

7/5/2024

Freedom Forever LLC 43445 Buisiness Park Dr., Suite 110 Temecula, CA 92590

Job Number: 458094

Project Name: Patrick Norris
Project Address: 221 Red Cedar Wy
City: Fuquay-Varina

State: NC

Design Criteria:

Applicable Code = ASCE 7-16

Design Wind Speed = 130 mph (3 Second Gust)

Exposure Category = C

Ground Snow Load = 15 psf

Module Type = JINKO SOLAR: JKM390M-72HBL-V

Module Quantity = 22

To whom is may concern,

The above mentioned residential rooftop solar project has been designed to the specifications shown above. The team at Freedom Forever LLC has visited the site to observe the roof and its framing as well as gather other required information for the project. During this observation they did not see any signs of damage or distress to the roof structure which would preclude solar from being installed. Based on that review and the information provided, the calculations on the following pages were completed to determine the adequacy of the roof framing as well as the allowable attachment spacing for the PV panels. The calculations show that the roof can support the proposed PV system.

Sincerely,

Taqi Khawaja, PE Freedom Forever LLC



Wind Calculations

Pressures based on Section 29.4.4

$$p = q_h(GC_p)(\gamma_E)(\gamma_a)$$

$$q_h = .00256 * K_z * K_{zt} * K_d * V^2$$

 $K_z = 0.98$

K_{zt} = 1.0

K_d = 0.85 ASCE7 Table 26.6-1

 $q_z = 36.1 \text{ psf}$

Mounting Plan	0		1		2		3		4		5
Woulding Flane		GC	Wind	GC	Wind	GC	Wind	GC	Wind	GC	Wind
	1	-1.48	-53.45								
	2e	-1.48	-53.45								
	2r	-2.13	-76.91								
Zone	2n	-2.13	-76.91								
	3r	-2.40	-86.57								
	3e	-2.13	-76.91								
	Down	0.46	16.63								

Mounting Plan	Mounting Plane		6		7		8		9	-	10
Woulding Flatie		GC	Wind								
	1										
	2e										
	2r										
Zone	2n										
	3r										
	3e										
	Down										



Snow Load Calculations

Flat Roof Snow Load based on Section 7.3

$$p_f = 0.7C_eC_tI_sp_g$$

p_g = 15 $p_f = 11.55$

 $C_e =$ 1.00

 $C_t =$ 1.10

 $I_s =$ 1.0

Mounting Plane		1		2		3		4		5	
Roof Snow Load (psf)	C _s	Snow									
Nooi silow Load (psi)	0.72	8.35									

Mounting Plane		6		7		8		9		10	
Roof Snow Load (psf)	C _s	Snow	C _s	Snow	C_s	Snow	C _s	Snow	C_s	Snow	

Load Combinations

3 psf Dead Load =

EM = Edge Module IM = Interior Module

Uplift

 $\gamma_{\rm E}$ =

 $\gamma_{\rm a}$ = 0.55 per Figure 29.4-8

Mounting Plar	ne		1		2		3		4		5
0.6D + 0.6W (psf)		EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
	1	-24.57	-15.78								
	2e	-24.57	-15.78								
7000	2r	-36.15	-23.50								
Zone	2n	-36.15	-23.50								
3r	3r	-40.92	-26.68								
	3e	-36.15	-23.50								

Mounting Plan	e		6		7		8		9	-	10
0.6D + 0.6W (psf)		EM	IM								
	1										
	2e										
7000	2r										
Zone	2n										
3r	3r										
	3e										



Down Force

Mounting Plane		1		2		3		4		5
Module Location	EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
D+S (psf)	9.36	9.36								
D+06W (psf)	10.89	8.15								

Mounting Plane		6		7		8		9	3	10
Module Location	EM	IM								
D+S (psf)										
D+06W (psf)										

Lateral Parallel to Roof

Mounting Plane	1	2	3	4	5
D+S (psf)	4.69				

Mounting Plane	6	7	8	9	10
D+S (psf)					

Framing Check

Lumber Species: DF

PV Load = 3 psf

Mounting Plane	1	2	3	4	5
Framing Size	2x4				
Framing Spacing (in)	24				
Span (ft)	8				
Moment (lb-ft)	262				
Shear (lbs)	131				
% Stressed	57%				
Upgrade Size	NA				
New % Stressed	NA				

Mounting Plane	6	7	8	9	10
Framing Size					
Framing Spacing (in)					
Span (ft)					
Moment (lb-ft)					
Shear (lbs)					
% Stressed					
Upgrade Size					
New % Stressed					



Array Attachment Spacing

Min Lag Embedment (in)

Landscape
Max Spacing (in)

Portrait
Max Spacing (in)

Module Model = JINKO SOLAR: JKM390M-72HBL-V Module Quantity = 22

Mounting Plane	1	2	3	4	5
Attachment Type	Ecofasten Rocklt Smart Slide				
Lag Count Per Attachment	2				
Min Lag Embedment (in)	2				
Landscape Max Spacing (in)	72				
Portrait Max Spacing (in)	48				
Mounting Plane	6	7	8	9	10
Attachment Type					
Lag Count Per Attachment					