12/3/2024

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

Job Number:	502646
Project Name:	Spencer Richard
Project Address:	44 Jack Harris Ln , Spring Lake, NC

Design Criteria:

Applicable Code =	ASCE 7-16		
Design Wind Speed =	130 mph (3 Second Gust)		
Exposure Category =	C		
Ground Snow Load =	15 psf	Roof Snow Load=	11.55 psf
Module Type =	HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 410		
Module Quantity =	44		

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	Comp Shingle							
Framing Type	Truss	Truss	Truss							
Framing Size	2x10 @ 16	2x10 @ 16	2x10 @ 16							
Upgrade Size	NA	NA	NA							
Attachment Type	Ecofasten RockIt Smart Slide	Ecofasten RockIt Smart Slide	Ecofasten RockIt Smart Slide							
Lag Count	2	2	2							
Embedment Depth	2	2	2							

Sincerely,

Taqi Khawaja, PE
Freedom Forever LLC

NORTH CAROLINA PROFESSIONAL SEAL 057554 ENGINEER TAQI KHAWAJA

Signed by: Taqi Khawaja, PE
Signed on: 12/03/2024

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 psf

Mounting Plane		1		2		3		4		5	
		GC	Wind	GC	Wind	GC	Wind	GC	Wind	GC	Wind
Zone	1	-1.48	-53.29	-1.48	-53.29	-1.48	-53.29				
	2e	-1.48	-53.29	-1.48	-53.29	-1.48	-53.29				
	2r	-1.75	-63.23	-1.75	-63.23	-1.75	-63.23				
	2n	-1.75	-63.23	-1.75	-63.23	-1.75	-63.23				
	3r	-2.16	-78.20	-2.16	-78.20	-2.16	-78.20				
	3e	-2.16	-78.20	-2.16	-78.20	-2.16	-78.20				
	Down	0.77	27.79	0.77	27.79	0.77	27.79				

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
	0.67	7.70	0.67	7.70	0.67	7.70				

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	-24.61	-15.80	-24.61	-15.80	-24.61	-15.80				
	2e	-24.61	-15.80	-24.61	-15.80	-24.61	-15.80				
	2r	-29.53	-19.09	-29.53	-19.09	-29.53	-19.09				
	2n	-29.53	-19.09	-29.53	-19.09	-29.53	-19.09				
	3r	-36.95	-24.03	-36.95	-24.03	-36.95	-24.03				
	3e	-36.95	-24.03	-36.95	-24.03	-36.95	-24.03				

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)	8.37	8.37	8.37	8.37	8.37	8.37				
D+06W (psf)	16.37	11.78	16.37	11.78	16.37	11.78				

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)	4.83	4.83	4.83		

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	Truss	Truss	Truss		
Framing Size	2x10	2x10	2x10		
Framing Spacing (in)	16	16	16		
Span (ft)	5	6	6		
Moment (lb-ft)	64	92	92		
Shear (lbs)	51	61	61		
Upgrade Size	NA	NA	NA		

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

Array Attachment Spacing

Module = HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 410

Mounting Plane	1	2	3	4	5
Roofing Material	Comp Shingle	Comp Shingle	Comp Shingle		
Attachment Type	Ecofasten RockIt Smart Slide	Ecofasten RockIt Smart Slide	Ecofasten RockIt Smart Slide		
Lag Count Per Attachment	2	2	2		
Min Lag Embedment (in)	2	2	2		
Landscape	64	64	64		
Portrait	48	48	48		

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