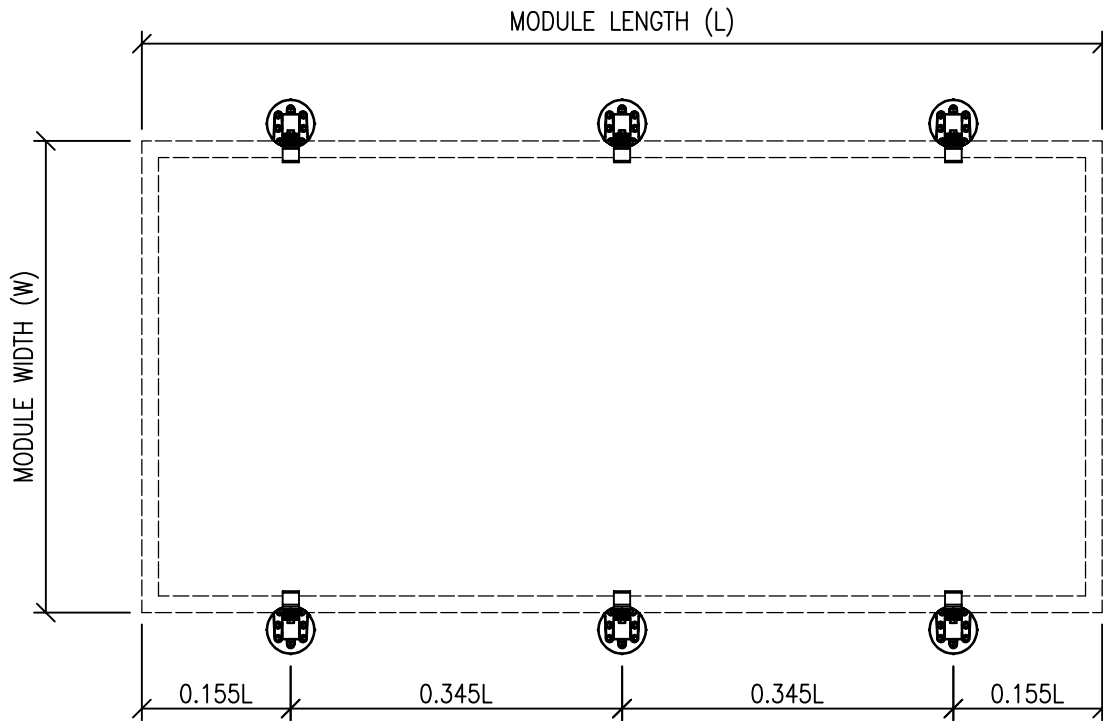
**Mount Spacing Requirements:**

The following guide for mount spacing shall be used to ensure applied loading is evenly distributed across all installed mounting brackets. Tolerance for mount spacing shall be considered as +/- 1 inch. The following figures are specific to installations utilizing long-side clamping. For installations utilizing short-side clamping, the module width (W) shall be substituted for module length (L) in the formulas shown.

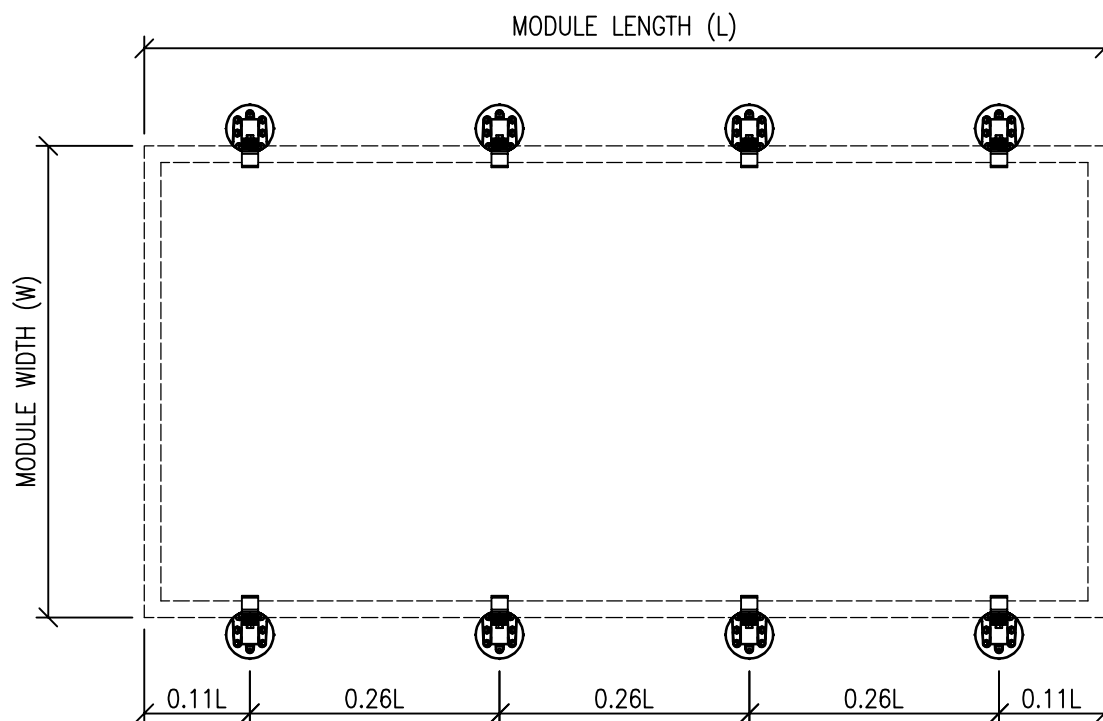
**FIGURE 1: MOUNT SPACING FOR 4 PER PANEL CONFIGURATIONS:**



**FIGURE 2: MOUNT SPACING FOR 6 PER PANEL CONFIGURATIONS:**



**FIGURE 3: MOUNT SPACING FOR 8 PER PANEL CONFIGURATIONS:**





**Limitations:**

The following items are not included in the scope of this review:

- **PV Modules:** PV modules shall be installed in accordance with manufacturer's and EOR's instructions. It is the responsibility of the EOR to determine the adequacy of PV modules installed with the NanoRack product per the guidance provided in this letter.
- **Roof Framing:** The adequacy of roof framing to support PV installations is to be determined by the project EOR on a case-by-case basis.

**Conclusions:**

Vector Structural Engineering, LLC (VSE) has determined that if the NanoRack product is installed in accordance with SunModo's installation instructions and the requirements listed in this letter, then the installation will be structurally adequate to support the design loads listed in this letter.

This conclusion is based on calculations performed by our office, as well as third-party load testing. Supporting calculations and test reports may be provided upon request.

VSE (or the EOR) shall supply a site-specific approval letter, signed and sealed by a licensed Professional Engineer (PE), for each site-specific installation to confirm the proper interpretation and application of this letter. This letter is not valid for site-specific installations unless accompanied by a site-specific approval letter.

We hope this meets your needs. If you have any further questions regarding this matter, please call this office at your convenience.

Very truly yours,  
VECTOR STRUCTURAL ENGINEERING, LLC

---

Russell Emery, P.E.  
Project Engineer

RNE/mih  
Enclosures





**TABLE 1:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-16 ON GABLE ROOFS WITH MAXIMUM  
MODULE SURFACE AREA OF 3120 IN SQ**





Number of Required NanoRack Mounts Per Module					Maximum Module Size: 3120 sq in																																																
ASCE 7-16 Gable Roofs					Wind speed (mph) →						130 mph						140 mph						150 mph						160 mph						170 mph						180 mph						190 mph						
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r							
				≤ 80	B	0 ≤ θ ≤ 7	60.48	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Non-Exposed	4	4	4					4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
7 < θ ≤ 20	60.48	Exposed	4			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		Non-Exposed	4			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
20 < θ ≤ 27	55.04	Exposed	4			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		Non-Exposed	4			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
27 < θ ≤ 45	47.17	Exposed	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
		Non-Exposed	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4								
90	B	0 ≤ θ ≤ 7	68.04		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
		7 < θ ≤ 20	68.04		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
		20 < θ ≤ 27	61.92		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
	27 < θ ≤ 45	53.07	Exposed		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
	C	0 ≤ θ ≤ 7	68.04		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
		7 < θ ≤ 20	68.04		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
		20 < θ ≤ 27	61.92		Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
					Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
	27 < θ ≤ 45	53.07	Exposed		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
	D	0 ≤ θ ≤ 7	60.48	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
		7 < θ ≤ 20	60.48	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
		20 < θ ≤ 27	55.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
	27 < θ ≤ 45	47.17	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6								

TABLE NOTES:  
1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



**TABLE 2:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-16 ON GABLE ROOFS WITH MAXIMUM  
MODULE SURFACE AREA OF 4500 IN SQ**





Number of Required NanoRack Mounts Per Module					Maximum Module Size: 4500 sq in																																																
ASCE 7-16 Gable Roofs					Wind speed (mph) →						130 mph						140 mph						150 mph						160 mph						170 mph						180 mph						190 mph						
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r	1	2e	2r	2n	3e	3r							
≤ 60	B	0 ≤ θ ≤ 7	45.36	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		7 < θ ≤ 20	45.36	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
	27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4								
	C	0 ≤ θ ≤ 7	45.36	Exposed	4	4	4	4	6	6	6	4	4	6	6	6	6	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		7 < θ ≤ 20	45.36	Exposed	4	4	6	6	6	6	6	6	6	6	6	8	6	6	8	8	8	8	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8							
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	6	6	6	4	4	6	6	6	6	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6					
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
	27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4								
	D	0 ≤ θ ≤ 7	40.32	Exposed	4	6	6	6	6	6	4	6	6	6	8	8	6	6	6	8	8	8	6	6	6	8	8	8	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8							
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		7 < θ ≤ 20	40.32	Exposed	6	6	6	6	6	8	6	6	8	8	8	8	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8							
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
		20 < θ ≤ 27	36.69	Exposed	4	4	6	6	6	6	4	4	6	6	6	8	4	4	8	8	8	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4							
	27 < θ ≤ 45	31.45	Exposed	4	4	4	4	6	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6								
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4								

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



**TABLE 3:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-16 ON HIP ROOFS WITH MAXIMUM  
MODULE SURFACE AREA OF 3120 IN SQ**



Number of Required NanoRack Mounts Per Module ASCE 7-16 Hip Roofs					Maximum Module Size: 3120 sq in																															
Wind speed (mph) →					90 mph				95 mph				100 mph				105 mph				110 mph				115 mph				120 mph							
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3				
≤ 80	B	7 ≤ θ ≤ 20	60.48	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		20 < θ ≤ 27	55.04	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	47.17	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	C	7 ≤ θ ≤ 20	60.48	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		20 < θ ≤ 27	55.04	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	47.17	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
D	7 ≤ θ ≤ 20	53.76	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	20 < θ ≤ 27	48.92	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	27 < θ ≤ 45	41.93	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
90	B	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	C	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
D	7 ≤ θ ≤ 20	60.48	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	20 < θ ≤ 27	55.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	27 < θ ≤ 45	47.17	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.





Number of Required NanoRack Mounts Per Module ASCE 7-16 Hip Roofs					Maximum Module Size: 3120 sq in																															
Wind speed (mph) →					130 mph				140 mph				150 mph				160 mph				170 mph				180 mph				190 mph							
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3				
≤ 80	B	7 ≤ θ ≤ 20	60.48	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		20 < θ ≤ 27	55.04	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	47.17	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	6	4	6
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	C	7 ≤ θ ≤ 20	60.48	Exposed	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6	4	6	8	8	6	8	8	8
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	6	6	6	4	6	6	6
		20 < θ ≤ 27	55.04	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	47.17	Exposed	4	4	4	4	4	4	4	4	4	4	6	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	6	6	6	8	6	8
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
D	7 ≤ θ ≤ 20	53.76	Exposed	4	4	4	4	4	6	6	6	4	6	6	6	6	6	6	6	6	8	8	8	6	8	8	8	6	8	8	8	6	8	8	8	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6	
	20 < θ ≤ 27	48.92	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6	6	8	8	8	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	
	27 < θ ≤ 45	41.93	Exposed	4	4	4	4	4	4	4	6	4	6	4	6	4	6	6	6	4	6	6	8	6	8	6	8	6	8	6	8	6	8	6	8	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	6	
90	B	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	C	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	6	8	8	8	6	8	8	8
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	6	8
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
D	7 ≤ θ ≤ 20	60.48	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	6	8	8	8	6	8	8	8	6	8	8	8	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	20 < θ ≤ 27	55.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	27 < θ ≤ 45	47.17	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	6	8	6	8	6	8	6	8	6	8	6	8	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	

TABLE NOTES:  
1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



**TABLE 4:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-16 ON HIP ROOFS WITH MAXIMUM  
MODULE SURFACE AREA OF 4500 IN SQ**



Number of Required NanoRack Mounts Per Module ASCE 7-16 Hip Roofs					Maximum Module Size: 4500 sq in																															
Wind speed (mph) →					90 mph				95 mph				100 mph				105 mph				110 mph				115 mph				120 mph							
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3				
≤ 60	B	7 ≤ θ ≤ 20	45.36	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	C	7 ≤ θ ≤ 20	45.36	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
D	7 ≤ θ ≤ 20	40.32	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	20 < θ ≤ 27	36.69	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	27 < θ ≤ 45	31.45	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
90	B	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	C	7 ≤ θ ≤ 20	68.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		20 < θ ≤ 27	61.92	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		27 < θ ≤ 45	53.07	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
				Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
D	7 ≤ θ ≤ 20	60.48	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	20 < θ ≤ 27	55.04	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
	27 < θ ≤ 45	47.17	Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
			Non-Exposed	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



Number of Required NanoRack Mounts Per Module ASCE 7-16 Hip Roofs					Maximum Module Size: 4500 sq in																																			
Wind speed (mph) →					130 mph				140 mph				150 mph				160 mph				170 mph				180 mph				190 mph											
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3	1	2r	2e	3								
≤ 60	B	7 ≤ θ ≤ 20	45.36	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6				
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
		27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	6	4	6	4	6	4	6	4	6				
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
	C	7 ≤ θ ≤ 20	45.36	Exposed	4	4	6	6	4	6	6	6	4	6	6	6	4	6	8	8	4	6	8	8	6	8	8	8	6	8	8	8	6	8	8	8	6	8	8	8
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6				
		20 < θ ≤ 27	41.28	Exposed	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	4	6	6	6	6	6	6	6	6	6	6	6				
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
		27 < θ ≤ 45	35.38	Exposed	4	4	4	4	4	4	4	4	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6				
				Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
D	7 ≤ θ ≤ 20	40.32	Exposed	4	6	6	6	6	6	6	6	6	6	8	8	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	6	6	4	6	6	6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6					
	20 < θ ≤ 27	36.69	Exposed	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6	6	8	8	8	6	8	8	8	6	8	8	8	6	8	8	8					
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	6	4	6	6	6	4	6	6	6					
	27 < θ ≤ 45	31.45	Exposed	4	6	4	6	4	6	4	6	4	6	6	6	6	8	6	8	6	8	6	8	6	8	6	8	6	8	6	8	6	8	6	8					
			Non-Exposed	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	6	4	6	4	6	4	6	4	6					

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-16 FIGURES 30.3-2A-D. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



**TABLE 5:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-10 ON GABLE AND HIP ROOFS  
WITH MAXIMUM MODULE SURFACE AREA  
OF 3120 IN SQ**



Number of Required Mounts Per Module ASCE 7-10 Gable and Hip Roofs					Maximum Module Size: 3120 sq in																																									
Wind speed (mph) →					90 mph			95 mph			100 mph			105 mph			110 mph			115 mph			120 mph			130 mph			140 mph			150 mph			160 mph			170 mph			180 mph			190 mph		
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
≤ 80	B	0 ≤ θ ≤ 7	60.48		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6
		7 < θ ≤ 27	60.48		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
		27 < θ ≤ 45	47.17		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
	C	0 ≤ θ ≤ 7	60.48		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	8
		7 < θ ≤ 27	60.48		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	8			
		27 < θ ≤ 45	47.17		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
	D	0 ≤ θ ≤ 7	53.76		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	8	4	6	8	4	6	8
		7 < θ ≤ 27	53.76		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	6	8	4	6	8			
		27 < θ ≤ 45	41.93		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			

Wind speed (mph) →					90 mph			95 mph			100 mph			105 mph			110 mph			115 mph			120 mph			130 mph			140 mph			150 mph			160 mph			170 mph			180 mph			190 mph					
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
90	B	0 ≤ θ ≤ 7	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		7 < θ ≤ 27	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		27 < θ ≤ 45	53.07		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
	C	0 ≤ θ ≤ 7	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8
		7 < θ ≤ 27	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8			
		27 < θ ≤ 45	53.07		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
	D	0 ≤ θ ≤ 7	60.48		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8			
		7 < θ ≤ 27	60.48		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8						
		27 < θ ≤ 45	47.17		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-10 FIGURES 30.4-2A-C. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.



**TABLE 6:  
SUMMARY TABLE FOR INSTALLATIONS PER  
ASCE 7-10 ON GABLE AND HIP ROOFS  
WITH MAXIMUM MODULE SURFACE AREA  
OF 4500 IN SQ**



Number of Required Mounts Per Module ASCE 7-10 Gable and Hip Roofs					Maximum Module Size: 4500 sq in																																												
Wind speed (mph) →					90 mph			95 mph			100 mph			105 mph			110 mph			115 mph			120 mph			130 mph			140 mph			150 mph			160 mph			170 mph			180 mph			190 mph					
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3						
≤ 60	B	0 ≤ θ ≤ 7	45.36		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	6	4	6	8			
		7 < θ ≤ 27	45.36		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	8			
		27 < θ ≤ 45	35.38		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
	C	0 ≤ θ ≤ 7	45.36		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	6	8	4	6	8	4	6	8	4	6	8	4	6	8
		7 < θ ≤ 27	45.36		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	4	8	4	6	8	4	6	8	4	6	8			
		27 < θ ≤ 45	35.38		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
	D	0 ≤ θ ≤ 7	40.32		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	6	8	4	6	8	4	6	8	4	6	8	4	6	8
		7 < θ ≤ 27	40.32		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	4	4	6	4	4	6	4	6	8	4	6	8	4	6	8	4	6	8			
		27 < θ ≤ 45	31.45		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			

Wind speed (mph) →					90 mph			95 mph			100 mph			105 mph			110 mph			115 mph			120 mph			130 mph			140 mph			150 mph			160 mph			170 mph			180 mph			190 mph					
Pg (psf) <sup>1</sup>	Exposure Category	Roof Slope, θ (°)	Ps (psf) <sup>1</sup>	Roof Zone <sup>2</sup> →	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
90	B	0 ≤ θ ≤ 7	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		7 < θ ≤ 27	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		27 < θ ≤ 45	53.07		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
	C	0 ≤ θ ≤ 7	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		7 < θ ≤ 27	68.04		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		27 < θ ≤ 45	53.07		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
	D	0 ≤ θ ≤ 7	60.48		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		7 < θ ≤ 27	60.48		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
		27 < θ ≤ 45	47.17		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			

TABLE NOTES:  
 1: Pg IS THE DESIGN GROUND SNOW LOAD. Ps IS THE DESIGN SLOPED ROOF SNOW LOAD. REFER TO PAGE 5 FOR ADDITIONAL INFORMATION.  
 2: ROOF ZONES ARE IN ACCORDANCE WITH ASCE 7-10 FIGURES 30.4-2A-C. SEE PAGE 5 FOR ADDITIONAL INFORMATION.  
 3: INSTALLATION IS NOT ALLOWED IN CONDITIONS CORRESPONDING WITH TABLE VALUES THAT ARE BLACKED OUT.