

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

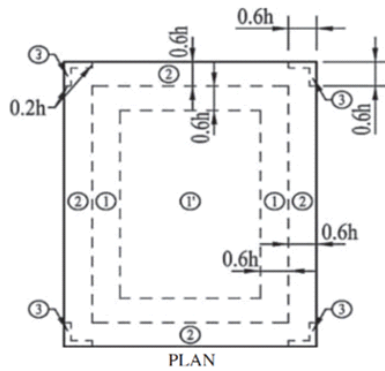
- 0.2-s Spectral Response Acceleration, $SS \leq 3$
- $S_S = 1.25$ and 3 per criteria shown on individual span tables sheets.
- $S_1 = 0.5$
- Seismic site class D

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.

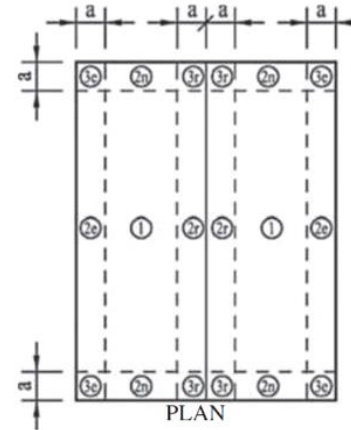
Span Tables

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



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

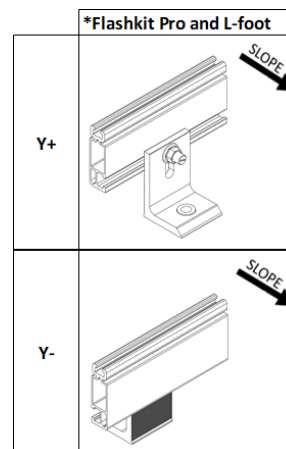
Rails can be installed in these possible orientations.



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



10 Highlighted cell indicate 3-rail system span. 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.

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

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			Exposed	127	127	124	127	127	117	127	127	109	127	121	100	127	116	94	127	109	89	124	102	84	114	91	69	102	83	54	93	71	44	85	59	38	78	49	33	65	42	30
		7-20	Interior	127	127	127	127	127	127	127	127	127	127	127	127	127	127	124	127	127	118	127	124	111	127	112	95	127	97	86	120	88	74	98	80	58	88	65	47	82	53	40
			Exposed	127	127	124	127	127	116	127	121	106	127	114	97	127	103	90	127	96	85	125	90	80	99	81	59	87	63	45	80	49	38	67	40	33	57	36	30	50	32	40
		20-27	Interior	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	123	117	128	113	101	126	99	91	118	90	83	109	83	69	98	72	55
			Exposed	128	128	128	128	128	128	128	128	126	128	124	119	128	118	111	128	112	99	128	102	93	118	91	83	107	82	66	96	67	51	88	53	41	82	43	35	72	38	30
	27-45	Interior	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	124	109	129	115	97	121	103	89	112	94	82	99	88	70	
		Exposed	129	129	129	129	129	129	129	129	129	128	129	129	129	129	116	129	123	108	129	118	100	122	104	89	110	93	81	96	85	65	87	76	53	80	62	43	64	51	37	
	C	0-7	Interior	127	127	127	127	127	121	127	127	115	127	126	106	127	120	98	127	115	93	127	108	88	118	95	77	108	87	60	97	79	49	89	65	41	82	54	36	72	46	32
			Exposed	127	127	98	127	113	91	126	104	85	120	97	80	114	91	68	107	86	59	99	82	52	90	66	41	82	53	35	68	43	31	56	38	40	47	33	36	40	29	32
		7-20	Interior	127	127	127	127	127	121	127	126	114	127	118	102	127	111	95	127	101	89	127	95	84	114	85	67	92	71	51	83	55	41	73	44	36	63	38	32	54	34	42
			Exposed	127	111	95	127	99	88	127	92	82	116	86	70	98	81	59	91	69	50	85	59	43	74	45	36	61	38	31	5											

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.

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]

* 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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[illegible]

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[illegible]

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

[illegible]

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[illegible]

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

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	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	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120																																																																																																														
			Exposed	120	120	115	120	120	107	120	118	100	120	113	93	120	106	88	119	100	83	115	94	75	104	85	58	94	74	45	86	60	37	78	49	32	65	41	42	54	35	37																																																																																																																					
		7-20	Interior	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120																																																																																																												
			Exposed	120	120	114	120	117	106	120	111	98	120	103	91	120	96	85	117	90	80	111	85	67	95	69	49	84	52	38	67	41	32	56	34	42	48	30	37	41	40	33																																																																																																																					
		20-27	Interior	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121																																																																																																												
			Exposed	121	121	121	121	121	121	121	121	120	115	121	115	108	121	108	101	121	101	94	119	95	88	109	85	76	98	72	56	89	56	43	82	44	34	70	36	29	60	32	37																																																																																																																				
	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	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121																																																																																																												
		Exposed	121	121	121	121	121	121	121	121	121	118	121	121	112	121	118	105	121	114	99	121	108	93	112	97	84	100	87	69	91	79	55	82	63	44	68	52	36	54	43	31																																																																																																																					
	C	0-7	Interior	120	120	118	120	120	113	120	120	116	98	120	111	92	120	105	87	119	99	82	109	89	64	99	81	51	90	66	41	83	54	34	72	45	30	60	38	40																																																																																																																							
			Exposed	120	111	92	120	103	85	116	96	79	111	90	67	104	85	57	98	80	50	93	70	43	83	55	34	70	44	29	57	36	38	47	31	34	39	42	46	34	37	26																																																																																																																					
		7-20	Interior	120	120	118	120	120	111	120	115	103	120	108	96	120	101	89	120	95	84	116	89	77	102	79	56	89	59	43	75	46	34	61	37	30	52	32	40	45	43	35																																																																																																																					
			Exposed	120	101	89	120	93	83	114	87	71	104	81	58	95	69	49	88	58	42	82	50	36	62	37	30	51	31	39	43	41	34	36	36	36	32	32	26	43	28	29																																																																																																																					
		20-27	Interior	121	121	121	121	121	121	121	121	121	119	121	118	114	121	113	106	121	106	99	121	100	93	114	89	83	103	81	64	94	63	48	86	50	38	78	41	32	66	34	27																																																																																																																				
			Exposed	121	113	106	121	105	97	120	97	90	115	91	84	109	85	75	102	80	62	96	68	52	86	51	39	76	39	31	62	33	39	53	29	33	45	38	28	39	34	24																																																																																																																					
	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	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121																																																																																																														
		Exposed	121	121	110	121	116	102	121	110	95	117	103	89	112	96	84	104	91	77	98	86	66	87	72	50	85	75	56	39	57	45	32	44	36	41	35	32	36	31	43	31																																																																																																																					
	D	0-7	Interior	120	120	108	120	118	100	120	113	93	120	105	87	119	99	82	114	93	73	109	88	64	97	79	49	88	63	39	81	51	33	67	42	43	55	35	38	47	31	34																																																																																																																					
			Exposed	119	99	82	113	92	70	106	86	59	99	81	51	93	71	44	88	62	38	54	34	68	43	43	54	35	37	44	30	32	36	40	28	32	35	25	43	31	22																																																																																																																						
7-20		Interior	120	118	106	120	111	98	120	103	91	120	96	85	117	90	78	109	84	65	101	78	55	87	57	41	70	44	30	33	58	35	29	49	30	38	42	41	34	36	36	36																																																																																																																					
		Exposed	116	89	77	107	83	62	97	72	51	89	59	43	82	50	36	69	43	33	62	37	30	50	31	38	41	40	33	35	35	29	30	30	25	41	27	22	36	24	20																																																																																																																						
20-27		Interior	121	121	121	121	120	115	121	115	108	121	107	100	121	100	93	118	94	87	114	89	82	102	79	61	92	60	46	84	47	35	72	37	30	61	32	38	53	29	33																																																																																																																						
		Exposed	121	100	93	117	93	86	110	86	79	103	81	64	97	69	53	91	58	45	86	50	38	73	38	30	60	32	37	50	42	31	42	36	26	36	32	22	32	29	20																																																																																																																						
27-45	Interior	121	121	121	121	121	118	121	121	121	121	121	118	105	121	113	98	121	107	92	116	101	87	104	90	75	93	82	58	84	66	46	71	53	37	55	44	32	44	36	27																																																																																																																						
	Exposed	121	113	98	119	105	91	114	98	85	106	92	79	98	86	66	92	81	57	87	71	49	72	54	38	53	43	31	41	35	39	34	30	34	30	40	29	40	36	25																																																																																																																							
10	B	0-7	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104																																																																																																													
			Exposed	104	104	104	104	104	104	104	104	104	100	104	104	93	104	88	104	100	83	104	94	75	104	85	58	94	74	45	86	60	37	78	49	32	65	41	42	54	35	37																																																																																																																					
		7-20	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104																																																																																																											
			Exposed	104	104	104	104	104	104	104	104	98	104	103	91	104	96	85	104	90	80	104	85	67	95	69	49	84	52	38	67	41	32	56	34	42	48	30	37	41	40	33																																																																																																																					
		20-27	Interior	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117																																																																																																													
			Exposed	117	117	117	117	117	117	117	117	115	117	115	108	117	108	101	117	101	94	117	95	88	109	85	76	98	72	56	89	56	43	82	44	34	70	36	29	60	32	37																																																																																																																					
	27-45	Interior	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*	119*																																																																																																														
		Exposed	119*	119*	119*	119*	119*	119*	119*	119*	118*	119*	119*	112	119*	118*	105	119*	114*	99	119*	108	93	112	97	84	100	87	69	91	79	55	82	63	44	68	52	36	54	43	31																																																																																																																						
	C	0-7	Interior	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104																																																																																																												
			Exposed	104	104	92	104	103	85	104	96	79	104	90	67	104	85	57	98	80	50	93	70	43	83	55	34	70	44	29																																																																																																																																	

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]

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]

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

[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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0	B	0-7	Interior	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
			Exposed	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		7-20	Interior	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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10 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]

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

[illegible]

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

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

34 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]

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.

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

[illegible]

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

[illegible]

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

[illegible]

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

[illegible]

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