

May 1, 2019

Everest Solar Systems, LLC
3809 Ocean Ranch Blvd, Suite 111
Oceanside, CA 92056
Attn: Andy Neshat



RE: *MiniRail XPress PV Panel Mounting System Evaluation*

To whom it may concern:

Per your request, MOMENT ENGINEERING + DESIGN has performed a comprehensive structural analysis of the Everest Solar MiniRail XPress Solar PV Mounting System for typical installations in the Commonwealth of Massachusetts. When installed per the conditions and design criteria described herein, the Everest Solar MiniRail - XPress PV Mounting System is compliant with the sections of the design reference documents noted below.

Design Reference Documents

- *Massachusetts State Building Code, 9th Edition*
Based on 2015 International Building Code & 2015 International Residential Code
- ASCE/SEI 7-10 – *Minimum Design Loads for Buildings and Other Structures*
- *2010 Aluminum Design Manual*, by the Aluminum Association
- AAMA / TIR 1991 “*Metal Curtain Wall Fasteners*”, American Architectural Manufacturer’s Association
- SSMA ICBO ER-4943P “*Product Technical Information*,” Steel Stud Manufacturer’s Association
- Additional fastener load test data provided by EJOT UK LTD
- Installation per Minirail XPress System Assembly Instructions with specified number of JT3-2-13 (6mm diam.) or JF3-2-12 (5.5mm diam.)
- Section and materials data provided by Everest Solar Systems

Overview

The MiniRail XPress PV-panel roof mounting system consists of extruded 17” aluminum support rails, module clamps, and galvanized or stainless steel fasteners between points of attachment on an existing metal roof. Attachment of the MiniRail XPress Mounting System to the existing roof structure shall be the responsibility of the installer and should be analyzed by a registered design professional where required by the local authority having jurisdiction.

Methods & Design Parameters

Applicable combinations of dead, wind, and snow loads were evaluated in accordance with current code requirements to determine allowable stresses in components and fasteners.

Design wind pressures were determined using Components and Cladding calculations in Chapter 26-30 of ASCE 7-10, using the loading parameters listed below. Configurations not conforming to these parameters will require additional analysis. Calculation of applicable roof snow load should be based upon ground snow load maps and equations and factors of ASCE 7-10, Chapter 7 and applicable sections of the 780 CMR. For designated Case Study areas noted in the Massachusetts State Building Code, 9th Edition, refer to local jurisdiction requirements for snow and wind load determination. Seismic criteria were not considered per provisions of ASCE 7-10 Section 13.1.4.

Loading Parameters:

- Ground snow load: 60 PSF (max.)
- Ultimate 3-second gust wind speed (V) = 150 mph (max.)
- Building roof mean height: 30 ft. or less
- Roof wind pressure region: Zone 1
- Structural risk category: II
- Wind exposure: B & C
- Panel orientation: Portrait/Landscape
- Panel installation angle: Flush with roof slope
- Module type: 72 cell modules or other modules of equal or lesser area
- Roof slope (θ): 0-27°
- Minimum metal roof deck thickness: See Table 1.1 – Minimum Roof Gauge for Rail Attachment

Design Results

The allowable minimum roof gauges for rail attachment of the system are principally controlled by applicable wind (speed, exposure, pressure zone) and snow loads to the structure. Fastener allowable uplift and shear at attachment points typically govern minimum roof gauge.

Refer to MiniRail - XPress calculations for allowable minimum roof gauge based on combinations of these loading parameters. If loading parameters are exceeded by those listed above, refer to Everest Solar Systems for engineering support.

Installation Notes

The following guidelines apply to all installations using the MiniRail product line:

- Calculations assume four independent fasteners per rail, two on each end of the rail
- Installations over roof overhangs is not advised
- Observe all local jurisdictional requirements regarding roof setback requirements

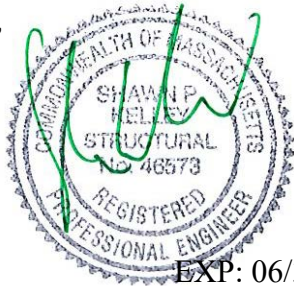
Summary

This assessment has provided design validation for code-compliant installations of the MiniRail XPress PV Mounting system in the Commonwealth of Massachusetts. For all configurations, refer to Everest Solar Systems for engineering support.

This report does not provide analysis of any existing structures, as may be required by the local authority having jurisdiction.

We appreciate the opportunity to have assisted you with this project. Should you have any further questions regarding this analysis, please feel free to contact us by phone or email.

Best Regards,



EXP: 06/30/20

Shawn P. Kelley, P.E.

Principal

moment ENGINEERING + DESIGN

spkelley@msegllc.com

Attachments:

1) Table 1.1: Minimum Steel Roof Gauge for Rail Attachment

ASCE 7-10
 Roof Height: 30'
 Risk Category: II

4/29/2019

TABLE 1.1: MINIMUM STEEL ROOF GAUGE FOR RAIL ATTACHMENT*						
Ground Snow (psf) ¹	Wind Speed - Exposure C					
	110	115	120	130	140	150
0	26	26	26	26	24	24
20	26	26	26	24	24	24
30	26	26	26	24	24	24
40	26	26	26	24	24	24
50	26	26	24	24	24	24
60	24	24	24	24	24	24

*Minirail XPress System per Assembly Instructions with specified number of JT3-2-13 (6mm diam.) or JF3-2-12 (5.5mm diam.)
 1. May be substituted with roof snow load in accordance with Table 1.3

TABLE 1.2: MINIMUM STEEL ROOF GAUGE FOR RAIL ATTACHMENT*						
Ground Snow (psf) ¹	Wind Speed - Exposure B					
	110	115	120	130	140	150
0	26	26	26	26	26	26
20	26	26	26	26	26	24
30	26	26	26	26	26	24
40	26	26	26	26	26	24
50	26	26	26	26	24	24
60	26	26	26	24	24	24

*Minirail XPress System per Assembly Instructions with specified number of JT3-2-13 (6mm diam.) or JF3-2-12 (5.5mm diam.)
 1. May be substituted with roof snow load in accordance with Table 1.3

TABLE 1.3: GROUND SNOW TO ROOF SNOW CONVERSION**		
Ground Snow Load (Pg)	Roof Snow per Slope (Ps)	
	0-7	7-27
0	0	0
10	10	10
20	20	20
30	30	20
40	30	30
50	40	30
60	50	40
70	60	50

**Derived per ASCE 7-10 per Figure 7-2c (assumes panel surface as unobstructed slippery surface)

Note: this table may be used as a guide for design professionals of record to convert ground snow to roof snow for use in the above referenced tables. Conversion does not account for project specific conditions that may affect design roof snow load such as drift, exposure, importance factor, etc. All project design snow loads shall be verified in accordance with local building codes and the Authority Having Jurisdiction (AHJ).