
Double Stud XL Span Tables

60 Cell Modules
24" Rafter Spacing
1/2" Plywood

Roof Pitch 0-7 Degree

Interior Wind Zone 1, page 2

Edge Wind Zone 2, page 3

Edge Wind Zone 3, page 4

Roof Pitch 7-27 Degree

Interior Wind Zone 1, page 5

Edge Wind Zone 2, page 6

Edge Wind Zone 3, page 7

Roof Pitch 27-45 Degree

Interior Wind Zone 1, page 8

Edge Wind Zone 2, page 9

Edge Wind Zone 3, page 10

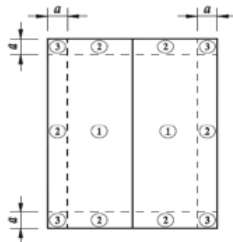
**Table 155: Zilla® Double Stud XL – 24" Rafter Spacing, 1/2" Plywood, 48" Continuous Rail Spans
Maximum Module Size 66" x 41"- Typical 60 Cell Module**

| Roof Pitch ≤ 7° | | | | | | |
|--|------------------|-----------------|------------------|------------------|------------------|------------------|
| Interior Wind Zone 1 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
| B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |

Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
- Residential gable roofs with roof slope less than or equal to 7 degrees.
- Maximum photovoltaic module size is 66 inches long by 41 inches wide.
- Standard Zilla Double Stud XL spaced at 48" OC assumes photovoltaic modules supported by two continuous rails spanning a maximum of 48" parallel to the short side of the module.
- Standard Zilla Double Stud XL design pertains only to the Double Stud XL connection. Design of rails attached to the Double Stud XL and existing structure are outside the scope of this design.
- Photovoltaic modules are parallel with the roof slope.
- Loads per ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.
- ASCE 7-10 Wind Exposure Categories:
 - Exposure B = Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
 - Exposure C = Open terrain with scattered obstructions having heights generally less than 30 ft. Includes flat open country and grasslands.
 - Exposure D = Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats, and unbroken ice.
- ASCE 7-10 Wind Load Parameters:
 - Risk Category II
 - Topographic Factor (K_{zt}) = 1.0 [*Note: This value has been set to 1.0 under the assumption that the system is NOT located on the upper half of a hill or ridge or near the crest of an escarpment.]
 - Directionality Factor (K_d) = 0.85
- The snow load indicated in the tables is the snow load applied to the modules.
- Edge Wind Zone is defined by ASCE 7-10 as a with a being equal to: 10 percent of least horizontal dimension or $0.4h$ (h = height of building), whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 feet.

Wind Zones for Gable Roofs with $\theta \leq 7^\circ$:



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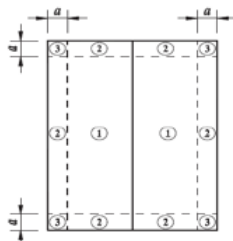
**Table 156: Zilla® Double Stud XL – 24" Rafter Spacing, 1/2" Plywood, 48" Continuous Rail Spans
Maximum Module Size 66" x 41"- Typical 60 Cell Module**

| Roof Pitch ≤ 7° | | | | | | |
|---|------------------|-----------------|------------------|------------------|------------------|------------------|
| Edge Wind Zone 2 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
|  B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |

Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
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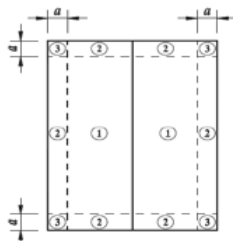
**Table 157: Zilla® Double Stud XL – 24" Rafter Spacing, 1/2" Plywood, 48" Continuous Rail Spans
Maximum Module Size 66" x 41"- Typical 60 Cell Module**

| Roof Pitch ≤ 7° | | | | | | |
|--|------------------|-----------------|------------------|------------------|------------------|------------------|
| Edge Wind Zone 3 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
| B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | custom | custom | custom | custom | custom |
| D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | custom | custom | custom | custom | custom |
| | 120 mph | custom | custom | custom | custom | custom |

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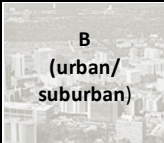
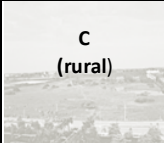

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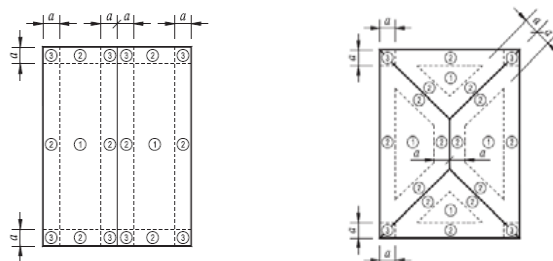
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Maximum Module Size 66" x 41"- Typical 60 Cell Module**

| 7° < Roof Pitch ≤ 27° | | | | | | |
|---|------------------|-----------------|------------------|------------------|------------------|------------------|
| Interior Wind Zone 1 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
|  B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |

Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
- Residential gable/hip roofs with roof slope greater than 7 degrees and less than or equal to 27 degrees.
- Maximum photovoltaic module size is 66 inches long by 41 inches wide.
- Standard Zilla Double Stud XL spaced at 48" OC assumes photovoltaic modules supported by two continuous rails spanning a maximum of 48" parallel to the short side of the module.
- Standard Zilla Double Stud XL design pertains only to the Double Stud XL connection. Design of rails attached to the Double Stud XL and existing structure are outside the scope of this design.
- Photovoltaic modules are parallel with the roof slope.
- Loads per ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.
- ASCE 7-10 Wind Exposure Categories:
 - Exposure B = Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
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Wind Zones for Gable/Hip Roofs with $7^\circ < \theta \leq 27^\circ$:



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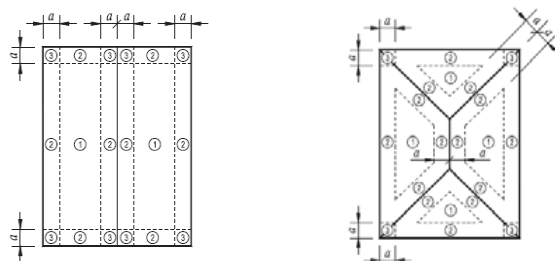
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|---|------------------|-----------------|------------------|------------------|------------------|------------------|
| Edge Wind Zone 2 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
|  B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
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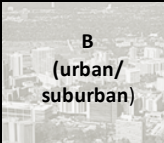

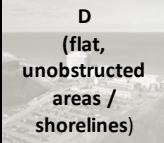
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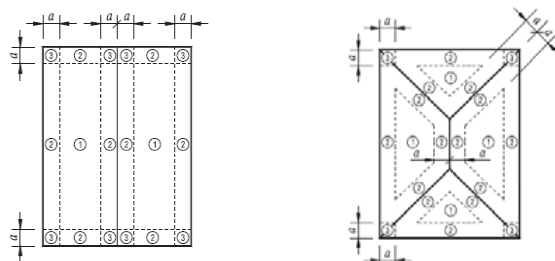
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| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
|  C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | custom | custom | custom | custom | custom |
|  D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | custom | custom | custom | custom | custom |
| | 120 mph | custom | custom | custom | custom | custom |

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Wind Zones for Gable/Hip Roofs with $7^\circ < \theta \leq 27^\circ$:



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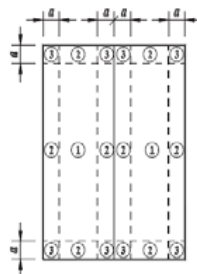
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Maximum Module Size 66” x 41”- Typical 60 Cell Module**

| 27° < Roof Pitch ≤ 45° | | | | | | |
|--|------------------|-----------------|------------------|------------------|------------------|------------------|
| Interior Wind Zone 1 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
| B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
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| D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
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| | 100 mph | standard | standard | standard | standard | custom |
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| | 120 mph | standard | standard | standard | custom | custom |

Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
- Residential gable roofs with roof slope greater than 27 degrees and less than or equal to 45 degrees.
- Maximum photovoltaic module size is 66 inches long by 41 inches wide.
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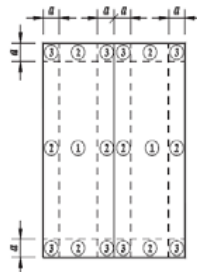
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| 27° < Roof Pitch ≤ 45° | | | | | | |
|--|------------------|-----------------|------------------|------------------|------------------|------------------|
| Edge Wind Zone 2 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
| B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
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Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
- Residential gable roofs with roof slope greater than 27 degrees and less than or equal to 45 degrees.
- Maximum photovoltaic module size is 66 inches long by 41 inches wide.
- Standard Zilla Double Stud XL spaced at 48" OC assumes photovoltaic modules supported by two continuous rails spanning a maximum of 48" parallel to the short side of the module.
- Standard Zilla Double Stud XL design pertains only to the Double Stud XL connection. Design of rails attached to the Double Stud XL and existing structure are outside the scope of this design.
- Photovoltaic modules are parallel with the roof slope.
- Loads per ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.
- ASCE 7-10 Wind Exposure Categories:
 - Exposure B = Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
 - Exposure C = Open terrain with scattered obstructions having heights generally less than 30 ft. Includes flat open country and grasslands.
 - Exposure D = Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats, and unbroken ice.
- ASCE 7-10 Wind Load Parameters:
 - Risk Category II
 - Topographic Factor (K_{zt}) = 1.0 [*Note: This value has been set to 1.0 under the assumption that the system is NOT located on the upper half of a hill or ridge or near the crest of an escarpment.]
 - Directionality Factor (K_d) = 0.85
- The snow load indicated in the tables is the snow load applied to the modules.
- Edge Wind Zone is defined by ASCE 7-10 as **a** with **a** being equal to: 10 percent of least horizontal dimension or 0.4h (h = height of building), whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 feet.

Wind Zones for Gable Roofs with 27° < θ ≤ 45°:



For installations that do not conform to the assumptions listed above contact Zilla for a more complete engineering analysis.

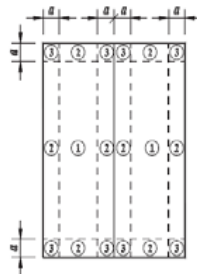
**Table 163: Zilla® Double Stud XL – 24" Rafter Spacing, 1/2" Plywood, 48" Continuous Rail Spans
Maximum Module Size 66" x 41"- Typical 60 Cell Module**

| 27° < Roof Pitch ≤ 45° | | | | | | |
|--|------------------|-----------------|------------------|------------------|------------------|------------------|
| Edge Wind Zone 3 | | | | | | |
| Exposure | Basic Wind Speed | 0 psf Snow Load | 10 psf Snow Load | 20 psf Snow Load | 30 psf Snow Load | 40 psf Snow Load |
| B (urban/ suburban) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| C (rural) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | standard | custom |
| D (flat, unobstructed areas / shorelines) | 85 mph | standard | standard | standard | standard | custom |
| | 90 mph | standard | standard | standard | standard | custom |
| | 100 mph | standard | standard | standard | standard | custom |
| | 110 mph | standard | standard | standard | standard | custom |
| | 120 mph | standard | standard | standard | custom | custom |

Tabulated values are based upon the following:

- Building height is less than or equal to 30 feet.
- Residential gable roofs with roof slope greater than 27 degrees and less than or equal to 45 degrees.
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- Standard Zilla Double Stud XL design pertains only to the Double Stud XL connection. Design of rails attached to the Double Stud XL and existing structure are outside the scope of this design.
- Photovoltaic modules are parallel with the roof slope.
- Loads per ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.
- ASCE 7-10 Wind Exposure Categories:
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- ASCE 7-10 Wind Load Parameters:
 - Risk Category II
 - Topographic Factor (K_{zt}) = 1.0 [*Note: This value has been set to 1.0 under the assumption that the system is NOT located on the upper half of a hill or ridge or near the crest of an escarpment.]
 - Directionality Factor (K_d) = 0.85
- The snow load indicated in the tables is the snow load applied to the modules.
- Edge Wind Zone is defined by ASCE 7-10 as a with a being equal to: 10 percent of least horizontal dimension or $0.4h$ (h = height of building), whichever is smaller, but not less than either 4 percent of least horizontal dimension or 3 feet.

Wind Zones for Gable Roofs with $27^\circ < \theta \leq 45^\circ$:



For installations that do not conform to the assumptions listed above contact Zilla for a more complete engineering analysis.