



Project Details

Project Name

L52

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 107, Part number 113009-102)

[Module Support Plate](#)(Quantity 84, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 17, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 24, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 60, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 14, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

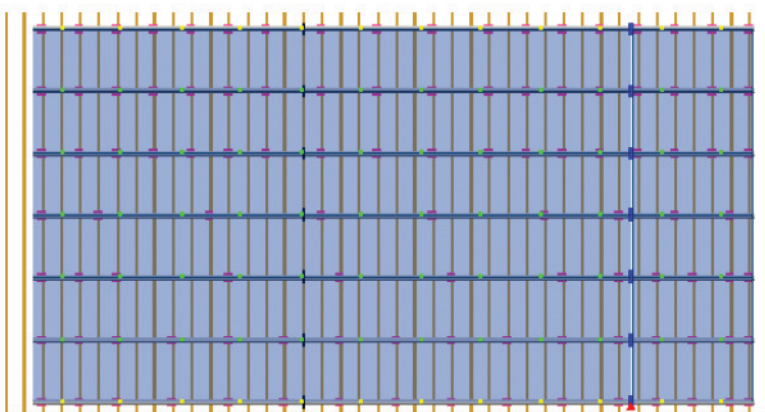
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

-  Rafter
-  Rail
-  Roof Mount
-  Splice
-  Thermal Expansion Joint
-  Thermal Expansion Joint Marker
-  Middle Clamp
-  End Clamp
-  Solar Module
-  Corner Zone
-  Exterior Zone
-  Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase seventeen 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 210.84 inches
- Seven 6.2m rails, each cut to 175.2 inches
- Two 6.2m rails, each cut into 3 pieces:
 - 78.21 in. segment
 - 78.21 in. segment
 - 78.21 in. segment
- One 6.2m rail, cut to 78.21 inches

The rails should then be laid out as follows:

- **Rail 1:**
 - 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 15.58 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 336.32 inches, 360.32 inches, 384.32 inches, 408.32 inches, 432.32 inches, 456.32 inches and 480.32 inches from the left edge of the roof.
- **Rail 2:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 54.59 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 336.32 inches, 360.32 inches, 384.32 inches, 408.32 inches, 432.32 inches, 456.32 inches and 480.32 inches from the left edge of the roof.

- **Rail 3:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 93.61 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 336.32 inches, 360.32 inches, 384.32 inches, 408.32 inches, 432.32 inches, 456.32 inches and 480.32 inches from the left edge of the roof.

- **Rail 4:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 132.62 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 60.32 inches, 132.32 inches, 204.32 inches, 276.32 inches, 348.32 inches, 396.32 inches, 432.32 inches and 468.32 inches from the left edge of the roof.

- **Rail 5:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 171.64 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 144.32 inches, 216.32 inches, 288.32 inches, 360.32 inches, 396.32 inches, 420.32 inches, 444.32 inches, 468.32 inches and 480.57 inches from the left edge of the roof.

- **Rail 6:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 210.65

inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 420.32 inches, 444.32 inches, 468.32 inches and 480.57 inches from the left edge of the roof.

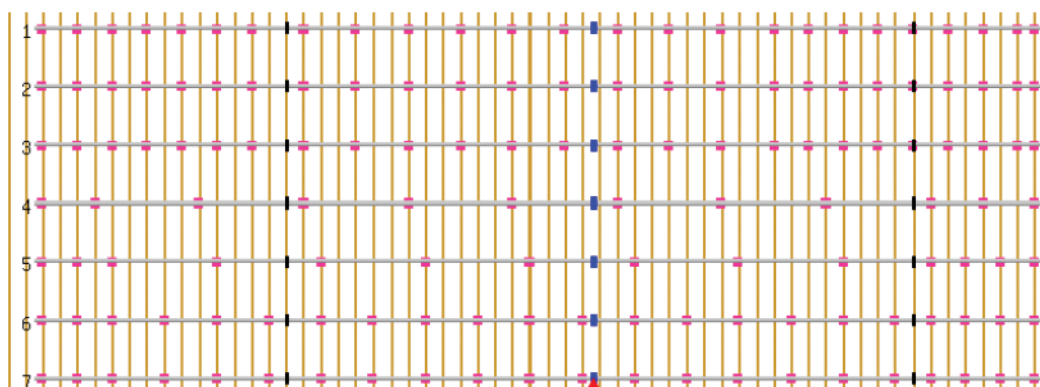
- **Rail 7:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 78.21 inch rail segment, positioned 18.32 inches from the left edge of the roof and 249.67 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 420.32 inches, 444.32 inches, 468.32 inches and 480.57 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

- | Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Building Information

Roof Design

Mono

Building Dimensions

41.17 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

41.17 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

2" × 4" rafters, spaced 12 inches apart

Offset from the peak

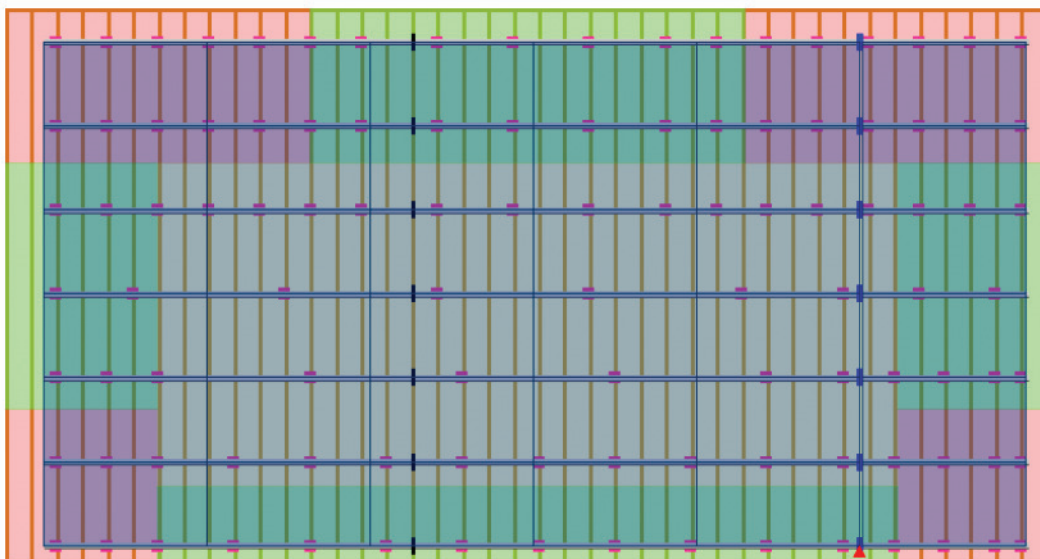
1.3 ft.

Offset from the edge

1.5 ft.

Layout

[The peak of the roof is this direction]



Legend

	Rafter
	Rail
	Roof Mount
	Splice
	Thermal Expansion Joint
	Thermal Expansion Joint Marker
	Middle Clamp
	End Clamp
	Solar Module
	Corner Zone
	Exterior Zone
	Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 72 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 17.2 ft. × 6 ft

Zone F

Edge Zone, 29.2 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

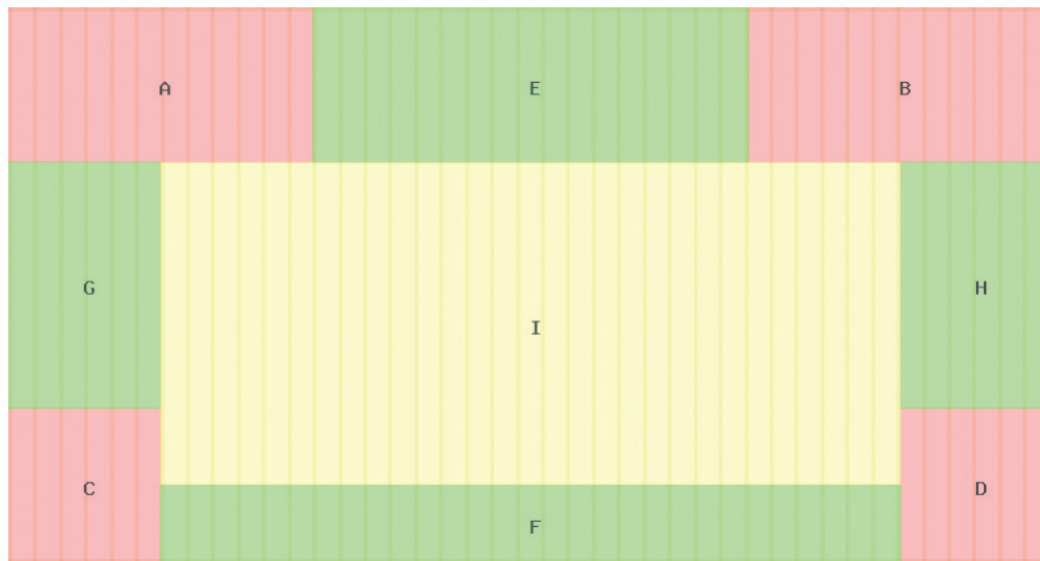
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 29.2 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

6

Service Load Reactions (in lbs)

Gravity (tension)

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 66.99

Edge: 33.49

Corner: 22.33

Gravity (shear)

Interior: 0

Edge: 0

Corner: 0

Snow (tension)

Interior: 0

Edge: 0

Corner: 0

Snow (compression)

Interior: 0

Edge: 0

Corner: 0

Snow (shear)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (tension)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (compression)

Interior: 134.84

Edge: 67.42

Corner: 44.95

Wind +ve (shear)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (tension)

Interior: 359.56

Edge: 323.61

Corner: 335.59

Wind -ve (compression)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0

Corner: 0

Applied Service Loads (Global Axis) (plf)**Gravity**

Interior: 8.93

Edge: 8.93

Corner: 8.93

Snow

Interior: 0

Edge: 0

Corner: 0

Wind +ve

Interior: 17.98

Edge: 17.98

Corner: 17.98

Wind -ve

Interior: -59.93

Edge: -107.87

Corner: -167.8

GCp Zones

GCp +ve

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis

Velocity Pressure Coeff (Kz)

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (Kzt)

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (Kd)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (qz)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (Ce)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (Ct)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (Is)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (Pg)

0 psf

Slope Factor (Cs)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (Pf)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof (Pf min)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (Ps)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis**Height of Module (Long) (L)**

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (Wt.)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global**Wind Downward / Rail (w+)**

17.98 plf

Wind Upward / Rail (w-): interior

-59.93 plf

Wind Upward / Rail (w-): edge

-107.87 plf

Wind Upward / Rail (w-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations

$$1.2 g + 1.6 s + 0.5 w+ = LC1$$

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)

Tension

Interior: 390 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 216 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 45 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 6 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations

Site Class

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS	1.6 (From Seismic Hazard Calculator)
ap	1
Rp	2.5
Wp	2.94 psf
Fp	2.26 psf (ASCE 7-10, Eq - 13.3-1)
FpMAX	7.53 psf (ASCE 7-10, Eq - 13.3-2)
FpMIN	1.41 psf (ASCE 7-10, Eq - 13.3-3)
Fp Design	2.26 psf
Tributary Area (interior)	19.51 sft
Tributary Area (edge)	9.75 sft
Tributary Area (corner)	6.5 sft
Seismic Shear Force Per Connection (interior)	44.05 lbs
Seismic Shear Force Per Connection (edge)	22.02 lbs
Seismic Shear Force Per Connection (corner)	14.68 lbs



Project Details

Project Name

L50 #1

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 130, Part number 113009-102)

[Module Support Plate](#)(Quantity 112, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 21, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 32, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 80, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 21, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

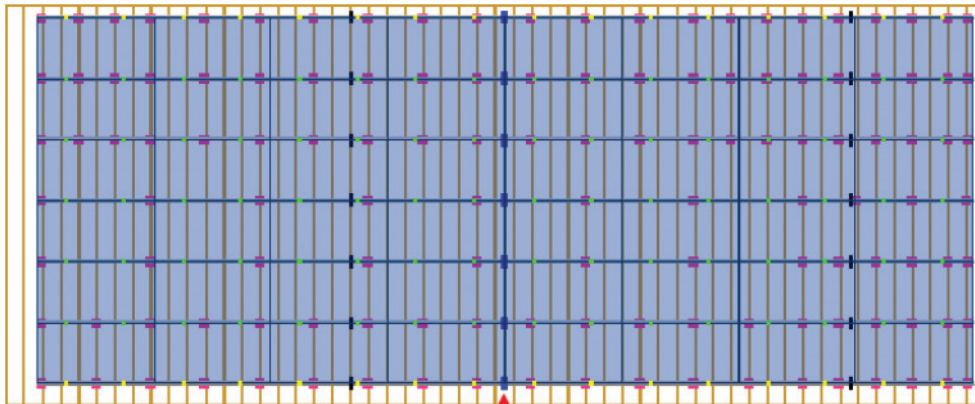
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

-  Rafter
-  Rail
-  Roof Mount
-  Splice
-  Thermal Expansion Joint
-  Thermal Expansion Joint Marker
-  Middle Clamp
-  End Clamp
-  Solar Module
-  Corner Zone
-  Exterior Zone
-  Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase twenty-one 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 229.17 inches
- Seven 6.2m rails, each cut to 208.2 inches
- Seven 6.2m rails, each cut into 2 pieces:
 - 80.66 in. segment
 - 100.63 in. segment

The rails should then be laid out as follows:

- **Rail 1:**
 - 208.2 inch rail segment spliced with a 100.63 inch rail segment spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 9.15 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 132.22 inches, 156.22 inches, 180.22 inches, 216.22 inches, 252.22 inches, 288.22 inches, 324.22 inches, 360.22 inches, 396.22 inches, 432.22 inches, 468.22 inches, 504.22 inches, 540.22 inches, 564.22 inches, 588.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.
- **Rail 2:**
 - 208.2 inch rail segment spliced with a 100.63 inch rail segment

spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 48.17 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 132.22 inches, 156.22 inches, 180.22 inches, 216.22 inches, 252.22 inches, 288.22 inches, 324.22 inches, 360.22 inches, 396.22 inches, 432.22 inches, 468.22 inches, 504.22 inches, 540.22 inches, 564.22 inches, 588.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.

- **Rail 3:**

- 208.2 inch rail segment spliced with a 100.63 inch rail segment spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 87.18 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 132.22 inches, 156.22 inches, 180.22 inches, 216.22 inches, 252.22 inches, 288.22 inches, 324.22 inches, 360.22 inches, 396.22 inches, 432.22 inches, 468.22 inches, 504.22 inches, 540.22 inches, 564.22 inches, 588.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.

- **Rail 4:**

- 208.2 inch rail segment spliced with a 100.63 inch rail segment spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 126.2 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 180.22 inches, 252.22 inches, 324.22 inches, 396.22 inches, 468.22 inches, 540.22 inches, 612.22 inches, 648.22 inches, 684.22 inches and 720.22 inches from the left edge of the roof.

- **Rail 5:**

- 208.2 inch rail segment spliced with a 100.63 inch rail segment spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 165.21 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 180.22 inches, 252.22 inches, 324.22 inches, 396.22 inches, 468.22 inches, 540.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.

- **Rail 6:**

- 208.2 inch rail segment spliced with a 100.63 inch rail segment

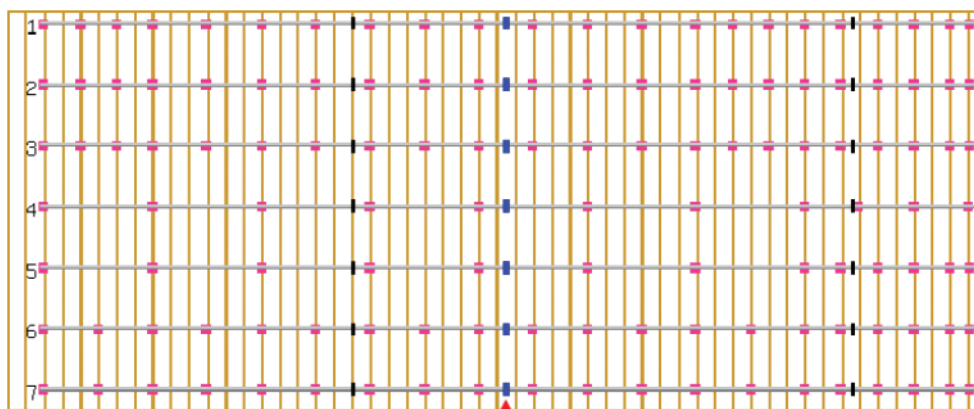
spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 204.23 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 144.22 inches, 180.22 inches, 216.22 inches, 252.22 inches, 288.22 inches, 324.22 inches, 360.22 inches, 396.22 inches, 432.22 inches, 468.22 inches, 504.22 inches, 540.22 inches, 576.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.

- **Rail 7:**

- 208.2 inch rail segment spliced with a 100.63 inch rail segment spliced (thermal expansion joint) with a 229.17 inch rail segment spliced with a 80.66 inch rail segment, positioned 105.22 inches from the left edge of the roof and 243.24 inches from the peak of the roof. Roof mounts should be positioned at 108 inches, 144.22 inches, 180.22 inches, 216.22 inches, 252.22 inches, 288.22 inches, 324.22 inches, 360.22 inches, 396.22 inches, 432.22 inches, 468.22 inches, 504.22 inches, 540.22 inches, 576.22 inches, 612.22 inches, 636.22 inches, 660.22 inches, 684.22 inches, 708.22 inches and 720.89 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

-  Rafter
 -  Rail
 -  Roof Mount
 -  Splice
 -  Thermal Expansion Joint
 -  Thermal Expansion Joint Marker
 -  Middle Clamp
 -  End Clamp
 -  Solar Module
 -  Corner Zone
 -  Exterior Zone
 -  Interior Zone
-

Building Information

Roof Design

Mono

Building Dimensions

61 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

61 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

2" × 4" rafters, spaced 12 inches apart

Offset from the peak

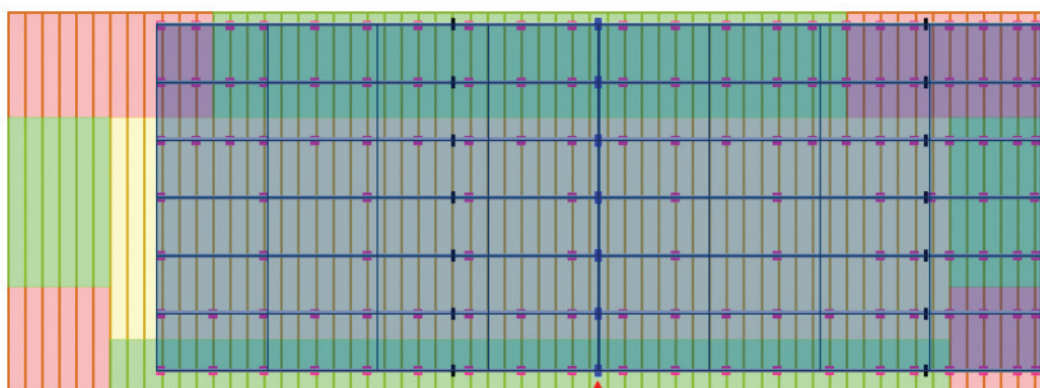
0.8 ft.

Offset from the edge

8.8 ft.

Layout

[The peak of the roof is this direction]



Legend

-  Rafter
-  Rail
-  Roof Mount
-  Splice
-  Thermal Expansion Joint
-  Thermal Expansion Joint Marker
-  Middle Clamp
-  End Clamp
-  Solar Module
-  Corner Zone
-  Exterior Zone
-  Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 72 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 37 ft. × 6 ft

Zone F

Edge Zone, 49 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

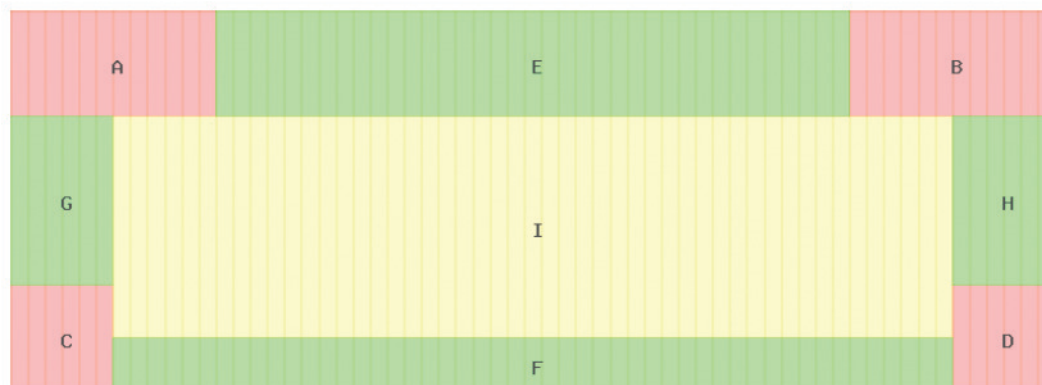
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 49 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

8

Service Load Reactions (in lbs)**Gravity (tension)**

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 66.99

Edge: 33.49

Corner: 22.33

Gravity (shear)

Interior: 0

Edge: 0

Corner: 0

Snow (tension)

Interior: 0

Edge: 0

Corner: 0

Snow (compression)

Interior: 0

Edge: 0

Corner: 0

Snow (shear)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (tension)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (compression)

Interior: 134.84

Edge: 67.42

Corner: 44.95

Wind +ve (shear)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (tension)

Interior: 359.56

Edge: 323.61

Corner: 335.59

Wind -ve (compression)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0

Corner: 0

Applied Service Loads (Global Axis) (plf)

Gravity

Interior: 8.93

Edge: 8.93

Corner: 8.93

Snow

Interior: 0

Edge: 0

Corner: 0

Wind +ve

Interior: 17.98

Edge: 17.98

Corner: 17.98

Wind -ve

Interior: -59.93

Edge: -107.87

Corner: -167.8

GCp Zones

GCp +ve

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis

Velocity Pressure Coeff (Kz)

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (Kzt)

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (Kd)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (qz)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (Ce)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (Ct)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (I_s)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (P_g)

0 psf

Slope Factor (C_s)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (P_f)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof (P_f min)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (P_s)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis**Height of Module (Long) (L)**

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (Wt.)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global**Wind Downward / Rail (w_+)**

17.98 plf

Wind Upward / Rail (w_-): interior

-59.93 plf

Wind Upward / Rail (w_-): edge

-107.87 plf

Wind Upward / Rail (w_-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations

1.2 g + 1.6 s + 0.5 w+ = LC1

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)

Tension

Interior: 390 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 216 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 45 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 6 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations

Site Class

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS

1.6 (From Seismic Hazard Calculator)

a_p

1

R_p

2.5

W_p

2.94 psf

F_p

2.26 psf (ASCE 7-10, Eq - 13.3-1)

F_{pMAX}

7.53 psf (ASCE 7-10, Eq - 13.3-2)

F_{pMIN}

1.41 psf (ASCE 7-10, Eq - 13.3-3)

F_p Design

2.26 psf

Tributary Area (interior)

19.51 sft

Tributary Area (edge)

9.75 sft

Tributary Area (corner)

6.5 sft

Seismic Shear Force Per Connection (interior)

44.05 lbs

Seismic Shear Force Per Connection (edge)

22.02 lbs

Seismic Shear Force Per Connection (corner)

14.68 lbs



Project Details

Project Name

L52

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 145, Part number 113009-102)

[Module Support Plate](#)(Quantity 126, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 25, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 36, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 90, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 21, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

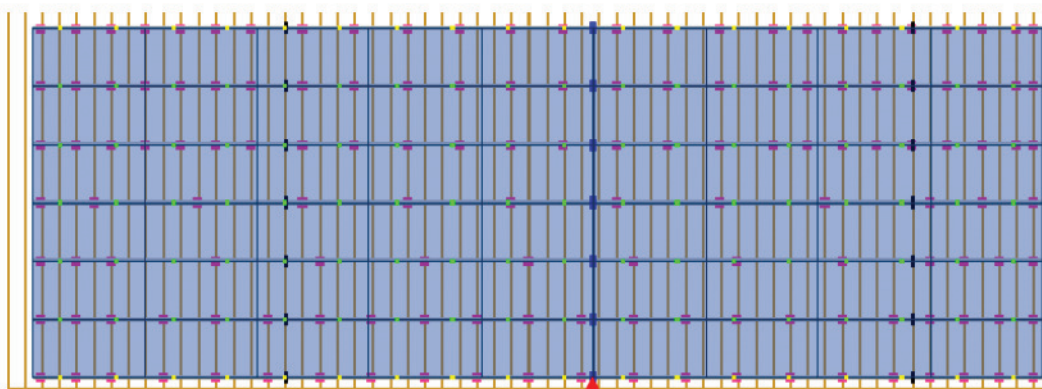
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

- Rafter
- Rail
- Roof Mount
- Splice
- Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase twenty-five 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 220.16 inches
- Seven 6.2m rails, each cut to 210.84 inches
- Seven 6.2m rails, each cut to 175.2 inches
- Three 6.2m rails, each cut into 2 pieces:
 - 89.67 in. segment
 - 89.67 in. segment
- One 6.2m rail, cut to 89.67 inches

The rails should then be laid out as follows:

- **Rail 1:**
 - 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 15.58 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 552.32 inches, 576.32 inches, 600.32 inches, 624.32 inches, 648.32 inches, 672.32 inches, 696.32 inches and 708.2 inches from the left edge of the roof.
- **Rail 2:**
 - 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 54.59 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 552.32 inches, 576.32 inches, 600.32 inches, 624.32 inches, 648.32 inches, 672.32 inches, 696.32 inches and 708.2 inches

from the left edge of the roof.

- **Rail 3:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 93.61 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 552.32 inches, 576.32 inches, 600.32 inches, 624.32 inches, 648.32 inches, 672.32 inches, 696.32 inches and 708.2 inches from the left edge of the roof.

- **Rail 4:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 132.62 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 60.32 inches, 132.32 inches, 204.32 inches, 276.32 inches, 348.32 inches, 420.32 inches, 492.32 inches, 564.32 inches, 636.32 inches, 672.32 inches and 708.32 inches from the left edge of the roof.

- **Rail 5:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 171.64 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 144.32 inches, 216.32 inches, 288.32 inches, 360.32 inches, 432.32 inches, 504.32 inches, 576.32 inches, 636.32 inches, 660.32 inches, 684.32 inches and 708.32 inches from the left edge of the roof.

- **Rail 6:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 210.65 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 432.32 inches, 468.32 inches, 504.32 inches, 540.32 inches,

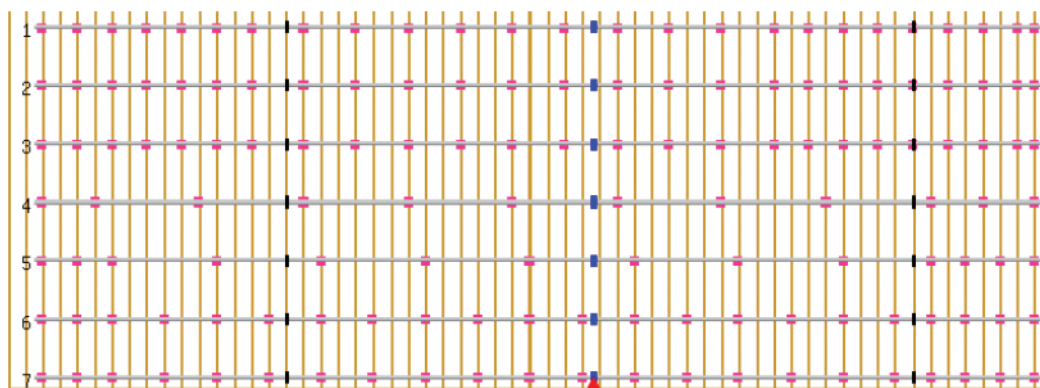
576.32 inches, 612.32 inches, 636.32 inches, 660.32 inches, 684.32 inches and 708.32 inches from the left edge of the roof.

- **Rail 7:**

- 175.2 inch rail segment spliced with a 210.84 inch rail segment spliced (thermal expansion joint) with a 220.16 inch rail segment spliced with a 89.67 inch rail segment, positioned 18.32 inches from the left edge of the roof and 249.67 inches from the peak of the roof. Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 432.32 inches, 468.32 inches, 504.32 inches, 540.32 inches, 576.32 inches, 612.32 inches, 636.32 inches, 660.32 inches, 684.32 inches and 708.32 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

- ┆ Rafter
- Rail
- Roof Mount
- ┆ Splice
- ┆ Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Building Information

Roof Design

Mono

Building Dimensions

61.08 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

61.08 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

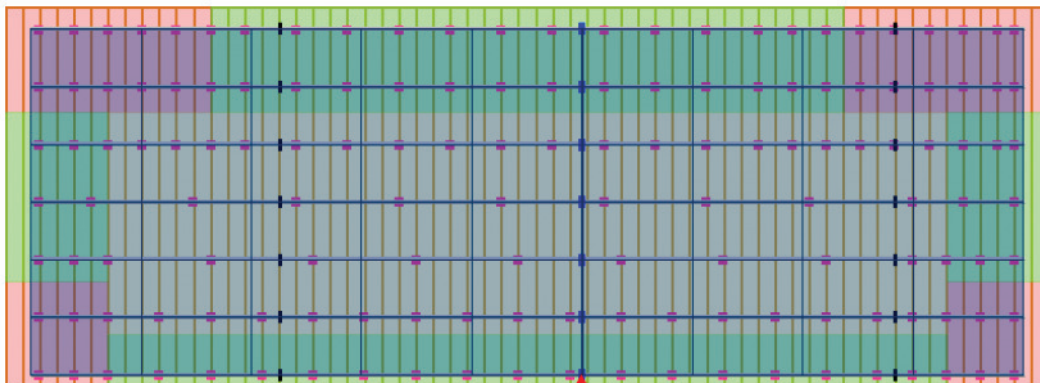
2" × 4" rafters, spaced 12 inches apart

Offset from the peak

1.3 ft.

Offset from the edge

1.5 ft.

Layout*[The peak of the roof is this direction]***Legend**

	Rafter
	Rail
	Roof Mount
	Splice
	Thermal Expansion Joint
	Thermal Expansion Joint Marker
	Middle Clamp
	End Clamp
	Solar Module
	Corner Zone
	Exterior Zone
	Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 72 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 37.1 ft. × 6 ft

Zone F

Edge Zone, 49.1 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

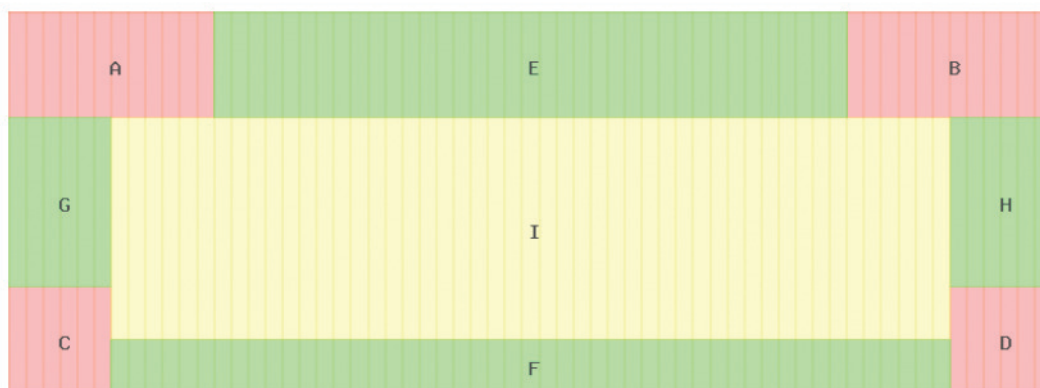
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 49.1 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

9

Service Load Reactions (in lbs)**Gravity (tension)**

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 66.99

Edge: 33.49

Corner: 22.33

Gravity (shear)

Interior: 0

Edge: 0

Corner: 0

Snow (tension)

Interior: 0

Edge: 0

Corner: 0

Snow (compression)

Interior: 0

Edge: 0

Corner: 0

Snow (shear)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (tension)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (compression)

Interior: 134.84

Edge: 67.42

Corner: 44.95

Wind +ve (shear)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (tension)

Interior: 359.56

Edge: 323.61

Corner: 335.59

Wind -ve (compression)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0

Corner: 0

Applied Service Loads (Global Axis) (plf)

Gravity

Interior: 8.93

Edge: 8.93

Corner: 8.93

Snow

Interior: 0

Edge: 0

Corner: 0

Wind +ve

Interior: 17.98

Edge: 17.98

Corner: 17.98

Wind -ve

Interior: -59.93

Edge: -107.87

Corner: -167.8

GCp Zones

GCp +ve

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis

Velocity Pressure Coeff (K_z)

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (K_{zt})

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (K_d)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (q_z)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (C_e)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (C_t)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (I_s)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (P_g)

0 psf

Slope Factor (C_s)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (P_f)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof (Pf min)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (Ps)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis**Height of Module (Long) (L)**

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (Wt.)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global**Wind Downward / Rail (w+)**

17.98 plf

Wind Upward / Rail (w-): interior

-59.93 plf

Wind Upward / Rail (w-): edge

-107.87 plf

Wind Upward / Rail (w-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations**1.2 g + 1.6 s + 0.5 w+ = LC1**

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)

Tension

Interior: 390 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 216 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 45 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 6 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations

Site Class

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS

1.6 (From Seismic Hazard Calculator)

ap	1
Rp	2.5
Wp	2.94 psf
Fp	2.26 psf (ASCE 7-10, Eq - 13.3-1)
FpMAX	7.53 psf (ASCE 7-10, Eq - 13.3-2)
FpMIN	1.41 psf (ASCE 7-10, Eq - 13.3-3)
Fp Design	2.26 psf
Tributary Area (interior)	19.51 sft
Tributary Area (edge)	9.75 sft
Tributary Area (corner)	6.5 sft
Seismic Shear Force Per Connection (interior)	44.05 lbs
Seismic Shear Force Per Connection (edge)	22.02 lbs
Seismic Shear Force Per Connection (corner)	14.68 lbs



Project Details

Project Name

L50 #1

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 155, Part number 113009-102)

[Module Support Plate](#)(Quantity 140, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 28, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 40, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 100, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 21, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

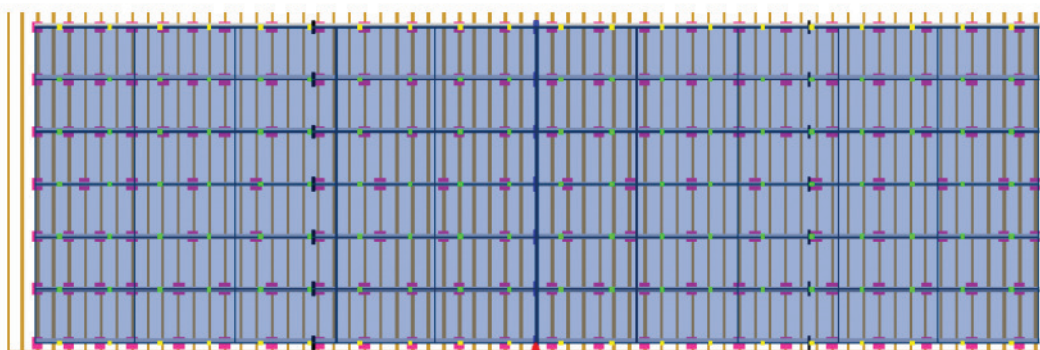
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

- Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase twenty-eight 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 215 inches
- Seven 6.2m rails, each cut to 209.96 inches
- Seven 6.2m rails, each cut to 177.08 inches
- Seven 6.2m rails, each cut to 171.04 inches

The rails should then be laid out as follows:

- **Rail 1:**
 - 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 15.76 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches and 780.82 inches from the left edge of the roof.
- **Rail 2:**
 - 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 54.78 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches and 780.82 inches from the left edge of the roof.
- **Rail 3:**
 - 215 inch rail segment spliced with a 171.04 inch rail segment spliced

(thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 93.79 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches and 780.82 inches from the left edge of the roof.

- **Rail 4:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 132.81 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 60.82 inches, 96.82 inches, 144.82 inches, 192.82 inches, 240.82 inches, 288.82 inches, 336.82 inches, 384.82 inches, 432.82 inches, 480.82 inches, 528.82 inches, 576.82 inches, 624.82 inches, 672.82 inches, 720.82 inches, 768.82 inches and 792.9 inches from the left edge of the roof.

- **Rail 5:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 171.82 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 144.82 inches, 192.82 inches, 240.82 inches, 288.82 inches, 336.82 inches, 384.82 inches, 432.82 inches, 480.82 inches, 528.82 inches, 576.82 inches, 624.82 inches, 672.82 inches, 720.82 inches, 768.82 inches and 792.9 inches from the left edge of the roof.

- **Rail 6:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 210.84 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 132.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches,

564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches and 780.82 inches from the left edge of the roof.

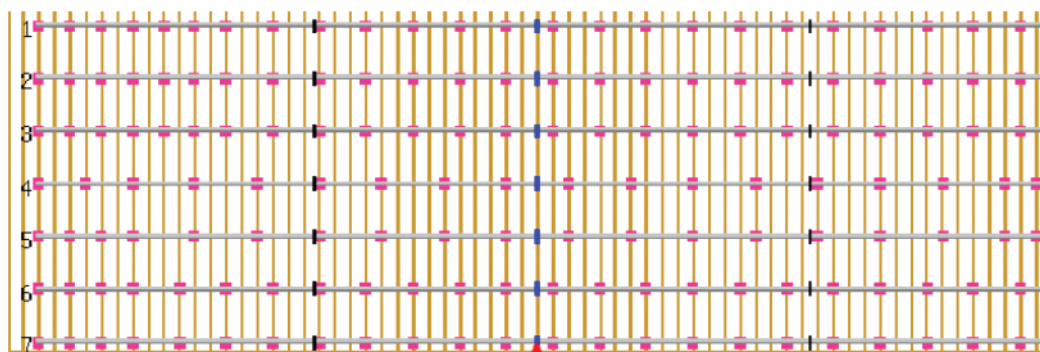
- **Rail 7:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 177.08 inch rail segment, positioned 21.82 inches from the left edge of the roof and 249.86 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 132.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches and 780.82 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

- | Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Building Information

Roof Design

Mono

Building Dimensions

80.83 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

80.83 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

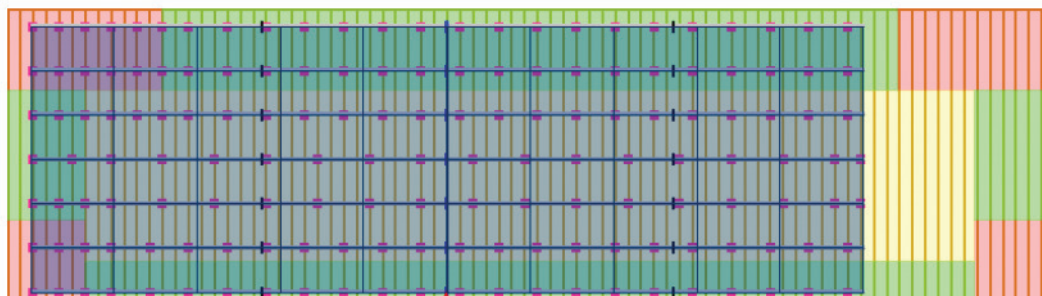
2" × 4" rafters, spaced 12 inches apart

Offset from the peak

1.3 ft.

Offset from the edge

1.8 ft.

Layout*[The peak of the roof is this direction]***Legend**

- Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 48 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 56.8 ft. × 6 ft

Zone F

Edge Zone, 68.8 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

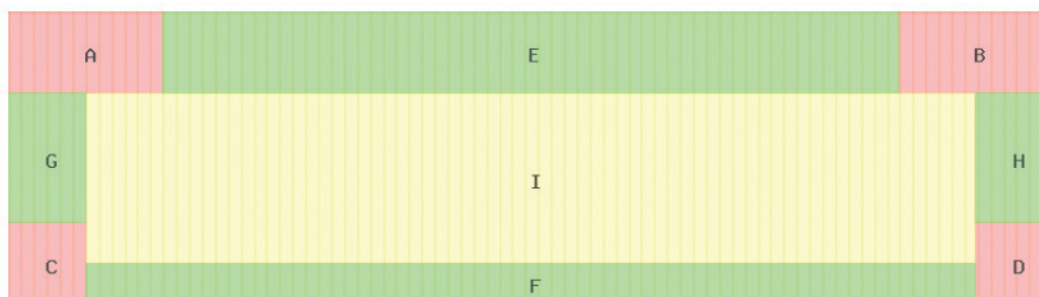
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 68.8 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

10

Service Load Reactions (in lbs)

Gravity (tension)

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 44.66

Edge: 33.49
Corner: 22.33

Gravity (shear)

Interior: 0
Edge: 0
Corner: 0

Snow (tension)

Interior: 0
Edge: 0
Corner: 0

Snow (compression)

Interior: 0
Edge: 0
Corner: 0

Snow (shear)

Interior: 0
Edge: 0
Corner: 0

Wind +ve (tension)

Interior: 0
Edge: 0
Corner: 0

Wind +ve (compression)

Interior: 89.89
Edge: 67.42
Corner: 44.95

Wind +ve (shear)

Interior: 0
Edge: 0
Corner: 0

Wind -ve (tension)

Interior: 239.71
Edge: 323.61
Corner: 335.59

Wind -ve (compression)

Interior: 0
Edge: 0
Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0
Corner: 0

Applied Service Loads (Global Axis) (plf)

Gravity

Interior: 8.93
Edge: 8.93
Corner: 8.93

Snow

Interior: 0
Edge: 0
Corner: 0

Wind +ve

Interior: 17.98
Edge: 17.98
Corner: 17.98

Wind -ve

Interior: -59.93
Edge: -107.87
Corner: -167.8

GCp Zones

GCp +ve

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis

Velocity Pressure Coeff (Kz)

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (K_{zt})

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (K_d)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (q_z)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (C_e)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (C_t)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (I_s)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (P_g)

0 psf

Slope Factor (C_s)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (P_f)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof ($P_{f \min}$)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (P_s)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis

Height of Module (Long) (L)

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (Wt.)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global

Wind Downward / Rail (w+)

17.98 plf

Wind Upward / Rail (w-): interior

-59.93 plf

Wind Upward / Rail (w-): edge

-107.87 plf

Wind Upward / Rail (w-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations

1.2 g + 1.6 s + 0.5 w+ = LC1

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)

Tension

Interior: 260 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 144 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 30 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 4 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations**Site Class**

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS

1.6 (From Seismic Hazard Calculator)

a_p

1

R_p

2.5

W_p

2.94 psf

F_p

2.26 psf (ASCE 7-10, Eq - 13.3-1)

F_pMAX

7.53 psf (ASCE 7-10, Eq - 13.3-2)

F_pMIN

1.41 psf (ASCE 7-10, Eq - 13.3-3)

F_p Design

2.26 psf

Tributary Area (interior)

13.01 sft

Tributary Area (edge)

9.75 sft

Tributary Area (corner)

6.5 sft

Seismic Shear Force Per Connection (interior)

29.36 lbs

Seismic Shear Force Per Connection (edge)

22.02 lbs

Seismic Shear Force Per Connection (corner)

14.68 lbs



Project Details

Project Name

L50 #1

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 196, Part number 113009-102)

[Module Support Plate](#)(Quantity 168, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 35, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 48, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 120, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 28, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

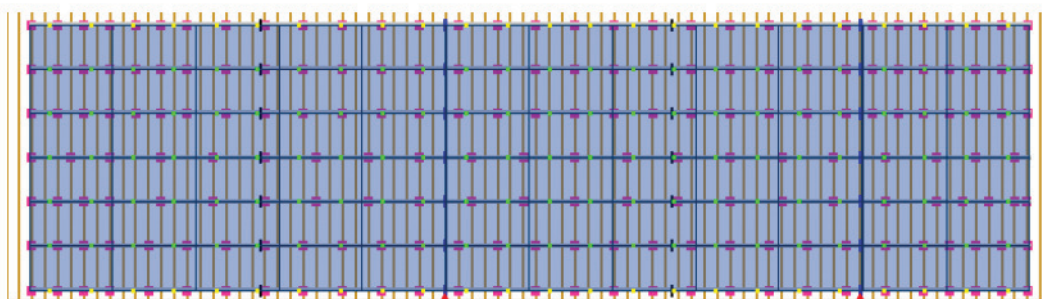
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

- Rafter
- Rail
- Roof Mount
- Splice
- Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase thirty-five 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 215 inches
- Seven 6.2m rails, each cut to 209.96 inches
- Seven 6.2m rails, each cut to 175.08 inches
- Seven 6.2m rails, each cut to 171.04 inches
- Seven 6.2m rails, each cut to 157.42 inches

The rails should then be laid out as follows:

- **Rail 1:**
 - 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 13.34 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches, 780.82 inches, 804.82 inches, 828.82 inches, 852.82 inches, 876.82 inches, 900.82 inches, 924.82 inches and 948.82 inches from the left edge of the roof.
- **Rail 2:**
 - 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 52.35 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82

inches, 708.82 inches, 744.82 inches, 780.82 inches, 804.82 inches, 828.82 inches, 852.82 inches, 876.82 inches, 900.82 inches, 924.82 inches and 948.82 inches from the left edge of the roof.

- **Rail 3:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 91.37 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 120.82 inches, 144.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches, 780.82 inches, 804.82 inches, 828.82 inches, 852.82 inches, 876.82 inches, 900.82 inches, 924.82 inches and 948.82 inches from the left edge of the roof.

- **Rail 4:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 130.38 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 60.82 inches, 96.82 inches, 144.82 inches, 192.82 inches, 240.82 inches, 288.82 inches, 336.82 inches, 384.82 inches, 432.82 inches, 480.82 inches, 528.82 inches, 576.82 inches, 624.82 inches, 672.82 inches, 720.82 inches, 768.82 inches, 816.82 inches, 864.82 inches, 900.82 inches and 936.82 inches from the left edge of the roof.

- **Rail 5:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 169.4 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 144.82 inches, 192.82 inches, 240.82 inches, 288.82 inches, 336.82 inches, 384.82 inches, 432.82 inches, 480.82 inches, 528.82 inches, 576.82 inches, 624.82 inches, 672.82 inches, 720.82 inches, 768.82 inches, 816.82 inches, 864.82 inches, 888.82

inches, 912.82 inches, 936.82 inches and 948.32 inches from the left edge of the roof.

- **Rail 6:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 208.42 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 132.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches, 780.82 inches, 816.82 inches, 852.82 inches, 876.82 inches, 900.82 inches, 924.82 inches and 948.82 inches from the left edge of the roof.

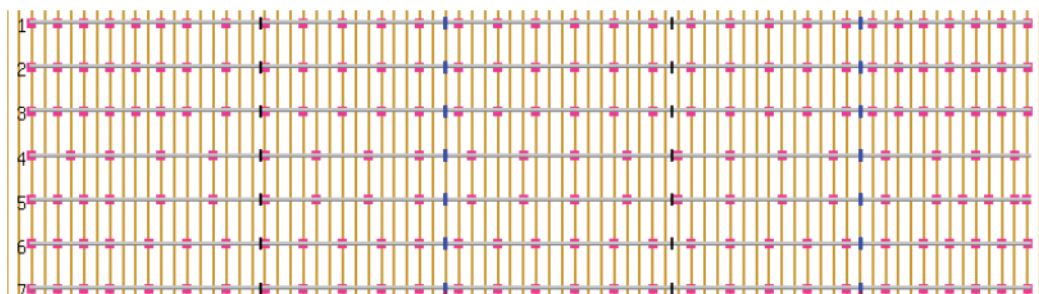
- **Rail 7:**

- 215 inch rail segment spliced with a 171.04 inch rail segment spliced (thermal expansion joint) with a 209.96 inch rail segment spliced with a 175.08 inch rail segment spliced (thermal expansion joint) with a 157.42 inch rail segment, positioned 21.82 inches from the left edge of the roof and 247.43 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.82 inches, 72.82 inches, 96.82 inches, 132.82 inches, 168.82 inches, 204.82 inches, 240.82 inches, 276.82 inches, 312.82 inches, 348.82 inches, 384.82 inches, 420.82 inches, 456.82 inches, 492.82 inches, 528.82 inches, 564.82 inches, 600.82 inches, 636.82 inches, 672.82 inches, 708.82 inches, 744.82 inches, 780.82 inches, 816.82 inches, 852.82 inches, 876.82 inches, 900.82 inches, 924.82 inches and 948.82 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

-  Rafter
 -  Rail
 -  Roof Mount
 -  Splice
 -  Thermal Expansion Joint
 -  Thermal Expansion Joint Marker
 -  Middle Clamp
 -  End Clamp
 -  Solar Module
 -  Corner Zone
 -  Exterior Zone
 -  Interior Zone
-

Building Information**Roof Design**

Mono

Building Dimensions

80.83 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

80.83 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

2" × 4" rafters, spaced 12 inches apart

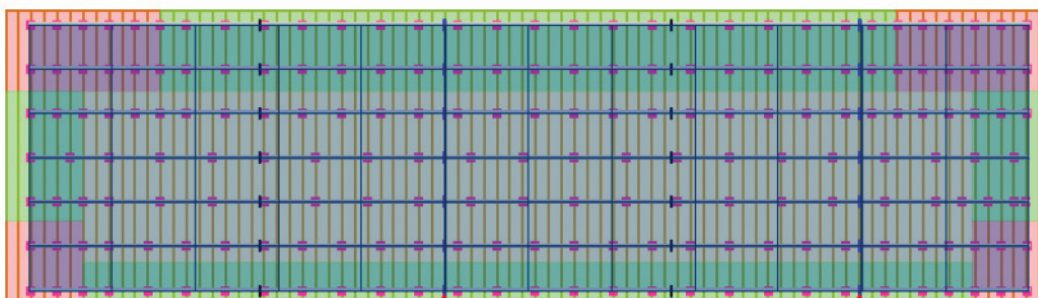
Offset from the peak

1.1 ft.

Offset from the edge

1.8 ft.

Layout*[The peak of the roof is this direction]*



Legend

-  Rafter
-  Rail
-  Roof Mount
-  Splice
-  Thermal Expansion Joint
-  Thermal Expansion Joint Marker
-  Middle Clamp
-  End Clamp
-  Solar Module
-  Corner Zone
-  Exterior Zone
-  Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 48 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 56.8 ft. × 6 ft

Zone F

Edge Zone, 68.8 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

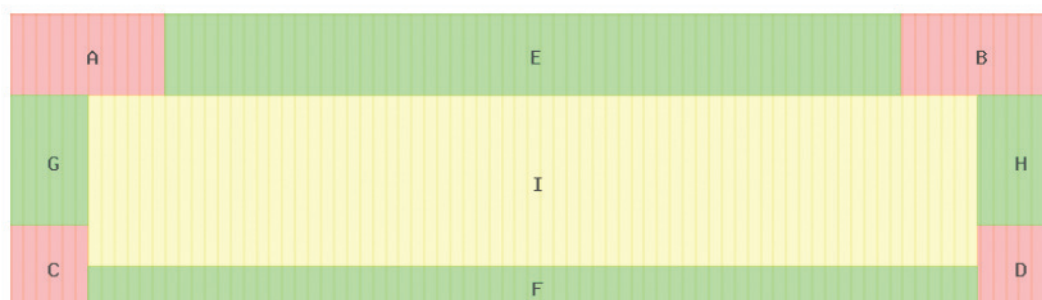
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 68.8 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

12

Service Load Reactions (in lbs)

Gravity (tension)

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 44.66

Edge: 33.49

Corner: 22.33

Gravity (shear)

Interior: 0

Edge: 0

Corner: 0

Snow (tension)

Interior: 0

Edge: 0

Corner: 0

Snow (compression)

Interior: 0

Edge: 0

Corner: 0

Snow (shear)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (tension)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (compression)

Interior: 89.89

Edge: 67.42

Corner: 44.95

Wind +ve (shear)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (tension)

Interior: 239.71

Edge: 323.61

Corner: 335.59

Wind -ve (compression)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0

Corner: 0

Applied Service Loads (Global Axis) (plf)

Gravity

Interior: 8.93

Edge: 8.93

Corner: 8.93

Snow

Interior: 0

Edge: 0

Corner: 0

Wind +ve

Interior: 17.98

Edge: 17.98

Corner: 17.98

Wind -ve

Interior: -59.93

Edge: -107.87

Corner: -167.8

GCp Zones

GCp +ve

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis

Velocity Pressure Coeff (Kz)

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (Kzt)

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (Kd)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (qz)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (Ce)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (Ct)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (Is)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (Pg)

0 psf

Slope Factor (Cs)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (Pf)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof (Pf min)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (Ps)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis**Height of Module (Long) (L)**

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (Wt.)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global**Wind Downward / Rail (w+)**

17.98 plf

Wind Upward / Rail (w-): interior

-59.93 plf

Wind Upward / Rail (w-): edge

-107.87 plf

Wind Upward / Rail (w-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations

1.2 g + 1.6 s + 0.5 w+ = LC1

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)**Tension**

Interior: 260 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 144 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 30 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 4 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations**Site Class**

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS

1.6 (From Seismic Hazard Calculator)

ap

1

Rp

2.5

Wp

2.94 psf

Fp

2.26 psf (ASCE 7-10, Eq - 13.3-1)

FpMAX

7.53 psf (ASCE 7-10, Eq - 13.3-2)

FpMIN

1.41 psf (ASCE 7-10, Eq - 13.3-3)

Fp Design

2.26 psf

Tributary Area (interior)

13.01 sft

Tributary Area (edge)

9.75 sft

Tributary Area (corner)

6.5 sft

Seismic Shear Force Per Connection (interior)

29.36 lbs

Seismic Shear Force Per Connection (edge)

22.02 lbs

Seismic Shear Force Per Connection (corner)

14.68 lbs



Project Details

Project Name

L88

Contact Email Address

Project Address

LAGUNA WOODS, CA 92637

Environment

Design Wind Speed

110 MPH

Ground Snow Load

0 psf

Non-Reducible Snow Load

No

Terrain Category

Category B: Suburban or urban areas

Risk Category

II

Parts Needed

Parts

[Single Fix-V Kit](#) (Quantity 214, Part number 113009-102)

[Module Support Plate](#)(Quantity 196, Part number 139004-005)

[6.2M Solo05 Rail](#) (Quantity 38, Part number 120002-06200)

[Grounding Rapid2+ End Clamp H. Assembly](#) (Quantity 56, Part number 135013-045)

[Grounding Rapid2+ Mid Clamp H. Assembly](#) (Quantity 140, Part number 135011-003)

[Solo05/Profi05 Internal Splice Kit](#) (Quantity 35, Part number 129060-001)

* For the Single Fix-V Kit trapezoidal sheet metal must be 26 gauge or more

This project requires the use of thermal expansion splices. **Please note that there should be a 1-inch gap between modules where a thermal expansion splice is placed.

Module Information

Module Length

1956 mm

Module Width

991 mm

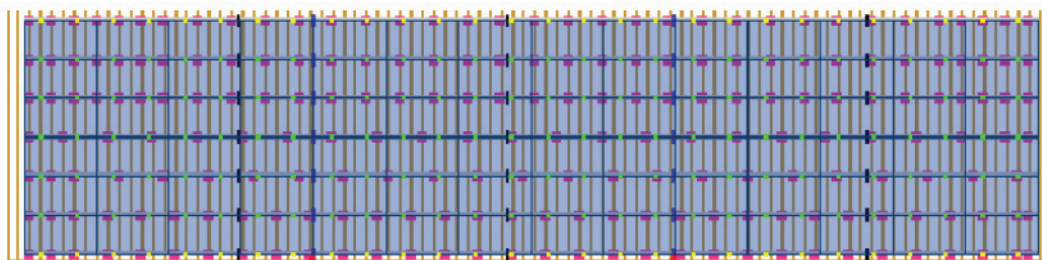
Module Thickness

45 mm

Module Weight:

26 kg

Layout



Legend

- | Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- | Middle Clamp
- | End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Rail Information

Your project consists of an array mounted across 7 rows of rail. You will need to purchase thirty-eight 6.2-meter rails in order to complete your project. The rails should be cut as follows:

- Seven 6.2m rails, each cut to 230 inches
- Seven 6.2m rails, each cut to 208.17 inches
- Seven 6.2m rails, each cut to 206.13 inches
- Seven 6.2m rails, each cut to 182.91 inches
- Seven 6.2m rails, each cut to 176.87 inches
- Two 6.2m rails, each cut into 3 pieces:
 - 78.83 in. segment
 - 78.83 in. segment
 - 78.83 in. segment
- One 6.2m rail, cut to 78.83 inches

The rails should then be laid out as follows:

- **Rail 1:**
 - 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 15.58 inches from the peak of the roof.
Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 564.32 inches, 600.32 inches, 636.32 inches, 672.32 inches, 708.32 inches, 744.32 inches, 780.32 inches, 816.32 inches, 852.32 inches, 888.32 inches, 924.32 inches, 960.32 inches, 996.32 inches, 1020.32 inches, 1044.32 inches, 1068.32 inches and 1092.32 inches from the left edge of the roof.
- **Rail 2:**
 - 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a

206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 54.59 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 564.32 inches, 600.32 inches, 636.32 inches, 672.32 inches, 708.32 inches, 744.32 inches, 780.32 inches, 816.32 inches, 852.32 inches, 888.32 inches, 924.32 inches, 960.32 inches, 996.32 inches, 1020.32 inches, 1044.32 inches, 1068.32 inches and 1092.32 inches from the left edge of the roof.

- **Rail 3:**

- 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 93.61 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 96.32 inches, 120.32 inches, 144.32 inches, 168.32 inches, 204.32 inches, 240.32 inches, 276.32 inches, 312.32 inches, 348.32 inches, 384.32 inches, 420.32 inches, 456.32 inches, 492.32 inches, 528.32 inches, 564.32 inches, 600.32 inches, 636.32 inches, 672.32 inches, 708.32 inches, 744.32 inches, 780.32 inches, 816.32 inches, 852.32 inches, 888.32 inches, 924.32 inches, 960.32 inches, 996.32 inches, 1020.32 inches, 1044.32 inches, 1068.32 inches and 1092.32 inches from the left edge of the roof.

- **Rail 4:**

- 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 132.62 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 60.32 inches, 108.32 inches, 156.32 inches, 204.32 inches, 252.32 inches, 300.32 inches, 348.32 inches, 396.32 inches, 444.32 inches, 492.32 inches, 540.32 inches, 588.32 inches, 636.32 inches, 684.32 inches, 732.32 inches, 780.32 inches, 828.32 inches, 876.32 inches, 924.32 inches, 972.32

inches, 1020.32 inches, 1068.32 inches and 1092.23 inches from the left edge of the roof.

- **Rail 5:**

- 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 171.64 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 120.32 inches, 168.32 inches, 216.32 inches, 264.32 inches, 312.32 inches, 360.32 inches, 408.32 inches, 456.32 inches, 504.32 inches, 552.32 inches, 600.32 inches, 648.32 inches, 696.32 inches, 744.32 inches, 792.32 inches, 840.32 inches, 888.32 inches, 936.32 inches, 984.32 inches, 1032.32 inches and 1080.32 inches from the left edge of the roof.

- **Rail 6:**

- 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 210.65 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32 inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 432.32 inches, 468.32 inches, 504.32 inches, 540.32 inches, 576.32 inches, 612.32 inches, 648.32 inches, 684.32 inches, 720.32 inches, 756.32 inches, 792.32 inches, 828.32 inches, 864.32 inches, 900.32 inches, 936.32 inches, 972.32 inches, 1008.32 inches, 1044.32 inches, 1080.32 inches and 1092.23 inches from the left edge of the roof.

- **Rail 7:**

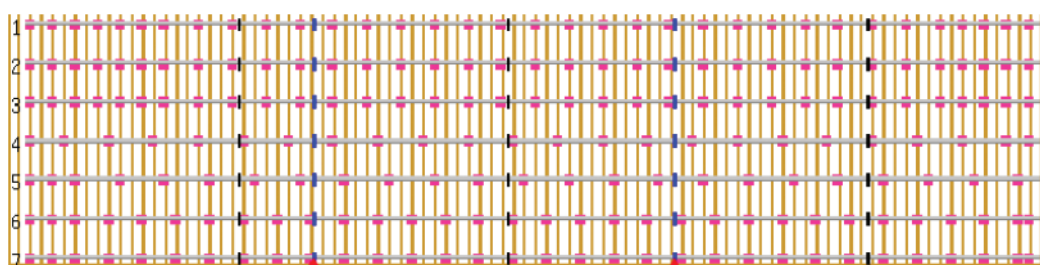
- 230 inch rail segment spliced with a 78.83 inch rail segment spliced (thermal expansion joint) with a 208.17 inch rail segment spliced with a 176.87 inch rail segment spliced (thermal expansion joint) with a 206.13 inch rail segment spliced with a 182.91 inch rail segment, positioned 18.32 inches from the left edge of the roof and 249.67 inches from the peak of the roof.

Roof mounts should be positioned at 24 inches, 48.32 inches, 72.32

inches, 108.32 inches, 144.32 inches, 180.32 inches, 216.32 inches, 252.32 inches, 288.32 inches, 324.32 inches, 360.32 inches, 396.32 inches, 432.32 inches, 468.32 inches, 504.32 inches, 540.32 inches, 576.32 inches, 612.32 inches, 648.32 inches, 684.32 inches, 720.32 inches, 756.32 inches, 792.32 inches, 828.32 inches, 864.32 inches, 900.32 inches, 936.32 inches, 972.32 inches, 1008.32 inches, 1044.32 inches, 1080.32 inches and 1092.23 inches from the left edge of the roof.

See below for an approximate visual representation:

[The peak of the roof is this direction]



Legend:

- | Rafter
- Rail
- Roof Mount
- | Splice
- | Thermal Expansion Joint
- ▲ Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Building Information

Roof Design

Mono

Building Dimensions

100.83 × 21.5 ft.

Building Height

11 ft.

Roof Dimensions

100.83 × 21.5 ft.

Roof Slope

0°

Roof Type

Trapezoidal Sheet Metal

Rafters

2" × 4" rafters, spaced 12 inches apart

Offset from the peak

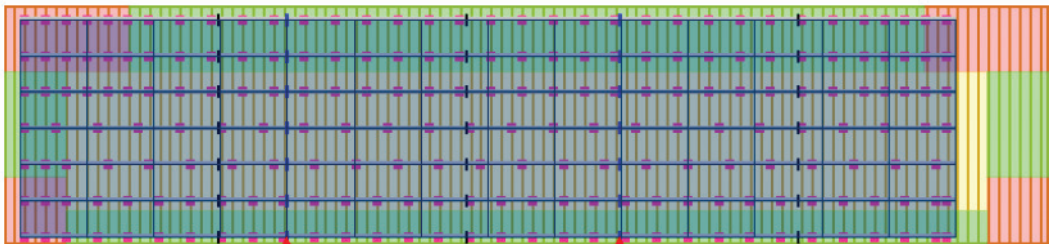
1.3 ft.

Offset from the edge

1.5 ft.

Layout

[The peak of the roof is this direction]



Legend

- Rafter
- Rail
- Roof Mount
- Splice
- Thermal Expansion Joint
- Thermal Expansion Joint Marker
- Middle Clamp
- End Clamp
- Solar Module
- Corner Zone
- Exterior Zone
- Interior Zone

Zone Information

Maximum Roof Connection Span

Interior Zone: 48 in.

Edge Zone: 36 in.

Corner Zone: 24 in.

Zone A

Corner Zone, 12 ft. × 6 ft

Zone B

Corner Zone, 12 ft. × 6 ft

Zone C

Corner Zone, 6 ft. × 6 ft

Zone D

Corner Zone, 6 ft. × 6 ft

Zone E

Edge Zone, 76.8 ft. × 6 ft

Zone F

Edge Zone, 88.8 ft. × 3 ft

Zone G

Edge Zone, 6 ft. × 9.5 ft

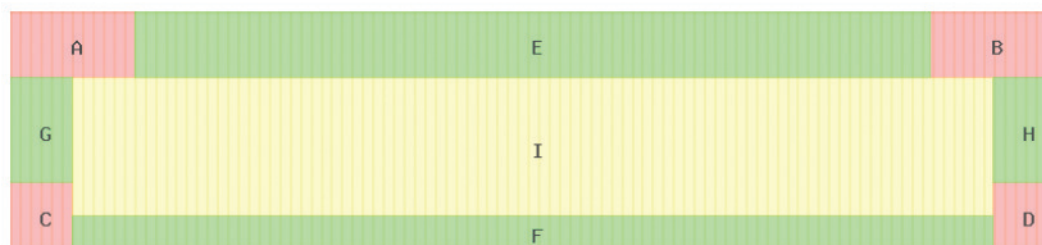
Zone H

Edge Zone, 6 ft. × 9.5 ft

Zone I

Interior Zone, 88.8 ft. × 12.5 ft

[The peak of the roof is this direction]



Calculations

Project Parameters

Height of the Module

1956 mm

Width of the Module

991 mm

Assumed Module Weight

26 kg

Wind Speed

110 MPH

Ground Snow Load

0 psf

Exposure Category

B

Risk Category

II

Tilt of the Roof

0 degrees

Height of the Building

11 ft

Type of Roof

Mono Slope

System Design Required

Landscape

No. of Rows

6

No. of Columns

14

Service Load Reactions (in lbs)**Gravity (tension)**

Interior: 0

Edge: 0

Corner: 0

Gravity (compression)

Interior: 44.66

Edge: 33.49

Corner: 22.33

Gravity (shear)

Interior: 0

Edge: 0

Corner: 0

Snow (tension)

Interior: 0

Edge: 0

Corner: 0

Snow (compression)

Interior: 0

Edge: 0

Corner: 0

Snow (shear)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (tension)

Interior: 0

Edge: 0

Corner: 0

Wind +ve (compression)

Interior: 89.89

Edge: 67.42

Corner: 44.95

Wind +ve (shear)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (tension)

Interior: 239.71

Edge: 323.61

Corner: 335.59

Wind -ve (compression)

Interior: 0

Edge: 0

Corner: 0

Wind -ve (shear)

Interior: 0

Edge: 0

Corner: 0

Applied Service Loads (Global Axis) (plf)

Gravity

Interior: 8.93

Edge: 8.93
Corner: 8.93

Snow

Interior: 0
Edge: 0
Corner: 0

Wind +ve

Interior: 17.98
Edge: 17.98
Corner: 17.98

Wind -ve

Interior: -59.93
Edge: -107.87
Corner: -167.8

GCp Zones**GCp +ve**

Interior: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Edge: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Corner: 0.3 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

GCp -ve

Interior: -1 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Edge: -1.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)
Corner: -2.8 (ASCE 7-10, Fig. 30.4-5A,30.4-5B)

Wind Load Analysis**Velocity Pressure Coeff (K_z)**

0.7 (ASCE 7-10, Table 30.3-1)

Topographic factor (K_{zt})

1 (ASCE 7-10, Fig 26.8-1)

Wind Directional Factor (K_d)

0.85 (ASCE 7-10, Table 26.6-1)

Velocity Pressure (q_z)

18.43 psf (ASCE 7-10, Eq. 30.3-1)

Snow Load Analysis

Exposure Factor (C_e)

0.9 (ASCE 7-10, Table 7-2)

Thermal Factor (C_t)

1.2 (ASCE 7-10, Table 7-3)

Importance Factor Snow (I_s)

1 (ASCE 7-10, Table 1.5-2)

Ground Snow Load (P_g)

0 psf

Slope Factor (C_s)

1 (ASCE 7-10, Fig. 7-2)

Snow Load Flat Roof (P_f)

0 psf (ASCE 7-10, Eq. 7.4-1)

Min. Snow Load Flat Roof ($P_{f \min}$)

0 psf (ASCE 7-10, Section 7.3.4)

Sloped Roof Snow Load (P_s)

0 psf (ASCE 7-10, Eq. 7.4-1)

Gravity Load Analysis

Height of Module (Long) (L)

6.42 ft

Width of Module (Short) (W)

3.25 ft

Weight of Module (W_t)

57.32 lbs

Gravity Load Module (G)

2.75 psf

Structural Analysis Global

Wind Downward / Rail (w_+)

17.98 plf

Wind Upward / Rail (w_-): interior

-59.93 plf

Wind Upward / Rail (w-): edge

-107.87 plf

Wind Upward / Rail (w-): corner

-167.8 plf

Snow Load / Rail (s)

0 plf

Gravity Load / Rail (g)

8.93 plf

LRFD Load Combinations**1.2 g + 1.6 s + 0.5 w+ = LC1**

Interior: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Edge: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

Corner: 19.71 plf (ASCE 07-10 - Section 2.3.2 -3)

1.2 g + 0.5 s + 1 w+ = LC2

Interior: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Edge: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

Corner: 28.7 plf (ASCE 07-10 - Section 2.3.2 -4)

0.9 g + 1 w- = LC3

Interior: -51.89 plf (ASCE 07-10 - Section 2.3.2 -6)

Edge: -99.83 plf (ASCE 07-10 - Section 2.3.2 -6)

Corner: -159.76 plf (ASCE 07-10 - Section 2.3.2 -6)

LRFD Reactions (Point Loads)**Tension**

Interior: 260 lbs (DL,WL)

Edge: 375 lbs (DL,WL)

Corner: 400 lbs (DL,WL)

Compression

Interior: 144 lbs (DL,SL,WL)

Edge: 108 lbs (DL,SL,WL)

Corner: 72 lbs (DL,SL,WL)

Shear

Interior: 30 lbs (DL,EL)

Edge: 23 lbs (DL,EL)

Corner: 15 lbs (DL,EL)

Spacing

Interior: 4 ft

Edge: 3 ft

Corner: 2 ft

Seismic Calculations

Site Class

D (ASCE 7-10, Section 11.4.2)

I_p

1 (ASCE 7-10, Table 1.5-2)

SDS

1.6 (From Seismic Hazard Calculator)

a_p

1

R_p

2.5

W_p

2.94 psf

F_p

2.26 psf (ASCE 7-10, Eq - 13.3-1)

F_pMAX

7.53 psf (ASCE 7-10, Eq - 13.3-2)

F_pMIN

1.41 psf (ASCE 7-10, Eq - 13.3-3)

F_p Design

2.26 psf

Tributary Area (interior)

13.01 sft

Tributary Area (edge)

9.75 sft

Tributary Area (corner)

6.5 sft

Seismic Shear Force Per Connection (interior)

29.36 lbs

Seismic Shear Force Per Connection (edge)

22.02 lbs

Seismic Shear Force Per Connection (corner)

14.68 lbs

Via Email: RPantel@Princeton-Engineering.com

May 20, 2016

Princeton Engineering
35091 Paxson Road
Round Hill, VA 20141

Re: Johnson Controls, Inc. (JCI)
Structural Evaluation for the Proposed PV Carport Project at Laguna Woods Village

Dear Mr. Pantel:

On your behalf, NS Structural Engineering, Inc. (NSSE) performed a site visit with Mr. Howard of JCI on March 29, 2016 to the Laguna Woods Village apartment complex located in Laguna Woods, California. During our visit, we understood Johnson Controls Inc. (JCI) desires to install a new solar panel racking system positively mounted to the structural roof framing elements to generate and provide additional electricity to the community. The purpose of our site visit was to perform a limited review of the roof framing capacity of the existing carport structure(s) located throughout the Laguna Woods apartment complex sites. Following is a brief description of the existing carport structures along with a summary of our findings. Figures referenced in the text of this report follow at the end.

Background and Observations

The existing carport structures located at the Laguna Woods Village apartment complex may be an option to install a new solar rack system to aid in energy reduction and independence with minimized expenses. NSSE was asked to visit and assess the existing condition of the typical carport structure for the new solar racking system installation and provide recommendations for cost estimation purposes.

The existing carport is a single-story structure(s) approximately 8 feet in height. The plan dimensions are approximately 60'-8" feet long x 20'-0" feet wide. The roof structure is comprised of a 20 GA metal deck roof spanning to existing 10" x 3.5" x 12 GA Z purlins. The Z purlins are simply supported with a span of 20'-0" feet which are supported by 3.5" diameter steel pipe columns. The steel pipe columns are typically spaced at 11'-6" feet in the transverse direction and 20 feet in longitudinal direction. The lateral resisting framing system (LRFS) are the cantilevered steel pipe columns supported by a concrete caisson foundation system.

Findings and Recommendations

At this time, NSSE does not have an overlay drawing of the final solar rack layout on top of the existing carport structure roof framing plan. To address any structural issues and report our findings, we have made the following professional assumptions based on information in the (15 sets) as-built drawings prepared by FE MacDonald dated circa mid-1960s:

1. Dead load (DL) of solar modules including racking = 2.5 pounds per square feet (psf)
2. Structural analysis based on the latest building code.
3. Strength level wind speed = 110 mph and wind exposure C.
4. Seismic Design Category D
5. Wind and seismic importance factor = 1.0
6. Uniform loading (psf) based on dead, live and wind loads

Based on current design code, our findings indicate the overall structure will perform satisfactory under vertical downward and lateral loads with the exception of the existing Z purlins. Under current wind design level uplift forces, the existing long span purlins appear to fail in flexural buckling. We recommend the existing Z purlins shall be strengthened by installing an additional track to span between these purlins. A detailed analysis of the Z purlins can be found in the attached calculation. During this phase of work, the study of the existing foundation is beyond the scope of this report and analysis of substructure will be excluded. The next phase will include hand sketch details for the strengthening of the Z purlins.

If you have any questions regarding this letter, please do not hesitate to call us.

Sincerely,
NS STRUCTURAL ENGINEERING, INC.



Neal Shah, PE, SE
Principal Structural Engineer



Figure 1. Site observation photos.



Figure 2. Site observation photos.



Figure 3. Site observation photos.

STRUCTURAL CALCULATIONS

for

LAGUNA WOODS VILLAGE EXISTING CARPORT STRUCTURE SOLAR PV PROJECT FEASIBILITY STUDY

Prepared By:

NS Structural Engineering, Inc.

May 20, 2016





Client:	Princeton Engineering
Project:	Johnson Controls, Inc.: Laguna Woods Village
	Existing Carport Struct. Feasibility Study

Sheet	1
Job no	
Date	5/20/2016
Engineer	PD

Site Address

Laguna Woods Carport
24351 El Toro Road
Laguna Woods, CA 92637

Building Code

2013 California Building Code
ASCE 07-10

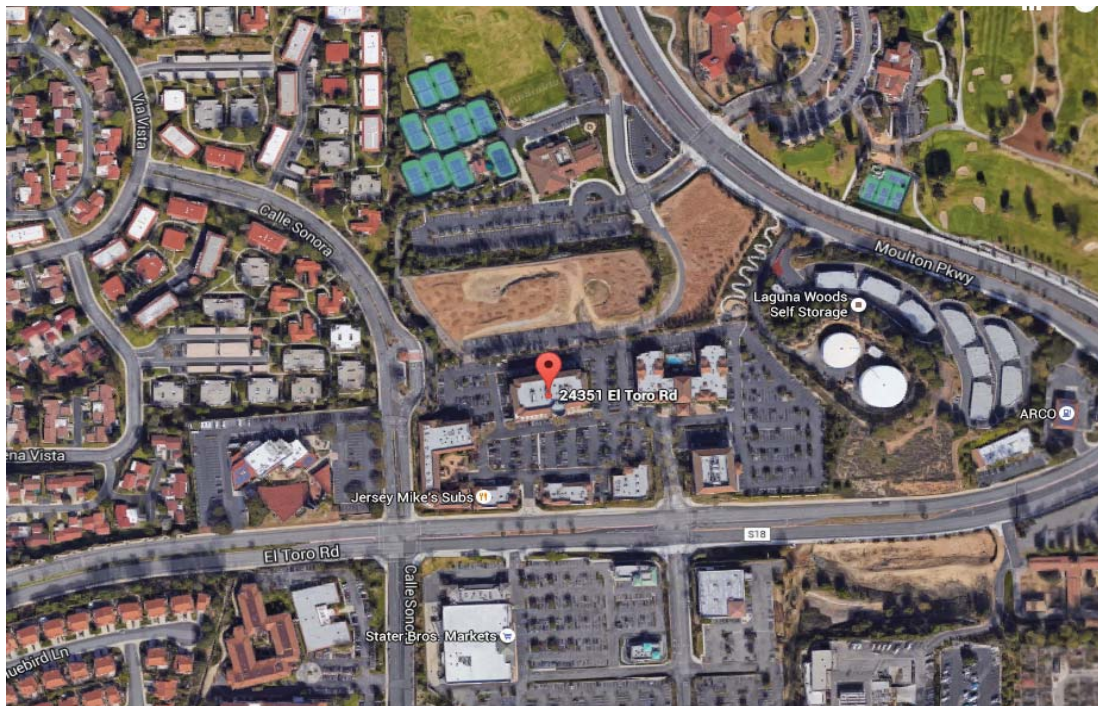
Site Specifications

Wind Speed, V	110 mph
Exposure	C
S_{DS}	1.00

Load Combination

1.4D
1.2D + 1.6L_r
1.2D + 1.0W + 0.5L_r
0.9D + 1.0W
(1.2 + 0.2S_{DS})D + E
(0.9 - 0.2S_{DS})D + E

Site Map





Client: Princeton Engineering
Project: Johnson Controls, Inc.: Laguna Woods Village
Existing Carport Struct. Feasibility Study

Sheet 2
Job no
Date 5/20/2016
Engineer PD

Load Criteria

Dead Load

Existing Metal Deck	2.5 psf
New PV Panel System	2.5 psf
Misc	1 psf
Total	6 psf

Roof Live Load

20 psf

Wind Load Roof, WL

-22.3 psf (LRFD)

See "Wind Design" section

Seismic Parameter

USGS Design Maps Summary Report

User-Specified Input

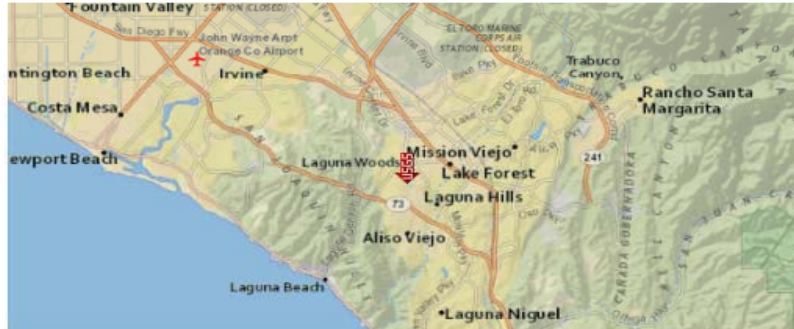
Report Title Laguna Woods
Sun May 15, 2016 19:07:00 UTC

Building Code Reference Document 2012 International Building Code
(which utilizes USGS hazard data available in 2008)

Site Coordinates 33.60924°N, 117.73079°W

Site Soil Classification Site Class D - "Stiff Soil"

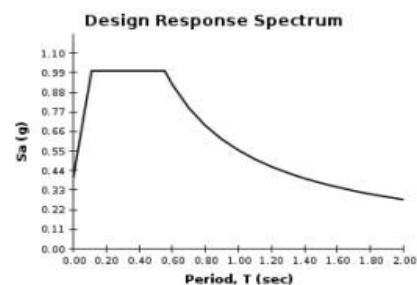
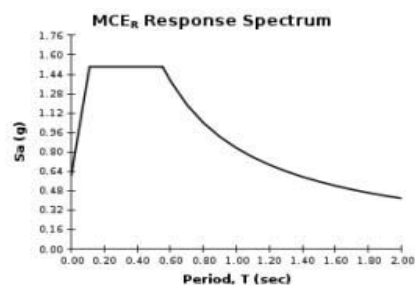
Risk Category I/II/III



USGS-Provided Output

$S_s = 1.501 \text{ g}$ $S_{M5} = 1.501 \text{ g}$ $S_{D5} = 1.001 \text{ g}$
 $S_1 = 0.555 \text{ g}$ $S_{M1} = 0.832 \text{ g}$ $S_{D1} = 0.555 \text{ g}$

For information on how the S_s and S_1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.



Client:	Princeton Engineering
Project:	Johnson Controls, Inc.: Laguna Woods Village
	Existing Carport Struct. Feasibility Study

Sheet	3
Job no	
Date	5/20/2016
Engineer	PD

Wind Analysis (Directional Procedure)

2013 CBC Chapter 16, ASCE 7-10 Chapter 27

Wind Design Procedure

Basic Wind Speed, V	110	mph
Risk Category	I	
Exposure Category	C	
Wind directionality Factor, K_d	0.85	
Velocity Press. Exp. Coeff., K_z	0.85	
Topographical Factor, K_{zt}	1	
Gust Effect Factor, G	0.85	
Net Pressure Coefficient, C_N	-1.2	*Max for all case *Obstructed wind flow *Roof angle = 0 deg.
Velocity Pressure, q_z (psf)	21.9	psf
Net Design Pressure on Monoslope roof, p	-22.3	psf (LRFD)



Client:	Princeton Engineering	Sheet	4
Project:	Johnson Controls, Inc.: Laguna Woods Village	Job no	
	Existing Carport Struct. Feasibility Study	Date	5/20/2016
		Engineer	PD

Seismic Lateral

System	Steel Ordinary Cantilever Column System
Response Modification Coeff., R	1 1/4
Overstrength Factor, Ω	1 1/4
Deflection Amplification Factor, C_d	1 1/4
Importance Factor, I_E	1
Seismic Response Coeff., C_s	0.8 *W (Eqn 12.8-2)

CANTILEVER COLUMN

3 1/2" ϕ STD PIPE COL
H = 8'

$$V = 0.8W,$$

$$W = \frac{6 \text{ PSF} \times 20' \times 60.3'}{1000} = 7.2 \text{ K}$$

$$V = 0.8 \times 7.2 = 5.8 \text{ K}$$

$$F = 5.8 \text{ K} / 8 \text{ columns} = 0.725 \text{ K/column}$$

$$M = 0.725 \text{ K} \times 8' = 5.8 \text{ K}'$$

$$= 70 \text{ K}''$$

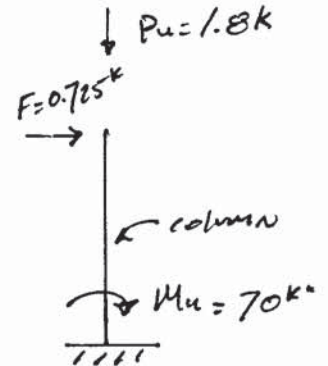
$$P_u = (1.2 + 0.2 S_{DS}) D = 1.8 \text{ K}$$

$$\phi M_n = 95 \text{ K}'' > 70 \text{ K}'' , \text{ ok}$$

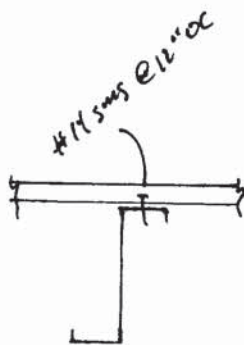
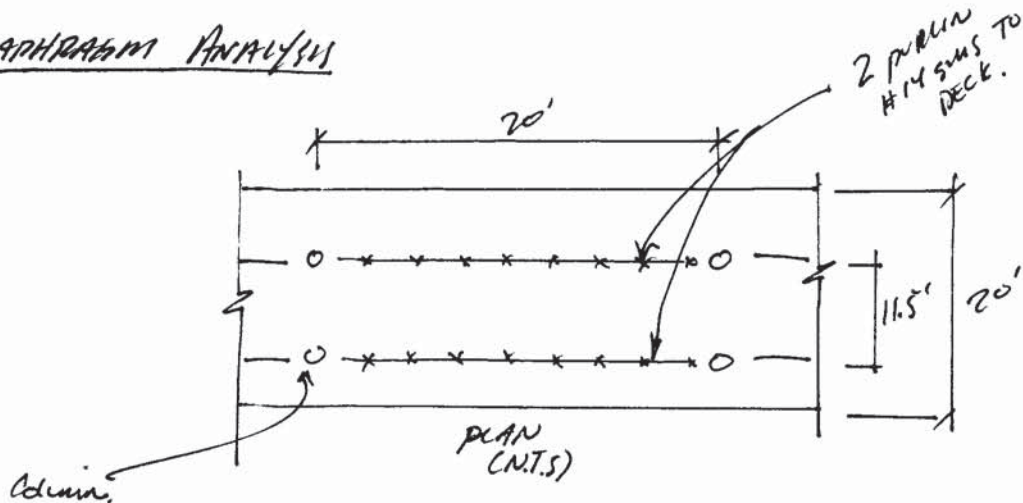
$$\phi P_n = 60.6 \text{ K} > 1.8 \text{ K} , \text{ ok}$$

COMBINED STRESS U

$$U = \frac{1.8}{2 \times 60.6} + \frac{70}{95} = 0.75 < 1.0, \text{ ok}$$



DIAPHRAGM ANALYSIS



$$W = 0.8 \times 6 \text{ PSF} \times 20' = 96 \#$$

$$R = 96 \#$$

$$V = 96 \#$$

$$R = 96 \times 20' / 2 = 960 \#$$

$$V = 960 \# / 20' = 96 \#$$

$$M_u = 96 \times 20^2 / 6 = 4800 \#$$

$$\text{CHORD FORCE} = \frac{4800 \#}{11.5'} = 417 \#$$

FLANGE AREA (2" PURLIN)

$$A = 3.5 \times 0.1 = 0.35 \text{ in}^2$$

$$\phi P_n = 0.9 \times 0.35 \times 50 \text{ ksi} = 15.8 \text{ kips} > 417 \#, \text{ OK}$$

$$\text{CONN. \#14 steel @ 12" o.c. } \phi V_n = 1.5 \times 203 = 305 \#/\text{steel}$$

$$\therefore 2 \times 305 = 610 \# > V_u = 96 \#, \text{ OK}$$

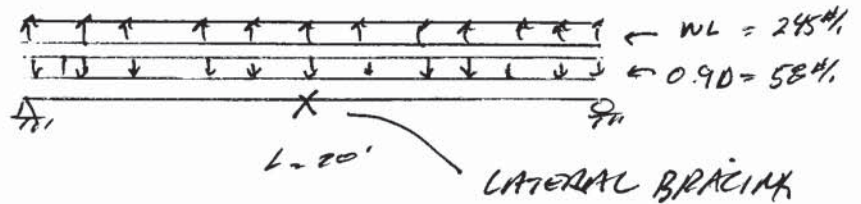
PURLIN CONN. PL - 6" x 3/16"

$$M_u = 960 \# \times 1.5" = 1440 \text{ in-in}, R_{eq} \approx 2 = 0.044$$

$$R_{eq} \approx t = \sqrt{\frac{4 \times 0.044}{6}} = 0.17" < 3/16", \text{ OK}$$

CHECK (F) "2" BEAM FOR WIND UPLIFT. (CASE 1 w/o STORAGE)

GOVN. LOAD COMB. $0.90 + WL$



$$\begin{aligned} w_{wl} &= 22.8 \times 10.75 = 245 \text{ \#/ft} \\ w_{dl} &= 0.9 \times 6 \times 10.75 = 58 \text{ \#/ft} \end{aligned} \quad \left. \vphantom{\begin{aligned} w_{wl} &= 22.8 \times 10.75 = 245 \text{ \#/ft} \\ w_{dl} &= 0.9 \times 6 \times 10.75 = 58 \text{ \#/ft} \end{aligned}} \right\} w_{net} = 187 \text{ \#/ft}$$

$$M_u = 0.187 \times 20^2 / 8 = 9.35 \text{ k'} = 112 \text{ k''}$$

$$V_u = 0.187 \times 10 = 1.87 \text{ k.}$$

STRESS CHECK U

(SEE CFS OUTPUT)

$U = 2.3 > 1.0$, N.G. REINFORCING REQ'D
BRACE BOTTOM FLANGE @ MID SPAN.

CONNECTION: (2) 1/2" ϕ BOLTS

w/ 6" x 3/16" CONN. PL. WELDED TO P.I.E COLUMN.
1/8" FILLET 2 SIDES

$$\text{BOLTS: } \phi V_n = (2) 13.5 \text{ ksi} \times 0.2 \text{ in}^2 = 5.3 \text{ k} > 1.87 \text{ k, OK}$$

$$\text{CONN. PL.} = \phi V_n = 0.9 \times 0.6 \times 36 \times 6 \times 3/16 = 21.9 \text{ k} > 1.87 \text{ k, OK}$$

$$\text{WELD: } \phi V_n = 1.392 \times 6 \times 2 \times 2 \text{ sides} = 33.4 \text{ k} > 1.87 \text{ k, OK}$$

CHECK (E) "2" BEAM FOR WIND UPLIFT (CASE 2 w/STORAGE)

Govan LC: 0.9D + WL

$L = 20'$

$W = 245 \text{ #/ft} \uparrow$

$0.9 W_{DL} = 58 \text{ #/ft} \downarrow$

$0.9 W_{STORAGE} = 0.9(20 \text{ pcft} \times 2.5 \times 2.67 + 10 \text{ #/ft}) = 130 \text{ #/ft}$

$W_{net} = 57 \text{ #/ft} \uparrow$

$M_u = -2850 \text{ #'} = -34.2 \text{ #K}$

$V_u = 570 \text{ #} = 0.57 \text{ K}$

STRESS CHECK $U = 0.577 < 1.0, \text{OK}$
 $\uparrow$ SEE CFS OUTPUT.

NO REINFORCING REQD

CONN: (2) $\frac{1}{2}" \phi$ M.B.

$V_u = 0.57 \text{ K} < 5.3 \text{ K}$, CONN BOLTS OK

$< 21.9 \text{ K}$, SHEAR CONN. OK

$< 33.4 \text{ K}$, WELD CONN. OK

CHECK (E) "Z" BEAM FOR GRAVITY (CASE 3 w/o STORAGE)

$$\text{GOVN L.C.} = 1.2D + 1.6L$$

$$W_u = 20 \times 9.75 = 195 \text{ #/}$$

$$W_{DL} = 6 \times 9.75 = 59 \text{ #/}$$

$$W_u = 382 \text{ #/}$$

$$M_u = 19.1 \text{ K'} = 229 \text{ K''}$$

$$V_u = 3.8 \text{ K.}$$

$$\text{STRESS CHECK } U = 0.985 < 1.0, \underline{\text{OK}}$$

NO REINFORCING REQ'D

CONN. : (2) 1/2" ϕ M.B.

$$V_u = 4.2 \text{ K} < 5.3 \text{ K}, \text{ CONN. BOLTS } \underline{\text{OK}}$$

$$< 21.9 \text{ K}, \text{ SHEAR CONN. } \underline{\text{OK}}$$

$$< 33.4 \text{ K}, \text{ WELD CONN. } \underline{\text{OK}}$$

CHECK (E) "Z" BEAM FOR GRAVITY (CASE 4 W/ STORAGE)

LC: 1.2D + 1.6L

$$\left. \begin{aligned} w_{LL} &= 195 \text{ #/ft} (3/4) = 146 \text{ #/ft} \\ w_{DL} &= 59 \text{ #/ft} (3/4) = 44 \text{ #/ft} \\ w_{STORAGE} &= 144 \text{ #/ft} / 2 = 72 \text{ #/ft} \end{aligned} \right\} w_u = 373 \text{ #/ft}$$

$$M_u = 18.7 \text{ K'} = 224 \text{ K''} < M_n = 309 \text{ K''} \quad \underline{\text{OK}}$$

$$V_u = 3.7 \text{ K} < \phi V_n = 24.9 \text{ K}, \quad \underline{\text{OK}}$$

COMBINED STRESS U

$$U = 0.725 < 1.0, \quad \underline{\text{OK}}$$

CONN: (2) 1/2" ϕ MB

REINFORCING NOT REQ'D

$$V_u = 4.0 \text{ K} < 5.3 \text{ K}, \quad \text{BOLTS CONN.} \quad \underline{\text{OK}}$$

$$< 21.9 \text{ K}, \quad \text{SHEAR PL CONN.} \quad \underline{\text{OK}}$$

$$< 33.4 \text{ K} \quad \text{WELD CONN.} \quad \underline{\text{OK}}$$



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Existing Carport Struct. Feasibility Study

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Section: LagunaWoods.cfss
Zee 10x3.5x1-12 Gage

Rev. Date: 5/18/2016

CASE 1

Printed: 5/18/2016 Z purlin check with wind uplift load w/o storage load

Full Section Properties

Area	1.8554 in ²	Wt.	0.0063084 k/ft	Width	18.244 in
Ix	28.152 in ⁴	rx	3.8952 in	Ixy	8.448 in ⁴
Sx(t)	5.6304 in ³	y(t)	5.0000 in	α	-17.876 deg
Sx(b)	5.6304 in ³	y(b)	5.0000 in		
		Height	10.0000 in		
Iy	4.684 in ⁴	ry	1.5888 in	Xo	0.0000 in
Sy(l)	1.3579 in ³	x(l)	3.4492 in	Yo	0.0000 in
Sy(r)	1.3579 in ³	x(r)	3.4492 in	jx	0.0000 in
		width	6.8983 in	jy	0.0000 in
I1	30.877 in ⁴	r1	4.0794 in		
I2	1.959 in ⁴	r2	1.0274 in		
Ic	32.836 in ⁴	rc	4.2068 in	Cw	81.230 in ⁶
Io	32.836 in ⁴	ro	4.2068 in	J	0.006397 in ⁴

Member Check - 1999 AISI Specification (LRFD)

Material Type: A572 Grade 50, Fy=50 ksi

Design Parameters:

Lx	20.000 ft	Ly	20.000 ft	Lt	20.000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in

Braced Flange: Top $k\phi$ 0 k
Red. Factor, R: 0 Lm 20.000 ft

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Entered	0.000	-112.00	1.900	0.00	0.000
Applied	0.000	-112.00	1.900	0.00	0.000
Strength	23.589	48.11	14.201	49.44	18.255

Effective section properties at applied loads:

Ae	1.8554 in ²	Ixe	28.152 in ⁴	Iye	4.684 in ⁴
		Sxe(t)	5.6304 in ³	Sye(l)	1.3579 in ³
		Sxe(b)	5.6304 in ³	Sye(r)	1.3579 in ³

Interaction Equations

AISI Eq. C5.2.2-1 (P, Mx, My)	0.000 + 2.328 + 0.000 = 2.328 > 1.0
AISI Eq. C5.2.2-2 (P, Mx, My)	0.000 + 2.328 + 0.000 = 2.328 > 1.0
AISI Eq. C3.3.2-1 (Mx, Vy)	0.218 + 0.018 = 0.236 < 1.0
AISI Eq. C3.3.2-1 (My, Vx)	0.000 + 0.000 = 0.000 < 1.0

OVERSTRESSED,
PURLIN NEEDS TO
BE STRENGTHENED



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CFS Version 9.0.4
Section: LagunaWoods.cfss
Zee 10x3.5x1-12 Gage

Rev. Date: 5/18/2016

CASE 2

Printed: 5/18/2016 Z purlin check with wind uplift load w/ storage load

Full Section Properties

Area	2.2451 in^2	Wt.	0.0076334 k/ft	Width	18.077 in
Ix	33.780 in^4	rx	3.8789 in	Ixy	10.060 in^4
Sx(t)	6.7560 in^3	y(t)	5.0000 in	α	-17.732 deg
Sx(b)	6.7560 in^3	y(b)	5.0000 in		
		Height	10.0000 in		
Iy	5.535 in^4	ry	1.5702 in	Xo	0.0000 in
Sy(l)	1.6101 in^3	x(l)	3.4379 in	Yo	0.0000 in
Sy(r)	1.6101 in^3	x(r)	3.4379 in	jx	0.0000 in
		width	6.8758 in	jy	0.0000 in
I1	36.996 in^4	r1	4.0594 in		
I2	2.319 in^4	r2	1.0163 in		
Ic	39.315 in^4	rc	4.1847 in	Cw	95.608 in^6
Io	39.315 in^4	ro	4.1847 in	J	0.011544 in^4

Member Check - 1999 AISI Specification (LRFD)

Material Type: A572 Grade 50, Fy=50 ksi

Design Parameters:

Lx	20.000 ft	Ly	20.000 ft	Lt	20.000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: Top		k ϕ	0 k		
Red. Factor, R: 0		Lm	20.000 ft		

Loads:	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.000	-34.000	0.570	0.000	0.000
Applied	0.000	-34.000	0.570	0.000	0.000
Strength	29.260	58.969	24.936	65.154	21.454

Effective section properties at applied loads:

Ae	2.2451 in^2	Ixe	33.780 in^4	Iye	5.535 in^4
		Sxe(t)	6.7560 in^3	Sye(l)	1.6101 in^3
		Sxe(b)	6.7560 in^3	Sye(r)	1.6101 in^3

Interaction Equations

AISI Eq. C5.2.2-1 (P, Mx, My)	0.000 + 0.577 + 0.000 = 0.577	<= 1.0
AISI Eq. C5.2.2-2 (P, Mx, My)	0.000 + 0.577 + 0.000 = 0.577	<= 1.0
AISI Eq. C3.3.2-1 (Mx, Vy)	0.012 + 0.001 = 0.013	<= 1.0
AISI Eq. C3.3.2-1 (My, Vx)	0.000 + 0.000 = 0.000	<= 1.0

OK



Client: Princeton Engineering
Project: Johnson Controls, Inc.: Laguna Woods Village
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Engineer PD

CFS Version 9.0.4
Section: LagunaWoods.cfss
Zee 10x3.5x1-12 Gage

Rev. Date: 5/19/2016

CASE 3

Printed: 5/19/2016

Z purlin check with gravity load w/o storage load

Full Section Properties

Area	1.8554 in ²	Wt.	0.0063084 k/ft	Width	18.244 in
Ix	28.152 in ⁴	rx	3.8952 in	Ixy	8.448 in ⁴
Sx(t)	5.6304 in ³	y(t)	5.0000 in	α	-17.876 deg
Sx(b)	5.6304 in ³	y(b)	5.0000 in		
		Height	10.0000 in		
Iy	4.684 in ⁴	ry	1.5888 in	Xo	0.0000 in
Sy(l)	1.3579 in ³	x(l)	3.4492 in	Yo	0.0000 in
Sy(r)	1.3579 in ³	x(r)	3.4492 in	jx	0.0000 in
		width	6.8983 in	jy	0.0000 in
I1	30.877 in ⁴	r1	4.0794 in		
I2	1.959 in ⁴	r2	1.0274 in		
Ic	32.836 in ⁴	rc	4.2068 in	Cw	81.230 in ⁶
Io	32.836 in ⁴	ro	4.2068 in	J	0.006397 in ⁴

Member Check - 1999 AISI Specification (LRFD)

Material Type: A572 Grade 50, Fy=50 ksi

Design Parameters:

Lx	19.500 ft	Ly	19.500 ft	Lt	19.500 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in

Braced Flange: Top kφ 0 k
Red. Factor, R: 0 Lm 19.500 ft

Loads:	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.000	229.00	3.800	0.00	0.000
Applied	0.000	229.00	3.800	0.00	0.000
Strength	23.589	239.62	14.201	49.57	18.255

Effective section properties at applied loads:

Ae	1.8080 in ²	Ixe	27.226 in ⁴	Iye	4.182 in ⁴
		Sxe(t)	5.3237 in ³	Sye(l)	1.2426 in ³
		Sxe(b)	5.5724 in ³	Sye(r)	1.1838 in ³

Interaction Equations

AISI Eq. C5.2.2-1 (P, Mx, My)	0.000 + 0.956 + 0.000	= 0.956	<= 1.0
AISI Eq. C5.2.2-2 (P, Mx, My)	0.000 + 0.956 + 0.000	= 0.956	<= 1.0
AISI Eq. C3.3.2-1 (Mx, Vy)	0.913 + 0.072	= 0.985	<= 1.0
AISI Eq. C3.3.2-1 (My, Vx)	0.000 + 0.000	= 0.000	<= 1.0

OK



Client: Princeton Engineering
Project: Johnson Controls, Inc.: Laguna Woods Village
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Engineer PD

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Section: LagunaWoods.cfss
Zee 10x3.5x1-12 Gage

Rev. Date: 5/19/2016

CASE 4

Printed: 5/19/2016

Z purlin check with gravity load w/ storage load

Full Section Properties

Area	2.2451 in ²	Wt.	0.0076334 k/ft	Width	18.077 in
Ix	33.780 in ⁴	rx	3.8789 in	Ixy	10.060 in ⁴
Sx(t)	6.7560 in ³	y(t)	5.0000 in	α	-17.732 deg
Sx(b)	6.7560 in ³	y(b)	5.0000 in		
		Height	10.0000 in		
Iy	5.535 in ⁴	ry	1.5702 in	Xo	0.0000 in
Sy(l)	1.6101 in ³	x(l)	3.4379 in	Yo	0.0000 in
Sy(r)	1.6101 in ³	x(r)	3.4379 in	jx	0.0000 in
		width	6.8758 in	jy	0.0000 in
I1	36.996 in ⁴	r1	4.0594 in		
I2	2.319 in ⁴	r2	1.0163 in		
Ic	39.315 in ⁴	rc	4.1847 in	Cw	95.608 in ⁶
Io	39.315 in ⁴	ro	4.1847 in	J	0.011544 in ⁴

Member Check - 1999 AISI Specification (LRFD)

Material Type: A572 Grade 50, Fy=50 ksi

Design Parameters:

Lx	19.500 ft	Ly	19.500 ft	Lt	19.500 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: Top		kφ	0 k		
Red. Factor, R: 0		Lm	19.500 ft		

Loads:	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.000	224.00	3.700	0.00	0.000
Applied	0.000	224.00	3.700	0.00	0.000
Strength	29.260	308.86	24.936	65.40	21.454

Effective section properties at applied loads:

Ae	2.2451 in ²	Ixe	33.780 in ⁴	Iye	5.535 in ⁴
		Sxe(t)	6.7560 in ³	Sye(l)	1.6101 in ³
		Sxe(b)	6.7560 in ³	Sye(r)	1.6101 in ³

Interaction Equations

AISI Eq. C5.2.2-1 (P, Mx, My)	0.000 + 0.725 + 0.000	= 0.725	<= 1.0
AISI Eq. C5.2.2-2 (P, Mx, My)	0.000 + 0.725 + 0.000	= 0.725	<= 1.0
AISI Eq. C3.3.2-1 (Mx, Vy)	0.526 + 0.022	= 0.548	<= 1.0
AISI Eq. C3.3.2-1 (My, Vx)	0.000 + 0.000	= 0.000	<= 1.0

OK

STRUCTURAL CALCULATIONS

for

LAGUNA WOODS VILLAGE EXISTING CARPORT STRUCTURE SOLAR PV PROJECT FEASIBILITY STUDY

PHASE 3 – RECOMMENDED STRENGTHENING OF EXISTING STRUCTURE

Prepared By:

NS Structural Engineering, Inc.

May 23, 2016



ANALYZE "Z" PURLINS w/ BOTTOM FLANGE BRACING. FOR LTB.

$L_x = 20'$
 $L_y = 14'$ (BRACE CAN BE $\pm 4'$ FROM C/PURLIN)

$M_u = 112 \text{ k'}$
 $V_u = 1.9 \text{ kips}$ } PREVIOUS CALCS DATED MAY 20, 2016

PURLIN CHECK FOR CASE 1 (WIND UPLIFT)
 STRESS CHECK PER CFS. (SEE ATTACHED OUTPUT)

$U = 0.986 < 1.0$, OK

BRACE BOTTOM FLANGE
 PER ATTACHED
 SKETCH.

CFS Version 9.0.4
 Section: LagunaWoods.cfss
 Zee 10x3.5x1-12 Gage

Rev. Date: 5/22/2016

Printed: 5/22/2016

Full Section Properties

Area	2.2451 in ²	Wt.	0.0076334 k/ft	Width	18.077 in
Ix	33.780 in ⁴	rx	3.8789 in	Ixy	10.060 in ⁴
Sx(t)	6.7560 in ³	y(t)	5.0000 in	α	-17.732 deg
Sx(b)	6.7560 in ³	y(b)	5.0000 in		
		Height	10.0000 in		
Iy	5.535 in ⁴	ry	1.5702 in	Xo	0.0000 in
Sy(l)	1.6101 in ³	x(l)	3.4379 in	Yo	0.0000 in
Sy(r)	1.6101 in ³	x(r)	3.4379 in	jx	0.0000 in
		Width	6.8758 in	jy	0.0000 in
I1	36.996 in ⁴	r1	4.0594 in		
I2	2.319 in ⁴	r2	1.0163 in		
Ic	39.315 in ⁴	rc	4.1847 in	Cw	95.608 in ⁶
Io	39.315 in ⁴	ro	4.1847 in	J	0.011544 in ⁴

Member Check - 1999 AISI Specification (LRFD)

Material Type: A572 Grade 50, Fy=50 ksi

Design Parameters:

Lx	20.000 ft	Ly	14.000 ft	Lt	14.000 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000
Cbx	1.0000	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in

Braced Flange: None

Red. Factor, R: 0

kφ 0 k
 Lm 20.000 ft

Loads from case 2 of
 previous calc's.
 phase 2 Calc's

Loads:

	P	Mx	Vy	My	Vx
	(k)	(k-in)	(k)	(k-in)	(k)
Entered	0.000	112.00	1.900	0.00	0.000
Applied	0.000	112.00	1.900	0.00	0.000
Strength	16.174	113.63	24.936	66.66	21.454

Effective section properties at applied loads:

Ae	2.2451 in ²	Ixe	33.780 in ⁴	Iye	5.535 in ⁴
		Sxe(t)	6.7560 in ³	Sye(l)	1.6101 in ³
		Sxe(b)	6.7560 in ³	Sye(r)	1.6101 in ³

Interaction Equations

AISI Eq. C5.2.2-1 (P, Mx, My)	0.000 + 0.986 + 0.000 = 0.986 <= 1.0
AISI Eq. C5.2.2-2 (P, Mx, My)	0.000 + 0.986 + 0.000 = 0.986 <= 1.0
AISI Eq. C3.3.2-1 (Mx, Vy)	0.131 + 0.006 = 0.137 <= 1.0
AISI Eq. C3.3.2-1 (My, Vx)	0.000 + 0.000 = 0.000 <= 1.0

< 1.0, OK