

**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 7-22 Sec. 29.4.4
- 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 7-22, 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**

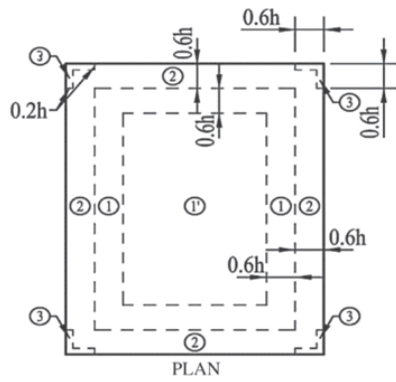
- 0.2-s Spectral Response Acceleration
- $S_S = 1.25$  and 3 with  $S_d = 1, 2.4$  respectively per criteria shown on individual span tables sheets.
- $S_1 = 0.5$  &  $S_{d1} = 0.6$
- Seismic site class D

**Array Assumptions**

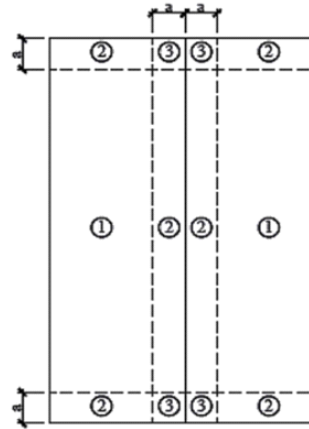
- Module orientation and Rail direction per criteria shown on individual span tables sheets.
- Maximum module dimensions of 40.1" x 67" (~19 sq.ft, 47.65 lbs) and 41" x 80" (~23 sq.ft, 58.6 lbs) per criteria shown on individual span tables sheets.
- Minimum distance between modules and roof edge is at 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 7-22 sec. 29.4.4 shall be used when any part of an exposed module or panel as is attributed to that span.

### Span Tables

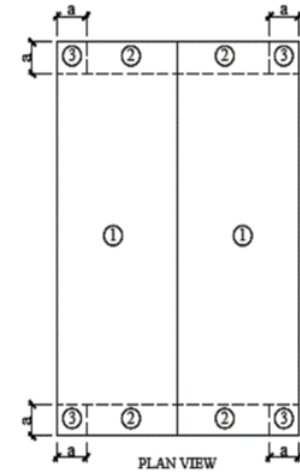
Zone should be considered as per ASCE 7-22, Fig. 30.3-2A to 30.3-2D



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

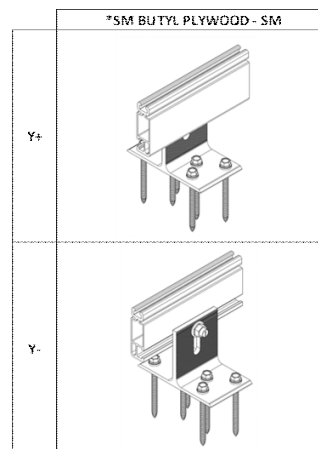


Gable Roofs  $7^\circ < \theta \leq 27^\circ$



Gable Roofs  $27^\circ < \theta \leq 45^\circ$

Rails can be installed in these possible orientations.





ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

19 sq.ft  
Module Area

PORTRAIT  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## 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         |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |     |    |    |    |    |    |    |     |    |    |    |    |    |    |     |    |    |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
| 0                      | B                      | 0-7                   | Interior       | 46                     | 46 | 44 | 46 | 46 | 39 | 46 | 46 | 34 | 46 | 46 | 31 | 46 | 40 | 28  | 46 | 36 | 25 | 46 | 33 | 39 | 28  | 19 | 33 | 24 | 16 | 28 | 20 | 14  | 24 | 18 | 12 | 21 | 15 | 11 | 19  | 14 | 10 |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 46                     | 40 | 28 | 46 | 35 | 25 | 45 | 32 | 22 | 40 | 28 | 20 | 36 | 26 | 18  | 32 | 23 | 16 | 29 | 21 | 15 | 25  | 18 | 12 | 21 | 15 | 11 | 18 | 13  | 9  | 16 | 11 | 8  | 14 | 10 | 7   | 12 | 9  | 9  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 47                     | 47 | 38 | 47 | 47 | 34 | 47 | 41 | 30 | 47 | 37 | 27 | 47 | 33 | 24  | 42 | 30 | 22 | 38 | 28 | 20 | 32  | 23 | 17 | 27 | 20 | 14 | 24 | 17  | 12 | 20 | 15 | 11 | 18 | 13 | 9   | 16 | 11 | 8  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 47                     | 33 | 24 | 41 | 30 | 22 | 37 | 26 | 19 | 33 | 24 | 17 | 30 | 21 | 16  | 27 | 19 | 14 | 25 | 18 | 13 | 21  | 15 | 11 | 18 | 13 | 9  | 15 | 11  | 8  | 13 | 10 | 7  | 12 | 8  | 9   | 10 | 7  | 8  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 47 | 47 | 47 | 47 | 41 | 47 | 47 | 47 | 37 | 47 | 40 | 33 | 47 | 36  | 30 | 47 | 33 | 27 | 47 | 30 | 24  | 45 | 25 | 21 | 37 | 21 | 18 | 32  | 18 | 15 | 28 | 16 | 13 | 24 | 14  | 12 | 22 | 12 | 10 |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 47                     | 36 | 29 | 47 | 32 | 26 | 47 | 29 | 23 | 47 | 26 | 21 | 41 | 23 | 19  | 37 | 21 | 17 | 34 | 19 | 16 | 28  | 16 | 13 | 24 | 14 | 11 | 21 | 12  | 10 | 18 | 10 | 8  | 16 | 9  | 7   | 14 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 48             | 48                     | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 39 | 48 | 41 | 35 | 48  | 41 | 32 | 42 | 37 | 29 | 35 | 31  | 25 | 30 | 27 | 21 | 26 | 23 | 18  | 23 | 20 | 16 | 20 | 18 | 14 | 17  | 16 | 12 |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | Exposed               | 48             | 47                     | 35 | 47 | 40 | 31 | 40 | 36 | 28 | 36 | 32 | 25 | 33 | 29 | 23 | 30  | 26 | 21 | 27 | 24 | 19 | 23 | 20  | 16 | 19 | 17 | 14 | 17 | 15 | 12  | 15 | 13 | 10 | 13 | 11 | 9  | 11  | 10 | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 46                     | 43 | 29 | 46 | 38 | 26 | 46 | 34 | 23 | 42 | 30 | 21 | 38 | 27 | 19  | 34 | 25 | 17 | 31 | 22 | 16 | 26  | 19 | 13 | 22 | 16 | 11 | 19 | 14  | 10 | 17 | 12 | 8  | 15 | 11 | 7   | 13 | 9  | 10 |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 27 | 19 | 34 | 24 | 17 | 30 | 21 | 15 | 27 | 19 | 13 | 24 | 17 | 12  | 22 | 16 | 11 | 20 | 14 | 10 | 17  | 12 | 8  | 14 | 10 | 7  | 12 | 9   | 10 | 11 | 8  | 14 | 10 | 7  | 8   | 9  | 7  | 8  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 47                     | 35 | 26 | 45 | 31 | 23 | 39 | 28 | 20 | 35 | 25 | 18 | 32 | 23 | 17  | 29 | 21 | 15 | 26 | 19 | 14 | 22  | 16 | 12 | 19 | 13 | 10 | 16 | 12  | 8  | 14 | 10 | 7  | 12 | 9  | 10  | 11 | 8  | 9  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 31                     | 23 | 17 | 28 | 20 | 15 | 25 | 18 | 13 | 22 | 16 | 12 | 20 | 15 | 11  | 18 | 13 | 10 | 17 | 12 | 9  | 14  | 10 | 7  | 12 | 9  | 10 | 10 | 7   | 8  | 9  | 10 | 7  | 8  | 9  | 6   | 7  | 8  | 6  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 38 | 31 | 47 | 34 | 28 | 47 | 30 | 25 | 47 | 27 | 22 | 44 | 25 | 20  | 39 | 22 | 18 | 36 | 20 | 17 | 30  | 17 | 14 | 25 | 15 | 12 | 22 | 13  | 10 | 19 | 11 | 9  | 17 | 10 | 8   | 15 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 43                     | 24 | 20 | 38 | 22 | 18 | 34 | 19 | 16 | 31 | 18 | 14 | 28 | 16 | 13  | 25 | 14 | 12 | 23 | 13 | 11 | 19  | 11 | 9  | 16 | 9  | 8  | 14 | 8   | 7  | 12 | 7  | 9  | 11 | 10 | 8   | 10 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 48             | 48                     | 37 | 48 | 42 | 33 | 43 | 38 | 30 | 38 | 34 | 27 | 35 | 31 | 24 | 31  | 28 | 22 | 29 | 26 | 20 | 24 | 22  | 17 | 21 | 18 | 14 | 18 | 16 | 12  | 15 | 14 | 11 | 14 | 12 | 10 | 12  | 11 | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | Exposed               | 34             | 31                     | 24 | 31 | 27 | 21 | 27 | 24 | 19 | 25 | 22 | 17 | 22 | 20 | 16 | 20  | 18 | 14 | 19 | 14 | 11 | 13 | 12  | 9  | 11 | 13 | 12 | 9  | 11 | 10  | 8  | 10 | 9  | 7  | 9  | 8  | 9   | 8  | 7  | 8  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | D                      | 0-7                   | Interior       | 46                     | 35 | 24 | 44 | 31 | 22 | 39 | 28 | 19 | 35 | 25 | 17 | 31 | 22 | 16  | 28 | 20 | 14 | 26 | 19 | 13 | 22  | 16 | 11 | 18 | 13 | 9  | 16 | 11  | 8  | 14 | 10 | 7  | 12 | 9  | 11  | 8  | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 31                     | 22 | 16 | 28 | 20 | 14 | 25 | 18 | 12 | 22 | 16 | 11 | 20 | 14 | 10  | 18 | 13 | 9  | 17 | 12 | 8  | 14  | 10 | 7  | 12 | 9  | 9  | 10 | 7   | 8  | 9  | 10 | 7  | 8  | 9  | 6   | 7  | 8  | 5  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 41                     | 29 | 21 | 36 | 26 | 19 | 32 | 23 | 17 | 29 | 21 | 15 | 26 | 19 | 14  | 24 | 17 | 12 | 22 | 16 | 11 | 18  | 13 | 10 | 15 | 11 | 8  | 13 | 10  | 7  | 12 | 8  | 9  | 10 | 7  | 8   | 9  | 10 | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13 | 10 | 17 | 12 | 9   | 15 | 11 | 8  | 14 | 10 | 7  | 12  | 8  | 9  | 10 | 7  | 8  | 9  | 10  | 7  | 7  | 8  | 6  | 10 | 7  | 6   | 9  | 6  | 5  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 31 | 26 | 47 | 28 | 23 | 45 | 25 | 21 | 39 | 22 | 18 | 36 | 20 | 17  | 32 | 18 | 15 | 29 | 17 | 14 | 25  | 14 | 12 | 21 | 12 | 10 | 18 | 10  | 9  | 16 | 9  | 7  | 14 | 8  | 10  | 12 | 7  | 9  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 35                     | 20 | 17 | 31 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12 | 23 | 13 | 11  | 21 | 12 | 10 | 19 | 11 | 9  | 16  | 9  | 8  | 14 | 8  | 10 | 12 | 7   | 8  | 10 | 9  | 7  | 9  | 8  | 6   | 8  | 7  | 6  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 46             | 39                     | 31 | 39 | 35 | 28 | 35 | 31 | 25 | 32 | 28 | 22 | 29 | 26 | 20 | 26  | 23 | 18 | 24 | 21 | 17 | 20 | 18  | 14 | 17 | 15 | 12 | 15 | 13 | 10  | 13 | 11 | 9  | 11 | 10 | 8  | 10  | 9  | 7  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | Exposed               | 28             | 25                     | 20 | 25 | 23 | 18 | 23 | 20 | 16 | 20 | 18 | 14 | 19 | 17 | 13 | 17  | 15 | 12 | 14 | 11 | 13 | 12 | 9   | 11 | 10 | 8  | 10 | 9  | 7  | 8   | 7  | 9  | 7  | 8  | 10 | 8  | 10  | 9  | 7  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
| 10                     | B                      | 0-7                   | Interior       | 38                     | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 34 | 38 | 38 | 31 | 38 | 38 | 28  | 38 | 36 | 25 | 38 | 33 | 23 | 38  | 28 | 19 | 33 | 24 | 16 | 28 | 20  | 14 | 24 | 18 | 12 | 21 | 15 | 11  | 19 | 14 | 10 |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 38 | 28 | 38 | 35 | 25 | 38 | 32 | 22 | 38 | 28 | 20 | 36 | 26 | 18  | 32 | 23 | 16 | 29 | 21 | 15 | 25  | 18 | 12 | 21 | 15 | 11 | 18 | 13  | 9  | 16 | 11 | 8  | 14 | 10 | 7   | 12 | 9  | 9  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 38                     | 38 | 38 | 38 | 34 | 38 | 38 | 30 | 38 | 37 | 27 | 38 | 33 | 24 | 38  | 30 | 22 | 38 | 28 | 20 | 32 | 23  | 17 | 27 | 20 | 14 | 24 | 17 | 12  | 20 | 15 | 11 | 18 | 13 | 9  | 16  | 11 | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 33 | 24 | 38 | 30 | 22 | 37 | 26 | 19 | 33 | 24 | 17 | 30 | 21 | 16  | 27 | 19 | 14 | 25 | 18 | 13 | 21  | 15 | 11 | 18 | 13 | 9  | 15 | 11  | 8  | 13 | 10 | 7  | 12 | 8  | 9   | 10 | 7  | 8  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 43                     | 43 | 43 | 43 | 41 | 43 | 43 | 43 | 37 | 43 | 40 | 33 | 43 | 36 | 30  | 43 | 33 | 27 | 43 | 30 | 24 | 43  | 25 | 21 | 37 | 21 | 18 | 32 | 18  | 15 | 28 | 16 | 13 | 24 | 14 | 12  | 22 | 12 | 10 |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 43                     | 36 | 29 | 43 | 32 | 26 | 43 | 29 | 23 | 43 | 26 | 21 | 41 | 23 | 19  | 37 | 21 | 17 | 34 | 19 | 16 | 28  | 16 | 13 | 24 | 14 | 11 | 21 | 12  | 10 | 18 | 10 | 8  | 16 | 9  | 7   | 14 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 47             | 47                     | 47 | 47 | 47 | 47 | 47 | 47 | 45 | 47 | 47 | 39 | 47 | 45 | 41 | 32  | 42 | 37 | 29 | 35 | 31 | 25 | 30  | 27 | 21 | 26 | 23 | 18 | 23 | 20  | 16 | 20 | 18 | 14 | 17 | 16 | 12  |    |    |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | Exposed               | 47             | 47                     | 35 | 47 | 40 | 31 | 40 | 36 | 28 | 36 | 32 | 25 | 33 | 29 | 23 | 30  | 26 | 21 | 27 | 24 | 19 | 23 | 20  | 16 | 19 | 17 | 14 | 17 | 15 | 12  | 15 | 13 | 10 | 13 | 11 | 9  | 11  | 10 | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 38                     | 38 | 29 | 38 | 38 | 26 | 38 | 34 | 23 | 38 | 30 | 21 | 38 | 27 | 19  | 34 | 25 | 17 | 31 | 22 | 16 | 26  | 19 | 13 | 22 | 16 | 11 | 19 | 14  | 10 | 17 | 12 | 8  | 15 | 11 | 7   | 13 | 9  | 10 |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 27 | 19 | 34 | 24 | 17 | 30 | 21 | 15 | 27 | 19 | 13 | 24 | 17 | 12  | 22 | 16 | 11 | 20 | 14 | 10 | 17  | 12 | 8  | 14 | 10 | 7  | 12 | 9   | 10 | 11 | 8  | 9  | 7  | 7  | 8   | 9  | 6  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 38                     | 35 | 26 | 38 | 31 | 23 | 38 | 28 | 20 | 35 | 25 | 18 | 32 | 23 | 17  | 29 | 21 | 15 | 26 | 19 | 14 | 22  | 16 | 12 | 19 | 13 | 10 | 16 | 12  | 8  | 14 | 10 | 7  | 12 | 9  | 10  | 11 | 8  | 9  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 31                     | 23 | 17 | 28 | 20 | 15 | 25 | 18 | 13 | 22 | 16 | 12 | 20 | 15 | 11  | 18 | 13 | 10 | 17 | 12 | 9  | 14  | 10 | 7  | 12 | 9  | 10 | 10 | 7   | 8  | 9  | 10 | 7  | 8  | 9  | 6   | 7  | 8  | 6  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 43                     | 38 | 31 | 43 | 34 | 28 | 43 | 30 | 25 | 43 | 27 | 22 | 44 | 25 | 20  | 39 | 22 | 18 | 36 | 20 | 17 | 30  | 17 | 14 | 25 | 15 | 12 | 22 | 13  | 10 | 19 | 11 | 9  | 17 | 10 | 8   | 15 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 43                     | 24 | 20 | 38 | 22 | 18 | 34 | 19 | 16 | 31 | 18 | 14 | 28 | 16 | 13  | 25 | 14 | 12 | 23 | 13 | 11 | 19  | 11 | 9  | 16 | 9  | 8  | 14 | 8   | 7  | 12 | 7  | 9  | 11 | 10 | 8   | 10 | 8  | 7  |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 47             | 47                     | 37 | 47 | 42 | 33 | 43 | 38 | 30 | 38 | 34 | 27 | 35 | 31 | 24 | 31  | 28 | 22 | 29 | 26 | 20 | 24 | 22  | 17 | 21 | 18 | 14 | 18 | 16 | 12  | 15 | 14 | 11 | 14 | 12 | 10 | 12  | 11 | 8  |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |
|                        |                        | Exposed               | 34             | 31                     | 24 | 31 | 27 | 21 | 27 | 24 | 19 | 25 | 22 | 17 | 22 | 20 | 16 | 20  | 18 | 14 | 19 | 14 | 11 | 13 | 12  | 9  | 11 | 13 | 12 | 9  | 11 | 10  | 8  | 10 | 9  |    |    |    |     |    |    |    |    |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |     |  |  |  |  |  |  |









ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

19 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## 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       | 77                     | 77 | 77 | 77 | 65 | 77 | 77  | 58 | 77 | 77  | 52 | 77 | 72  | 47 | 77 | 62  | 43 | 77 | 56  | 39 | 66 | 47  | 33 | 56 | 40  | 28 | 48 | 34  | 24 | 41 | 30  | 21 | 36 | 26  | 18 | 32 | 23  | 16 |    |    |
|                        |                        |                       | Exposed        | 77                     | 72 | 47 | 77 | 60 | 42 | 77  | 53 | 37 | 71  | 48 | 33 | 61  | 43 | 30 | 55  | 39 | 28 | 50  | 36 | 25 | 42  | 30 | 21 | 36  | 26 | 18 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 21  | 15 | 16 |    |
|                        |                        | 7-20                  | Interior       | 77                     | 77 | 64 | 77 | 77 | 57 | 77  | 77 | 51 | 77  | 63 | 46 | 77  | 57 | 41 | 77  | 51 | 37 | 65  | 47 | 34 | 54  | 39 | 29 | 46  | 33 | 25 | 40  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 16 | 27  | 20 | 14 |    |
|                        |                        |                       | Exposed        | 77                     | 56 | 41 | 77 | 50 | 36 | 62  | 45 | 33 | 56  | 40 | 29 | 50  | 36 | 27 | 46  | 33 | 24 | 42  | 30 | 22 | 35  | 25 | 19 | 30  | 22 | 16 | 26  | 19 | 14 | 22  | 16 | 12 | 20  | 14 | 16 | 17  | 13 | 14 |    |
|                        |                        | 20-27                 | Interior       | 78                     | 78 | 78 | 78 | 78 | 78 | 78  | 78 | 78 | 62  | 78 | 78 | 55  | 78 | 61 | 50  | 78 | 55 | 45  | 78 | 50 | 41  | 78 | 42 | 35  | 63 | 36 | 30  | 54 | 31 | 26  | 47 | 27 | 22  | 41 | 24 | 20  | 36 | 21 | 17 |
|                        |                        |                       | Exposed        | 78                     | 61 | 50 | 78 | 54 | 44 | 78  | 48 | 40 | 78  | 43 | 36 | 78  | 39 | 32 | 62  | 36 | 29 | 57  | 33 | 27 | 48  | 27 | 23 | 40  | 23 | 19 | 35  | 20 | 17 | 30  | 18 | 15 | 27  | 16 | 13 | 24  | 14 | 11 |    |
|                        | 27-45                  | Interior              | 80             | 80                     | 80 | 80 | 80 | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 71 | 80 | 80  | 60 | 80 | 80  | 54 | 80 | 63  | 50 | 60 | 53  | 42 | 51 | 45  | 36 | 44 | 39  | 31 | 38 | 34  | 27 | 33 | 24  | 30 | 27 | 21 |
|                        |                        | Exposed               | 80             | 80                     | 60 | 80 | 74 | 53 | 80 | 60  | 47 | 61 | 54  | 43 | 55 | 49  | 39 | 50 | 45  | 35 | 46 | 41  | 32 | 38 | 34  | 27 | 33 | 29  | 23 | 28 | 25  | 20 | 25 | 22  | 18 | 22 | 20  | 15 | 19 | 17  | 14 |    |    |
|                        | C                      | 0-7                   | Interior       | 77                     | 77 | 50 | 77 | 64 | 44 | 77  | 57 | 39 | 77  | 51 | 35 | 64  | 46 | 32 | 58  | 42 | 29 | 53  | 38 | 27 | 44  | 32 | 22 | 38  | 27 | 19 | 32  | 23 | 17 | 28  | 20 | 14 | 25  | 18 | 13 | 22  | 16 | 11 |    |
|                        |                        |                       | Exposed        | 64                     | 46 | 32 | 57 | 41 | 28 | 51  | 36 | 25 | 45  | 33 | 23 | 41  | 30 | 21 | 37  | 27 | 19 | 34  | 25 | 17 | 29  | 21 | 15 | 24  | 18 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 12 | 13 | 14  | 16 | 11 |    |
|                        |                        | 7-20                  | Interior       | 77                     | 60 | 43 | 77 | 53 | 39 | 71  | 47 | 35 | 59  | 42 | 31 | 53  | 38 | 28 | 48  | 35 | 26 | 44  | 32 | 23 | 37  | 27 | 20 | 32  | 23 | 15 | 24  | 17 | 12 | 21  | 15 | 11 | 18  | 13 | 15 | 11  | 13 | 15 |    |
|                        |                        |                       | Exposed        | 53                     | 38 | 28 | 47 | 34 | 25 | 42  | 30 | 22 | 38  | 27 | 20 | 34  | 25 | 18 | 31  | 23 | 17 | 28  | 21 | 15 | 24  | 17 | 13 | 20  | 15 | 17 | 18  | 13 | 14 | 15  | 11 | 13 | 14  | 15 | 11 | 12  | 13 | 14 |    |
| 20-27                  |                        | Interior              | 78             | 65                     | 53 | 78 | 57 | 47 | 78 | 51  | 42 | 78 | 46  | 38 | 78 | 42  | 34 | 68 | 38  | 31 | 60 | 34  | 28 | 50 | 29  | 24 | 43 | 25  | 20 | 37 | 21  | 18 | 32 | 19  | 15 | 28 | 16  | 14 | 25 | 15  | 12 |    |    |
|                        |                        | Exposed               | 78             | 41                     | 34 | 64 | 37 | 30 | 57 | 33  | 27 | 52 | 30  | 24 | 47 | 27  | 22 | 42 | 24  | 20 | 39 | 22  | 18 | 32 | 19  | 16 | 28 | 16  | 13 | 24 | 14  | 11 | 21 | 12  | 15 | 18 | 16  | 13 | 16 | 14  | 12 |    |    |
| 27-45                  | Interior               | 80                    | 80             | 63                     | 80 | 80 | 56 | 80 | 64 | 50  | 65 | 58 | 45  | 58 | 52 | 41  | 53 | 47 | 37  | 48 | 43 | 34  | 41 | 36 | 29  | 35 | 31 | 25  | 30 | 27 | 21  | 26 | 23 | 19  | 23 | 21 | 16  | 20 | 18 | 14  |    |    |    |
|                        | Exposed                | 58                    | 52             | 41                     | 52 | 46 | 36 | 46 | 41 | 33  | 42 | 37 | 29  | 38 | 34 | 27  | 34 | 31 | 24  | 31 | 28 | 22  | 26 | 24 | 19  | 23 | 20 | 16  | 20 | 18 | 14  | 17 | 15 | 12  | 15 | 13 | 16  | 13 | 12 | 14  |    |    |    |
| D                      | 0-7                    | Interior              | 77             | 59                     | 41 | 77 | 52 | 36 | 66 | 47  | 33 | 59 | 42  | 29 | 53 | 38  | 27 | 48 | 34  | 24 | 44 | 31  | 22 | 37 | 26  | 19 | 31 | 23  | 16 | 27 | 20  | 14 | 23 | 17  | 12 | 21 | 15  | 16 | 18 | 13  | 14 |    |    |
|                        |                        | Exposed               | 53             | 38                     | 26 | 47 | 34 | 24 | 42 | 30  | 21 | 38 | 27  | 19 | 34 | 25  | 17 | 31 | 22  | 16 | 28 | 20  | 14 | 24 | 17  | 12 | 20 | 15  | 16 | 17 | 13  | 14 | 15 | 17  | 12 | 13 | 15  | 16 | 12 | 13  | 9  |    |    |
|                        | 7-20                   | Interior              | 77             | 49                     | 36 | 61 | 44 | 32 | 54 | 39  | 29 | 49 | 35  | 26 | 44 | 32  | 23 | 40 | 29  | 21 | 36 | 26  | 19 | 31 | 22  | 16 | 26 | 19  | 14 | 23 | 16  | 12 | 20 | 14  | 16 | 17 | 13  | 14 | 15 | 11  | 13 |    |    |
|                        |                        | Exposed               | 44             | 32                     | 23 | 39 | 28 | 21 | 35 | 25  | 19 | 31 | 23  | 17 | 28 | 21  | 15 | 26 | 19  | 14 | 24 | 17  | 13 | 20 | 14  | 16 | 17 | 12  | 14 | 15 | 16  | 12 | 13 | 14  | 10 | 11 | 12  | 9  | 15 | 11  | 8  |    |    |
|                        | 20-27                  | Interior              | 78             | 53                     | 44 | 78 | 47 | 39 | 78 | 42  | 35 | 70 | 38  | 31 | 60 | 34  | 28 | 54 | 31  | 26 | 50 | 29  | 24 | 42 | 24  | 20 | 35 | 21  | 17 | 31 | 18  | 15 | 27 | 16  | 13 | 23 | 14  | 11 | 21 | 12  | 15 |    |    |
|                        |                        | Exposed               | 60             | 34                     | 28 | 53 | 31 | 25 | 47 | 27  | 23 | 43 | 25  | 20 | 39 | 22  | 18 | 35 | 20  | 17 | 32 | 19  | 15 | 27 | 16  | 13 | 23 | 13  | 17 | 20 | 12  | 15 | 17 | 15  | 13 | 15 | 14  | 11 | 14 | 12  | 10 |    |    |
| 27-45                  | Interior               | 80                    | 70             | 52                     | 80 | 59 | 46 | 59 | 53 | 42  | 53 | 48 | 38  | 48 | 43 | 34  | 44 | 39 | 31  | 40 | 36 | 28  | 34 | 30 | 24  | 29 | 26 | 20  | 25 | 22 | 18  | 22 | 20 | 15  | 19 | 17 | 14  | 17 | 15 | 12  |    |    |    |
|                        | Exposed                | 48                    | 43             | 34                     | 43 | 38 | 30 | 38 | 34 | 27  | 35 | 31 | 24  | 31 | 28 | 22  | 29 | 26 | 20  | 26 | 23 | 18  | 22 | 20 | 16  | 19 | 17 | 13  | 16 | 15 | 12  | 14 | 13 | 15  | 13 | 11 | 13  | 17 | 15 | 12  |    |    |    |
| 10                     | B                      | 0-7                   | Interior       | 63                     | 63 | 63 | 63 | 63 | 63 | 58  | 63 | 63 | 52  | 63 | 63 | 47  | 63 | 62 | 43  | 63 | 56 | 39  | 63 | 47 | 33  | 56 | 40 | 28  | 48 | 34 | 24  | 41 | 30 | 21  | 36 | 26 | 18  | 32 | 23 | 16  |    |    |    |
|                        |                        |                       | Exposed        | 63                     | 63 | 47 | 63 | 60 | 42 | 63  | 53 | 37 | 63  | 48 | 33 | 61  | 43 | 30 | 55  | 39 | 28 | 50  | 36 | 25 | 42  | 30 | 21 | 36  | 26 | 18 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 21  | 15 | 16 |    |
|                        |                        | 7-20                  | Interior       | 63                     | 63 | 63 | 63 | 63 | 57 | 63  | 63 | 51 | 63  | 63 | 46 | 63  | 57 | 41 | 63  | 51 | 37 | 63  | 47 | 34 | 54  | 39 | 29 | 46  | 33 | 25 | 40  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 16 | 27  | 20 | 14 |    |
|                        |                        |                       | Exposed        | 63                     | 56 | 41 | 63 | 50 | 36 | 62  | 45 | 33 | 56  | 40 | 29 | 50  | 36 | 27 | 46  | 33 | 24 | 42  | 30 | 22 | 35  | 25 | 19 | 30  | 22 | 16 | 26  | 19 | 14 | 22  | 16 | 12 | 20  | 14 | 16 | 17  | 13 | 14 |    |
|                        |                        | 20-27                 | Interior       | 72                     | 72 | 72 | 72 | 72 | 72 | 72  | 72 | 62 | 72  | 72 | 55 | 72  | 61 | 50 | 72  | 55 | 45 | 72  | 50 | 41 | 72  | 42 | 35 | 63  | 36 | 30 | 54  | 31 | 26 | 47  | 27 | 22 | 41  | 24 | 20 | 36  | 21 | 17 |    |
|                        |                        |                       | Exposed        | 72                     | 61 | 50 | 72 | 54 | 44 | 72  | 48 | 40 | 72  | 43 | 36 | 72  | 39 | 32 | 62  | 36 | 29 | 57  | 33 | 27 | 48  | 27 | 23 | 40  | 23 | 19 | 35  | 20 | 17 | 30  | 18 | 15 | 27  | 16 | 13 | 24  | 14 | 11 |    |
|                        | 27-45                  | Interior              | 77             | 77                     | 77 | 77 | 77 | 77 | 77 | 77  | 77 | 77 | 71  | 77 | 77 | 60  | 77 | 77 | 63  | 50 | 60 | 53  | 42 | 51 | 45  | 36 | 44 | 39  | 31 | 38 | 34  | 27 | 33 | 24  | 27 | 33 | 24  | 30 | 24 | 30  | 27 | 21 |    |
|                        |                        | Exposed               | 77             | 77                     | 60 | 77 | 74 | 53 | 77 | 60  | 47 | 61 | 54  | 43 | 55 | 49  | 39 | 50 | 45  | 35 | 46 | 41  | 32 | 38 | 34  | 27 | 33 | 29  | 23 | 28 | 25  | 20 | 25 | 22  | 18 | 22 | 20  | 15 | 19 | 17  | 14 |    |    |
|                        | C                      | 0-7                   | Interior       | 63                     | 63 | 50 | 63 | 63 | 44 | 63  | 57 | 39 | 63  | 51 | 35 | 63  | 46 | 32 | 58  | 42 | 29 | 53  | 38 | 27 | 44  | 32 | 22 | 38  | 27 | 19 | 32  | 23 | 17 | 28  | 20 | 14 | 25  | 18 | 13 | 22  | 16 | 11 |    |
|                        |                        |                       | Exposed        | 63                     | 46 | 32 | 57 | 41 | 28 | 51  | 36 | 25 | 45  | 33 | 23 | 41  | 30 | 21 | 37  | 27 | 19 | 34  | 25 | 17 | 29  | 21 | 15 | 24  | 18 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 12 | 13 | 14  | 16 | 11 |    |
|                        |                        | 7-20                  | Interior       | 63                     | 60 | 43 | 63 | 53 | 39 | 63  | 47 | 35 | 59  | 42 | 31 | 53  | 38 | 28 | 48  | 35 | 26 | 44  | 32 | 23 | 37  | 27 | 20 | 32  | 23 | 15 | 24  | 17 | 12 | 21  | 15 | 11 | 18  | 13 | 15 | 11  | 13 | 15 |    |
|                        |                        |                       | Exposed        | 53                     | 38 | 28 | 47 | 34 | 25 | 42  | 30 | 22 | 38  | 27 | 20 | 34  | 25 | 18 | 31  | 23 | 17 | 28  | 21 | 15 | 24  | 17 | 13 | 20  | 15 | 17 | 18  | 13 | 14 | 15  | 11 | 13 | 14  | 15 | 11 | 12  | 13 | 10 |    |
| 20-27                  |                        | Interior              | 72             | 65                     | 53 | 72 | 57 | 47 | 72 | 51  | 42 | 72 | 46  | 38 | 72 | 42  | 34 | 68 | 38  | 31 | 60 | 34  | 28 | 50 | 29  | 24 | 43 | 25  | 20 | 37 | 21  | 18 | 32 | 19  | 15 | 28 | 16  | 14 | 25 | 15  | 12 |    |    |
|                        |                        | Exposed               | 72             | 41                     | 34 | 64 | 37 | 30 | 57 | 33  | 27 | 52 | 30  | 24 | 47 | 27  | 22 | 42 | 24  | 20 | 39 | 22  | 18 | 32 | 19  | 16 | 28 | 16  | 13 | 24 | 14  | 11 | 21 | 12  | 15 | 18 | 16  | 13 | 16 | 14  | 12 |    |    |
| 27-45                  | Interior               | 77                    | 77             | 63                     | 77 | 77 | 56 |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |









ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

23 sq.ft  
Module Area

PORTRAIT  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## 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         |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
| 0                      | B                      | 0-7                   | Interior       | 39                     | 39 | 37 | 39 | 39 | 32 | 39 | 39 | 29 | 39 | 38 | 26 | 39 | 34 | 23 | 39 | 30 | 21 | 39  | 28 | 19 | 32 | 23 | 16 | 27 | 20 | 14 | 24  | 17 | 12 | 20 | 15 | 10 | 18 | 13 | 9  | 16  | 11 | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 33 | 32 | 39 | 30 | 20 | 38 | 26 | 18 | 33 | 24 | 16 | 30 | 21 | 15 | 27 | 19 | 13 | 25  | 18 | 12 | 21 | 15 | 10 | 18 | 13 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 9  | 10  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 39                     | 39 | 32 | 39 | 39 | 28 | 39 | 35 | 25 | 39 | 31 | 22 | 39 | 28 | 20 | 35 | 25 | 18 | 32  | 23 | 17 | 27 | 19 | 14 | 23 | 16 | 12 | 20  | 14 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 13  | 7  | 10 | 7 | 8 |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 28 | 20 | 34 | 25 | 18 | 31 | 22 | 16 | 28 | 20 | 14 | 25 | 18 | 13 | 22 | 16 | 12 | 20  | 15 | 11 | 17 | 12 | 9  | 15 | 11 | 8  | 13  | 9  | 7  | 11 | 8  | 9  | 10 | 7  | 8  | 9   | 10 | 7  | 8 |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 40                     | 40 | 40 | 40 | 40 | 34 | 40 | 39 | 30 | 40 | 34 | 27 | 40 | 30 | 25 | 40 | 27 | 22 | 40  | 25 | 20 | 38 | 21 | 17 | 31 | 18 | 15 | 27  | 15 | 13 | 23 | 13 | 11 | 20 | 12 | 10 | 18  | 10 | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 40                     | 30 | 25 | 40 | 27 | 22 | 40 | 24 | 20 | 39 | 21 | 18 | 34 | 19 | 16 | 31 | 18 | 14 | 28  | 16 | 13 | 23 | 13 | 11 | 20 | 11 | 9  | 17  | 10 | 8  | 15 | 9  | 7  | 13 | 8  | 9  | 12  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 40             | 40                     | 40 | 40 | 40 | 40 | 40 | 40 | 37 | 40 | 40 | 33 | 40 | 39 | 30 | 40 | 34 | 27 | 35 | 31  | 24 | 27 | 35 | 31 | 24 | 27 | 25 | 22 | 18  | 22 | 19 | 15 | 19 | 17 | 13 | 16 | 15 | 12  | 13 | 10 |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 40             | 39                     | 29 | 39 | 33 | 26 | 34 | 30 | 23 | 30 | 23 | 20 | 27 | 21 | 27 | 24 | 19 | 25 | 22 | 17  | 23 | 20 | 16 | 19 | 17 | 13 | 16 | 14 | 11  | 14 | 12 | 10 | 12 | 11 | 9  | 11 | 10 | 7   | 9  | 8  | 7 |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 39                     | 36 | 24 | 39 | 31 | 22 | 39 | 28 | 19 | 35 | 25 | 17 | 32 | 23 | 16 | 29 | 13 | 22 | 16  | 11 | 19 | 13 | 9  | 16 | 11 | 8  | 14 | 10  | 7  | 12 | 9  | 9  | 11 | 8  | 9  | 11 | 8   | 8  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 23 | 16 | 28 | 20 | 14 | 25 | 18 | 12 | 22 | 16 | 11 | 20 | 15 | 10 | 18 | 13 | 9  | 17  | 12 | 8  | 14 | 10 | 7  | 12 | 9  | 9  | 10  | 7  | 8  | 9  | 10 | 7  | 8  | 9  | 6  | 7   | 8  | 5  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 39                     | 29 | 21 | 37 | 26 | 19 | 33 | 23 | 17 | 29 | 21 | 15 | 26 | 19 | 14 | 24 | 17 | 13 | 22  | 16 | 11 | 18 | 13 | 10 | 16 | 11 | 8  | 13  | 10 | 7  | 12 | 8  | 9  | 10 | 7  | 8  | 9   | 6  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 14  | 10 | 7  | 12 | 8  | 14 | 10 | 7  | 12 | 8   | 9  | 10 | 7  | 8  | 9  | 7  | 7  | 5  | 9   | 6  | 5  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 40                     | 32 | 26 | 40 | 28 | 23 | 40 | 25 | 21 | 40 | 23 | 19 | 36 | 20 | 17 | 33 | 19 | 15 | 30  | 17 | 14 | 25 | 14 | 12 | 21 | 12 | 10 | 18  | 10 | 9  | 16 | 9  | 7  | 14 | 8  | 7  | 12  | 7  | 9  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 36                     | 20 | 17 | 32 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12 | 23 | 13 | 11 | 21 | 12 | 10 | 19  | 11 | 9  | 17 | 10 | 8  | 16 | 9  | 7  | 13  | 8  | 10 | 9  | 7  | 8  | 7  | 6  | 7  | 6   | 5  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 40             | 40                     | 40 | 40 | 35 | 28 | 36 | 32 | 25 | 32 | 28 | 22 | 29 | 26 | 20 | 26 | 23 | 18 | 24 | 21  | 17 | 20 | 18 | 14 | 17 | 15 | 12 | 15 | 13  | 10 | 13 | 11 | 9  | 11 | 10 | 8  | 10 | 9   | 7  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 29             | 26                     | 20 | 26 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19 | 17 | 13 | 17 | 15 | 12 | 15 | 14  | 11 | 13 | 12 | 9  | 11 | 10 | 8  | 10 | 9   | 7  | 8  | 7  | 9  | 7  | 6  | 8  | 7  | 9   |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | D                      | 0-7                   | Interior       | 39                     | 29 | 20 | 37 | 26 | 18 | 32 | 23 | 16 | 29 | 21 | 14 | 26 | 19 | 13 | 24 | 17 | 12 | 22  | 15 | 11 | 18 | 13 | 9  | 15 | 11 | 8  | 13  | 10 | 7  | 11 | 8  | 9  | 10 | 7  | 8  | 9   | 10 | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 13 | 23 | 17 | 12 | 21 | 15 | 10 | 18 | 13 | 9  | 17 | 12 | 8  | 15 | 11 | 8  | 14  | 10 | 7  | 12 | 8  | 14 | 10 | 7  | 12 | 8   | 9  | 10 | 7  | 8  | 8  | 9  | 7  | 7  | 5   | 9  | 6  | 4 |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 34                     | 24 | 18 | 30 | 22 | 16 | 27 | 19 | 14 | 24 | 17 | 13 | 22 | 16 | 11 | 20 | 14 | 10 | 18  | 13 | 9  | 15 | 11 | 8  | 13 | 9  | 7  | 11  | 8  | 9  | 10 | 7  | 8  | 8  | 9  | 7  | 7   | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 22                     | 16 | 11 | 19 | 14 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 14 | 10 | 7  | 13 | 9  | 7  | 12  | 8  | 9  | 10 | 7  | 8  | 8  | 9  | 7  | 11  | 8  | 6  | 9  | 7  | 8  | 6  | 6  | 4  | 7   | 5  | 4  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 40                     | 26 | 22 | 40 | 23 | 19 | 37 | 21 | 17 | 33 | 19 | 15 | 30 | 17 | 14 | 27 | 15 | 13 | 24  | 14 | 12 | 21 | 12 | 10 | 17 | 10 | 8  | 15  | 9  | 7  | 13 | 8  | 9  | 11 | 7  | 8  | 10  | 9  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 30                     | 17 | 14 | 26 | 15 | 12 | 23 | 13 | 11 | 21 | 12 | 10 | 19 | 11 | 9  | 17 | 10 | 8  | 16  | 9  | 7  | 13 | 8  | 10 | 11 | 6  | 8  | 10  | 9  | 7  | 8  | 7  | 6  | 7  | 6  | 5  |     |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 38             | 33                     | 26 | 33 | 29 | 23 | 29 | 26 | 21 | 26 | 24 | 18 | 24 | 21 | 17 | 22 | 19 | 15 | 20 | 18  | 14 | 17 | 15 | 12 | 14 | 13 | 10 | 12 | 11  | 9  | 11 | 10 | 7  | 8  | 7  | 8  | 7  | 9   |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 24             | 21                     | 17 | 21 | 19 | 15 | 19 | 17 | 13 | 17 | 15 | 12 | 15 | 14 | 11 | 14 | 13 | 10 | 13 | 11  | 9  | 11 | 10 | 8  | 9  | 8  | 6  | 8  | 7   | 9  | 7  | 9  | 7  | 8  | 7  | 8  | 7  | 6   |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
| 10                     | B                      | 0-7                   | Interior       | 32                     | 32 | 32 | 32 | 32 | 32 | 32 | 29 | 32 | 32 | 26 | 32 | 32 | 23 | 32 | 30 | 21 | 32 | 28  | 19 | 32 | 23 | 16 | 27 | 20 | 14 | 24 | 17  | 12 | 20 | 15 | 10 | 18 | 13 | 9  | 16 | 11  | 8  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 32 | 32 | 32 | 30 | 30 | 32 | 26 | 18 | 32 | 24 | 16 | 30 | 21 | 15 | 27 | 19 | 13 | 25  | 18 | 12 | 21 | 15 | 10 | 18 | 13 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 9  | 10  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 32                     | 32 | 32 | 32 | 32 | 28 | 32 | 32 | 25 | 32 | 31 | 22 | 32 | 28 | 20 | 32 | 25 | 18 | 32  | 23 | 17 | 27 | 19 | 14 | 23 | 16 | 12 | 20  | 14 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 13  | 10 | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 28 | 20 | 32 | 25 | 18 | 31 | 22 | 16 | 28 | 20 | 14 | 25 | 18 | 13 | 22 | 16 | 12 | 20  | 15 | 11 | 17 | 12 | 9  | 15 | 11 | 8  | 13  | 9  | 7  | 11 | 8  | 9  | 10 | 7  | 8  | 8   | 9  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 36                     | 36 | 36 | 36 | 36 | 34 | 36 | 36 | 30 | 36 | 34 | 27 | 36 | 30 | 25 | 36 | 27 | 22 | 36  | 25 | 20 | 36 | 21 | 17 | 31 | 18 | 15 | 27  | 15 | 13 | 23 | 13 | 11 | 20 | 12 | 10 | 18  | 10 | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 36                     | 30 | 25 | 36 | 27 | 22 | 36 | 24 | 20 | 36 | 21 | 18 | 34 | 19 | 16 | 31 | 18 | 14 | 28  | 16 | 13 | 23 | 13 | 11 | 20 | 11 | 9  | 17  | 10 | 8  | 15 | 9  | 7  | 13 | 8  | 9  | 12  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 39             | 39                     | 39 | 39 | 39 | 39 | 39 | 39 | 37 | 39 | 39 | 33 | 39 | 39 | 30 | 39 | 34 | 27 | 35 | 31  | 24 | 29 | 26 | 21 | 25 | 22 | 18 | 22 | 19  | 15 | 19 | 17 | 13 | 16 | 15 | 12 | 15 | 13  | 10 |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 39             | 39                     | 29 | 39 | 33 | 26 | 34 | 30 | 23 | 30 | 27 | 21 | 27 | 24 | 19 | 25 | 22 | 17 | 23 | 20  | 16 | 19 | 17 | 13 | 16 | 14 | 11 | 14 | 12  | 10 | 12 | 11 | 9  | 11 | 10 | 7  | 9  | 8   | 7  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 32                     | 32 | 24 | 32 | 31 | 22 | 32 | 28 | 19 | 32 | 25 | 17 | 32 | 23 | 16 | 29 | 21 | 14 | 26  | 19 | 13 | 22 | 16 | 11 | 19 | 13 | 9  | 16  | 11 | 8  | 14 | 10 | 7  | 12 | 9  | 9  | 11  | 8  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 23 | 16 | 28 | 20 | 14 | 25 | 18 | 12 | 22 | 16 | 11 | 20 | 15 | 10 | 18 | 13 | 9  | 17  | 12 | 8  | 14 | 10 | 7  | 12 | 9  | 9  | 10  | 7  | 8  | 9  | 10 | 7  | 8  | 9  | 6  | 7   | 8  | 5  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 32                     | 29 | 21 | 32 | 26 | 19 | 32 | 23 | 17 | 29 | 21 | 15 | 26 | 19 | 14 | 24 | 17 | 13 | 22  | 16 | 11 | 18 | 13 | 10 | 16 | 11 | 8  | 13  | 10 | 7  | 12 | 8  | 9  | 10 | 7  | 8  | 9   | 6  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 14  | 10 | 7  | 12 | 8  | 14 | 10 | 7  | 12 | 8   | 9  | 10 | 7  | 8  | 9  | 7  | 7  | 5  | 9   | 6  | 5  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 36                     | 32 | 26 | 36 | 28 | 23 | 36 | 25 | 21 | 36 | 23 | 19 | 36 | 20 | 17 | 33 | 19 | 15 | 30  | 17 | 14 | 25 | 14 | 12 | 21 | 12 | 10 | 18  | 10 | 9  | 16 | 9  | 7  | 14 | 8  | 7  | 12  | 7  | 9  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 36                     | 20 | 17 | 32 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12 | 23 | 13 | 11 | 21 | 12 | 10 | 19  | 11 | 9  | 16 | 9  | 8  | 14 | 8  | 6  | 12  | 7  | 8  | 10 | 9  | 7  | 8  | 7  | 6  | 7   | 6  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 39             | 39                     | 31 | 39 | 35 | 28 | 36 | 32 | 25 | 32 | 28 | 22 | 29 | 26 | 20 | 26 | 23 | 18 | 24 | 21  | 17 | 20 | 18 | 14 | 17 | 15 | 12 | 15 | 13  | 10 | 13 | 11 | 9  | 11 | 10 | 8  | 10 | 9   | 7  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 29             | 26                     | 20 | 26 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19 | 17 | 13 | 17 | 15 | 12 | 15 | 14  | 11 | 13 | 12 | 9  | 11 | 10 | 8  | 10 | 9   | 7  | 8  | 7  | 9  | 7  | 6  | 8  | 7  | 9   |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | D                      | 0-7                   | Interior       | 32                     | 29 | 20 | 32 | 26 | 18 | 32 | 23 | 16 | 29 | 21 | 14 | 26 |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |









ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

23 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

SPAN TABLES

### 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  |     |    |    |    |
| 0                      | B                      | 0-7                   | Interior       | 75                     | 75 | 75 | 75 | 64 | 75 | 75  | 57 | 75 | 75  | 51 | 75 | 69  | 46 | 75 | 60  | 42 | 75 | 55  | 38 | 64 | 46  | 32 | 54 | 39  | 27 | 47 | 34  | 24 | 40 | 29  | 20 | 35 | 26  | 18 | 31 | 23  | 16 |    |    |
|                        |                        |                       | Exposed        | 75                     | 68 | 46 | 75 | 59 | 41 | 75  | 52 | 36 | 67  | 47 | 33 | 59  | 42 | 30 | 54  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 18 | 20  | 15 | 16 |    |
|                        |                        | 7-20                  | Interior       | 75                     | 75 | 63 | 75 | 56 | 75 | 56  | 75 | 50 | 75  | 61 | 45 | 75  | 55 | 40 | 75  | 50 | 37 | 64  | 46 | 33 | 53  | 38 | 28 | 45  | 33 | 24 | 39  | 28 | 21 | 34  | 25 | 18 | 30  | 22 | 16 | 26  | 19 | 14 |    |
|                        |                        |                       | Exposed        | 75                     | 55 | 40 | 75 | 49 | 36 | 61  | 44 | 32 | 55  | 39 | 29 | 49  | 35 | 26 | 45  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 16 | 17  | 12 | 14 |    |
|                        |                        | 20-27                 | Interior       | 77                     | 77 | 77 | 77 | 77 | 77 | 77  | 77 | 77 | 60  | 77 | 77 | 54  | 77 | 60 | 49  | 77 | 54 | 44  | 77 | 49 | 40  | 77 | 41 | 34  | 62 | 35 | 29  | 53 | 30 | 25  | 46 | 27 | 22  | 40 | 23 | 19  | 36 | 21 | 17 |
|                        |                        |                       | Exposed        | 77                     | 60 | 49 | 77 | 53 | 43 | 77  | 47 | 39 | 77  | 42 | 35 | 73  | 38 | 32 | 61  | 35 | 29 | 55  | 32 | 26 | 47  | 27 | 22 | 40  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 17 |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 78 | 78 | 78 | 78 | 78 | 78  | 78 | 78 | 78  | 65 | 78 | 78  | 59 | 78 | 53  | 78 | 62 | 48  | 58 | 52 | 41  | 50 | 44 | 35  | 43 | 38 | 30  | 37 | 33 | 26  | 33 | 29 | 23  | 29 | 26 | 20  |    |    |    |
|                        |                        | Exposed               | 78             | 78                     | 58 | 78 | 68 | 52 | 78 | 59  | 46 | 60 | 53  | 42 | 54 | 48  | 38 | 49 | 44  | 34 | 45 | 40  | 31 | 38 | 34  | 27 | 32 | 29  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 |    |    |
|                        | C                      | 0-7                   | Interior       | 75                     | 75 | 49 | 75 | 62 | 43 | 75  | 55 | 39 | 75  | 50 | 35 | 63  | 45 | 31 | 57  | 41 | 28 | 52  | 37 | 26 | 43  | 31 | 22 | 37  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 18 | 12 | 21  | 16 | 17 |    |
|                        |                        |                       | Exposed        | 63                     | 45 | 31 | 59 | 40 | 28 | 49  | 36 | 25 | 44  | 32 | 22 | 40  | 29 | 20 | 36  | 26 | 18 | 33  | 24 | 17 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 17 | 12 | 14  | 15 | 11 |    |
|                        |                        | 7-20                  | Interior       | 75                     | 58 | 42 | 75 | 52 | 38 | 65  | 46 | 34 | 58  | 42 | 30 | 52  | 38 | 28 | 47  | 34 | 25 | 43  | 31 | 23 | 36  | 26 | 19 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 17 | 18  | 13 | 15 |    |
|                        |                        |                       | Exposed        | 52                     | 37 | 27 | 46 | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 34  | 24 | 18 | 30  | 22 | 16 | 28  | 20 | 15 | 23  | 17 | 13 | 20  | 15 | 16 | 17  | 13 | 14 | 15  | 17 | 12 | 13  | 15 | 11 | 12  | 13 | 10 |    |
| 20-27                  |                        | Interior              | 77             | 63                     | 52 | 77 | 56 | 46 | 77 | 50  | 41 | 77 | 45  | 37 | 77 | 41  | 33 | 65 | 37  | 30 | 59 | 34  | 28 | 49 | 28  | 23 | 42 | 24  | 20 | 36 | 21  | 17 | 31 | 18  | 15 | 28 | 16  | 13 | 24 | 14  | 12 |    |    |
|                        |                        | Exposed               | 77             | 40                     | 33 | 63 | 36 | 30 | 56 | 32  | 27 | 50 | 29  | 24 | 46 | 26  | 22 | 41 | 24  | 20 | 38 | 22  | 18 | 32 | 18  | 15 | 27 | 16  | 13 | 23 | 14  | 17 | 20 | 12  | 15 | 18 | 16  | 13 | 16 | 14  | 12 |    |    |
| 27-45                  | Interior               | 78                    | 78             | 62                     | 78 | 78 | 55 | 78 | 63 | 49  | 63 | 56 | 44  | 57 | 51 | 40  | 52 | 46 | 36  | 47 | 42 | 33  | 40 | 36 | 28  | 34 | 30 | 24  | 29 | 26 | 21  | 26 | 23 | 18  | 23 | 20 | 16  | 20 | 18 | 14  |    |    |    |
|                        | Exposed                | 57                    | 51             | 40                     | 51 | 45 | 36 | 45 | 40 | 32  | 41 | 36 | 29  | 37 | 33 | 26  | 34 | 30 | 24  | 31 | 27 | 22  | 26 | 23 | 18  | 22 | 20 | 16  | 19 | 17 | 14  | 17 | 15 | 12  | 15 | 13 | 16  | 13 | 18 | 14  |    |    |    |
| D                      | 0-7                    | Interior              | 75             | 58                     | 40 | 75 | 51 | 36 | 64 | 46  | 32 | 57 | 41  | 29 | 52 | 37  | 26 | 47 | 34  | 24 | 43 | 31  | 22 | 36 | 26  | 18 | 31 | 22  | 16 | 26 | 19  | 13 | 23 | 17  | 18 | 20 | 15  | 16 | 18 | 13  | 14 |    |    |
|                        |                        | Exposed               | 51             | 37                     | 26 | 46 | 33 | 23 | 41 | 29  | 21 | 37 | 26  | 19 | 33 | 24  | 17 | 30 | 22  | 15 | 28 | 20  | 14 | 23 | 17  | 18 | 20 | 14  | 15 | 17 | 12  | 13 | 15 | 16  | 12 | 13 | 14  | 10 | 18 | 13  | 9  |    |    |
|                        | 7-20                   | Interior              | 75             | 48                     | 35 | 60 | 43 | 31 | 53 | 38  | 28 | 48 | 34  | 25 | 43 | 31  | 23 | 39 | 28  | 21 | 36 | 26  | 19 | 30 | 22  | 16 | 26 | 19  | 14 | 22 | 16  | 12 | 19 | 14  | 16 | 17 | 12  | 14 | 15 | 17  | 12 |    |    |
|                        |                        | Exposed               | 43             | 31                     | 23 | 38 | 28 | 20 | 34 | 25  | 18 | 31 | 22  | 16 | 28 | 20  | 15 | 25 | 18  | 14 | 23 | 17  | 12 | 19 | 14  | 16 | 17 | 12  | 14 | 14 | 16  | 12 | 13 | 14  | 10 | 17 | 12  | 9  | 15 | 11  | 8  |    |    |
|                        | 20-27                  | Interior              | 77             | 52                     | 43 | 77 | 46 | 38 | 77 | 41  | 34 | 65 | 37  | 31 | 59 | 34  | 28 | 53 | 31  | 25 | 49 | 28  | 23 | 41 | 24  | 19 | 35 | 20  | 17 | 30 | 17  | 14 | 26 | 15  | 12 | 23 | 13  | 17 | 20 | 12  | 15 |    |    |
|                        |                        | Exposed               | 59             | 34                     | 28 | 52 | 30 | 25 | 46 | 27  | 22 | 42 | 24  | 20 | 38 | 22  | 18 | 34 | 20  | 16 | 31 | 18  | 15 | 26 | 15  | 13 | 23 | 13  | 16 | 19 | 17  | 14 | 17 | 15  | 12 | 15 | 13  | 11 | 12 | 14  | 10 |    |    |
| 27-45                  | Interior               | 78                    | 65             | 51                     | 65 | 58 | 45 | 58 | 52 | 41  | 52 | 47 | 37  | 47 | 42 | 33  | 43 | 38 | 30  | 39 | 35 | 28  | 33 | 30 | 23  | 28 | 25 | 20  | 24 | 22 | 17  | 21 | 19 | 15  | 19 | 17 | 13  | 17 | 15 | 12  |    |    |    |
|                        | Exposed                | 47                    | 42             | 33                     | 42 | 37 | 30 | 38 | 34 | 26  | 34 | 30 | 24  | 31 | 27 | 22  | 28 | 25 | 20  | 25 | 23 | 18  | 22 | 19 | 15  | 18 | 16 | 13  | 16 | 14 | 17  | 14 | 12 | 15  | 12 | 17 | 13  | 16 | 15 | 12  |    |    |    |
| 10                     | B                      | 0-7                   | Interior       | 61                     | 61 | 61 | 61 | 61 | 61 | 61  | 57 | 61 | 61  | 51 | 61 | 61  | 46 | 61 | 60  | 42 | 61 | 55  | 38 | 61 | 46  | 32 | 54 | 39  | 27 | 47 | 34  | 24 | 40 | 29  | 20 | 35 | 26  | 18 | 31 | 23  | 16 |    |    |
|                        |                        |                       | Exposed        | 61                     | 61 | 46 | 61 | 59 | 41 | 61  | 52 | 36 | 61  | 47 | 33 | 59  | 42 | 30 | 54  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 18 | 20  | 15 | 16 |    |
|                        |                        | 7-20                  | Interior       | 62                     | 62 | 62 | 62 | 62 | 56 | 62  | 62 | 50 | 62  | 61 | 45 | 62  | 55 | 40 | 62  | 50 | 37 | 62  | 46 | 33 | 53  | 38 | 28 | 45  | 33 | 24 | 39  | 28 | 21 | 34  | 25 | 18 | 30  | 22 | 16 | 26  | 19 | 14 |    |
|                        |                        |                       | Exposed        | 62                     | 55 | 40 | 62 | 49 | 36 | 61  | 44 | 32 | 55  | 39 | 29 | 49  | 35 | 26 | 45  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 16 | 17  | 12 | 14 |    |
|                        |                        | 20-27                 | Interior       | 70                     | 70 | 70 | 70 | 70 | 70 | 70  | 70 | 60 | 70  | 70 | 54 | 70  | 60 | 49 | 70  | 54 | 44 | 70  | 49 | 40 | 70  | 41 | 34 | 62  | 35 | 29 | 53  | 30 | 25 | 46  | 27 | 22 | 40  | 23 | 19 | 36  | 21 | 17 |    |
|                        |                        |                       | Exposed        | 70                     | 60 | 49 | 70 | 53 | 43 | 70  | 47 | 39 | 70  | 42 | 35 | 70  | 38 | 32 | 61  | 35 | 29 | 55  | 32 | 26 | 47  | 27 | 22 | 40  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 17 |    |
|                        | 27-45                  | Interior              | 76             | 76                     | 76 | 76 | 76 | 76 | 76 | 76  | 76 | 76 | 65  | 76 | 76 | 59  | 76 | 75 | 53  | 76 | 62 | 48  | 58 | 52 | 41  | 50 | 44 | 35  | 43 | 38 | 30  | 37 | 33 | 26  | 33 | 29 | 23  | 29 | 26 | 20  |    |    |    |
|                        |                        | Exposed               | 76             | 76                     | 58 | 76 | 68 | 52 | 76 | 59  | 46 | 60 | 53  | 42 | 54 | 48  | 38 | 49 | 44  | 34 | 45 | 40  | 31 | 38 | 34  | 27 | 32 | 29  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 |    |    |
|                        | C                      | 0-7                   | Interior       | 61                     | 61 | 49 | 61 | 61 | 43 | 61  | 55 | 39 | 61  | 50 | 35 | 61  | 45 | 31 | 57  | 41 | 28 | 52  | 37 | 26 | 43  | 31 | 22 | 37  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 18 | 12 | 21  | 16 | 17 |    |
|                        |                        |                       | Exposed        | 61                     | 45 | 31 | 55 | 40 | 28 | 49  | 36 | 25 | 44  | 32 | 22 | 40  | 29 | 20 | 36  | 26 | 18 | 33  | 24 | 17 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 17 | 12 | 14  | 15 | 11 |    |
|                        |                        | 7-20                  | Interior       | 62                     | 58 | 42 | 62 | 52 | 38 | 62  | 46 | 34 | 58  | 42 | 30 | 52  | 38 | 28 | 47  | 34 | 25 | 43  | 31 | 23 | 36  | 26 | 19 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 17 | 18  | 13 | 15 |    |
|                        |                        |                       | Exposed        | 52                     | 37 | 27 | 46 | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 34  | 24 | 18 | 30  | 22 | 16 | 28  | 20 | 15 | 23  | 17 | 13 | 20  | 15 | 16 | 17  | 13 | 14 | 15  | 17 | 12 | 13  | 15 | 11 | 12  | 13 | 10 |    |
| 20-27                  |                        | Interior              | 70             | 63                     | 52 | 70 | 56 | 46 | 70 | 50  | 41 | 70 | 45  | 37 | 70 | 41  | 33 | 65 | 37  | 30 | 59 | 34  | 28 | 49 | 28  | 23 | 42 | 24  | 20 | 36 | 21  | 17 | 31 | 18  | 15 | 28 | 16  | 13 | 24 | 14  | 12 |    |    |
|                        |                        | Exposed               | 70             | 40                     | 33 | 63 | 36 | 30 | 56 | 32  | 27 | 50 | 29  | 24 | 46 | 26  | 22 | 41 | 24  | 20 | 38 | 22  | 18 | 32 | 18  | 15 | 27 | 16  | 13 | 23 | 14  | 17 | 20 | 12  | 15 | 18 | 16  | 13 | 16 | 14  | 12 |    |    |
| 27-45                  | Interior               | 76                    | 76             | 62                     | 76 | 76 | 55 | 76 | 63 | 49  | 63 | 56 | 44  | 57 | 51 | 40  |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |







## 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         |    |    |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |
| 0                      | B                      | 0-7                   | Interior       | 46                     | 46 | 44 | 46 | 46 | 39 | 46  | 46 | 34 | 46  | 46 | 31 | 46  | 40 | 28 | 46  | 36 | 25 | 46  | 33 | 39 | 28  | 19 | 33 | 24  | 16 | 28 | 20  | 14 | 24 | 18  | 12 | 21 | 15  | 11 | 19 | 14  | 10 |    |
|                        |                        |                       | Exposed        | 46                     | 40 | 38 | 46 | 35 | 25 | 45  | 32 | 22 | 40  | 28 | 20 | 36  | 26 | 18 | 32  | 23 | 16 | 29  | 21 | 15 | 25  | 18 | 12 | 21  | 15 | 11 | 18  | 13 | 9  | 16  | 11 | 8  | 14  | 10 | 7  | 12  | 9  | 9  |
|                        |                        |                       | Interior       | 47                     | 47 | 47 | 47 | 47 | 34 | 47  | 41 | 30 | 47  | 37 | 27 | 47  | 33 | 24 | 42  | 30 | 22 | 38  | 28 | 20 | 32  | 23 | 17 | 27  | 20 | 14 | 24  | 17 | 12 | 20  | 15 | 11 | 18  | 13 | 9  | 16  | 11 | 8  |
|                        |                        | 7-20                  | Interior       | 47                     | 47 | 47 | 47 | 47 | 41 | 47  | 47 | 47 | 37  | 47 | 40 | 33  | 47 | 36 | 30  | 47 | 30 | 24  | 45 | 25 | 21  | 37 | 21 | 18  | 32 | 18 | 15  | 28 | 16 | 13  | 24 | 14 | 12  | 22 | 12 | 10  |    |    |
|                        |                        |                       | Exposed        | 47                     | 33 | 24 | 41 | 30 | 22 | 37  | 26 | 19 | 33  | 24 | 17 | 30  | 21 | 16 | 27  | 19 | 14 | 25  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 9  | 15  | 11 | 8  | 13  | 10 | 7  | 12  | 8  | 9  | 10  | 7  | 8  |
|                        |                        |                       | Interior       | 47                     | 47 | 47 | 47 | 47 | 41 | 47  | 47 | 47 | 47  | 37 | 47 | 40  | 33 | 47 | 36  | 30 | 47 | 30  | 24 | 45 | 25  | 21 | 37 | 21  | 18 | 32 | 18  | 15 | 28 | 16  | 13 | 24 | 14  | 12 | 22 | 12  | 10 |    |
|                        | 20-27                  | Interior              | 47             | 47                     | 47 | 47 | 47 | 41 | 47 | 47  | 47 | 37 | 47  | 40 | 33 | 47  | 36 | 30 | 47  | 30 | 24 | 45  | 25 | 21 | 37  | 21 | 18 | 32  | 18 | 15 | 28  | 16 | 13 | 24  | 14 | 12 | 22  | 12 | 10 |     |    |    |
|                        |                        | Exposed               | 47             | 36                     | 29 | 47 | 32 | 26 | 47 | 29  | 23 | 47 | 26  | 21 | 41 | 23  | 19 | 37 | 21  | 17 | 34 | 19  | 16 | 28 | 16  | 13 | 24 | 14  | 11 | 21 | 12  | 10 | 18 | 10  | 8  | 16 | 9   | 7  | 14 | 8   | 7  |    |
|                        |                        | Interior              | 48             | 48                     | 48 | 48 | 48 | 48 | 48 | 48  | 48 | 48 | 39  | 48 | 41 | 39  | 48 | 41 | 32  | 42 | 37 | 29  | 35 | 31 | 25  | 30 | 27 | 21  | 26 | 23 | 18  | 23 | 20 | 16  | 20 | 18 | 14  | 17 | 16 | 12  |    |    |
|                        | 27-45                  | Interior              | 48             | 47                     | 35 | 47 | 40 | 31 | 40 | 36  | 28 | 36 | 32  | 25 | 33 | 29  | 23 | 30 | 26  | 21 | 27 | 24  | 19 | 23 | 20  | 16 | 19 | 17  | 14 | 17 | 15  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  |    |
|                        |                        | Exposed               | 48             | 47                     | 35 | 47 | 40 | 31 | 40 | 36  | 28 | 36 | 32  | 25 | 33 | 29  | 23 | 30 | 26  | 21 | 27 | 24  | 19 | 23 | 20  | 16 | 19 | 17  | 14 | 17 | 15  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  |    |
|                        |                        | Interior              | 46             | 43                     | 29 | 46 | 38 | 26 | 46 | 34  | 23 | 42 | 30  | 21 | 38 | 27  | 19 | 34 | 25  | 17 | 31 | 22  | 16 | 26 | 19  | 13 | 22 | 16  | 11 | 19 | 14  | 10 | 17 | 12  | 8  | 15 | 11  | 7  | 13 | 9   | 10 |    |
| C                      | 0-7                    | Interior              | 38             | 27                     | 19 | 34 | 24 | 17 | 30 | 21  | 15 | 27 | 19  | 13 | 24 | 17  | 12 | 22 | 16  | 11 | 20 | 14  | 10 | 17 | 12  | 8  | 14 | 10  | 7  | 12 | 9   | 10 | 11 | 8   | 9  | 10 | 11  | 8  | 9  | 6   |    |    |
|                        |                        | Exposed               | 41             | 29                     | 21 | 36 | 26 | 19 | 32 | 23  | 17 | 29 | 21  | 15 | 26 | 19  | 14 | 24 | 17  | 12 | 22 | 16  | 11 | 18 | 13  | 10 | 15 | 11  | 8  | 13 | 10  | 7  | 12 | 8   | 9  | 10 | 7   | 8  | 9  | 10  | 7  |    |
|                        |                        | Interior              | 47             | 47                     | 47 | 47 | 47 | 41 | 47 | 47  | 47 | 47 | 37  | 47 | 40 | 33  | 47 | 36 | 30  | 47 | 30 | 24  | 45 | 25 | 21  | 37 | 21 | 18  | 32 | 18 | 15  | 28 | 16 | 13  | 24 | 14 | 12  | 22 | 12 | 10  |    |    |
|                        | 7-20                   | Interior              | 37             | 23                     | 17 | 28 | 20 | 15 | 25 | 18  | 13 | 22 | 16  | 12 | 20 | 15  | 11 | 18 | 13  | 10 | 17 | 12  | 9  | 14 | 10  | 7  | 12 | 9   | 10 | 10 | 7   | 8  | 9  | 10  | 7  | 8  | 9   | 6  | 7  | 8   | 6  |    |
|                        |                        | Exposed               | 47             | 38                     | 31 | 47 | 34 | 28 | 47 | 30  | 25 | 47 | 27  | 22 | 44 | 25  | 20 | 39 | 22  | 18 | 36 | 20  | 17 | 30 | 17  | 14 | 25 | 15  | 12 | 22 | 13  | 10 | 19 | 11  | 9  | 17 | 10  | 8  | 15 | 8   | 7  |    |
|                        |                        | Interior              | 43             | 24                     | 20 | 38 | 22 | 18 | 34 | 19  | 16 | 31 | 18  | 14 | 28 | 16  | 13 | 25 | 14  | 12 | 23 | 13  | 11 | 19 | 11  | 9  | 16 | 9   | 8  | 14 | 8   | 7  | 12 | 7   | 9  | 11 | 10  | 8  | 10 | 8   | 7  |    |
| 20-27                  | Interior               | 48                    | 48             | 37                     | 48 | 42 | 33 | 43 | 38 | 30  | 38 | 34 | 27  | 35 | 31 | 24  | 31 | 28 | 22  | 29 | 26 | 20  | 24 | 22 | 17  | 21 | 18 | 14  | 18 | 16 | 12  | 15 | 14 | 11  | 14 | 12 | 10  | 12 | 11 | 8   |    |    |
|                        | Exposed                | 34                    | 31             | 24                     | 31 | 27 | 21 | 27 | 24 | 19  | 25 | 22 | 17  | 22 | 20 | 16  | 20 | 18 | 14  | 19 | 17 | 13  | 16 | 14 | 11  | 13 | 12 | 9   | 11 | 10 | 8   | 10 | 9  | 7   | 9  | 8  | 9   | 8  | 7  | 8   |    |    |
|                        | Interior               | 46                    | 35             | 24                     | 44 | 31 | 22 | 39 | 28 | 19  | 35 | 25 | 17  | 31 | 22 | 16  | 28 | 20 | 14  | 26 | 19 | 13  | 22 | 16 | 11  | 18 | 13 | 9   | 16 | 11 | 8   | 14 | 10 | 7   | 12 | 9  | 11  | 8  | 8  |     |    |    |
| 27-45                  | Interior               | 31                    | 22             | 16                     | 28 | 20 | 14 | 25 | 18 | 12  | 22 | 16 | 11  | 20 | 14 | 10  | 18 | 13 | 9   | 17 | 12 | 8   | 14 | 10 | 7   | 12 | 9  | 10  | 7  | 8  | 9   | 10 | 7  | 8   | 9  | 6  | 7   | 8  | 5  |     |    |    |
|                        | Exposed                | 41                    | 29             | 21                     | 36 | 26 | 19 | 32 | 23 | 17  | 29 | 21 | 15  | 26 | 19 | 14  | 24 | 17 | 12  | 22 | 16 | 11  | 18 | 13 | 10  | 15 | 11 | 8   | 13 | 10 | 7   | 12 | 8  | 9   | 10 | 7  | 8   | 9  | 10 | 7   |    |    |
|                        | Interior               | 26                    | 19             | 14                     | 23 | 17 | 12 | 21 | 15 | 11  | 19 | 13 | 10  | 17 | 12 | 9   | 15 | 11 | 8   | 14 | 10 | 7   | 12 | 8  | 9   | 10 | 7  | 8   | 9  | 10 | 7   | 8  | 9  | 6   | 7  | 8  | 9   | 6  | 5  |     |    |    |
| D                      | 0-7                    | Interior              | 47             | 31                     | 26 | 47 | 28 | 23 | 45 | 25  | 21 | 39 | 22  | 18 | 36 | 20  | 17 | 32 | 18  | 15 | 29 | 17  | 14 | 25 | 14  | 12 | 21 | 12  | 10 | 18 | 10  | 9  | 16 | 9   | 7  | 14 | 8   | 10 | 12 | 7   | 9  |    |
|                        |                        | Exposed               | 35             | 20                     | 17 | 31 | 18 | 15 | 28 | 16  | 13 | 25 | 15  | 12 | 23 | 13  | 11 | 21 | 12  | 10 | 19 | 11  | 9  | 16 | 9   | 8  | 14 | 8   | 10 | 12 | 7   | 8  | 10 | 9   | 7  | 9  | 8   | 6  | 8  | 7   | 6  |    |
|                        |                        | Interior              | 46             | 39                     | 31 | 39 | 35 | 28 | 35 | 31  | 25 | 32 | 28  | 22 | 29 | 26  | 20 | 26 | 23  | 18 | 24 | 21  | 17 | 20 | 18  | 14 | 17 | 15  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  | 10 | 9   | 7  |    |
|                        | 7-20                   | Interior              | 28             | 25                     | 20 | 25 | 23 | 18 | 23 | 20  | 16 | 20 | 18  | 14 | 19 | 17  | 13 | 17 | 15  | 12 | 15 | 14  | 11 | 13 | 12  | 9  | 11 | 10  | 8  | 10 | 9   | 7  | 8  | 7   | 9  | 7  | 10  | 8  | 10 | 9   | 7  |    |
|                        |                        | Exposed               | 28             | 25                     | 20 | 25 | 23 | 18 | 23 | 20  | 16 | 20 | 18  | 14 | 19 | 17  | 13 | 17 | 15  | 12 | 15 | 14  | 11 | 13 | 12  | 9  | 11 | 10  | 8  | 10 | 9   | 7  | 8  | 7   | 9  | 7  | 10  | 8  | 10 | 9   | 7  |    |
|                        |                        | Interior              | 28             | 28                     | 28 | 28 | 28 | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 |
| 20-27                  | Interior               | 28                    | 28             | 28                     | 28 | 28 | 28 | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 | 28 | 28  | 28 |    |
|                        | Exposed                | 34                    | 34             | 34                     | 34 | 34 | 34 | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 | 34 | 34  | 34 |    |
|                        | Interior               | 34                    | 34             | 29                     | 34 | 32 | 26 | 34 | 29 | 23  | 34 | 26 | 21  | 34 | 23 | 19  | 34 | 21 | 17  | 34 | 19 | 16  | 28 | 16 | 13  | 24 | 14 | 11  | 21 | 12 | 10  | 18 | 10 | 8   | 16 | 9  | 7   | 14 | 8  | 7   |    |    |
| 27-45                  | Interior               | 38                    | 38             | 38                     | 38 | 38 | 38 | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 | 38 | 38  | 38 |    |
|                        | Exposed                | 38                    | 38             | 35                     | 38 | 38 | 31 | 38 | 36 | 32  | 25 | 33 | 29  | 23 | 30 | 26  | 21 | 27 | 24  | 19 | 23 | 20  | 16 | 19 | 17  | 14 | 17 | 15  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  | 10 | 8   |    |    |
|                        | Interior               | 28                    | 28             | 28                     | 28 | 28 | 26 | 28 | 28 | 23  | 28 | 28 | 21  | 28 | 27 | 19  | 28 | 25 | 17  | 28 | 22 | 16  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 8  | 15  | 11 | 7  | 13  | 9  | 10 |     |    |    |
| 20                     | C                      | 0-7                   | Interior       | 28                     | 27 | 19 | 28 | 24 | 17 | 28  | 21 | 15 | 27  | 19 | 13 | 24  | 17 | 12 | 22  | 16 | 11 | 20  | 14 | 10 | 17  | 12 | 8  | 14  | 10 | 7  | 12  | 9  | 10 | 11  | 8  | 9  | 10  | 11 | 8  | 9   |    |    |
|                        |                        |                       | Exposed        | 28                     | 28 | 26 | 28 | 28 | 23 | 28  | 28 | 25 | 18  | 28 | 23 | 17  | 28 | 21 | 15  | 26 | 19 | 14  | 22 | 16 | 12  | 19 | 13 | 10  | 16 | 12 | 8   | 14 | 10 | 7   | 12 | 9  | 10  | 11 | 8  | 9   |    |    |
|                        |                        |                       | Interior       | 28                     | 23 | 17 | 28 | 20 | 15 | 25  | 18 | 13 | 22  | 16 | 12 | 20  | 15 | 11 | 18  | 13 | 10 | 17  | 12 | 9  | 14  | 10 | 7  | 12  | 9  | 10 | 10  | 7  | 8  | 9   | 10 | 7  | 8   | 9  | 6  | 7   | 8  | 6  |
|                        | 7-20                   | Interior              | 34             | 34                     | 31 | 34 | 34 | 28 | 34 | 30  | 25 | 34 | 27  | 22 | 34 | 25  | 20 | 34 | 22  | 18 | 34 | 20  | 17 | 30 | 17  | 14 | 25 | 15  | 12 | 22 | 13  | 10 | 19 | 11  | 9  | 17 | 10  |    |    |     |    |    |

















ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

23 sq.ft  
Module Area

PORTRAIT  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

SPAN TABLES

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 |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 0                      | B                      | 0-7                   | Interior       | 39                     | 39 | 37 | 39 | 39 | 32 | 39 | 39 | 29 | 39 | 38  | 26 | 39 | 34 | 23 | 39  | 30 | 21 | 39 | 28 | 19  | 32 | 23 | 16 | 27 | 20  | 14 | 24 | 17 | 12 | 20  | 15 | 10 | 18 | 13 | 9   | 16 | 11 | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 33 | 32 | 39 | 30 | 20 | 38 | 26 | 18 | 33 | 24  | 16 | 30 | 21 | 15 | 27  | 19 | 13 | 25 | 18 | 12  | 21 | 15 | 10 | 18 | 13  | 9  | 15 | 11 | 8  | 13  | 9  | 7  | 11 | 8  | 9   | 10 | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 39                     | 39 | 32 | 39 | 39 | 28 | 39 | 35 | 25 | 39 | 31  | 22 | 39 | 28 | 20 | 35  | 25 | 18 | 32 | 23 | 17  | 27 | 19 | 14 | 23 | 16  | 12 | 20 | 14 | 10 | 17  | 12 | 9  | 15 | 11 | 8   | 13 | 10 | 7  | 8 |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 28 | 20 | 34 | 25 | 18 | 31 | 22 | 16 | 28 | 20  | 14 | 25 | 18 | 13 | 22  | 16 | 12 | 20 | 15 | 11  | 17 | 12 | 9  | 15 | 11  | 8  | 13 | 9  | 7  | 11  | 8  | 9  | 10 | 7  | 8   | 9  | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 40                     | 40 | 40 | 40 | 40 | 34 | 40 | 39 | 30 | 40 | 34  | 27 | 40 | 30 | 25 | 40  | 25 | 20 | 38 | 21 | 17  | 31 | 18 | 15 | 27 | 15  | 13 | 23 | 13 | 11 | 20  | 12 | 10 | 18 | 10 | 8   | 10 | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 40                     | 30 | 25 | 40 | 27 | 22 | 40 | 24 | 20 | 39 | 21  | 18 | 34 | 19 | 16 | 31  | 18 | 14 | 28 | 16 | 13  | 23 | 13 | 11 | 20 | 11  | 9  | 17 | 10 | 8  | 15  | 9  | 7  | 13 | 8  | 9   | 12 | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | 27-45                  | Interior              | 40             | 40                     | 40 | 40 | 40 | 40 | 40 | 40 | 37 | 40 | 40 | 33  | 40 | 39 | 30 | 40 | 34  | 27 | 35 | 31 | 24 | 27  | 35 | 31 | 24 | 27 | 25  | 22 | 18 | 22 | 19 | 15  | 19 | 17 | 13 | 16 | 15  | 12 | 13 | 10 |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 40             | 39                     | 29 | 39 | 33 | 26 | 34 | 30 | 23 | 30 | 23 | 20  | 27 | 21 | 27 | 24 | 19  | 25 | 22 | 17 | 23 | 20  | 16 | 19 | 17 | 13 | 16  | 14 | 11 | 14 | 12 | 10  | 12 | 11 | 9  | 11 | 10  | 7  | 9  | 8  | 7 |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 39                     | 36 | 24 | 39 | 31 | 22 | 39 | 28 | 19 | 35 | 25  | 17 | 32 | 23 | 16 | 29  | 13 | 22 | 16 | 11 | 19  | 13 | 9  | 16 | 11 | 8   | 14 | 10 | 7  | 12 | 9   | 9  | 11 | 8  | 9  | 11  | 8  | 8  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 23 | 16 | 28 | 20 | 14 | 25 | 18 | 12 | 22 | 16  | 11 | 20 | 15 | 10 | 18  | 13 | 9  | 17 | 12 | 8   | 14 | 10 | 7  | 12 | 9   | 9  | 10 | 7  | 8  | 9   | 10 | 7  | 8  | 9  | 6   | 7  | 8  | 5  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 39                     | 29 | 21 | 37 | 26 | 19 | 33 | 23 | 17 | 29 | 21  | 15 | 26 | 19 | 14 | 24  | 17 | 13 | 22 | 16 | 11  | 18 | 13 | 10 | 16 | 11  | 8  | 13 | 10 | 7  | 12  | 8  | 9  | 10 | 7  | 8   | 9  | 6  | 7  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13  | 10 | 17 | 12 | 9  | 15  | 11 | 8  | 14 | 10 | 7   | 12 | 8  | 14 | 10 | 7   | 8  | 9  | 10 | 7  | 8   | 9  | 10 | 7  | 7  | 5   | 9  | 6  | 5  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 20-27                  |                        | Interior              | 40             | 32                     | 26 | 40 | 28 | 23 | 40 | 25 | 21 | 40 | 23 | 19  | 36 | 20 | 17 | 33 | 19  | 15 | 30 | 17 | 14 | 25  | 14 | 12 | 21 | 12 | 10  | 18 | 10 | 9  | 16 | 9   | 7  | 14 | 8  | 7  | 12  | 7  | 9  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 36             | 20                     | 17 | 32 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12  | 23 | 13 | 11 | 21 | 12  | 10 | 19 | 11 | 9  | 17  | 10 | 8  | 16 | 9  | 7   | 13 | 8  | 10 | 9  | 7   | 8  | 7  | 6  | 7  | 6   | 5  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 27-45                  | Interior               | 40                    | 40             | 40                     | 40 | 35 | 28 | 36 | 32 | 25 | 32 | 28 | 22 | 29  | 26 | 20 | 26 | 23 | 18  | 24 | 21 | 17 | 20 | 18  | 14 | 17 | 15 | 12 | 15  | 13 | 10 | 13 | 11 | 9   | 11 | 10 | 8  | 10 | 9   | 7  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | Exposed                | 29                    | 26             | 20                     | 26 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19  | 17 | 13 | 17 | 15 | 12  | 15 | 14 | 11 | 13 | 12  | 9  | 11 | 10 | 8  | 10  | 9  | 7  | 8  | 7  | 9   | 7  | 8  | 7  | 8  | 7   | 9  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| D                      | 0-7                    | Interior              | 39             | 29                     | 20 | 37 | 26 | 18 | 32 | 23 | 16 | 29 | 21 | 14  | 26 | 19 | 13 | 24 | 17  | 12 | 22 | 15 | 11 | 18  | 13 | 9  | 15 | 11 | 8   | 13 | 10 | 7  | 11 | 8   | 9  | 10 | 7  | 8  | 9   | 10 | 7  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 26             | 19                     | 13 | 23 | 17 | 12 | 21 | 15 | 10 | 18 | 13 | 9   | 17 | 12 | 8  | 15 | 11  | 8  | 14 | 10 | 7  | 12  | 8  | 14 | 10 | 7  | 8   | 9  | 10 | 7  | 8  | 9   | 10 | 7  | 5  | 9  | 6   | 4  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | 7-20                   | Interior              | 34             | 24                     | 18 | 30 | 22 | 16 | 27 | 19 | 14 | 24 | 17 | 13  | 22 | 16 | 11 | 20 | 14  | 10 | 18 | 13 | 9  | 15  | 11 | 8  | 13 | 9  | 7   | 11 | 8  | 9  | 10 | 7   | 8  | 8  | 9  | 7  | 7   | 8  | 6  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 22             | 16                     | 11 | 19 | 14 | 10 | 17 | 12 | 9  | 15 | 11 | 8   | 14 | 10 | 7  | 13 | 9   | 7  | 12 | 8  | 9  | 10  | 7  | 8  | 9  | 10 | 7   | 8  | 9  | 10 | 7  | 7   | 8  | 6  | 9  | 7  | 6   | 4  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | 20-27                  | Interior              | 40             | 26                     | 22 | 40 | 23 | 19 | 37 | 21 | 17 | 33 | 19 | 15  | 30 | 17 | 14 | 27 | 15  | 13 | 24 | 14 | 12 | 21  | 12 | 10 | 17 | 10 | 8   | 15 | 9  | 7  | 13 | 8   | 9  | 11 | 7  | 8  | 10  | 9  | 7  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 30             | 17                     | 14 | 26 | 15 | 12 | 23 | 13 | 11 | 21 | 12 | 10  | 19 | 11 | 9  | 17 | 10  | 8  | 16 | 9  | 7  | 13  | 8  | 10 | 11 | 6  | 8   | 10 | 9  | 7  | 8  | 7   | 6  | 7  | 6  | 5  |     |    |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 27-45                  | Interior               | 38                    | 33             | 26                     | 33 | 29 | 23 | 29 | 26 | 21 | 26 | 24 | 18 | 24  | 21 | 17 | 22 | 19 | 15  | 20 | 18 | 14 | 17 | 15  | 12 | 14 | 13 | 10 | 12  | 11 | 9  | 11 | 10 | 7   | 8  | 7  | 8  | 7  | 9   |    |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | Exposed                | 24                    | 21             | 17                     | 21 | 19 | 15 | 19 | 17 | 13 | 17 | 15 | 12 | 15  | 14 | 11 | 14 | 13 | 10  | 13 | 11 | 9  | 11 | 10  | 8  | 9  | 8  | 6  | 8   | 7  | 9  | 7  | 9  | 7   | 8  | 7  | 8  | 7  | 6   |    |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 10                     | B                      | 0-7                   | Interior       | 32                     | 32 | 32 | 32 | 32 | 32 | 32 | 29 | 32 | 32 | 26  | 32 | 32 | 23 | 32 | 30  | 21 | 32 | 28 | 19 | 32  | 23 | 16 | 27 | 20 | 14  | 24 | 17 | 12 | 20 | 15  | 10 | 18 | 13 | 9  | 16  | 11 | 8  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 32 | 32 | 32 | 30 | 20 | 32 | 26 | 18 | 32 | 24  | 16 | 30 | 21 | 15 | 27  | 19 | 13 | 25 | 18 | 12  | 21 | 15 | 10 | 18 | 13  | 9  | 15 | 11 | 8  | 13  | 9  | 7  | 11 | 8  | 9   | 10 | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 32                     | 32 | 32 | 32 | 32 | 28 | 32 | 32 | 25 | 32 | 31  | 22 | 32 | 28 | 20 | 32  | 25 | 18 | 32 | 23 | 17  | 27 | 19 | 14 | 23 | 16  | 12 | 20 | 14 | 10 | 17  | 12 | 9  | 15 | 11 | 8   | 13 | 10 | 7  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 28 | 20 | 32 | 25 | 18 | 31 | 22 | 16 | 28 | 20  | 14 | 25 | 18 | 13 | 22  | 16 | 12 | 20 | 15 | 11  | 17 | 12 | 9  | 15 | 11  | 8  | 13 | 9  | 7  | 11  | 8  | 9  | 10 | 7  | 8   | 9  | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 36                     | 36 | 36 | 36 | 36 | 34 | 36 | 36 | 30 | 36 | 34  | 27 | 36 | 30 | 25 | 36  | 27 | 22 | 36 | 25 | 20  | 36 | 21 | 17 | 31 | 18  | 15 | 27 | 15 | 13 | 23  | 13 | 11 | 20 | 12 | 10  | 18 | 10 | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 36                     | 30 | 25 | 36 | 27 | 22 | 36 | 24 | 20 | 36 | 21  | 18 | 34 | 19 | 16 | 31  | 18 | 14 | 28 | 16 | 13  | 23 | 13 | 11 | 20 | 11  | 9  | 17 | 10 | 8  | 15  | 9  | 7  | 13 | 8  | 9   | 12 | 7  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | 27-45                  | Interior              | 39             | 39                     | 39 | 39 | 39 | 39 | 39 | 39 | 37 | 39 | 39 | 33  | 39 | 39 | 30 | 39 | 34  | 27 | 35 | 31 | 24 | 29  | 26 | 21 | 25 | 22 | 18  | 22 | 19 | 15 | 19 | 17  | 13 | 16 | 15 | 12 | 15  | 13 | 10 |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 39             | 39                     | 29 | 39 | 33 | 26 | 34 | 30 | 23 | 30 | 27 | 21  | 27 | 24 | 19 | 25 | 22  | 17 | 23 | 20 | 16 | 19  | 17 | 13 | 16 | 14 | 11  | 14 | 12 | 10 | 12 | 11  | 9  | 11 | 10 | 7  | 9   | 8  | 7  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 32                     | 32 | 24 | 32 | 31 | 22 | 32 | 28 | 19 | 32 | 25  | 17 | 32 | 23 | 16 | 29  | 21 | 14 | 26 | 19 | 13  | 22 | 16 | 11 | 19 | 13  | 9  | 16 | 11 | 8  | 14  | 10 | 7  | 12 | 9  | 9   | 11 | 8  | 8  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 32                     | 23 | 16 | 28 | 20 | 14 | 25 | 18 | 12 | 22 | 16  | 11 | 20 | 15 | 10 | 18  | 13 | 9  | 17 | 12 | 8   | 14 | 10 | 7  | 12 | 9   | 9  | 10 | 7  | 8  | 9   | 10 | 7  | 8  | 9  | 6   | 7  | 8  | 5  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 32                     | 29 | 21 | 32 | 26 | 19 | 32 | 23 | 17 | 29 | 21  | 15 | 26 | 19 | 14 | 24  | 17 | 13 | 22 | 16 | 11  | 18 | 13 | 10 | 16 | 11  | 8  | 13 | 10 | 7  | 12  | 8  | 9  | 10 | 7  | 8   | 9  | 6  | 7  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        |                       | Exposed        | 26                     | 19 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13  | 10 | 17 | 12 | 9  | 15  | 11 | 8  | 14 | 10 | 7   | 12 | 8  | 14 | 10 | 7   | 8  | 9  | 10 | 7  | 7   | 8  | 6  | 7  | 7  | 5   | 9  | 6  | 5  |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 20-27                  |                        | Interior              | 36             | 32                     | 26 | 36 | 28 | 23 | 36 | 25 | 21 | 36 | 23 | 19  | 36 | 20 | 17 | 33 | 19  | 15 | 30 | 17 | 14 | 25  | 14 | 12 | 21 | 12 | 10  | 18 | 10 | 9  | 16 | 9   | 7  | 14 | 8  | 7  | 12  | 7  | 9  |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        |                        | Exposed               | 36             | 20                     | 17 | 32 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12  | 23 | 13 | 11 | 21 | 12  | 10 | 19 | 11 | 9  | 16  | 9  | 8  | 14 | 8  | 6   | 12 | 7  | 8  | 10 | 9   | 7  | 8  | 7  | 6  | 7   | 6  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
| 27-45                  | Interior               | 39                    | 39             | 31                     | 39 | 35 | 28 | 36 | 32 | 25 | 32 | 28 | 22 | 29  | 26 | 20 | 26 | 23 | 18  | 24 | 21 | 17 | 20 | 18  | 14 | 17 | 15 | 12 | 15  | 13 | 10 | 13 | 11 | 9   | 11 | 10 | 8  | 10 | 9   | 7  |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |
|                        | Exposed                | 29                    | 26             | 20                     | 26 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19  | 17 | 13 |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |   |     |   |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |     |  |  |  |  |







**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) |    |    |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |    |    |
|------------------------|------------------------|-----------------------|----------------|------------------------|----|----|----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|----|----|----|
|                        |                        |                       |                | Roof Wind Zone         |    |    |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |    |    |
|                        |                        |                       |                | 90                     |    |    | 95 |    |    | 100 |    |    | 105 |    |    | 110 |    |    | 115 |    |    | 120 |    |    | 130 |    |    | 140 |    |    | 150 |    |    | 160 |    |    | 170 |    |    | 180 |    |    |    |    |    |
|                        |                        |                       |                | 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       | 75                     | 75 | 75 | 75 | 75 | 64 | 75  | 75 | 57 | 75  | 75 | 51 | 75  | 69 | 46 | 75  | 60 | 42 | 75  | 55 | 38 | 64  | 46 | 32 | 54  | 39 | 27 | 47  | 34 | 24 | 40  | 29 | 20 | 35  | 26 | 18 | 31  | 23 | 16 |    |    |    |
|                        |                        |                       | Exposed        | 75                     | 68 | 46 | 75 | 59 | 41 | 75  | 52 | 36 | 67  | 47 | 33 | 59  | 42 | 30 | 54  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 18 | 20  | 15 | 16 |    |    |    |
|                        |                        | 7-20                  | Interior       | 75                     | 75 | 63 | 75 | 75 | 56 | 75  | 75 | 50 | 75  | 61 | 45 | 75  | 55 | 40 | 75  | 50 | 37 | 64  | 46 | 33 | 53  | 38 | 28 | 45  | 33 | 24 | 39  | 28 | 21 | 34  | 25 | 18 | 30  | 22 | 16 | 26  | 19 | 14 |    |    |    |
|                        |                        |                       | Exposed        | 75                     | 55 | 40 | 75 | 49 | 36 | 61  | 44 | 32 | 55  | 39 | 29 | 49  | 35 | 26 | 45  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 16 | 17  | 12 | 14 |    |    |    |
|                        |                        | 20-27                 | Interior       | 77                     | 77 | 77 | 77 | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 60 | 77  | 77 | 54 | 77  | 60 | 49 | 77  | 54 | 44 | 77  | 49 | 40 | 77  | 41 | 34 | 62  | 35 | 29 | 53  | 30 | 25 | 46  | 27 | 22 | 40  | 23 | 19 | 36 | 21 | 17 |
|                        |                        |                       | Exposed        | 77                     | 60 | 49 | 77 | 53 | 43 | 77  | 47 | 39 | 77  | 42 | 35 | 73  | 38 | 32 | 61  | 35 | 29 | 55  | 32 | 26 | 47  | 27 | 22 | 40  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 17 |    |    |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 78 | 78 | 78 | 78 | 78 | 78  | 78 | 78 | 78  | 78 | 78 | 78  | 65 | 78 | 78  | 59 | 78 | 75  | 53 | 78 | 62  | 48 | 58 | 52  | 41 | 50 | 44  | 35 | 43 | 38  | 30 | 37 | 33  | 26 | 33 | 29  | 23 | 29 | 26 | 20 |    |
|                        |                        | Exposed               | 78             | 78                     | 58 | 78 | 68 | 52 | 78 | 59  | 46 | 60 | 53  | 42 | 54 | 48  | 38 | 49 | 44  | 34 | 45 | 40  | 31 | 38 | 34  | 27 | 32 | 29  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 |    |    |    |    |
|                        | C                      | 0-7                   | Interior       | 75                     | 75 | 49 | 75 | 62 | 43 | 75  | 55 | 39 | 75  | 50 | 35 | 63  | 45 | 31 | 57  | 41 | 28 | 52  | 37 | 26 | 43  | 31 | 22 | 37  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 18 | 12 | 21  | 16 | 17 |    |    |    |
|                        |                        |                       | Exposed        | 63                     | 45 | 31 | 59 | 40 | 28 | 49  | 36 | 25 | 44  | 32 | 22 | 40  | 29 | 20 | 36  | 26 | 18 | 33  | 24 | 17 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 17 | 12 | 14  | 15 | 17 | 13 | 15 |    |
|                        |                        | 7-20                  | Interior       | 75                     | 58 | 42 | 75 | 52 | 38 | 65  | 46 | 34 | 58  | 42 | 30 | 52  | 38 | 28 | 47  | 34 | 25 | 43  | 31 | 23 | 36  | 26 | 19 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 17 | 18  | 13 | 15 |    |    |    |
|                        |                        |                       | Exposed        | 52                     | 37 | 27 | 46 | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 34  | 24 | 18 | 30  | 22 | 16 | 28  | 20 | 15 | 23  | 17 | 13 | 20  | 15 | 16 | 17  | 13 | 14 | 15  | 17 | 12 | 13  | 15 | 14 | 13  | 14 | 12 | 14 |    |    |
|                        |                        | 20-27                 | Interior       | 77                     | 63 | 52 | 77 | 56 | 46 | 77  | 50 | 41 | 77  | 45 | 37 | 77  | 41 | 33 | 65  | 37 | 30 | 59  | 34 | 28 | 49  | 28 | 23 | 42  | 24 | 20 | 36  | 21 | 17 | 31  | 18 | 15 | 28  | 16 | 13 | 24  | 14 | 12 |    |    |    |
|                        |                        |                       | Exposed        | 77                     | 40 | 33 | 63 | 36 | 30 | 56  | 32 | 27 | 50  | 29 | 24 | 46  | 26 | 22 | 41  | 24 | 20 | 38  | 22 | 18 | 32  | 18 | 15 | 27  | 16 | 13 | 23  | 14 | 17 | 20  | 12 | 15 | 18  | 16 | 13 | 16  | 14 | 12 |    |    |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 62 | 78 | 78 | 55 | 78 | 63  | 49 | 63 | 56  | 44 | 57 | 51  | 40 | 52 | 46  | 36 | 47 | 42  | 33 | 40 | 36  | 28 | 34 | 30  | 24 | 29 | 26  | 21 | 26 | 23  | 18 | 23 | 20  | 16 | 20 | 18  | 14 |    |    |    |    |
|                        |                        | Exposed               | 57             | 51                     | 40 | 51 | 45 | 36 | 45 | 40  | 32 | 41 | 36  | 29 | 37 | 33  | 26 | 34 | 30  | 24 | 31 | 27  | 22 | 26 | 23  | 18 | 22 | 20  | 16 | 19 | 17  | 14 | 17 | 15  | 12 | 15 | 13  | 16 | 13 | 18  | 14 |    |    |    |    |
|                        | D                      | 0-7                   | Interior       | 75                     | 58 | 40 | 75 | 51 | 36 | 64  | 46 | 32 | 57  | 41 | 29 | 52  | 37 | 26 | 47  | 34 | 24 | 43  | 31 | 22 | 36  | 26 | 18 | 31  | 22 | 16 | 26  | 19 | 13 | 23  | 17 | 18 | 20  | 15 | 16 | 18  | 13 | 14 |    |    |    |
|                        |                        |                       | Exposed        | 51                     | 37 | 26 | 46 | 33 | 23 | 41  | 29 | 21 | 37  | 26 | 19 | 33  | 24 | 17 | 30  | 22 | 15 | 28  | 20 | 14 | 23  | 17 | 18 | 20  | 14 | 15 | 17  | 12 | 13 | 15  | 16 | 12 | 13  | 14 | 16 | 18  | 13 | 9  |    |    |    |
|                        |                        | 7-20                  | Interior       | 75                     | 48 | 35 | 60 | 43 | 31 | 53  | 38 | 28 | 48  | 34 | 25 | 43  | 31 | 23 | 39  | 28 | 21 | 36  | 26 | 19 | 30  | 22 | 16 | 26  | 19 | 14 | 22  | 16 | 12 | 19  | 14 | 16 | 17  | 12 | 14 | 15  | 17 | 12 |    |    |    |
|                        |                        |                       | Exposed        | 43                     | 31 | 23 | 38 | 28 | 20 | 34  | 25 | 18 | 31  | 22 | 16 | 28  | 20 | 15 | 25  | 18 | 14 | 23  | 17 | 12 | 19  | 14 | 16 | 17  | 12 | 14 | 14  | 16 | 12 | 13  | 14 | 14 | 10  | 17 | 12 | 9   | 15 | 14 | 8  |    |    |
|                        |                        | 20-27                 | Interior       | 77                     | 52 | 43 | 77 | 46 | 38 | 77  | 41 | 34 | 65  | 37 | 31 | 59  | 34 | 28 | 53  | 31 | 25 | 49  | 28 | 23 | 41  | 24 | 19 | 35  | 20 | 17 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 17 | 20  | 12 | 15 |    |    |    |
|                        |                        |                       | Exposed        | 59                     | 34 | 28 | 52 | 30 | 25 | 46  | 27 | 22 | 42  | 24 | 20 | 38  | 22 | 18 | 34  | 20 | 16 | 31  | 18 | 15 | 26  | 15 | 13 | 23  | 13 | 16 | 19  | 17 | 14 | 17  | 15 | 12 | 15  | 13 | 14 | 12  | 14 | 10 |    |    |    |
|                        | 27-45                  | Interior              | 78             | 65                     | 51 | 65 | 58 | 45 | 58 | 52  | 41 | 52 | 47  | 37 | 47 | 42  | 33 | 43 | 38  | 30 | 39 | 35  | 28 | 33 | 30  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 | 17 | 15  | 12 |    |    |    |    |
|                        |                        | Exposed               | 47             | 42                     | 33 | 42 | 37 | 30 | 38 | 34  | 26 | 34 | 30  | 24 | 31 | 27  | 22 | 28 | 25  | 20 | 25 | 23  | 18 | 22 | 19  | 15 | 18 | 16  | 13 | 16 | 14  | 17 | 14 | 12  | 15 | 12 | 17  | 13 | 16 | 15  | 12 |    |    |    |    |
| 10                     | B                      | 0-7                   | Interior       | 61                     | 61 | 61 | 61 | 61 | 61 | 61  | 61 | 57 | 61  | 61 | 61 | 61  | 61 | 46 | 61  | 60 | 42 | 61  | 55 | 38 | 61  | 46 | 32 | 54  | 39 | 27 | 47  | 34 | 24 | 40  | 29 | 20 | 35  | 26 | 18 | 31  | 23 | 16 |    |    |    |
|                        |                        |                       | Exposed        | 61                     | 61 | 46 | 61 | 59 | 41 | 61  | 52 | 36 | 61  | 47 | 33 | 59  | 42 | 30 | 54  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 18 | 20  | 15 | 16 |    |    |    |
|                        |                        | 7-20                  | Interior       | 62                     | 62 | 62 | 62 | 62 | 62 | 62  | 62 | 62 | 50  | 62 | 61 | 45  | 62 | 55 | 40  | 62 | 50 | 37  | 62 | 46 | 33  | 53 | 38 | 28  | 45 | 33 | 24  | 39 | 28 | 21  | 34 | 25 | 18  | 30 | 22 | 16  | 26 | 19 | 14 |    |    |
|                        |                        |                       | Exposed        | 62                     | 55 | 40 | 62 | 49 | 36 | 61  | 44 | 32 | 55  | 39 | 29 | 49  | 35 | 26 | 45  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 16 | 17  | 12 | 14 |    |    |    |
|                        |                        | 20-27                 | Interior       | 70                     | 70 | 70 | 70 | 70 | 70 | 70  | 70 | 70 | 60  | 70 | 70 | 54  | 70 | 60 | 49  | 70 | 54 | 44  | 70 | 49 | 40  | 70 | 41 | 34  | 62 | 35 | 29  | 53 | 30 | 25  | 46 | 27 | 22  | 40 | 23 | 19  | 36 | 21 | 17 |    |    |
|                        |                        |                       | Exposed        | 70                     | 60 | 49 | 70 | 53 | 43 | 70  | 47 | 39 | 70  | 42 | 35 | 70  | 38 | 32 | 61  | 35 | 29 | 55  | 32 | 26 | 47  | 27 | 22 | 40  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 17 |    |    |    |
|                        | 27-45                  | Interior              | 76             | 76                     | 76 | 76 | 76 | 76 | 76 | 76  | 76 | 76 | 65  | 76 | 76 | 76  | 65 | 76 | 76  | 59 | 76 | 75  | 53 | 76 | 62  | 48 | 58 | 52  | 41 | 50 | 44  | 35 | 43 | 38  | 30 | 37 | 33  | 26 | 33 | 29  | 23 | 29 | 26 | 20 |    |
|                        |                        | Exposed               | 76             | 76                     | 58 | 76 | 68 | 52 | 76 | 59  | 46 | 60 | 53  | 42 | 54 | 48  | 38 | 49 | 44  | 34 | 45 | 40  | 31 | 38 | 34  | 27 | 32 | 29  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 |    |    |    |    |
|                        | C                      | 0-7                   | Interior       | 61                     | 61 | 49 | 61 | 61 | 43 | 61  | 55 | 39 | 61  | 50 | 35 | 61  | 45 | 31 | 57  | 41 | 28 | 52  | 37 | 26 | 43  | 31 | 22 | 37  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 18 | 12 | 21  | 16 | 17 |    |    |    |
|                        |                        |                       | Exposed        | 61                     | 45 | 31 | 55 | 40 | 28 | 49  | 36 | 25 | 44  | 32 | 22 | 40  | 29 | 20 | 36  | 26 | 18 | 33  | 24 | 17 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 16 | 18  | 13 | 14 | 16  | 17 | 12 | 14  | 15 | 17 | 13 | 15 |    |
|                        |                        | 7-20                  | Interior       | 62                     | 58 | 42 | 62 | 52 | 38 | 62  | 46 | 34 | 58  | 42 | 30 | 52  | 38 | 28 | 47  | 34 | 25 | 43  | 31 | 23 | 36  | 26 | 19 | 31  | 22 | 16 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 17 | 18  | 13 | 15 |    |    |    |
|                        |                        |                       | Exposed        | 52                     | 37 | 27 | 46 | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 34  | 24 | 18 | 30  | 22 | 16 | 28  | 20 | 15 | 23  | 17 | 13 | 20  | 15 | 16 | 17  | 13 | 14 | 15  | 17 | 12 | 13  | 15 | 14 | 13  | 14 | 12 | 14 |    |    |
|                        |                        | 20-27                 | Interior       | 70                     | 63 | 52 | 70 |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |    |    |    |



ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

23 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

SPAN TABLES

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

Table with columns for Ground Snow Load, Wind Exposure Category, Roof Tilt Angle, Panel Exposure, Basic Wind Speed (mph), and Roof Wind Zone. Rows are categorized by height (30, 40, 50) and exposure (B, C, D).

\* 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.
19 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.















ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

19 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

UAF  
Clamp

SM BUTYL Plywood  
Attachment

SPAN TABLES

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

Table with columns for Ground Snow Load, Wind Exposure Category, Roof Tilt Angle, Panel Exposure, Basic Wind Speed (mph), and Roof Wind Zone. It contains a grid of numerical values representing allowable rail spans in inches.

\* 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.
19 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.









ASCE 7-22

Design Standard

II

Risk Category

30 ft

Roof Height

Ss = 1.25

Seismic

23 sq.ft

Module Area

PORTRAIT

Orientation

CROSS-SLOPE

Rail Direction

SM

Rail Type

UAF

Clamp

SM BUTYL Plywood

Attachment

# SPAN TABLES

## 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         |    |    |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |   |    |   |   |
| 0                      | B                      | 0-7                   | Interior       | 39                     | 39 | 33 | 39 | 39 | 30 | 39  | 39 | 26 | 39  | 34 | 24 | 39  | 31 | 21 | 39  | 28 | 19 | 36  | 25 | 18 | 30  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 13 | 9  | 16  | 12 | 8  | 14  | 10 | 7 | 7  |   |   |
|                        |                        |                       | Exposed        | 39                     | 31 | 21 | 39 | 27 | 19 | 34  | 24 | 17 | 30  | 22 | 15 | 27  | 20 | 14 | 25  | 18 | 12 | 23  | 16 | 11 | 19  | 14 | 10 | 16  | 12 | 8  | 14  | 10 | 7  | 12  | 9  | 6  | 11  | 8  | 8  | 9   | 7  | 7 |    |   |   |
|                        |                        | 7-20                  | Interior       | 39                     | 39 | 29 | 39 | 36 | 26 | 39  | 32 | 23 | 39  | 28 | 21 | 36  | 26 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 11 | 8  | 14  | 10 | 7  | 12  | 9  | 6 | 6  |   |   |
|                        |                        |                       | Exposed        | 36                     | 25 | 19 | 32 | 23 | 17 | 28  | 20 | 15 | 25  | 18 | 13 | 23  | 16 | 12 | 21  | 15 | 11 | 19  | 14 | 10 | 16  | 11 | 8  | 13  | 10 | 7  | 12  | 8  | 6  | 10  | 7  | 8  | 9   | 6  | 7  | 8   | 6  | 6 |    |   |   |
|                        |                        | 20-27                 | Interior       | 40                     | 40 | 35 | 40 | 40 | 31 | 40  | 34 | 28 | 40  | 31 | 25 | 40  | 28 | 23 | 40  | 25 | 21 | 40  | 23 | 19 | 34  | 19 | 16 | 29  | 16 | 13 | 25  | 14 | 12 | 21  | 12 | 10 | 19  | 11 | 9  | 17  | 9  | 8 |    |   |   |
|                        |                        |                       | Exposed        | 40                     | 28 | 23 | 40 | 25 | 20 | 40  | 22 | 18 | 35  | 20 | 16 | 31  | 18 | 15 | 28  | 16 | 13 | 26  | 15 | 12 | 22  | 12 | 10 | 18  | 11 | 9  | 16  | 9  | 7  | 14  | 8  | 6  | 12  | 7  | 6  | 11  | 6  | 8 |    |   |   |
|                        | 27-45                  | Interior              | 40             | 40                     | 28 | 40 | 40 | 39 | 40 | 34  | 40 | 40 | 30  | 40 | 35 | 27  | 35 | 32 | 25  | 32 | 29 | 23  | 27 | 24 | 19  | 23 | 21 | 16  | 20 | 18 | 14  | 17 | 15 | 12  | 15 | 14 | 11  | 13 | 12 | 9   | 8  |   |    |   |   |
|                        |                        | Exposed               | 40             | 35                     | 27 | 35 | 31 | 24 | 31 | 27  | 22 | 28 | 25  | 19 | 25 | 22  | 18 | 23 | 20  | 16 | 21 | 19  | 15 | 17 | 16  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  | 10 | 9   | 7  | 9  | 8   | 6  |   |    |   |   |
|                        | C                      | 0-7                   | Interior       | 39                     | 33 | 22 | 39 | 29 | 20 | 36  | 26 | 18 | 32  | 23 | 16 | 29  | 21 | 14 | 26  | 19 | 13 | 24  | 17 | 12 | 22  | 16 | 11 | 20  | 14 | 10 | 17  | 12 | 9  | 15  | 11 | 7  | 13  | 9  | 6  | 11  | 8  | 6 | 10 | 7 | 8 |
|                        |                        |                       | Exposed        | 29                     | 21 | 14 | 26 | 18 | 13 | 23  | 16 | 11 | 21  | 15 | 10 | 19  | 13 | 9  | 17  | 12 | 8  | 15  | 11 | 8  | 13  | 9  | 6  | 11  | 8  | 5  | 9   | 7  | 7  | 8   | 6  | 7  | 8   | 6  | 7  | 8   | 6  | 7 | 8  |   |   |
|                        |                        | 7-20                  | Interior       | 39                     | 27 | 20 | 34 | 24 | 17 | 30  | 21 | 16 | 27  | 19 | 14 | 24  | 17 | 13 | 22  | 16 | 12 | 20  | 14 | 11 | 17  | 12 | 9  | 14  | 10 | 8  | 12  | 9  | 6  | 11  | 8  | 6  | 9   | 7  | 8  | 8   | 6  | 7 | 8  | 6 | 7 |
|                        |                        |                       | Exposed        | 24                     | 17 | 13 | 23 | 15 | 11 | 19  | 14 | 10 | 17  | 12 | 9  | 16  | 11 | 8  | 14  | 10 | 7  | 13  | 9  | 7  | 11  | 8  | 6  | 9   | 7  | 7  | 8   | 6  | 6  | 7   | 8  | 6  | 7   | 8  | 6  | 7   | 8  | 6 | 4  |   |   |
|                        |                        | 20-27                 | Interior       | 40                     | 29 | 24 | 40 | 26 | 21 | 40  | 23 | 19 | 38  | 21 | 17 | 33  | 19 | 15 | 30  | 17 | 14 | 27  | 16 | 13 | 23  | 13 | 11 | 19  | 11 | 9  | 17  | 10 | 8  | 15  | 8  | 7  | 13  | 7  | 6  | 11  | 6  | 8 | 8  | 6 |   |
|                        |                        |                       | Exposed        | 33                     | 19 | 15 | 29 | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 11 | 21  | 12 | 10 | 19  | 11 | 9  | 17  | 10 | 8  | 15  | 8  | 7  | 13  | 7  | 6  | 11  | 6  | 8  | 9   | 5  | 7  | 8   | 7  | 6  | 7   | 6  | 7 | 6  | 8 |   |
|                        | 27-45                  | Interior              | 40             | 37                     | 29 | 38 | 33 | 26 | 33 | 29  | 23 | 29 | 26  | 21 | 27 | 24  | 19 | 24 | 21  | 17 | 22 | 20  | 15 | 18 | 17  | 13 | 16 | 14  | 11 | 14 | 12  | 10 | 12 | 11  | 8  | 10 | 9   | 7  | 9  | 8   | 6  | 8 | 6  |   |   |
|                        |                        | Exposed               | 26             | 24                     | 19 | 23 | 21 | 16 | 21 | 19  | 15 | 19 | 17  | 13 | 17 | 15  | 12 | 16 | 14  | 11 | 14 | 13  | 10 | 12 | 11  | 8  | 10 | 9   | 7  | 9  | 8   | 6  | 8  | 7   | 8  | 7  | 6   | 7  | 6  | 7   | 8  | 6 | 6  |   |   |
|                        | D                      | 0-7                   | Interior       | 39                     | 27 | 19 | 33 | 24 | 16 | 30  | 21 | 15 | 27  | 19 | 13 | 24  | 17 | 12 | 22  | 16 | 11 | 20  | 14 | 10 | 17  | 12 | 8  | 14  | 10 | 7  | 12  | 9  | 6  | 11  | 8  | 9  | 7   | 7  | 8  | 6   | 7  | 8 | 6  | 6 |   |
|                        |                        |                       | Exposed        | 24                     | 17 | 12 | 21 | 15 | 11 | 19  | 14 | 9  | 17  | 12 | 9  | 15  | 11 | 8  | 14  | 10 | 7  | 13  | 9  | 6  | 11  | 8  | 6  | 9   | 7  | 7  | 8   | 6  | 6  | 7   | 8  | 5  | 6   | 7  | 5  | 8   | 6  | 4 |    |   |   |
|                        |                        | 7-20                  | Interior       | 31                     | 22 | 16 | 28 | 20 | 14 | 25  | 18 | 13 | 22  | 16 | 12 | 20  | 14 | 11 | 18  | 13 | 10 | 16  | 12 | 9  | 14  | 10 | 7  | 12  | 9  | 6  | 10  | 7  | 8  | 9   | 6  | 7  | 8   | 6  | 6  | 7   | 8  | 6 | 6  |   |   |
|                        |                        |                       | Exposed        | 20                     | 14 | 10 | 18 | 13 | 9  | 16  | 11 | 8  | 14  | 10 | 7  | 13  | 9  | 7  | 12  | 8  | 6  | 11  | 8  | 6  | 9   | 6  | 7  | 8   | 5  | 6  | 7   | 7  | 6  | 6   | 6  | 6  | 5   | 6  | 6  | 4   | 7  | 5 | 4  |   |   |
|                        |                        | 20-27                 | Interior       | 40                     | 24 | 20 | 39 | 21 | 18 | 34  | 19 | 16 | 30  | 17 | 14 | 27  | 16 | 13 | 25  | 14 | 12 | 22  | 13 | 11 | 19  | 11 | 9  | 16  | 9  | 8  | 14  | 8  | 7  | 12  | 7  | 6  | 11  | 6  | 8  | 9   | 8  | 7 |    |   |   |
|                        |                        |                       | Exposed        | 27                     | 16 | 13 | 24 | 14 | 11 | 22  | 12 | 10 | 19  | 11 | 9  | 17  | 10 | 8  | 16  | 9  | 7  | 14  | 8  | 7  | 12  | 7  | 6  | 10  | 6  | 8  | 9   | 8  | 6  | 8   | 7  | 6  | 7   | 6  | 5  | 6   | 5  | 4 |    |   |   |
|                        | 27-45                  | Interior              | 34             | 30                     | 24 | 30 | 27 | 21 | 27 | 24  | 19 | 24 | 22  | 17 | 22 | 20  | 15 | 20 | 18  | 14 | 18 | 16  | 13 | 15 | 14  | 11 | 13 | 12  | 9  | 11 | 10  | 8  | 10 | 9   | 7  | 9  | 8   | 6  | 8  | 6   | 8  | 7 | 8  |   |   |
|                        |                        | Exposed               | 22             | 20                     | 15 | 19 | 17 | 14 | 17 | 16  | 12 | 16 | 14  | 11 | 14 | 13  | 10 | 13 | 12  | 9  | 12 | 11  | 8  | 10 | 9   | 7  | 8  | 6   | 7  | 8  | 6   | 6  | 6  | 6   | 6  | 7  | 6   | 8  | 6  | 8   | 7  | 5 |    |   |   |
| 10                     | B                      | 0-7                   | Interior       | 32                     | 32 | 32 | 32 | 32 | 30 | 32  | 32 | 26 | 32  | 32 | 24 | 32  | 31 | 21 | 32  | 28 | 19 | 32  | 25 | 18 | 30  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 13 | 9  | 16  | 12 | 8  | 14  | 10 | 7 | 7  |   |   |
|                        |                        |                       | Exposed        | 32                     | 31 | 21 | 32 | 27 | 19 | 32  | 24 | 17 | 30  | 22 | 15 | 27  | 20 | 14 | 25  | 18 | 12 | 23  | 16 | 11 | 19  | 14 | 10 | 16  | 12 | 8  | 14  | 10 | 7  | 12  | 9  | 6  | 11  | 8  | 9  | 7   | 8  | 9 | 7  | 7 |   |
|                        |                        | 7-20                  | Interior       | 32                     | 32 | 29 | 32 | 32 | 26 | 32  | 32 | 23 | 32  | 28 | 21 | 32  | 26 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 11 | 8  | 14  | 10 | 7  | 12  | 9  | 6 | 6  |   |   |
|                        |                        |                       | Exposed        | 32                     | 25 | 19 | 32 | 23 | 17 | 28  | 20 | 15 | 25  | 18 | 13 | 23  | 16 | 12 | 21  | 15 | 11 | 19  | 14 | 10 | 16  | 11 | 8  | 13  | 10 | 7  | 12  | 8  | 6  | 10  | 7  | 8  | 9   | 6  | 7  | 8   | 6  | 6 |    |   |   |
|                        |                        | 20-27                 | Interior       | 36                     | 36 | 35 | 36 | 36 | 31 | 36  | 34 | 28 | 36  | 31 | 25 | 36  | 28 | 23 | 36  | 25 | 21 | 36  | 23 | 19 | 34  | 19 | 16 | 29  | 16 | 13 | 25  | 14 | 12 | 21  | 12 | 10 | 19  | 11 | 9  | 17  | 9  | 8 |    |   |   |
|                        |                        |                       | Exposed        | 36                     | 28 | 23 | 36 | 25 | 20 | 36  | 22 | 18 | 35  | 20 | 16 | 31  | 18 | 15 | 28  | 16 | 13 | 26  | 15 | 12 | 22  | 12 | 10 | 18  | 11 | 9  | 16  | 9  | 7  | 14  | 8  | 6  | 12  | 7  | 6  | 11  | 6  | 8 |    |   |   |
|                        | 27-45                  | Interior              | 39             | 39                     | 39 | 39 | 39 | 39 | 39 | 39  | 34 | 39 | 39  | 30 | 39 | 35  | 27 | 35 | 32  | 25 | 32 | 29  | 23 | 27 | 24  | 19 | 23 | 21  | 16 | 20 | 18  | 14 | 17 | 15  | 12 | 15 | 14  | 11 | 13 | 12  | 9  | 8 |    |   |   |
|                        |                        | Exposed               | 39             | 35                     | 27 | 35 | 31 | 24 | 31 | 27  | 22 | 28 | 25  | 19 | 25 | 22  | 18 | 23 | 20  | 16 | 21 | 19  | 15 | 17 | 16  | 12 | 15 | 13  | 10 | 13 | 11  | 9  | 11 | 10  | 8  | 10 | 9   | 7  | 9  | 8   | 6  |   |    |   |   |
|                        | C                      | 0-7                   | Interior       | 32                     | 32 | 22 | 32 | 29 | 20 | 32  | 26 | 18 | 32  | 23 | 16 | 29  | 21 | 14 | 26  | 19 | 13 | 24  | 17 | 12 | 20  | 14 | 10 | 17  | 12 | 9  | 15  | 11 | 7  | 13  | 9  | 6  | 11  | 8  | 6  | 10  | 7  | 8 |    |   |   |
|                        |                        |                       | Exposed        | 29                     | 21 | 14 | 26 | 18 | 13 | 23  | 16 | 11 | 21  | 15 | 10 | 19  | 13 | 9  | 17  | 12 | 8  | 15  | 11 | 8  | 13  | 9  | 6  | 11  | 8  | 5  | 9   | 7  | 7  | 8   | 6  | 6  | 7   | 8  | 6  | 7   | 8  |   |    |   |   |
|                        |                        | 7-20                  | Interior       | 32                     | 27 | 20 | 32 | 24 | 17 | 30  | 21 | 16 | 27  | 19 | 14 | 24  | 17 | 13 | 22  | 16 | 12 | 20  | 14 | 11 | 17  | 12 | 9  | 14  | 10 | 8  | 12  | 9  | 6  | 11  | 8  | 6  | 9   | 7  | 8  | 8   | 6  | 7 |    |   |   |
|                        |                        |                       | Exposed        | 24                     | 17 | 13 | 21 | 15 | 11 | 19  | 14 | 10 | 17  | 12 | 9  | 16  | 11 | 8  | 14  | 10 | 7  | 13  | 9  | 7  | 11  | 8  | 6  | 9   | 7  | 7  | 8   | 6  | 6  | 7   | 8  | 6  | 7   | 8  | 6  | 4   |    |   |    |   |   |
|                        |                        | 20-27                 | Interior       | 36                     | 29 | 24 | 36 | 26 | 21 | 36  | 23 | 19 | 36  | 21 | 17 | 33  | 19 | 15 | 30  | 17 | 14 | 27  | 16 | 13 | 23  | 13 | 11 | 19  | 11 | 9  | 17  | 10 | 8  | 15  | 8  | 7  | 13  | 7  | 6  | 11  | 6  | 8 |    |   |   |
|                        |                        |                       | Exposed        | 33                     | 19 | 15 | 29 | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 11 | 21  | 12 | 10 | 19  | 11 | 9  | 17  | 10 | 8  | 15  | 8  | 7  | 13  | 7  | 6  | 11  | 6  | 8  | 9   | 5  | 7  | 8   | 7  | 6  | 7   | 6  | 5 |    |   |   |
|                        | 27-45                  | Interior              | 39             | 37                     | 29 | 38 | 33 | 26 | 33 | 29  | 23 | 29 | 26  | 21 | 27 | 24  | 19 | 24 | 21  | 17 | 22 | 20  | 15 | 18 | 17  | 13 | 16 | 14  | 11 | 14 | 12  | 10 | 12 | 11  | 8  |    |     |    |    |     |    |   |    |   |   |







## 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  |    |    |
| 0                      | B                      | 0-7                   | Interior       | 75                     | 75 | 69 | 75 | 75 | 59 | 75  | 75 | 52 | 75  | 73 | 47 | 75  | 61 | 42 | 75  | 55 | 38 | 75  | 50 | 35 | 59  | 42 | 29 | 50  | 36 | 25 | 43  | 31 | 22 | 37  | 27 | 19 | 33  | 24 | 17 | 29  | 21 | 15 |    |
|                        |                        |                       | Exposed        | 75                     | 61 | 42 | 75 | 54 | 37 | 72  | 48 | 33 | 60  | 43 | 30 | 54  | 39 | 27 | 49  | 35 | 25 | 45  | 32 | 23 | 38  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 11 | 19  | 14 | 15 |    |
|                        |                        | 7-20                  | Interior       | 75                     | 75 | 58 | 75 | 51 | 75 | 63  | 46 | 75 | 56  | 41 | 75 | 51  | 37 | 64 | 46  | 34 | 58 | 42  | 31 | 49 | 35  | 26 | 42 | 30  | 22 | 36 | 26  | 19 | 31 | 23  | 17 | 27 | 20  | 15 | 24 | 18  | 13 |    |    |
|                        |                        |                       | Exposed        | 75                     | 51 | 37 | 63 | 45 | 33 | 56  | 40 | 29 | 50  | 36 | 26 | 45  | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 31  | 23 | 17 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 11 | 18  | 13 | 14 | 16  | 11 | 13 |    |
|                        |                        | 20-27                 | Interior       | 77                     | 77 | 77 | 77 | 77 | 62 | 77  | 77 | 77 | 55  | 77 | 61 | 50  | 77 | 55 | 45  | 77 | 50 | 41  | 77 | 45 | 37  | 73 | 38 | 31  | 57 | 33 | 27  | 49 | 28 | 23  | 42 | 24 | 20  | 37 | 21 | 18  | 33 | 19 | 16 |
|                        |                        |                       | Exposed        | 77                     | 55 | 45 | 77 | 49 | 40 | 77  | 43 | 36 | 77  | 39 | 32 | 62  | 35 | 29 | 56  | 32 | 26 | 51  | 29 | 24 | 43  | 25 | 20 | 36  | 21 | 17 | 31  | 18 | 15 | 27  | 16 | 13 | 24  | 14 | 12 | 21  | 12 | 10 |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 78 | 78 | 78 | 78 | 78 | 78  | 78 | 73 | 78  | 78 | 78 | 78  | 54 | 78 | 62  | 49 | 64 | 57  | 45 | 54 | 48  | 38 | 46 | 41  | 32 | 39 | 35  | 28 | 34 | 31  | 24 | 30 | 27  | 21 | 27 | 24  | 19 |    |    |
|                        |                        | Exposed               | 78             | 78                     | 54 | 78 | 61 | 48 | 61 | 54  | 43 | 55 | 49  | 39 | 50 | 44  | 35 | 45 | 40  | 32 | 41 | 37  | 29 | 35 | 31  | 24 | 30 | 26  | 21 | 26 | 23  | 18 | 22 | 20  | 16 | 20 | 18  | 14 | 17 | 16  | 12 |    |    |
|                        | C                      | 0-7                   | Interior       | 75                     | 65 | 45 | 75 | 57 | 40 | 75  | 51 | 35 | 64  | 46 | 32 | 58  | 41 | 29 | 52  | 37 | 26 | 48  | 34 | 24 | 40  | 29 | 20 | 34  | 25 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 20  | 14 | 10 |    |
|                        |                        |                       | Exposed        | 57                     | 41 | 29 | 51 | 37 | 26 | 45  | 33 | 23 | 41  | 29 | 21 | 37  | 27 | 19 | 34  | 24 | 17 | 31  | 22 | 16 | 26  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 15 | 17  | 12 | 13 | 15  | 11 | 11 | 13  | 14 | 9  |    |
|                        |                        | 7-20                  | Interior       | 75                     | 54 | 39 | 75 | 48 | 35 | 59  | 43 | 31 | 53  | 38 | 28 | 48  | 35 | 25 | 43  | 31 | 23 | 40  | 29 | 21 | 33  | 24 | 18 | 28  | 21 | 15 | 25  | 18 | 13 | 21  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 14 |    |
|                        |                        |                       | Exposed        | 48                     | 34 | 25 | 42 | 31 | 23 | 38  | 27 | 20 | 34  | 25 | 18 | 31  | 22 | 16 | 28  | 20 | 15 | 26  | 19 | 14 | 22  | 16 | 12 | 18  | 13 | 10 | 16  | 12 | 13 | 14  | 10 | 11 | 12  | 14 | 10 | 11  | 12 | 9  |    |
|                        |                        | 20-27                 | Interior       | 77                     | 58 | 47 | 77 | 51 | 42 | 77  | 46 | 38 | 77  | 41 | 34 | 67  | 37 | 31 | 59  | 34 | 28 | 54  | 31 | 26 | 45  | 26 | 22 | 39  | 22 | 18 | 33  | 19 | 16 | 29  | 17 | 14 | 25  | 15 | 12 | 23  | 13 | 11 |    |
|                        |                        |                       | Exposed        | 65                     | 37 | 31 | 58 | 33 | 27 | 52  | 30 | 24 | 46  | 27 | 22 | 42  | 24 | 20 | 38  | 22 | 18 | 35  | 20 | 17 | 29  | 17 | 14 | 25  | 15 | 12 | 22  | 13 | 10 | 19  | 11 | 14 | 17  | 15 | 12 | 15  | 13 | 11 |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 57 | 78 | 64 | 51 | 65 | 58  | 45 | 58 | 52  | 41 | 52 | 47  | 37 | 48 | 43  | 34 | 44 | 39  | 31 | 37 | 33  | 26 | 31 | 28  | 22 | 27 | 24  | 19 | 24 | 21  | 17 | 21 | 19  | 15 | 18 | 16  | 13 |    |    |
|                        |                        | Exposed               | 52             | 47                     | 37 | 47 | 42 | 33 | 42 | 37  | 29 | 38 | 34  | 26 | 34 | 30  | 24 | 31 | 28  | 22 | 28 | 24  | 21 | 31 | 28  | 22 | 24 | 21  | 17 | 20 | 18  | 14 | 16 | 12  | 15 | 14 | 11  | 14 | 12 | 15  | 12 | 11 | 13 |
|                        | D                      | 0-7                   | Interior       | 75                     | 53 | 37 | 67 | 47 | 33 | 59  | 42 | 29 | 53  | 38 | 26 | 48  | 34 | 24 | 43  | 31 | 22 | 39  | 28 | 20 | 33  | 24 | 17 | 28  | 20 | 14 | 24  | 18 | 12 | 21  | 15 | 11 | 19  | 13 | 14 | 16  | 12 | 13 |    |
|                        |                        |                       | Exposed        | 47                     | 34 | 24 | 42 | 30 | 21 | 38  | 27 | 19 | 34  | 24 | 17 | 31  | 22 | 16 | 28  | 20 | 14 | 25  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 14 | 16  | 11 | 12 | 14  | 15 | 11 | 12  | 13 | 9  | 11  | 12 | 8  |    |
|                        |                        | 7-20                  | Interior       | 62                     | 44 | 32 | 55 | 39 | 29 | 49  | 35 | 26 | 44  | 32 | 23 | 40  | 29 | 21 | 36  | 26 | 19 | 33  | 24 | 18 | 28  | 20 | 15 | 24  | 17 | 13 | 20  | 15 | 11 | 18  | 13 | 14 | 16  | 11 | 13 | 14  | 10 | 11 |    |
|                        |                        |                       | Exposed        | 39                     | 29 | 21 | 35 | 25 | 19 | 31  | 23 | 17 | 28  | 21 | 15 | 26  | 19 | 14 | 23  | 17 | 12 | 21  | 15 | 11 | 18  | 13 | 15 | 11  | 11 | 13 | 13  | 15 | 11 | 12  | 13 | 9  | 10  | 11 | 8  | 14  | 10 | 7  |    |
|                        |                        | 20-27                 | Interior       | 77                     | 48 | 39 | 77 | 43 | 35 | 72  | 38 | 31 | 60  | 34 | 28 | 54  | 31 | 26 | 49  | 28 | 23 | 45  | 26 | 21 | 37  | 22 | 18 | 32  | 19 | 15 | 28  | 16 | 13 | 24  | 14 | 12 | 21  | 12 | 10 | 19  | 11 | 14 |    |
|                        |                        |                       | Exposed        | 54                     | 31 | 25 | 48 | 27 | 23 | 43  | 25 | 20 | 38  | 22 | 18 | 35  | 20 | 17 | 32  | 18 | 15 | 29  | 17 | 14 | 24  | 14 | 12 | 21  | 12 | 10 | 18  | 10 | 13 | 16  | 14 | 11 | 14  | 12 | 10 | 12  | 11 | 9  |    |
|                        | 27-45                  | Interior              | 78             | 60                     | 47 | 60 | 53 | 42 | 53 | 48  | 38 | 48 | 43  | 34 | 43 | 39  | 31 | 40 | 35  | 28 | 36 | 32  | 25 | 30 | 27  | 22 | 26 | 23  | 18 | 23 | 20  | 16 | 20 | 18  | 14 | 17 | 15  | 12 | 15 | 14  | 11 |    |    |
|                        |                        | Exposed               | 43             | 39                     | 31 | 39 | 34 | 27 | 35 | 31  | 24 | 31 | 28  | 22 | 28 | 25  | 20 | 26 | 23  | 18 | 24 | 21  | 17 | 20 | 18  | 14 | 17 | 15  | 12 | 15 | 13  | 10 | 13 | 11  | 14 | 11 | 10  | 12 | 10 | 14  | 11 |    |    |
| 10                     | B                      | 0-7                   | Interior       | 61                     | 61 | 61 | 61 | 59 | 61 | 61  | 52 | 61 | 61  | 47 | 61 | 61  | 42 | 61 | 55  | 38 | 61 | 50  | 35 | 59 | 42  | 29 | 50 | 36  | 25 | 43 | 31  | 22 | 37 | 27  | 19 | 33 | 24  | 17 | 29 | 21  | 15 |    |    |
|                        |                        |                       | Exposed        | 61                     | 61 | 42 | 61 | 54 | 37 | 61  | 48 | 33 | 60  | 43 | 30 | 54  | 39 | 27 | 49  | 35 | 25 | 45  | 32 | 23 | 38  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 11 | 19  | 14 | 15 |    |
|                        |                        | 7-20                  | Interior       | 62                     | 62 | 58 | 62 | 62 | 51 | 62  | 62 | 46 | 62  | 56 | 41 | 62  | 51 | 37 | 62  | 46 | 34 | 58  | 42 | 31 | 49  | 35 | 26 | 42  | 30 | 22 | 36  | 26 | 19 | 31  | 23 | 17 | 27  | 20 | 15 | 24  | 18 | 13 |    |
|                        |                        |                       | Exposed        | 62                     | 51 | 37 | 62 | 45 | 33 | 56  | 40 | 29 | 50  | 36 | 26 | 45  | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 31  | 23 | 17 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 11 | 18  | 13 | 14 | 16  | 11 | 13 |    |
|                        |                        | 20-27                 | Interior       | 70                     | 70 | 70 | 70 | 70 | 62 | 70  | 70 | 55 | 70  | 61 | 50 | 70  | 55 | 45 | 70  | 50 | 41 | 70  | 45 | 37 | 70  | 38 | 31 | 57  | 33 | 27 | 49  | 28 | 23 | 42  | 24 | 20 | 37  | 21 | 18 | 33  | 19 | 16 |    |
|                        |                        |                       | Exposed        | 70                     | 55 | 45 | 70 | 49 | 40 | 70  | 43 | 36 | 70  | 39 | 32 | 62  | 35 | 29 | 56  | 32 | 26 | 51  | 29 | 24 | 43  | 25 | 20 | 36  | 21 | 17 | 31  | 18 | 15 | 27  | 16 | 13 | 24  | 14 | 12 | 21  | 12 | 10 |    |
|                        | 27-45                  | Interior              | 76             | 76                     | 76 | 76 | 76 | 76 | 76 | 76  | 76 | 73 | 76  | 76 | 76 | 76  | 62 | 76 | 62  | 49 | 64 | 57  | 45 | 54 | 48  | 38 | 46 | 41  | 32 | 39 | 35  | 28 | 34 | 31  | 24 | 30 | 27  | 21 | 27 | 24  | 19 |    |    |
|                        |                        | Exposed               | 76             | 76                     | 54 | 76 | 61 | 48 | 61 | 54  | 43 | 55 | 49  | 39 | 50 | 44  | 35 | 45 | 40  | 32 | 41 | 37  | 29 | 35 | 31  | 24 | 30 | 26  | 21 | 26 | 23  | 18 | 22 | 20  | 16 | 20 | 18  | 14 | 17 | 16  | 12 |    |    |
|                        | C                      | 0-7                   | Interior       | 61                     | 61 | 45 | 61 | 57 | 40 | 61  | 51 | 35 | 61  | 46 | 32 | 58  | 41 | 29 | 52  | 37 | 26 | 48  | 34 | 24 | 40  | 29 | 20 | 34  | 25 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 20  | 14 | 10 |    |
|                        |                        |                       | Exposed        | 57                     | 41 | 29 | 51 | 37 | 26 | 45  | 33 | 23 | 41  | 29 | 21 | 37  | 27 | 19 | 34  | 24 | 17 | 31  | 22 | 16 | 26  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 15 | 17  | 12 | 13 | 15  | 11 | 11 | 13  | 14 | 9  |    |
|                        |                        | 7-20                  | Interior       | 62                     | 54 | 39 | 62 | 48 | 35 | 59  | 43 | 31 | 53  | 38 | 28 | 48  | 35 | 25 | 43  | 31 | 23 | 40  | 29 | 21 | 33  | 24 | 18 | 28  | 21 | 15 | 25  | 18 | 13 | 21  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 14 |    |
|                        |                        |                       | Exposed        | 48                     | 34 | 25 | 42 | 31 | 23 | 38  | 27 | 20 | 34  | 25 | 18 | 31  | 22 | 16 | 28  | 20 | 15 | 26  | 19 | 14 | 22  | 16 | 12 | 18  | 13 | 10 | 16  | 12 | 13 | 14  | 10 | 11 | 12  | 14 | 10 | 11  | 12 | 9  |    |
|                        |                        | 20-27                 | Interior       | 70                     | 58 | 47 | 70 | 51 | 42 | 70  | 46 | 38 | 70  | 41 | 34 | 67  | 37 | 31 | 59  | 34 | 28 | 54  | 31 | 26 | 45  | 26 | 22 | 39  | 22 | 18 | 33  | 19 | 16 | 29  | 17 | 14 | 25  | 15 | 12 | 23  | 13 | 11 |    |
|                        |                        |                       | Exposed        | 65                     | 37 | 31 | 58 | 33 | 27 | 52  | 30 | 24 | 46  | 27 | 22 | 42  | 24 | 20 | 38  | 22 | 18 | 35  | 20 | 17 | 29  | 17 | 14 | 25  | 15 | 12 | 2   |    |    |     |    |    |     |    |    |     |    |    |    |







## 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         |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |    |    |     |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
| 0                      | B                      | 0-7                   | Interior       | 46                     | 46 | 40 | 46 | 46 | 35 | 46 | 46 | 32 | 46 | 41 | 28 | 46 | 37 | 26 | 46 | 33 | 23 | 43  | 30 | 21 | 36 | 25 | 18 | 30 | 22 | 15 | 26  | 19 | 13 | 22 | 16 | 11 | 20 | 14 | 10 | 17  | 13 | 9  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 46                     | 37 | 25 | 46 | 33 | 23 | 41 | 29 | 20 | 36 | 26 | 18 | 33 | 24 | 16 | 30 | 21 | 15 | 27  | 19 | 14 | 23 | 16 | 11 | 19 | 14 | 10 | 17  | 12 | 8  | 14 | 10 | 7  | 13 | 9  | 6  | 11  | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 47                     | 47 | 35 | 47 | 43 | 31 | 47 | 38 | 28 | 47 | 34 | 25 | 43 | 31 | 22 | 39 | 28 | 20 | 35  | 25 | 19 | 30 | 21 | 16 | 25 | 18 | 13 | 22  | 16 | 11 | 19 | 14 | 10 | 16 | 12 | 9  | 15  | 11 | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 43                     | 31 | 22 | 38 | 27 | 20 | 34 | 24 | 18 | 30 | 22 | 16 | 27 | 20 | 14 | 25 | 18 | 13 | 23  | 16 | 12 | 19 | 14 | 10 | 16 | 12 | 9  | 14  | 10 | 7  | 12 | 9  | 6  | 11 | 8  | 6  | 9   | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 47 | 42 | 47 | 47 | 38 | 47 | 41 | 34 | 47 | 37 | 30 | 47 | 33 | 27 | 47 | 30 | 25 | 47  | 27 | 23 | 40 | 23 | 19 | 34 | 20 | 16 | 29  | 17 | 14 | 26 | 15 | 12 | 22 | 13 | 11 | 20  | 11 | 9  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 47                     | 33 | 27 | 47 | 29 | 24 | 47 | 26 | 22 | 41 | 24 | 19 | 37 | 21 | 18 | 34 | 19 | 16 | 31  | 18 | 15 | 26 | 15 | 12 | 22 | 13 | 10 | 19  | 11 | 9  | 16 | 10 | 8  | 14 | 8  | 7  | 13  | 7  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 48             | 48                     | 48 | 48 | 48 | 47 | 48 | 48 | 40 | 48 | 48 | 36 | 48 | 42 | 33 | 42 | 39 | 30 | 39 | 34  | 27 | 32 | 29 | 33 | 28 | 25 | 19 | 24 | 21  | 17 | 21 | 19 | 15 | 18 | 16 | 13 | 16 | 14  | 11 |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 48             | 41                     | 32 | 41 | 37 | 29 | 37 | 33 | 26 | 33 | 30 | 23 | 30 | 23 | 30 | 23 | 27 | 21 | 27 | 24  | 19 | 25 | 22 | 18 | 21 | 19 | 15 | 18 | 16  | 13 | 15 | 14 | 11 | 13 | 12 | 9  | 12 | 11  | 8  | 10 | 9 | 7 |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 46                     | 39 | 27 | 46 | 35 | 24 | 44 | 31 | 21 | 39 | 28 | 19 | 35 | 25 | 17 | 32 | 23 | 16 | 29  | 21 | 14 | 24 | 17 | 12 | 20 | 15 | 10 | 18  | 13 | 9  | 15 | 11 | 8  | 13 | 10 | 7  | 12  | 9  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 35                     | 25 | 17 | 31 | 22 | 15 | 27 | 20 | 14 | 25 | 18 | 12 | 22 | 16 | 11 | 20 | 15 | 10 | 18  | 13 | 9  | 16 | 11 | 8  | 13 | 10 | 7  | 11  | 8  | 6  | 10 | 7  | 8  | 9  | 6  | 7  | 8   | 6  | 7  | 8 |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 47                     | 32 | 24 | 40 | 29 | 21 | 36 | 26 | 19 | 32 | 23 | 17 | 29 | 21 | 15 | 26 | 19 | 14 | 24  | 17 | 13 | 20 | 15 | 11 | 17 | 12 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 6  | 10  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 29                     | 21 | 15 | 26 | 18 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13 | 10 | 17 | 12 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 6  | 10  | 7  | 8  | 8  | 6  | 7  | 7  | 8  | 6  | 6   | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 35 | 29 | 47 | 31 | 26 | 47 | 28 | 23 | 45 | 25 | 21 | 40 | 23 | 19 | 36 | 21 | 17 | 33  | 19 | 15 | 27 | 16 | 13 | 23 | 13 | 11 | 20  | 12 | 10 | 17 | 10 | 8  | 15 | 9  | 7  | 14  | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 23 | 18 | 35 | 20 | 16 | 31 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12 | 23 | 13 | 11 | 21  | 12 | 10 | 18 | 10 | 8  | 15 | 9  | 7  | 13  | 7  | 6  | 11 | 6  | 8  | 10 | 6  | 7  | 9   | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 48             | 45                     | 34 | 45 | 39 | 31 | 39 | 35 | 27 | 35 | 31 | 25 | 32 | 28 | 22 | 29 | 26 | 20 | 26 | 24  | 19 | 22 | 20 | 16 | 19 | 17 | 13 | 16 | 15  | 12 | 14 | 13 | 10 | 13 | 11 | 9  | 11 | 10  | 8  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 32             | 28                     | 22 | 28 | 25 | 20 | 25 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19 | 17 | 13 | 17 | 15  | 12 | 14 | 13 | 10 | 12 | 11 | 9  | 11 | 9   | 7  | 9  | 8  | 6  | 8  | 7  | 6  | 7  | 6   | 8  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | D                      | 0-7                   | Interior       | 46                     | 32 | 22 | 40 | 28 | 20 | 36 | 25 | 18 | 32 | 23 | 16 | 29 | 21 | 14 | 26 | 19 | 13 | 24  | 17 | 12 | 20 | 14 | 10 | 17 | 12 | 9  | 15  | 11 | 7  | 13 | 9  | 6  | 11 | 8  | 6  | 10  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 29                     | 21 | 14 | 25 | 18 | 13 | 23 | 16 | 11 | 20 | 15 | 10 | 18 | 13 | 9  | 17 | 12 | 8  | 15  | 11 | 8  | 13 | 9  | 6  | 11 | 8  | 6  | 10  | 7  | 7  | 8  | 6  | 6  | 7  | 8  | 6  | 7   | 5  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 37                     | 27 | 20 | 33 | 24 | 17 | 29 | 21 | 16 | 26 | 19 | 14 | 24 | 17 | 13 | 22 | 16 | 12 | 20  | 14 | 10 | 17 | 12 | 9  | 14 | 10 | 8  | 12  | 9  | 6  | 11 | 8  | 6  | 9  | 7  | 8  | 8   | 6  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 24                     | 17 | 13 | 21 | 15 | 11 | 19 | 14 | 10 | 17 | 12 | 9  | 15 | 11 | 8  | 14 | 10 | 7  | 13  | 9  | 7  | 11 | 8  | 6  | 9  | 7  | 7  | 8   | 6  | 6  | 7  | 8  | 6  | 6  | 7  | 5  | 8   | 6  | 4  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 29 | 24 | 47 | 26 | 21 | 40 | 23 | 19 | 36 | 21 | 17 | 33 | 19 | 15 | 30 | 17 | 14 | 27  | 16 | 13 | 23 | 13 | 11 | 19 | 11 | 9  | 17  | 10 | 8  | 14 | 8  | 7  | 13 | 7  | 6  | 11  | 6  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 33                     | 19 | 15 | 29 | 17 | 14 | 26 | 15 | 12 | 23 | 13 | 11 | 21 | 12 | 10 | 19 | 11 | 9  | 17  | 10 | 8  | 15 | 8  | 7  | 12 | 7  | 6  | 11  | 6  | 8  | 9  | 8  | 7  | 8  | 7  | 6  | 7   | 6  | 5  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 41             | 36                     | 28 | 36 | 32 | 25 | 32 | 29 | 23 | 29 | 26 | 20 | 26 | 24 | 19 | 24 | 21 | 17 | 22 | 20  | 15 | 18 | 16 | 13 | 16 | 14 | 11 | 14 | 12  | 10 | 12 | 11 | 8  | 10 | 9  | 7  | 9  | 8   | 6  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 26             | 23                     | 18 | 23 | 21 | 16 | 21 | 19 | 15 | 19 | 17 | 13 | 17 | 15 | 12 | 16 | 14 | 11 | 14 | 13  | 10 | 12 | 11 | 8  | 10 | 9  | 7  | 9  | 8   | 6  | 8  | 7  | 8  | 7  | 6  | 7  | 6  | 8   |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
| 10                     | B                      | 0-7                   | Interior       | 38                     | 38 | 38 | 38 | 35 | 38 | 38 | 32 | 38 | 38 | 28 | 38 | 37 | 26 | 38 | 33 | 23 | 38 | 30  | 21 | 36 | 25 | 18 | 30 | 22 | 15 | 26 | 19  | 13 | 22 | 16 | 11 | 20 | 14 | 10 | 17 | 13  | 9  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 37 | 25 | 38 | 33 | 23 | 38 | 29 | 20 | 36 | 26 | 18 | 33 | 24 | 16 | 30 | 21 | 15 | 27  | 19 | 14 | 23 | 16 | 11 | 19 | 14 | 10 | 17  | 12 | 8  | 14 | 10 | 7  | 13 | 9  | 6  | 11  | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 38                     | 38 | 35 | 38 | 38 | 31 | 38 | 38 | 28 | 38 | 34 | 25 | 38 | 31 | 22 | 38 | 28 | 20 | 35  | 25 | 19 | 30 | 21 | 16 | 25 | 18 | 13 | 22  | 16 | 11 | 19 | 14 | 10 | 16 | 12 | 9  | 15  | 11 | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 38                     | 31 | 22 | 38 | 27 | 20 | 34 | 24 | 18 | 30 | 22 | 16 | 27 | 20 | 14 | 25 | 18 | 13 | 23  | 16 | 12 | 19 | 14 | 10 | 16 | 12 | 9  | 14  | 10 | 7  | 12 | 9  | 6  | 11 | 8  | 6  | 9   | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 43                     | 43 | 42 | 43 | 43 | 38 | 43 | 41 | 34 | 43 | 37 | 30 | 43 | 33 | 27 | 43 | 30 | 25 | 43  | 27 | 23 | 40 | 23 | 19 | 34 | 20 | 16 | 29  | 17 | 14 | 26 | 15 | 12 | 22 | 13 | 11 | 20  | 11 | 9  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 43                     | 33 | 27 | 43 | 29 | 24 | 43 | 26 | 22 | 41 | 24 | 19 | 37 | 31 | 18 | 34 | 19 | 16 | 31  | 18 | 15 | 26 | 15 | 12 | 22 | 13 | 10 | 19  | 11 | 9  | 16 | 10 | 8  | 14 | 8  | 7  | 13  | 7  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 47             | 47                     | 47 | 47 | 47 | 47 | 47 | 47 | 40 | 47 | 47 | 36 | 47 | 42 | 33 | 42 | 38 | 30 | 39 | 34  | 27 | 32 | 29 | 33 | 28 | 25 | 19 | 24 | 21  | 17 | 21 | 19 | 15 | 18 | 16 | 13 | 16 | 14  | 11 |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 47             | 41                     | 32 | 41 | 37 | 29 | 37 | 33 | 26 | 33 | 30 | 23 | 30 | 27 | 21 | 27 | 24 | 19 | 25 | 22  | 18 | 21 | 19 | 15 | 18 | 16 | 13 | 15 | 14  | 11 | 13 | 12 | 9  | 12 | 11 | 8  | 10 | 9   | 7  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 38                     | 38 | 27 | 38 | 35 | 24 | 38 | 31 | 21 | 38 | 28 | 19 | 35 | 25 | 17 | 32 | 23 | 16 | 29  | 21 | 14 | 24 | 17 | 12 | 20 | 15 | 10 | 18  | 13 | 9  | 15 | 11 | 8  | 13 | 10 | 7  | 12  | 9  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 35                     | 25 | 17 | 31 | 22 | 15 | 27 | 20 | 14 | 25 | 18 | 12 | 22 | 16 | 11 | 20 | 15 | 10 | 18  | 13 | 9  | 16 | 11 | 8  | 13 | 10 | 7  | 11  | 8  | 6  | 10 | 7  | 8  | 9  | 6  | 7  | 8   | 6  | 7  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 38                     | 32 | 24 | 38 | 29 | 21 | 36 | 26 | 19 | 32 | 23 | 17 | 29 | 21 | 15 | 26 | 19 | 14 | 24  | 17 | 13 | 20 | 15 | 11 | 17 | 12 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 6  | 10  | 7  | 8  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 29                     | 21 | 15 | 26 | 18 | 14 | 23 | 17 | 12 | 21 | 15 | 11 | 19 | 13 | 10 | 17 | 12 | 9  | 15  | 11 | 8  | 13 | 9  | 7  | 11 | 8  | 6  | 10  | 7  | 8  | 8  | 6  | 7  | 7  | 8  | 6  | 7   | 5  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 43                     | 35 | 29 | 43 | 31 | 26 | 43 | 28 | 23 | 43 | 25 | 21 | 40 | 23 | 19 | 36 | 21 | 17 | 33  | 19 | 15 | 27 | 16 | 13 | 23 | 13 | 11 | 20  | 12 | 10 | 17 | 10 | 8  | 15 | 9  | 7  | 14  | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        |                       | Exposed        | 39                     | 23 | 18 | 35 | 20 | 16 | 31 | 18 | 15 | 28 | 16 | 13 | 25 | 15 | 12 | 23 | 13 | 11 | 21  | 12 | 10 | 18 | 10 | 8  | 15 | 9  | 7  | 13  | 7  | 6  | 11 | 6  | 8  | 10 | 6  | 7  | 9   | 8  | 6  |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        | 27-45                  | Interior              | 47             | 45                     | 34 | 45 | 39 | 31 | 39 | 35 | 27 | 35 | 31 | 25 | 32 | 28 | 22 | 29 | 26 | 20 | 26 | 24  | 19 | 22 | 20 | 16 | 19 | 17 | 13 | 16 | 15  | 12 | 14 | 13 | 10 | 13 | 11 | 9  | 11 | 10  | 8  |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |
|                        |                        | Exposed               | 32             | 28                     | 22 | 28 | 25 | 20 | 25 | 23 | 18 | 23 | 20 | 16 | 21 | 18 | 14 | 19 | 17 | 13 | 17 | 15  | 12 | 14 | 13 | 10 | 12 | 11 | 9  | 11 | 9   | 7  | 9  | 8  | 6  | 8  | 7  | 6  | 7  |     |    |    |   |   |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |     |  |  |  |  |  |  |  |  |









ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

19 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

UAF  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## 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  |     |    |    |     |    |    |
| 0                      | B                      | 0-7                   | Interior       | 77                     | 77 | 75 | 77 | 77 | 60 | 77  | 77 | 53 | 77  | 77 | 48 | 77  | 62 | 43 | 77  | 56 | 39 | 77  | 51 | 36 | 60  | 43 | 30 | 51  | 37 | 26 | 44  | 32 | 22 | 38  | 27 | 19 | 33  | 24 | 17 | 30  | 21 | 15 |
|                        |                        |                       | Exposed        | 77                     | 62 | 43 | 77 | 55 | 38 | 77  | 49 | 34 | 62  | 44 | 31 | 56  | 40 | 28 | 50  | 36 | 25 | 46  | 33 | 23 | 38  | 28 | 20 | 33  | 24 | 17 | 28  | 20 | 14 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 14 | 10 |
|                        |                        | 7-20                  | Interior       | 77                     | 77 | 59 | 77 | 77 | 52 | 77  | 64 | 47 | 77  | 58 | 42 | 77  | 52 | 38 | 71  | 47 | 34 | 60  | 43 | 31 | 50  | 36 | 26 | 43  | 31 | 23 | 37  | 27 | 20 | 32  | 23 | 17 | 28  | 20 | 15 | 25  | 18 | 13 |
|                        |                        |                       | Exposed        | 77                     | 52 | 38 | 64 | 46 | 34 | 57  | 41 | 30 | 51  | 37 | 27 | 46  | 33 | 25 | 42  | 30 | 22 | 38  | 28 | 20 | 32  | 23 | 17 | 27  | 20 | 15 | 24  | 17 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 12 | 9  |
|                        |                        | 20-27                 | Interior       | 78                     | 78 | 78 | 78 | 78 | 64 | 78  | 78 | 57 | 78  | 62 | 51 | 78  | 56 | 46 | 78  | 51 | 42 | 78  | 46 | 38 | 78  | 39 | 32 | 58  | 33 | 27 | 50  | 29 | 24 | 43  | 25 | 21 | 38  | 22 | 18 | 34  | 19 | 16 |
|                        |                        |                       | Exposed        | 78                     | 56 | 46 | 78 | 50 | 41 | 78  | 44 | 36 | 78  | 40 | 33 | 63  | 36 | 30 | 57  | 33 | 27 | 52  | 30 | 25 | 44  | 25 | 21 | 37  | 22 | 18 | 32  | 19 | 15 | 28  | 16 | 13 | 25  | 14 | 12 | 22  | 13 | 10 |
|                        | 27-45                  | Interior              | 80             | 80                     | 80 | 80 | 80 | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 | 80 | 80  | 80 |    |
|                        |                        | Exposed               | 80             | 80                     | 55 | 80 | 62 | 49 | 62 | 56  | 44 | 56 | 50  | 39 | 51 | 45  | 36 | 46 | 41  | 32 | 42 | 38  | 30 | 35 | 32  | 25 | 30 | 27  | 21 | 26 | 23  | 19 | 23 | 20  | 16 | 20 | 18  | 14 | 18 | 16  | 13 |    |
|                        | C                      | 0-7                   | Interior       | 77                     | 67 | 46 | 77 | 58 | 41 | 77  | 52 | 36 | 66  | 47 | 33 | 59  | 42 | 30 | 53  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 12 | 20  | 15 | 10 |
|                        |                        |                       | Exposed        | 59                     | 42 | 29 | 52 | 37 | 26 | 46  | 33 | 23 | 42  | 30 | 21 | 38  | 27 | 19 | 34  | 25 | 17 | 31  | 23 | 16 | 26  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 13 | 15  | 11 | 12 | 13  | 10 | 10 |
|                        |                        | 7-20                  | Interior       | 77                     | 55 | 40 | 77 | 49 | 36 | 61  | 43 | 32 | 54  | 39 | 29 | 49  | 35 | 26 | 44  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 10 | 17  | 12 | 14 |
|                        |                        |                       | Exposed        | 49                     | 35 | 26 | 43 | 31 | 23 | 39  | 28 | 21 | 35  | 25 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 26  | 19 | 14 | 22  | 16 | 12 | 19  | 14 | 10 | 16  | 12 | 13 | 14  | 10 | 12 | 14  | 10 | 11 | 12  | 9  | 9  |
|                        |                        | 20-27                 | Interior       | 78                     | 59 | 49 | 78 | 53 | 43 | 78  | 47 | 39 | 78  | 42 | 35 | 73  | 38 | 31 | 61  | 35 | 29 | 55  | 32 | 26 | 46  | 27 | 22 | 39  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 11 |
|                        |                        |                       | Exposed        | 72                     | 38 | 31 | 59 | 34 | 28 | 53  | 30 | 25 | 47  | 27 | 23 | 43  | 25 | 20 | 39  | 23 | 19 | 36  | 21 | 17 | 30  | 17 | 14 | 26  | 15 | 12 | 22  | 13 | 11 | 19  | 11 | 14 | 17  | 10 | 12 | 15  | 13 | 11 |
|                        | 27-45                  | Interior              | 80             | 80                     | 58 | 80 | 68 | 52 | 80 | 59  | 46 | 59 | 53  | 42 | 54 | 48  | 38 | 49 | 44  | 34 | 45 | 40  | 31 | 38 | 34  | 26 | 32 | 29  | 23 | 28 | 25  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 19 | 17  | 13 |    |
|                        |                        | Exposed               | 53             | 48                     | 38 | 48 | 42 | 33 | 43 | 38  | 30 | 38 | 34  | 27 | 35 | 31  | 25 | 32 | 28  | 22 | 29 | 26  | 20 | 24 | 22  | 17 | 21 | 19  | 15 | 18 | 16  | 13 | 16 | 14  | 11 | 14 | 12  | 10 | 12 | 11  | 13 |    |
|                        | D                      | 0-7                   | Interior       | 77                     | 54 | 38 | 72 | 48 | 34 | 60  | 43 | 30 | 54  | 39 | 27 | 49  | 35 | 24 | 44  | 32 | 22 | 40  | 29 | 20 | 34  | 24 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 13 |
|                        |                        |                       | Exposed        | 48                     | 35 | 24 | 43 | 31 | 22 | 38  | 28 | 19 | 35  | 25 | 18 | 31  | 23 | 16 | 28  | 21 | 14 | 26  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 10 | 16  | 12 | 13 | 14  | 10 | 11 | 12  | 14 | 10 | 11  | 12 | 9  |
|                        |                        | 7-20                  | Interior       | 63                     | 45 | 33 | 56 | 40 | 29 | 50  | 36 | 26 | 45  | 32 | 24 | 40  | 29 | 22 | 37  | 27 | 20 | 34  | 24 | 18 | 28  | 21 | 15 | 24  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 12 | 13 | 14  | 10 | 12 |
|                        |                        |                       | Exposed        | 40                     | 29 | 21 | 36 | 26 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 26  | 19 | 14 | 24  | 17 | 13 | 22  | 16 | 12 | 18  | 13 | 10 | 16  | 11 | 13 | 14  | 10 | 11 | 12  | 13 | 10 | 10  | 12 | 8  | 14  | 10 | 7  |
|                        |                        | 20-27                 | Interior       | 78                     | 49 | 40 | 78 | 43 | 36 | 78  | 39 | 32 | 61  | 35 | 29 | 55  | 32 | 26 | 50  | 29 | 24 | 46  | 26 | 22 | 38  | 22 | 18 | 33  | 19 | 16 | 28  | 16 | 14 | 25  | 14 | 12 | 22  | 13 | 10 | 19  | 11 | 14 |
|                        |                        |                       | Exposed        | 55                     | 32 | 26 | 49 | 28 | 23 | 44  | 25 | 21 | 39  | 23 | 19 | 36  | 21 | 17 | 32  | 19 | 15 | 29  | 17 | 14 | 25  | 14 | 12 | 21  | 12 | 10 | 18  | 11 | 13 | 16  | 14 | 12 | 14  | 12 | 10 | 12  | 11 | 9  |
|                        | 27-45                  | Interior              | 80             | 61                     | 48 | 61 | 54 | 43 | 55 | 49  | 38 | 49 | 44  | 35 | 44 | 40  | 31 | 40 | 36  | 29 | 37 | 33  | 26 | 31 | 28  | 22 | 27 | 24  | 19 | 23 | 21  | 16 | 20 | 18  | 14 | 18 | 16  | 13 | 16 | 14  | 11 |    |
|                        |                        | Exposed               | 44             | 40                     | 31 | 39 | 35 | 28 | 35 | 32  | 25 | 32 | 29  | 23 | 29 | 26  | 20 | 26 | 24  | 19 | 24 | 22  | 17 | 20 | 18  | 14 | 17 | 16  | 12 | 15 | 13  | 11 | 13 | 12  | 14 | 12 | 10  | 12 | 10 | 14  | 11 |    |
| 10                     | B                      | 0-7                   | Interior       | 63                     | 63 | 63 | 63 | 63 | 60 | 63  | 63 | 53 | 63  | 63 | 48 | 63  | 62 | 43 | 63  | 56 | 39 | 63  | 51 | 36 | 60  | 43 | 30 | 51  | 37 | 26 | 44  | 32 | 22 | 38  | 27 | 19 | 33  | 24 | 17 | 30  | 21 | 15 |
|                        |                        |                       | Exposed        | 63                     | 62 | 43 | 63 | 55 | 38 | 63  | 49 | 34 | 62  | 44 | 31 | 56  | 40 | 28 | 50  | 36 | 25 | 46  | 33 | 23 | 38  | 28 | 20 | 33  | 24 | 17 | 28  | 20 | 14 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 14 | 10 |
|                        |                        | 7-20                  | Interior       | 63                     | 63 | 59 | 63 | 63 | 52 | 63  | 63 | 47 | 63  | 58 | 42 | 63  | 52 | 38 | 63  | 47 | 34 | 60  | 43 | 31 | 50  | 36 | 26 | 43  | 31 | 23 | 37  | 27 | 20 | 32  | 23 | 17 | 28  | 20 | 15 | 25  | 18 | 13 |
|                        |                        |                       | Exposed        | 63                     | 52 | 38 | 63 | 46 | 34 | 57  | 41 | 30 | 51  | 37 | 27 | 46  | 33 | 25 | 42  | 30 | 22 | 38  | 28 | 20 | 32  | 23 | 17 | 27  | 20 | 15 | 24  | 17 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 12 | 13 |
|                        |                        | 20-27                 | Interior       | 72                     | 72 | 72 | 72 | 64 | 72 | 72  | 57 | 72 | 62  | 51 | 72 | 56  | 46 | 72 | 51  | 42 | 72 | 46  | 38 | 72 | 39  | 32 | 58 | 33  | 27 | 50 | 29  | 24 | 43 | 25  | 21 | 38 | 22  | 18 | 34 | 19  | 16 |    |
|                        |                        |                       | Exposed        | 72                     | 56 | 46 | 72 | 50 | 41 | 72  | 44 | 36 | 72  | 40 | 33 | 63  | 36 | 30 | 57  | 33 | 27 | 52  | 30 | 25 | 44  | 25 | 21 | 37  | 22 | 18 | 32  | 19 | 15 | 28  | 16 | 13 | 25  | 14 | 12 | 24  | 13 | 10 |
|                        | 27-45                  | Interior              | 77             | 77                     | 77 | 77 | 77 | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 | 77 | 77  | 77 |    |
|                        |                        | Exposed               | 77             | 77                     | 55 | 77 | 62 | 49 | 62 | 56  | 44 | 56 | 50  | 39 | 51 | 45  | 36 | 46 | 41  | 32 | 42 | 38  | 30 | 35 | 32  | 25 | 30 | 27  | 21 | 26 | 23  | 19 | 23 | 20  | 16 | 20 | 18  | 14 | 18 | 16  | 13 |    |
|                        | C                      | 0-7                   | Interior       | 63                     | 63 | 46 | 63 | 58 | 41 | 63  | 52 | 36 | 63  | 47 | 33 | 59  | 42 | 30 | 53  | 38 | 27 | 49  | 35 | 25 | 41  | 29 | 21 | 35  | 25 | 18 | 30  | 22 | 15 | 26  | 19 | 13 | 23  | 17 | 12 | 20  | 15 | 10 |
|                        |                        |                       | Exposed        | 59                     | 42 | 29 | 52 | 37 | 26 | 46  | 33 | 23 | 42  | 30 | 21 | 38  | 27 | 19 | 34  | 25 | 17 | 31  | 23 | 16 | 26  | 19 | 13 | 22  | 16 | 11 | 19  | 14 | 10 | 17  | 12 | 13 | 15  | 11 | 12 | 13  | 10 | 10 |
|                        |                        | 7-20                  | Interior       | 63                     | 55 | 40 | 63 | 49 | 36 | 61  | 43 | 32 | 54  | 39 | 29 | 49  | 35 | 26 | 44  | 32 | 24 | 41  | 29 | 22 | 34  | 25 | 18 | 29  | 21 | 16 | 25  | 18 | 13 | 22  | 16 | 12 | 19  | 14 | 10 | 17  | 12 | 14 |
|                        |                        |                       | Exposed        | 49                     | 35 | 26 | 43 | 31 | 23 | 39  | 28 | 21 | 35  | 25 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 26  | 19 | 14 | 22  | 16 | 12 | 19  | 14 | 10 | 16  | 12 | 13 | 14  | 10 | 12 | 14  | 10 | 11 | 12  | 9  |    |
|                        |                        | 20-27                 | Interior       | 72                     | 59 | 49 | 72 | 53 | 43 | 72  | 47 | 39 | 72  | 42 | 35 | 72  | 38 | 31 | 61  | 35 | 29 | 55  | 32 | 26 | 46  | 27 | 22 | 39  | 23 | 19 | 34  | 20 | 16 | 30  | 17 | 14 | 26  | 15 | 12 | 23  | 13 | 11 |
|                        |                        |                       | Exposed        | 72                     | 38 | 31 | 59 | 34 | 28 | 53  | 30 | 25 | 47  | 27 | 23 | 43  | 25 | 20 | 39  | 23 | 19 | 36  | 21 | 17 | 30  | 17 | 14 | 26  | 15 | 12 | 22  | 13 | 11 | 19  | 11 | 14 | 17  | 10 | 12 | 15  | 13 | 11 |
|                        | 27-45                  | Interior              | 77             | 77                     | 58 | 77 | 68 | 52 |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |



ASCE 7-22  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

19 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SM  
Rail Type

UAF  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## 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         |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
| 30                     | B                      | 0-7                   | Interior       | 37                     | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 |    |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 37                     | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 47                     | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 | 47 | 47 | 47 | 47 | 47  | 47 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 27-45                  | Interior              | 54             | 54                     | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 54             | 54                     | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  | 54 | 54 | 54 | 54 | 54 | 54  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | C                      | 0-7                   | Interior       | 37                     | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 | 37  | 37 | 37 | 37 | 37 | 37 |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 37 | 29 | 37 | 37 | 26 | 37 | 33 | 23 | 37 | 30 | 21 | 37  | 27 | 19 | 34 | 25 | 17 | 31  | 23 | 16 | 26 | 19 | 13 | 22  | 16 | 11 | 19 | 14 | 10 | 17  | 12 | 13 | 10 | 10 | 10 |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 37                     | 37 | 37 | 37 | 37 | 36 | 37 | 37 | 32 | 37 | 37 | 29 | 37  | 35 | 26 | 37 | 32 | 24 | 37  | 29 | 22 | 34 | 25 | 18 | 29  | 21 | 16 | 25 | 18 | 13 | 22  | 16 | 12 | 19 | 14 | 10 | 17  | 12 | 14 |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 35 | 26 | 37 | 31 | 23 | 36 | 37 | 28 | 21 | 35 | 25 | 19  | 32 | 23 | 17 | 29 | 21 | 15  | 26 | 19 | 14 | 24 | 17 | 13  | 22 | 16 | 12 | 18 | 13 | 10  | 16 | 12 | 14 | 10 | 11 | 12  | 9  |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 47                     | 47 | 47 | 47 | 47 | 43 | 47 | 47 | 39 | 47 | 47 | 42 | 35  | 47 | 38 | 31 | 47 | 35 | 29  | 47 | 32 | 26 | 46 | 27 | 22  | 39 | 23 | 19 | 34 | 20 | 16  | 30 | 17 | 14 | 26 | 15 | 12  | 23 | 13 | 11 |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 47                     | 38 | 31 | 47 | 34 | 28 | 47 | 30 | 25 | 47 | 27 | 23 | 43  | 25 | 20 | 39 | 23 | 19 | 36  | 21 | 17 | 32 | 19 | 15 | 29  | 17 | 14 | 25 | 14 | 12 | 21  | 12 | 10 | 18 | 11 | 13 | 16  | 14 | 12 | 11 | 9 |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 27-45                  | Interior              | 54             | 54                     | 54 | 54 | 54 | 52 | 54 | 54 | 46 | 54 | 53 | 42 | 54 | 48  | 38 | 49 | 44 | 34 | 45 | 40  | 31 | 38 | 34 | 26 | 32 | 29  | 23 | 28 | 25 | 20 | 24 | 22  | 17 | 21 | 19 | 15 | 19 | 17  | 13 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 53             | 48                     | 38 | 48 | 42 | 33 | 43 | 38 | 30 | 38 | 34 | 27 | 35 | 31  | 25 | 32 | 28 | 22 | 29 | 26  | 20 | 24 | 22 | 17 | 21 | 19  | 15 | 23 | 18 | 16 | 13 | 16  | 14 | 11 | 14 | 12 | 10 | 12  | 11 | 13 |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | D                      | 0-7                   | Interior       | 37                     | 37 | 37 | 37 | 37 | 34 | 37 | 37 | 30 | 37 | 37 | 27 | 37  | 35 | 24 | 37 | 32 | 22 | 37  | 29 | 20 | 34 | 24 | 17 | 29  | 21 | 15 | 25 | 18 | 13 | 22  | 16 | 11 | 19 | 14 | 10 | 17  | 12 | 13 |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 35 | 24 | 37 | 31 | 22 | 37 | 28 | 19 | 35 | 25 | 18 | 31  | 23 | 16 | 28 | 21 | 14 | 26  | 19 | 13 | 22 | 16 | 11 | 19  | 14 | 10 | 16 | 12 | 13 | 14  | 10 | 11 | 12 | 14 | 10 | 11  | 12 | 9  |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 7-20                  | Interior       | 37                     | 37 | 33 | 37 | 37 | 29 | 37 | 36 | 26 | 37 | 32 | 24 | 37  | 29 | 22 | 37 | 27 | 20 | 34  | 24 | 18 | 28 | 21 | 15 | 24  | 18 | 13 | 21 | 15 | 11 | 18  | 13 | 10 | 16 | 12 | 13 | 14  | 10 | 12 | 10 |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 37                     | 29 | 21 | 36 | 26 | 19 | 32 | 23 | 17 | 29 | 21 | 15 | 26  | 19 | 14 | 24 | 17 | 13 | 22  | 16 | 12 | 18 | 13 | 10 | 16  | 11 | 13 | 14 | 10 | 11 | 12  | 13 | 10 | 10 | 12 | 8  | 14  | 10 | 7  |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | 20-27                 | Interior       | 50                     | 49 | 40 | 50 | 43 | 36 | 50 | 39 | 32 | 50 | 35 | 29 | 50  | 32 | 26 | 50 | 29 | 24 | 46  | 26 | 22 | 38 | 22 | 18 | 33  | 19 | 16 | 28 | 16 | 14 | 25  | 14 | 12 | 22 | 13 | 10 | 19  | 11 | 14 |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        |                       | Exposed        | 50                     | 32 | 26 | 49 | 28 | 23 | 44 | 25 | 21 | 39 | 23 | 19 | 36  | 21 | 17 | 32 | 19 | 15 | 29  | 17 | 14 | 25 | 14 | 12 | 21  | 12 | 10 | 18 | 11 | 13 | 16  | 14 | 12 | 14 | 12 | 10 | 12  | 11 | 9  |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 27-45                  | Interior              | 56             | 56                     | 48 | 56 | 54 | 43 | 55 | 49 | 38 | 49 | 44 | 35 | 44 | 40  | 31 | 40 | 36 | 29 | 37 | 33  | 26 | 31 | 28 | 22 | 27 | 24  | 19 | 23 | 21 | 16 | 20 | 18  | 14 | 18 | 16 | 13 | 16 | 14  | 11 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 44             | 40                     | 31 | 39 | 35 | 28 | 35 | 32 | 25 | 32 | 29 | 23 | 29 | 26  | 20 | 26 | 24 | 19 | 24 | 22  | 17 | 20 | 18 | 14 | 17 | 16  | 12 | 15 | 13 | 11 | 13 | 12  | 14 | 12 | 10 | 12 | 10 | 14  | 11 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
| B                      | 0-7                    | Interior              | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 7-20                   | Interior              | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 20-27                  | Interior              | 40             | 40                     | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 40             | 40                     | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
| 27-45                  | Interior               | 46                    | 46             | 46                     | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | Exposed                | 46                    | 46             | 46                     | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
| C                      | 0-7                    | Interior              | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 35             | 35                     | 29 | 35 | 35 | 26 | 35 | 33 | 23 | 35 | 30 | 21 | 35 | 27  | 19 | 34 | 25 | 17 | 31 | 23  | 16 | 26 | 19 | 13 | 22 | 16  | 11 | 19 | 14 | 10 | 17 | 12  | 13 | 15 | 11 | 12 | 13 | 10  | 10 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 7-20                   | Interior              | 35             | 35                     | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 | 35 | 35 | 35 | 35 | 35  | 35 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 35             | 35                     | 26 | 35 | 31 | 23 | 35 | 28 | 21 | 35 | 25 | 19 | 32 | 23  | 17 | 29 | 21 | 15 | 26 | 19  | 14 | 22 | 16 | 12 | 19 | 14  | 10 | 16 | 12 | 13 | 14 | 10  | 12 | 14 | 10 | 11 | 12 | 9   |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | 20-27                  | Interior              | 40             | 40                     | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 | 40 | 40 | 40 | 40 | 40  | 40 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        |                        | Exposed               | 40             | 38                     | 31 | 40 | 34 | 28 | 40 | 30 | 25 | 40 | 27 | 23 | 40 | 25  | 20 | 39 | 23 | 19 | 36 | 21  | 17 | 30 | 17 | 14 | 26 | 15  | 12 | 22 | 13 | 11 | 19 | 11  | 14 | 17 | 10 | 12 | 15 | 13  | 11 |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
| 27-45                  | Interior               | 46                    | 46             | 46                     | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  | 46 | 46 | 46 | 46 | 46 | 46  |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |
|                        | Exposed                | 46                    | 46             | 38                     | 46 | 42 | 33 | 43 | 38 | 30 | 38 | 34 | 27 | 35 | 31 | 25  | 32 | 28 | 22 | 29 |    |     |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |     |    |    |    |   |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |     |  |  |  |  |  |





**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) |         |          |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |   |    |   |   |   |
|------------------------|------------------------|-----------------------|----------------|------------------------|---------|----------|----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|-----|----|---|----|---|---|---|
|                        |                        |                       |                | Roof Wind Zone         |         |          |    |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |    |     |    |   |    |   |   |   |
|                        |                        |                       |                | 90                     |         |          | 95 |    |    | 100 |    |    | 105 |    |    | 110 |    |    | 115 |    |    | 120 |    |    | 130 |    |    | 140 |    |    | 150 |    |    | 160 |    |    | 170 |    |    | 180 |    |   |    |   |   |   |
| 0                      | B                      | 0-7                   | Interior       | 39                     | 39      | 33       | 39 | 39 | 30 | 39  | 39 | 26 | 39  | 34 | 24 | 39  | 31 | 21 | 39  | 28 | 19 | 36  | 25 | 18 | 30  | 21 | 15 | 25  | 18 | 13 | 22  | 16 | 11 | 19  | 13 | 9  | 16  | 12 | 8  | 14  | 10 | 7 | 7  |   |   |   |
|                        |                        |                       | C              | 0-7                    | Exposed | 39       | 31 | 21 | 39 | 27  | 19 | 34 | 24  | 17 | 30 | 22  | 15 | 27 | 20  | 14 | 25 | 18  | 12 | 23 | 16  | 11 | 19 | 14  | 10 | 16 | 12  | 8  | 14 | 10  | 7  | 12 | 9   | 6  | 11 | 8   | 8  | 9 | 7  | 7 |   |   |
|                        |                        | D                     |                |                        | 0-7     | Interior | 39 | 39 | 29 | 39  | 36 | 26 | 39  | 32 | 23 | 39  | 28 | 19 | 32  | 23 | 17 | 29  | 21 | 15 | 25  | 18 | 13 | 21  | 15 | 11 | 18  | 13 | 10 | 16  | 11 | 8  | 14  | 10 | 7  | 12  | 9  | 6 | 11 | 8 | 8 | 6 |

\* 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.  
 19 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.







## 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       | 75                     | 75       | 69 | 75 | 75 | 59 | 75  | 75 | 52 | 75  | 73 | 47 | 75  | 61 | 42 | 75  | 55 | 38 | 75  | 50 | 35 | 59  | 42 | 29 | 50  | 36 | 25 | 43  | 31 | 22 | 37  | 27 | 19 | 33  | 24 | 17   | 29  | 21 | 15 |    |    |    |
|                        |                        |                       | Exposed        | 75                     | 61       | 42 | 75 | 54 | 37 | 72  | 48 | 33 | 60  | 43 | 30 | 54  | 39 | 27 | 49  | 35 | 25 | 45  | 32 | 23 | 38  | 27 | 19 | 32  | 23 | 16 | 28  | 20 | 14 | 24  | 17 | 12 | 21  | 15 | 11   | 19  | 14 | 15 |    |    |    |
|                        |                        | 7-20                  | Interior       | 75                     | 75       | 58 | 75 | 51 | 75 | 63  | 46 | 75 | 56  | 41 | 75 | 51  | 37 | 64 | 46  | 34 | 58 | 42  | 31 | 49 | 35  | 26 | 42 | 30  | 22 | 36 | 26  | 19 | 31 | 23  | 17 | 27 | 20  | 15 | 24   | 18  | 13 |    |    |    |    |
|                        |                        |                       | Exposed        | 75                     | 51       | 37 | 63 | 45 | 33 | 56  | 40 | 29 | 50  | 36 | 26 | 45  | 33 | 24 | 41  | 30 | 22 | 37  | 27 | 20 | 31  | 23 | 17 | 27  | 19 | 14 | 23  | 17 | 12 | 20  | 15 | 11 | 18  | 13 | 14   | 16  | 11 | 13 |    |    |    |
|                        |                        | 20-27                 | Interior       | 77                     | 77       | 77 | 77 | 62 | 77 | 77  | 55 | 77 | 61  | 50 | 77 | 55  | 45 | 77 | 50  | 41 | 77 | 45  | 37 | 73 | 38  | 31 | 57 | 33  | 27 | 49 | 28  | 23 | 42 | 24  | 20 | 37 | 21  | 18 | 33   | 19  | 16 |    |    |    |    |
|                        |                        |                       | Exposed        | 77                     | 55       | 45 | 77 | 49 | 40 | 77  | 43 | 36 | 77  | 39 | 32 | 62  | 35 | 29 | 56  | 32 | 26 | 51  | 29 | 24 | 43  | 25 | 20 | 36  | 21 | 17 | 31  | 18 | 15 | 27  | 16 | 13 | 24  | 14 | 12   | 21  | 12 | 10 |    |    |    |
|                        | 27-45                  | Interior              | 78             | 78                     | 78       | 78 | 78 | 78 | 78 | 78  | 78 | 73 | 78  | 73 | 78 | 62  | 49 | 64 | 57  | 45 | 78 | 48  | 38 | 46 | 41  | 37 | 39 | 35  | 28 | 34 | 31  | 24 | 30 | 27  | 21 | 27 | 24  | 19 | 16   | 12  |    |    |    |    |    |
|                        |                        | Exposed               | 78             | 78                     | 54       | 78 | 61 | 48 | 61 | 54  | 43 | 55 | 49  | 39 | 50 | 44  | 35 | 45 | 40  | 32 | 41 | 37  | 29 | 35 | 31  | 24 | 30 | 26  | 21 | 26 | 23  | 18 | 22 | 20  | 16 | 20 | 18  | 14 | 17   | 16  | 12 |    |    |    |    |
|                        | 10                     | B                     | 0-7            | Interior               | 75       | 65 | 45 | 75 | 57 | 40  | 75 | 51 | 35  | 64 | 46 | 32  | 58 | 41 | 29  | 52 | 37 | 26  | 48 | 34 | 24  | 40 | 29 | 20  | 34 | 25 | 17  | 29 | 21 | 15  | 25 | 18 | 13  | 22 | 16   | 11  | 20 | 14 | 10 |    |    |
|                        |                        |                       |                | Exposed                | 57       | 41 | 29 | 51 | 37 | 26  | 45 | 33 | 23  | 41 | 29 | 21  | 37 | 27 | 19  | 34 | 24 | 17  | 31 | 22 | 16  | 26 | 19 | 13  | 22 | 16 | 11  | 19 | 14 | 15  | 17 | 12 | 13  | 15 | 11   | 11  | 13 | 14 | 9  |    |    |
|                        |                        |                       | 7-20           | Interior               | 75       | 54 | 39 | 75 | 48 | 35  | 59 | 43 | 31  | 53 | 38 | 28  | 48 | 35 | 25  | 43 | 31 | 23  | 40 | 29 | 21  | 33 | 24 | 18  | 28 | 21 | 15  | 25 | 18 | 13  | 21 | 16 | 11  | 19 | 14   | 10  | 17 | 12 | 14 |    |    |
|                        |                        |                       |                | Exposed                | 48       | 34 | 25 | 42 | 31 | 23  | 38 | 27 | 20  | 34 | 25 | 18  | 31 | 22 | 16  | 28 | 20 | 15  | 26 | 19 | 14  | 22 | 16 | 12  | 18 | 13 | 10  | 16 | 12 | 13  | 14 | 10 | 11  | 12 | 14   | 10  | 11 | 12 | 9  |    |    |
|                        |                        |                       | 20-27          | Interior               | 77       | 58 | 47 | 77 | 51 | 42  | 77 | 46 | 38  | 77 | 41 | 34  | 67 | 37 | 31  | 59 | 34 | 28  | 54 | 31 | 26  | 45 | 26 | 22  | 39 | 22 | 18  | 33 | 19 | 16  | 29 | 17 | 14  | 25 | 15   | 12  | 23 | 13 | 11 |    |    |
|                        |                        |                       |                | Exposed                | 65       | 37 | 31 | 58 | 33 | 27  | 52 | 30 | 24  | 46 | 27 | 22  | 42 | 24 | 20  | 38 | 22 | 18  | 35 | 20 | 17  | 29 | 17 | 14  | 25 | 15 | 12  | 22 | 13 | 10  | 19 | 11 | 14  | 17 | 15   | 12  | 15 | 13 | 11 |    |    |
|                        |                        | 27-45                 | Interior       | 78                     | 78       | 57 | 78 | 64 | 51 | 65  | 58 | 45 | 58  | 52 | 41 | 52  | 47 | 37 | 48  | 43 | 34 | 44  | 39 | 31 | 37  | 33 | 26 | 31  | 28 | 22 | 27  | 24 | 19 | 24  | 21 | 17 | 21  | 19 | 15   | 18  | 16 | 13 |    |    |    |
|                        |                        |                       | Exposed        | 52                     | 47       | 37 | 47 | 42 | 33 | 42  | 37 | 29 | 38  | 34 | 26 | 34  | 30 | 24 | 31  | 28 | 22 | 28  | 25 | 20 | 24  | 21 | 17 | 20  | 18 | 14 | 17  | 15 | 12 | 15  | 14 | 11 | 14  | 12 | 15   | 12  | 11 | 13 |    |    |    |
|                        |                        | 20                    | B              | 0-7                    | Interior | 75 | 53 | 37 | 67 | 47  | 33 | 59 | 42  | 29 | 53 | 38  | 26 | 48 | 34  | 24 | 43 | 31  | 22 | 39 | 28  | 20 | 33 | 24  | 17 | 28 | 20  | 14 | 24 | 18  | 12 | 21 | 15  | 11 | 19   | 13  | 14 | 16 | 12 | 13 |    |
|                        |                        |                       |                |                        | Exposed  | 47 | 34 | 24 | 42 | 30  | 21 | 38 | 27  | 19 | 34 | 24  | 17 | 31 | 22  | 16 | 28 | 20  | 14 | 25 | 18  | 13 | 21 | 15  | 11 | 18 | 13  | 14 | 16 | 11  | 18 | 13 | 14  | 16 | 11   | 13  | 14 | 10 | 11 |    |    |
|                        |                        |                       |                | 7-20                   | Interior | 62 | 44 | 32 | 55 | 39  | 29 | 49 | 35  | 26 | 44 | 32  | 23 | 40 | 29  | 21 | 36 | 26  | 19 | 33 | 24  | 18 | 28 | 20  | 15 | 24 | 17  | 13 | 20 | 15  | 11 | 18 | 13  | 14 | 16   | 11  | 13 | 14 | 10 | 11 |    |
|                        |                        |                       |                |                        | Exposed  | 39 | 29 | 21 | 35 | 25  | 19 | 31 | 23  | 17 | 28 | 21  | 15 | 26 | 19  | 14 | 23 | 17  | 12 | 21 | 15  | 11 | 18 | 13  | 15 | 11 | 11  | 13 | 13 | 15  | 11 | 12 | 13  | 9  | 10   | 11  | 8  | 14 | 10 | 7  |    |
|                        |                        |                       |                | 20-27                  | Interior | 77 | 48 | 39 | 77 | 43  | 35 | 72 | 38  | 31 | 60 | 34  | 28 | 54 | 31  | 26 | 49 | 28  | 23 | 45 | 26  | 21 | 37 | 22  | 18 | 32 | 19  | 15 | 28 | 16  | 13 | 24 | 14  | 12 | 21   | 12  | 10 | 19 | 11 | 14 |    |
|                        |                        |                       |                |                        | Exposed  | 54 | 31 | 25 | 48 | 27  | 23 | 43 | 25  | 20 | 38 | 22  | 18 | 35 | 20  | 17 | 32 | 18  | 15 | 29 | 17  | 14 | 24 | 14  | 12 | 21 | 12  | 10 | 18 | 10  | 13 | 16 | 14  | 11 | 14   | 12  | 10 | 12 | 11 | 9  |    |
|                        |                        |                       | 27-45          | Interior               | 78       | 60 | 47 | 60 | 53 | 42  | 53 | 48 | 38  | 48 | 43 | 34  | 43 | 39 | 31  | 40 | 35 | 28  | 36 | 32 | 25  | 30 | 27 | 22  | 26 | 23 | 18  | 23 | 20 | 16  | 20 | 18 | 14  | 17 | 15   | 12  | 15 | 14 | 11 |    |    |
|                        |                        |                       |                | Exposed                | 43       | 39 | 31 | 39 | 34 | 27  | 35 | 31 | 24  | 31 | 28 | 22  | 28 | 25 | 20  | 26 | 23 | 18  | 24 | 21 | 17  | 20 | 18 | 14  | 17 | 15 | 12  | 15 | 13 | 10  | 13 | 11 | 14  | 11 | 10   | 12  | 10 | 14 | 11 |    |    |
| 30                     |                        |                       | B              | 0-7                    | Interior | 61 | 61 | 61 | 61 | 61  | 59 | 61 | 61  | 52 | 61 | 61  | 47 | 61 | 61  | 42 | 61 | 55  | 38 | 61 | 50  | 35 | 59 | 42  | 29 | 50 | 36  | 25 | 43 | 31  | 22 | 37 | 27  | 19 | 33   | 24  | 17 | 29 | 21 | 15 |    |
|                        |                        |                       |                |                        | Exposed  | 61 | 61 | 42 | 61 | 54  | 37 | 61 | 48  | 33 | 60 | 43  | 30 | 54 | 39  | 27 | 49 | 35  | 25 | 45 | 32  | 23 | 38 | 27  | 19 | 32 | 23  | 16 | 28 | 20  | 14 | 24 | 17  | 12 | 21   | 15  | 11 | 19 | 14 | 15 |    |
|                        |                        |                       |                | 7-20                   | Interior | 62 | 62 | 58 | 62 | 62  | 51 | 62 | 62  | 46 | 62 | 56  | 41 | 62 | 51  | 37 | 62 | 46  | 34 | 58 | 42  | 31 | 49 | 35  | 26 | 42 | 30  | 22 | 36 | 26  | 19 | 31 | 23  | 17 | 27   | 20  | 15 | 24 | 18 | 13 |    |
|                        |                        |                       |                |                        | Exposed  | 62 | 51 | 37 | 62 | 45  | 33 | 56 | 40  | 29 | 50 | 36  | 26 | 45 | 33  | 24 | 41 | 30  | 22 | 37 | 27  | 20 | 31 | 23  | 17 | 27 | 19  | 14 | 23 | 17  | 12 | 20 | 15  | 11 | 18   | 13  | 14 | 16 | 11 | 13 |    |
|                        |                        |                       |                | 20-27                  | Interior | 70 | 70 | 70 | 70 | 70  | 62 | 70 | 70  | 55 | 70 | 61  | 50 | 70 | 55  | 45 | 70 | 50  | 41 | 70 | 45  | 37 | 70 | 38  | 31 | 57 | 33  | 27 | 49 | 28  | 23 | 42 | 24  | 20 | 37   | 21  | 18 | 33 | 19 | 16 |    |
|                        |                        |                       |                |                        | Exposed  | 70 | 55 | 45 | 70 | 49  | 40 | 70 | 43  | 36 | 70 | 39  | 32 | 62 | 35  | 29 | 56 | 32  | 26 | 51 | 29  | 24 | 43 | 25  | 20 | 36 | 21  | 17 | 31 | 18  | 15 | 27 | 16  | 13 | 24   | 14  | 12 | 21 | 12 | 10 |    |
|                        |                        |                       | 27-45          | Interior               | 76       | 76 | 76 | 76 | 76 | 76  | 76 | 76 | 76  | 73 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76 | 76  | 76 | 76   | 76  | 76 | 76 | 76 | 76 | 76 |
|                        |                        |                       |                | Exposed                | 76       | 76 | 54 | 76 | 61 | 48  | 61 | 54 | 43  | 55 | 49 | 39  | 50 | 44 | 35  | 45 | 40 | 32  | 41 | 37 | 29  | 35 | 31 | 24  | 30 | 26 | 21  | 26 | 23 | 18  | 22 | 20 | 16  | 20 | 18   | 14  | 17 | 16 | 12 |    |    |
|                        | 40                     |                       | B              | 0-7                    | Interior | 61 | 61 | 45 | 61 | 57  | 40 | 61 | 51  | 35 | 61 | 46  | 32 | 58 | 41  | 29 | 52 | 37  | 26 | 48 | 34  | 24 | 40 | 29  | 20 | 34 | 25  | 17 | 29 | 21  | 15 | 25 | 18  | 13 | 22   | 16  | 11 | 20 | 14 | 10 |    |
|                        |                        |                       |                |                        | Exposed  | 57 | 41 | 29 | 51 | 37  | 26 | 45 | 33  | 23 | 41 | 29  | 21 | 37 | 27  | 19 | 34 | 24  | 17 | 31 | 22  | 16 | 26 | 19  | 13 | 22 | 16  | 11 | 19 | 14  | 15 | 17 | 12  | 13 | 15   | 11  | 11 | 13 | 14 | 9  |    |
|                        |                        |                       |                | 7-20                   | Interior | 62 | 54 | 39 | 62 | 48  | 35 | 59 | 43  | 31 | 53 | 38  | 28 | 48 | 35  | 25 | 43 | 31  | 23 | 40 | 29  | 21 | 33 | 24  | 18 | 28 | 21  | 15 | 25 | 18  | 13 | 21 | 16  | 11 | 19   | 14  | 10 | 17 | 12 | 14 |    |
|                        |                        |                       |                |                        | Exposed  | 48 | 34 | 25 | 42 | 31  | 23 | 38 | 27  | 20 | 34 | 25  | 18 | 31 | 22  | 16 | 28 | 20  | 15 | 26 | 19  | 14 | 22 | 16  | 12 | 18 | 13  | 10 | 16 | 12  | 13 | 14 | 10  | 11 | 12   | 14  | 10 | 11 | 12 | 9  |    |
|                        |                        |                       |                | 20-27                  | Interior | 70 | 58 | 47 | 70 | 51  | 42 | 70 | 46  | 38 | 70 | 41  | 34 | 67 | 37  | 31 | 59 | 34  | 28 | 54 | 31  | 26 | 45 | 26  | 22 | 39 | 22  | 18 | 33 | 19  | 16 | 29 | 17  | 14 | 25   | 15  | 12 | 23 | 13 | 11 |    |
|                        |                        |                       |                |                        | Exposed  | 65 | 37 | 31 | 58 | 33  | 27 | 52 | 30  | 24 | 46 | 27  | 22 | 42 | 24  | 20 | 38 | 22  | 18 | 35 | 20  | 17 | 29 | 17  | 14 | 25 | 15  | 12 | 22 | 13  | 10 | 19 | 11  | 14 | 17</ |     |    |    |    |    |    |





