![freedom FOREVER logo]

11/19/2024

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

Job Number: 518972
Project Name: Stephen Steward
Project Address: 4943 Barbecue Church Rd , Sanford, NC

Design Criteria:

Applicable Code =	ASCE 7-16		
Design Wind Speed =	130 mph (3 Second Gust)		
Exposure Category =	B		
Ground Snow Load =	15 psf	Roof Snow Load=	11.55 psf
Module Type =	Trina: TSM-410NE09RC.05		
Module Quantity =	16		

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 without structural modifications.

Mounting Plane	1	2	3	4	5	6	7	8	9	10
Roof Type	Comp Shingle	Comp Shingle								
Framing Type	Rafter	Rafter								
Framing Size	2x6 @ 24	2x6 @ 24								
Upgrade Size	NA	NA								
Attachment Type	Ecofasten RockIt Smart	Ecofasten RockIt Smart								
Lag Count	2	2								
Embedment Depth	2	2								

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 =   0.70

K_{zt} =   1.0

K_d =   0.85 ASCE7 Table 26.6-1

q_z =   25.8 psf

Mounting Plane		1		2		3		4		5	
		GC	Wind	GC	Wind	GC	Wind	GC	Wind	GC	Wind
Zone	1	-1.48	-38.17	-1.48	-38.17						
	2e	-1.48	-38.17	-1.48	-38.17						
	2r	-2.13	-54.94	-2.13	-54.94						
	2n	-2.13	-54.94	-2.13	-54.94						
	3r	-2.40	-61.87	-2.40	-61.87						
	3e	-2.13	-54.94	-2.13	-54.94						
	Down	0.46	11.88	0.46	11.88						

Mounting Plane		6		7		8		9		10	
		GC	Wind	GC	Wind	GC	Wind	GC	Wind	GC	Wind
Zone	1										
	2e										
	2r										
	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	C_s	Snow	C_s	Snow	C_s	Snow	C_s	Snow
	0.73	8.47	0.73	8.47						

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

Dead Load = 3 psf   EM = Edge Module   IM = Interior Module

Uplift γ_E = 1.5 γ_a = 0.55 per Figure 29.4-8

Mounting Plane		1		2		3		4		5	
0.6D + 0.6W (psf)		EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
Zone	1	-17.05	-10.77	-17.05	-10.77						
	2e	-17.05	-10.77	-17.05	-10.77						
	2r	-25.34	-16.30	-25.34	-16.30						
	2n	-25.34	-16.30	-25.34	-16.30						
	3r	-28.77	-18.58	-28.77	-18.58						
	3e	-25.34	-16.30	-25.34	-16.30						

Mounting Plane		6		7		8		9		10	
0.6D + 0.6W (psf)		EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
Zone	1										
	2e										
	2r										
	2n										
	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)	9.54	9.54	9.54	9.54						
D+06W (psf)	8.56	6.61	8.56	6.61						

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

Lateral Parallel to Roof

Mounting Plane	1	2	3	4	5
D+S (psf)	4.65	4.65			

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 Type	Rafter	Rafter			
Framing Size	2x6	2x6			
Framing Spacing (in)	24	24			
Span (ft)	7	7			
Moment (lb-ft)	203	203			
Shear (lbs)	116	116			
% Stressed	21%	21%			
Upgrade Size	NA	NA			
New % Stressed	NA	NA			

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

Array Attachment Spacing

Module = Trina: TSM-410NE09RC.05

Mounting Plane	1	2	3	4	5
Roofing Material	Comp Shingle	Comp Shingle			
Attachment Type	Ecofasten RockIt Smart Slide	Ecofasten RockIt Smart Slide			
Lag Count Per Attachment	2	2			
Min Lag Embedment (in)	2	2			
Landscape	72	72			
Portrait	48	48			

Mounting Plane	6	7	8	9	10
Roofing Material					
Attachment Type					
Lag Count Per Attachment					
Min Lag Embedment (in)					
Landscape					
Portrait					