

Design Criteria for Span Tables:

Values in the maximum allowable rail span tables provided herein are subject to the following general criteria and additional criteria shown on individual span tables sheets. Values in span tables are based on the same engineering methodology and calculation algorithms used for U-Builder and are provided here for reference.

Building Assumptions

- Building Risk Category: II
- Mean Roof Height: 30 ft
- Roof Pitch: 0°-45°
- Site Elevation: 0 ft

Wind Design Assumptions

- Wind loads used are based on ASCE 7-16 Sec 29.4.4 with Provisions from SEAOC PV2-2017
- Exposure Category B, C, or D
- Basic Wind Speed = 90 – 180 mph
- Level terrain. Topographic factor, $k_{zt} = 1.0$
- $\gamma_E = 1.0$ for 'Interior' spans, $\gamma_E = 1.5$ for 'Exposed' spans (ASCE 7-16, Fig. 29.4-7)

Snow Design Assumptions

- Ground Snow Load = 0-100 psf
- Exposure Factor coefficients of Partially Exposed condition
- Thermal Factor = 1.0
- Results based on uniform snow load

Seismic Design Assumptions

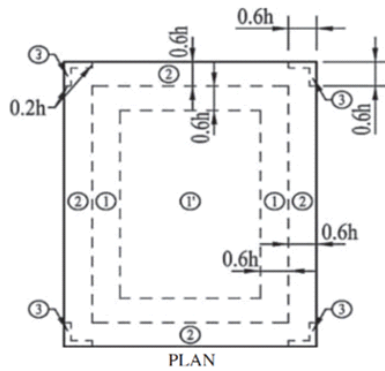
- 0.2-s Spectral Response Acceleration, $S_S \leq 3$
- $S_S = 1.25$ and 3 per criteria shown on individual span tables sheets.
- $S_1 = 0.5$
- Seismic site class D

Array Assumptions

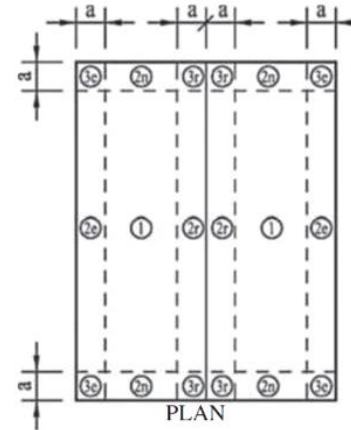
- Module orientation and Rail direction per criteria shown on individual span tables sheets.
- Maximum module dimensions of 40.1" x 67" (~19 sq.ft, 47.65 lbs) and 41" x 80" (~23 sq.ft, 58.6 lbs) per criteria shown on individual span tables sheets.
- Minimum distance between modules and roof edge is at least twice the module height above roof surface.
- Modules are parallel to roof surface and maximum height above roof surface is 5" to 10" depending on attachment type.
- Gaps between module rows and columns is 0.25" in to 1" depending on clamp type.
- The most restrictive of all roof zone spans shall be used when any part of the module is attributed to that span.
- 'Exposed' spans as defined in ASCE 7-16 sec. 29.4.4 shall be used when any part of an exposed module or panel as is attributed to that span.

Span Tables

Zone should be considered as per ASCE 7-16, Fig. 30.3-2A to 30.3-2D



Gable Roofs $\theta \leq 7^\circ$

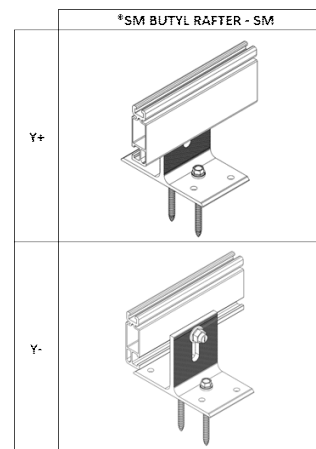


Gable Roofs $7^\circ < \theta \leq 45^\circ$

Grouping of ASCE 7-16 Roof Zones (Gable and Flat)

- **Roof Tilt 0° - 7°**
 - Roof Zone 1 = 1
 - Roof Zone 2 = 2
 - Roof Zone 3 = 3
- **Roof Tilt 7° - 27°**
 - Roof Zone 1 = 1, 2e
 - Roof Zone 2 = 2n, 2r, 3e
 - Roof Zone 3 = 3r
- **Roof Tilt 27° - 45°**
 - Roof Zone 1 = 1, 2e, 2r
 - Roof Zone 2 = 2n, 3r
 - Roof Zone 3 = 3e

Rails can be installed in these possible orientations.



[illegible]

* Cells with an asterisk indicates that the L-foot must be oriented in the Y- direction as indicated in the image.

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Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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[illegible]

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Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																					
				90			95			100			105			110			115			120			130			140			150			160			170			180																	
				Roof Wind Zone																																																					
				1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3															
0	B	0-7	Interior	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	113	120	120	103	120	114	78	120	98	61	115	79	49	105	64	40	86	54	34	72	45	30																	
			Exposed	120	120	117	120	120	111	120	120	96	120	115	81	120	109	69	120	96	60	117	84	52	107	65	40	84	52	33	67	43	29	55	35	25	46	31	33	39	28	30															
		7-20	Interior	120	120	120	120	120	120	120	120	120	120	120	120	120	120	117	120	120	111	120	116	97	120	99	70	120	73	53	111	57	41	71	45	34	61	36	30	52	32	26															
			Exposed	120	120	116	120	120	109	120	114	89	120	104	73	120	85	61	120	72	51	115	61	44	73	46	34	59	35	29	50	31	25	42	27	34	36	36	30	32	32	26															
		20-27	Interior	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	116	110	121	101	81	119	77	60	112	61	47	94	49	38	77	41	32																
			Exposed	121	121	121	121	121	121	121	121	118	121	117	112	121	112	96	121	99	79	121	84	66	112	62	48	92	48	36	72	38	30	61	32	25	52	29	32	45	25	28															
	27-45	Interior	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	114	121	117	95	121	108	74	114	86	59	99	69	48	77	57	40																
		Exposed	121	121	121	121	121	121	121	121	121	120	121	121	115	121	121	109	121	116	93	121	111	80	115	87	60	95	67	47	70	54	38	55	44	32	43	36	27	35	32	24															
	C	0-7	Interior	120	120	120	120	120	115	120	108	120	118	91	120	114	77	120	107	67	120	93	58	112	73	45	93	58	36	75	47	31	61	39	27	51	34	36	43	30	32																
			Exposed	120	114	77	120	103	64	119	87	54	114	75	46	106	65	40	92	57	35	80	50	32	62	40	27	50	33	35	41	29	31	34	38	27	30	33	24	27	29	24															
		7-20	Interior	120	120	120	120	120	114	120	118	103	120	112	84	120	98	69	120	82	58	119	69	50	97	51	38	65	40	31	54	33	27	46	29	36	39	25	32	34	34	28															
			Exposed	120	98	69	120	78	56	116	64	46	108	54	39	72	45	34	64	39	31	57	34	28	47	29	36	39	25	31	33	33	27	29	24	38	25	24	34	22	19																
20-27		Interior	121	121	121	121	121	121	121	121	121	121	121	116	112	116	110	121	110	92	121	95	76	116	70	54	104	54	41	81	43	33	66	35	28	57	31	23	49	27	30																
		Exposed	121	115	109	121	108	87	121	88	69	117	73	57	112	62	48	101	53	40	87	46	35	28	54	29	22	45	25	28	38	33	29	20	29	26	17	38	29	16																	
27-45	Interior	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	114	121	117	95	121	108	74	114	86	59	99	69	48	77	57	40																	
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10	D	0-7	Interior	120	120	111	120	120	96	120	115	80	120	109	68	120	94	58	116	82	51	112	72	44	90	56	35	71	45	30	58	37	26	48	32	34	40	28	30	34	38	27															
			Exposed	120	94	58	115	79	49	109	67	42	94	58	36	81	50	32	70	44	30	61	39	27	48	32	35	39	28	30	33	36	29	32	22	25	28	26	34	25	16																
		7-20	Interior	120	120	110	120	114	89	120	103	72	120	84	60	119	70	50	114	59	43	93	51	37	63	38	31	52	32	26	44	28	35	37	36	30	32	32	27	29	29	24															
			Exposed	119	69	50	112	57	41	78	47	35	65	40	32	58	35	29	51	32	26	46	29	36	38	37	31	32	32	26	28	27	23	36	24	20	32	24	17	29	19	16															
		20-27	Interior	121	121	121	121	121	118	121	117	112	121	111	95	121	97	77	72	80	81	64	116	69	54	100	52	40	77	40	32	63	33	26	53	29	33	46	26	28	40	34	24														
			Exposed	121	96	76	119	78	61	114	64	50	104	54	41	88	46	35	75	40	31	66	35	28	54	29	22	45	25	28	38	33	29	20	29	26	17	38	29	16																	
	27-45	Interior	121	121	121	121	121	120	121	121	115	121	120	108	121	115	91	121	110	77	118	97	67	106	73	51	76	57	40	58	46	33	45	37	28	36	32	24	32	29	31																
		Exposed	121	115	90	121	108	74	116	90	62	109	76	53	90	65	45	74	56	39	62	49	35	46	38	28	35	32	23	31	27	30	27	36	26	36	32	22	32	28	19																
	B	0-7	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	103	104	104	78	104	98	61	104	79	49	104	64	40	86	54	34	72	45	30																
			Exposed	104	104	104	104	104	104	104	104	96	104	104	81	104	69	104	96	60	104	84	52	104	65	40	84	52	33	67	43	29	55	35	25	46	31	33	39	28	30																
		7-20	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	97	104	104	70	104	73	53	104	57	41	71	45	34	61	36	30	52	32	26															
			Exposed	104	104	104	104	104	104	104	104	89	104	104	73	104	85	61	104	72	51	104	61	44	73	46	34	59	35	29	50	31	25	42	27	34	36	36	30	32	32	26															
20-27		Interior	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	116*	110	119*	101	81	119*	77	60	112	61	47	94	49	38	77	41	32																	
		Exposed	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	117*	112	96	119*	99	79	119*	84	66	112	62	48	92	48	36	72	38	30	61	32	25	52	29	32	45	25	28																		
27-45	Interior	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	108*	74	111*	86	59	99	69	48	77	57	40																	
	Exposed	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	108*	74	111*	86	59	99	69	48	77	57	40																
		111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	111*	108*	74	111*	86	59	99	69	48	77	57	40																
20	C	0-7	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	103	104	104	78	104	98	61	104	79	49	104	64	40	86	54	34	72	45	30																
			Exposed	104	104	77	104	103	64	104	87	54	104	75	46	104	65	40	92	57	35	80	50	32	62	40	27	50	33	35	41	29	31	34	38	27	30	33	24	27	29	24															
		7-20	Interior	104	104	104	104	104	104	104	104	104	103	104	104	84	104	98	69	104	82	58	104	69	50	97	51	38	65	40	31	54	33	27	46	29	36	39	25	32	34	34	28														
			Exposed	104	98	69	104	78	56	104	64	46	104	54	39	72	45	34	64	39	31	57	34	28	47	29	36	39	25	31	33	33	27	29	24	38	25	24	34	22	19																
		20-27	Interior	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	116*	119*	116*	110	119*	110	92	119*	95	76	116*	70	54	104	54	41	81	43	33	66	35	28	57	31	23	49	27	30																
			Exposed	119*	115																																																				

[illegible]

10 Highlighted cell indicate 3-rail system span. Contact Unirac Engineering Services for support.

Highlighted cell with strikethrough indicate 3-rail system span and module clamp allowable capacity exceeds with 3-rails. 4-Rail system required. Contact Unirac Engineering Services for support.

[illegible]

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[illegible]

[illegible]

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Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Highlighted cell with strikethrough indicate 3-rail system span and module clamp allowable capacity exceeds with 3-rails. 4-Rail system required. Contact Unirac Engineering Services for support.

[illegible]

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[illegible]

Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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[illegible]

Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Panel Exposure	Basic Wind Speed (mph)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Highlighted cell with strikethrough indicate 3-rail system span and module clamp allowable capacity exceeds with 3-rails. 4-Rail system required. Contact Unirac Engineering Services for support.

* Cells with an asterisk indicates that the L-foot must be oriented in the Y- direction as indicated in the image.

[illegible]

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[illegible]

10 Highlighted cell indicate 3-rail system span. Contact Unirac Engineering Services for support.

[illegible]

[illegible]

* Cells with an asterisk indicates that the L-foot must be oriented in the Y- direction as indicated in the image.

Basic Wind Speed (mph)

* Cells with an asterisk indicates that the L-foot must be oriented in the Y- direction as indicated in the image.

[illegible]

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[illegible]

10 Highlighted cell indicate 3-rail system span. Contact Unirac Engineering Services for support.

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