



January 19, 2017

Mounting Systems, Inc.
820 Riverside Pkwy
Sacramento, California 95606
TEL: (855) 731-9996
FAX: (916) 287-2269

Attn.: Mounting Systems, Inc. - Engineering Department

Re: Engineering Certification for the Mounting Systems, Inc. 10/48 Rail Alpha+ Shared Rail
Project No. 16-16231

PZSE, Inc.-Structural Engineers has reviewed Mounting Systems, Inc.'s 10/48 shared rail span chart. All information, data and analysis contained within the Mounting Systems, Inc. rail span charts are based on, and comply with Mounting Systems, Inc.'s *Alpha Engineering and Technical Data* and the following codes:

1. Minimum Design Loads for Buildings and other Structures, ASCE/SEI 7-10
2. 2015 International Building Codes, by International Code Council, Inc.
3. 2016 Utah Building Code, by the Utah Uniform Building Code Commission
4. 2010 Aluminum Design Manual, by The Aluminum Association
5. AC428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES

Following are typical specifications for the connections to meet the above code requirements:

Attachment Spacing: Mounting Systems, Inc. strongly recommends a maximum span of 8 feet, but in any case, not to exceed the maximum span indicated on the charts.

Cantilever: Maximum cantilever length is $L/3$, where "L" is the span noted in the Span Chart Tables.

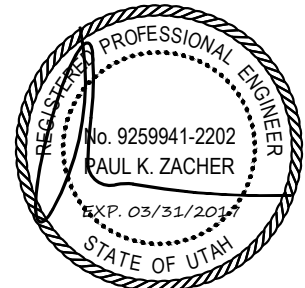
Clearance: 2" to 10" clear from top of roof to bottom of PV panel.

Rail/Roof Connection: Shall be calculated by the building Engineer of Record.

This letter is to certify that the loading criteria and design basis for the Alpha+ Shared Rail Span Charts within the attached tables are in compliance with the above codes.

If you have any questions on the above, do not hesitate to call.

Prepared by:
PZSE, Inc. – Structural Engineers
Roseville, CA



8150 Sierra College Boulevard, Suite 150, Roseville, CA 95661

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10/48 Portrait Shared Rail Zone 1 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
B	110	7.0	6.5	6.0	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	120	7.0	6.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	130	6.5	6.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	140	6.0	6.0	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	150	5.5	5.5	5.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	160	5.5	5.5	5.0	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	170	5.0	5.0	5.0	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	180	4.5	4.5	4.5	4.5	4.0	4.0	3.5	3.5	3.0	3.0
10/48 Portrait Shared Rail Zone 1 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
C	110	6.5	6.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	120	6.0	6.0	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	130	5.5	5.5	5.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	140	5.0	5.0	5.0	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	150	5.0	5.0	5.0	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	160	4.5	4.5	4.5	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	170	4.5	4.5	4.5	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	180	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.0	3.0
10/48 Portrait Shared Rail Zone 1 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
D	110	6.0	6.0	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	120	5.5	5.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	130	5.0	5.0	5.0	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	140	5.0	5.0	5.0	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	150	4.5	4.5	4.5	4.5	4.0	4.0	3.5	3.5	3.0	3.0
	160	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.0	3.0
	170	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.0	3.0
	180	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0

- The table above ONLY includes 10-48 rail capacity check. It does not include roof capacity check
- Wind Risk Category II per ASCE 7-10
- Topographic factor, k_{zt} is 1.0
- Maximum mean roof height is 30 ft.
- Average parapet height is 0 ft
- Roof pitch is between 7 degree and 27 degree
- Maximum solar panel weight is 60 lbs
- Height of solar panel is between 2" and 10" to roof
- Deflection criteria of L/60 per AC428 Section 4.3
- The wind speeds above are LRFD values
- Mounting Systems, Inc. strongly recommends a maximum span of 8 feet, but in any case, not to exceed the maximum span indicated on the chart
- The span length applies to a seismic design category E or less
- Maximum cantilever is L/3

10/48 Portrait Shared Rail Zone 2 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
B	110	5.5	5.5	5.5	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	120	5.0	5.0	5.0	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	130	4.5	4.5	4.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	140	4.5	4.5	4.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	150	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	160	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	170	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	180	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
10/48 Portrait Shared Rail Zone 2 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
C	110	5.0	5.0	5.0	5.0	4.5	4.0	3.5	3.5	3.0	3.0
	120	4.5	4.5	4.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	130	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
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10/48 Portrait Shared Rail Zone 2 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
D	110	4.5	4.5	4.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	120	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	130	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	140	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	150	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	160	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	170	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	180	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

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- Maximum cantilever is L/3

10/48 Portrait Shared Rail Zone 3 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
B	110	4.5	4.5	4.5	4.5	4.5	4.0	3.5	3.5	3.0	3.0
	120	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	130	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	140	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	150	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	160	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	170	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	180	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
10/48 Portrait Shared Rail Zone 3 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
C	110	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0
	120	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	130	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	140	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	150	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	160	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	170	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	180	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
10/48 Portrait Shared Rail Zone 3 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
D	110	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	120	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	130	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	140	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	150	3.0	3.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	160	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	170	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	180	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

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- Maximum cantilever is $L/3$

10/48 Landscape Shared Rail Zone 1 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
B	110	9.0	8.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	120	9.0	8.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	130	8.5	8.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	140	7.0	7.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	150	7.0	7.0	6.5	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	160	6.5	6.5	6.5	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	170	6.5	6.5	6.5	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	180	6.0	6.0	6.0	6.0	5.0	5.0	4.5	4.5	4.0	4.0
10/48 Landscape Shared Rail Zone 1 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
C	110	8.5	8.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	120	7.0	7.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	130	7.0	7.0	6.5	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	140	6.5	6.5	6.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	150	6.0	6.0	6.0	5.5	5.5	5.0	4.5	4.5	4.0	4.0
	160	6.0	6.0	6.0	5.5	5.0	5.0	4.5	4.5	4.0	4.0
	170	5.5	5.5	5.5	5.5	5.0	5.0	4.5	4.5	4.0	4.0
	180	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0	4.0
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Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
D	110	8.0	7.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	120	7.0	7.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	130	6.5	6.5	6.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
	140	6.0	6.0	6.0	5.5	5.5	5.0	4.5	4.5	4.0	4.0
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- The table above ONLY includes 10-48 rail capacity check. It does not include roof capacity or roof connection check
- Wind Risk Category II per ASCE 7-10
- Topographic factor, k_{zt} is 1.0
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Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
B	110	7.0	7.0	7.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
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	140	5.5	5.5	5.5	5.5	5.5	5.0	4.5	4.5	4.0	4.0
	150	5.0	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0
	160	5.0	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0
	170	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
	180	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
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C	110	6.0	6.0	6.0	6.0	5.5	5.0	4.5	4.5	4.0	4.0
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D	110	5.5	5.5	5.5	5.5	5.5	5.0	4.5	4.5	4.0	4.0
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	130	5.0	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0
	140	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
	150	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	160	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	170	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	180	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

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	140	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
	150	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	160	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	170	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	180	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
10/48 Landscape Shared Rail Zone 3 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
C	110	5.0	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.0	4.0
	120	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
	130	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	140	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	150	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	160	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	170	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	180	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
10/48 Landscape Shared Rail Zone 3 Span Chart											
Exposure Category	Wind Speed	Ground Snow Load (psf)									
		0	10	20	30	40	50	60	70	80	90
D	110	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.0	4.0
	120	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	130	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	140	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	150	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	160	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	170	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	180	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

- The table above ONLY includes 10-48 rail capacity check. It does not include roof capacity or roof connection check
- Wind Risk Category II per ASCE 7-10
- Topographic factor, k_{zt} is 1.0
- Maximum mean roof height is 30 ft.
- Average parapet height is 0 ft
- Roof pitch is between 7 degree and 27 degree
- Maximum solar panel weight is 60 lbs
- Height of solar panel is between 2" and 10" to roof
- Deflection criteria of $L/60$ per AC428 Section 4.3
- The wind speeds above are LRFD values
- Mounting Systems, Inc. strongly recommends a maximum span of 8 feet, but in any case, not to exceed the maximum span indicated on the chart
- The span length applies to a seismic design category E or less
- Maximum cantilever is $L/3$