Project Number: U2716-0365-221

May 21, 2025

SunModo Corp
14800 NE 65th St
Vancouver, WA 98682

REFERENCE: **NanoRack PV Mounting System – NanoPlus Deck Mount – Canada**

Per the request of SunModo, we have performed a review of the NanoRack PV Mounting system to provide guidance for typical residential installations in accordance with the National Building Code of Canada, 2020 Edition (2020 NBC). This document is applicable for the following components:

- NanoPlus Deck Mount – Part #: K50064-BK1
- (4) or (5) #14 Self-tapping Screws w/ Sealing Washers – Part #: K50055-BK2
- End Clamp Kit – Part #: NANORACK-END (K10529-BK1)
- Mid Clamp Kit – Part #: NANORACK-UNI (K10530-001)
- Module Hook Kit – Part #: NANORACK-HOOK (K10531-BK1)

SunModo contracted with Intertek to perform load testing of the components mentioned above to determine their ultimate capacity. Test reports, dated December 28, 2023, can be provided upon request. Vector Structural Engineering, LLC (VSE) performed an in-depth analysis of these test reports to determine the design load capacity of the system for both uplift and downforce loads. The design capacity, including applicable resistance factors, are as follows:

Allowable Design Pressure (kPa)				
Sheathing Material	**# of Mounts per Module**	**Uplift - 4-Fastener Configuration**	**Uplift - 5-Fastener Configuration**	**Downforce**
Min 12mm Plywood	4	1.77	2.63	3.34
	6	2.58	3.88	5.00
Min 12mm OSB	4	1.77	NA	3.34
	6	2.58	NA	5.00

The design pressures presented in the table above are based on a PV module size of 2000mm x 1000mm and must be adjusted to match the project-specific PV module size using the formula below:

$$\text{Project-Specific Design Pressure} = \text{Tabulated Pressure} \times \left(\frac{1000\text{mm}}{\text{wp}} \times \frac{2000\text{mm}}{\text{Lp}}\right)$$

Where:

- wp = PV Module Width in mm
- Lp = PV Module Length in mm

Once the allowable design pressures have been adjusted for PV module size, project-specific demand loads may be calculated to determine the number of required mounts per PV module for project-specific installations per the guidance provided in the following pages.

Instructions for Use

The design loads determined previously may be used in conjunction with the load combinations listed in Table 4.1.3.2-A of the 2020 NBC to determine the number of mounts required per PV module for project-specific installations. Controlling load combinations are listed below:

- Case 3: 1.25D + 1.5S + 0.4W (Downforce)
- Case 4: 1.25D + 1.4W + 0.5S (Downforce)
- Case 4: 0.9D + 1.4W (Uplift)

System dead load (D) shall be determined on a project-specific basis by the EOR and should account for all components that will be supported by the NanoRack mounting components.

Project-specific wind loads (W) shall be determined by the EOR in accordance with Section 4.1.7.13 of the 2020 NBC.

Project-specific snow loads (S), including any required associated rain loads, shall be determined by the EOR in accordance with Section 4.1.6.16 of the 2020 NBC.

The resulting factored demand load shall be compared to the allowable loads determined previously for both uplift and downforce conditions to determine the appropriate number of NanoRack mounts that must be used per PV module. Design Examples can be found on the following pages.

Design Example 1:

- Location: Calgary, Alberta
- Building Height: 10 m
- Gable Roof with 14° pitch (3/12) and Plywood Sheathing
- PV Module Size: 2200mm x 1100mm
- Normal Importance Category
- Rough Terrain

Calculate the project-specific allowable design load.

Project-Specific Allowable Design Pressure (kPa)				
Sheathing Material	**# of Mounts per Module**	**Uplift - 4-Fastener Configuration**	**Uplift - 5-Fastener Configuration**	**Downforce**
Min 12mm Plywood	4	1.46	2.17	2.76
	6	2.13	3.21	4.13

Refer to Table C-2 in Appendix C of the 2020 NBC for project-specific climatic design data.

- 1/50 Snow Load: 1.1 kPa
- 1/50 Rain Load: 0.1 kPa
- 1/50 Hourly Wind Pressure: 0.48 kPa

The total system dead load is assumed to be 0.1 kPa.

The specified snow load, S, calculated in accordance with Section 4.1.6.2 is 0.98 kPa.

The net wind pressure calculated in accordance with Section 4.1.7.13 is as follows (assumes only non-exposed modules:

- Uplift on Non-exposed Modules
  - Roof Zone ‘r’: 0.80 kPa
  - Roof Zone ‘s’: 1.17 kPa
  - Roof Zone ‘c’: 1.59 kPa
- Downforce
  - All Zones: 0.25 kPa

The total factored demand pressures are as follows. For this example, we will only consider non-exposed panels in Roof Zone ‘s’.

The total factored downforce load for Case 3 is 1.25(0.1 kPa) + 1.5(0.98 kPa) + 0.4(0.25 kPa) = 1.695 kPa

The total factored downforce load for Case 4 is 1.25(0.1 kPa) + 1.4(0.25 kPa) + 0.5(0.98 kPa) = 0.965 kPa

The total factored uplift load for Case 4 is -0.9(0.1 kPa) + 1.4(1.17 kPa) = 1.548 kPa

In this case, the downforce load from Case 3 controls. The demand load is less than 2.76 kPa, therefore 4 mounts per PV module are adequate to withstand demand downforce loads.

The demand uplift load is greater than 1.46 kPa but less than 2.13 kPa. Therefore, 6 mounts per module with 4 fasteners or 4 mounts per module with 5 fasteners must be used to withstand demand uplift loads.

The above steps should be repeated for all applicable roof zones and exposure conditions.

Design Example 2:

- Location: Windsor, Quebec
- Building Height: 20 m
- Gable Roof with 7° pitch and Plywood Sheathing
- PV Module Size: 1900mm x 1000mm
- Normal Importance Category
- Open Terrain

Calculate the project-specific allowable design load.

Project-Specific Allowable Design Pressure (kPa)				
Sheathing Material	**# of Mounts per Module**	**Uplift - 4-Fastener Configuration**	**Uplift - 5-Fastener Configuration**	**Downforce**
Min 12mm Plywood	4	1.86	2.77	3.51
	6	2.72	4.08	5.26

Refer to Table C-2 in Appendix C of the 2020 NBC for project-specific climatic design data.

- 1/50 Snow Load: 2.3 kPa
- 1/50 Rain Load: 0.4 kPa
- 1/50 Hourly Wind Pressure: 0.32 kPa

The total system dead load is assumed to be 0.1 kPa.

The specified snow load, S, calculated in accordance with Section 4.1.6.2 is 2.24 kPa.

The net wind pressure calculated in accordance with Section 4.1.7.13 is as follows (assumes only non-exposed modules):

- Uplift on Non-Exposed Modules
  - Roof Zone 'r': 0.66 kPa
  - Roof Zone 's': 0.91 kPa
  - Roof Zone 'c': 1.95 kPa
- Downforce
  - 0.18 kPa

The total factored demand pressures are as follows. For this example, we will only consider non-exposed panels in Roof Zone 'c'.

The total factored downforce load for Case 3 is 1.25(0.1 kPa) + 1.5(2.24 kPa) + 0.4(0.18 kPa) = 3.56 kPa

The total factored downforce load for Case 4 is 1.25(0.1 kPa) + 1.4(0.18 kPa) + 0.5(2.24 kPa) = 1.50 kPa

The total factored uplift load for Case 4 is -0.9(0.1 kPa) + 1.4(1.95 kPa) = 2.64 kPa

The demand downforce load is greater than 3.51 kPa but less than 5.26 kPa, therefore 6 mounts per PV module are required to withstand demand downforce loads.

Since the number of mounts per PV module is controlled by downforce loads, we need only use uplift loads to determine the number of fasteners required. The demand uplift load is less than 2.72 kPa, therefore 4 fasteners per mount are adequate.

The above steps should be repeated for all applicable roof zones and exposure conditions.

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 +/- 25 mm. 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 2-PER-SIDE CONFIGURATIONS

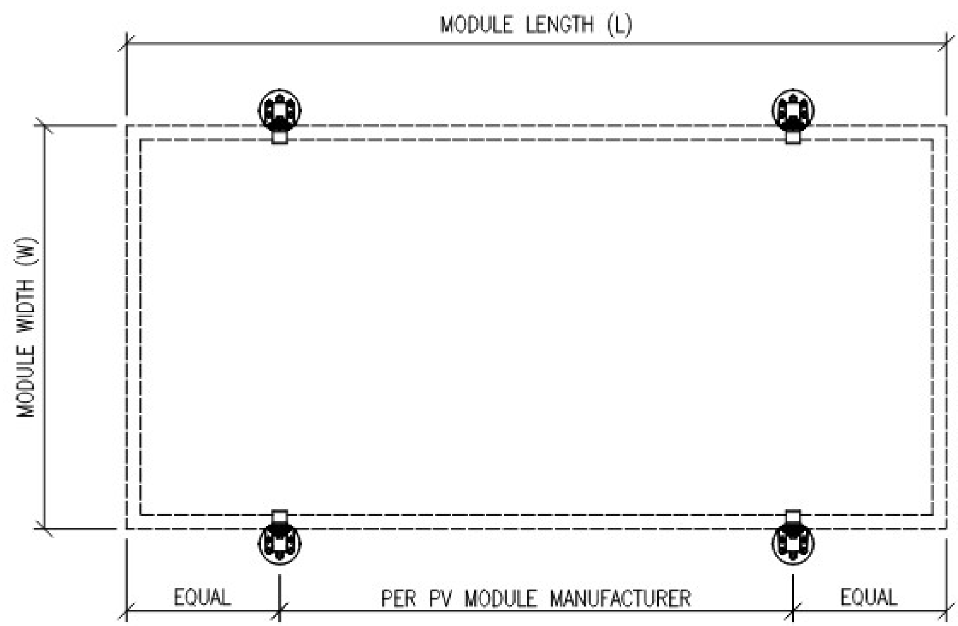
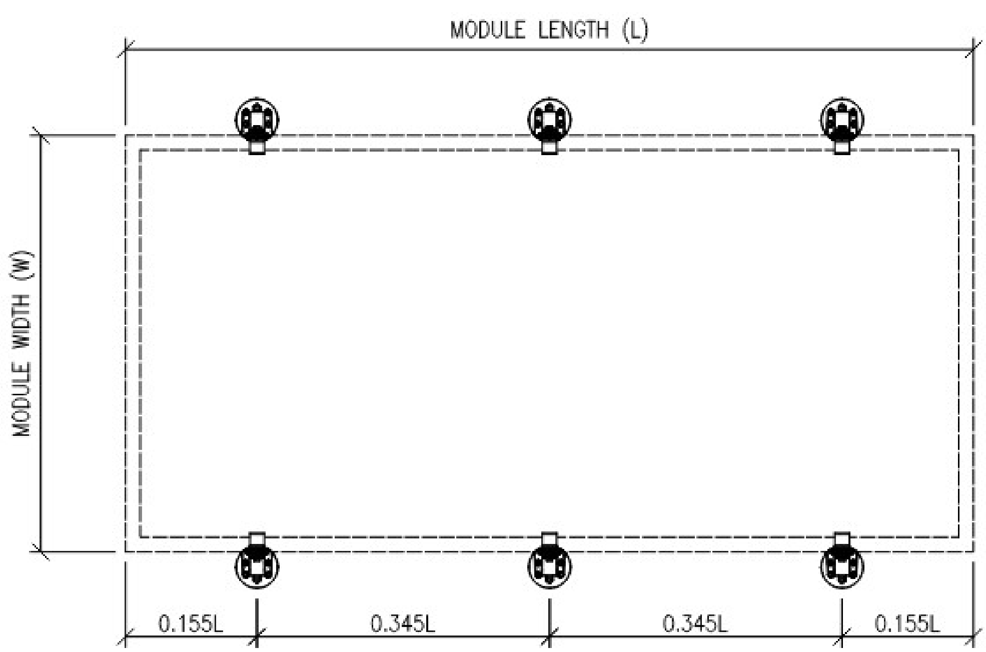


FIGURE 2: MOUNT SPACING FOR 3-PER-SIDE CONFIGURATIONS



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.
- **Existing Building Structure:** The adequacy of roof framing to support PV installations is to be determined by the project EOR on a case-by-case basis.
- **Non-Structural Elements:** All non-structural aspects of the installation, including but not limited to waterproofing and electrical, are not included in the scope of this letter.
- **Installation Means and Methods:** PV mounting components shall be installed in accordance with manufacturer's instructions and industry standards. VSE is not responsible for means and methods of installation, and assumes no liability for improper installations.

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.

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 (P.Eng), 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

PROFESSIONAL PROVINCE OF R. N. EMERY # 201804 BRITISH COLUMBIA ENGINEER

Russell N. Emery
05/22/2025

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