

Attn: David F. Taggart, VP Products, IronRidge Inc.

Date: June 29th, 2016

Re: Structural Design Compliance and Allowable Span Certification for IronRidge Tilt Mount Solar Racking System for Flat Roof Applications

The IronRidge Tilt Mount System certified in this letter is for use on flat or low pitched roofs with slopes of no more than 6 degrees from the horizontal. The south side of the Tilt Mount System is supported by the IronRidge South Leg, which includes two pre-assembled aluminum angles. The north side is supported by the IronRidge North Leg, which consists of an aluminum U-foot base and a square 1.5" by 1.5" cross-section vertical leg. Both the South and North Legs shall be connected to roof attachments or directly anchored to underlying roof members via use of appropriate fasteners. IronRidge XR Rails run east and west and are used on both the north and south sides of the Tilt Mount System to provide direct support for solar modules.

XR Rails fasten to the North and South Legs using hardware found in the Tilt Leg Kits. The section views of the Tilt Mount System included in Exhibit 0008 are for illustrative reference. The IronRidge Tilt Mount System is designed to accommodate module tilts ranging from 4 degrees to 30 degrees relative to the roof surface. All components of the IronRidge Tilt Mount System are to be installed in a workmanlike manner, following generally accepted standards of construction and industry best practices, and as described in the Tilt Mount Installation Manual (found on the IronRidge website).

The IronRidge Tilt Mount System was developed in compliance with the structural requirements of the following reference standards, and certified to the same standards for the load conditions listed in the allowable span charts included in this letter:

- ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
- ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures
- 2009 International Building Code
- 2012 International Building Code
- 2010 Aluminum Design Manual

The allowable span charts included in this letter provide the maximum span of a Tilt Mount System allowed under a particular load condition. Each span chart covers the chosen rail and wind exposure category, and includes the entire range of allowable snow and wind loads, roof zones 1-3, and tilt angles in 5 degree increments going up to 30 degrees.

The span charts shall be used when the following conditions are met:

1. The underlying roof pitch is 6 degrees or less relative to the horizon and the maximum module tilt (the angle between module and roof surface) is 30 degrees or less.
2. The tilt mount system is designed as an Occupancy Category II structure as defined by ASCE 7-05 Table 1-1 or as a Risk Category II structure per ASCE 7-10 Table 1.5-1.
3. The building height (the distance from the grade to the building eave) is 30 feet.
4. Span charts are calculated for a module size of 67.5" by 40" and in a portrait layout condition.

The parameters and adjustments used in the span charts are defined as the following:

1. The tilt used in the span chart shall be calculated as the angle between the solar module surface and the roof surface.
2. For any tilt not listed in the span charts, but no greater than 30°, the user can round up to the next higher 5° increment (e.g. if one is designing to a tilt angle of 12°, use the row for 15° in the span table.) except for tilts between 25° and 27°, in which the user shall use the results of 25°.
3. For counties which conform to 2012 International Building Code (IBC), the wind speed selection shall conform to ASCE 7-10 Fig. 26.5-1A (Risk Category II wind) and state & local county/city amendments to IBC, if any. No special wind topographic features are included and the topographic coefficient (K_{zt}) is taken as 1.0.

For counties which conform to 2009 IBC, the wind speed shall be determined as the following:

The wind speed used in the charts is the site ultimate design wind speed, V_{ult} . To calculate V_{ult} , first refer to ASCE 7-05 Fig. 6-1 and state & local county/city amendments to IBC, if any, to determine the site nominal design wind speed of V_{asd} , and then apply the following equation to convert V_{asd} to V_{ult} :

$$V_{ult} = V_{asd} / \sqrt{0.6} \quad (\text{both } V_{ult} \text{ and } V_{asd} \text{ are in mph})$$

The above calculated V_{ult} can be rounded off to the next higher wind speed listed in the charts to find the allowable span. Alternatively, linear interpolation can be used to calculate the allowable span for the actual V_{ult} . No special wind topographic features are included and the topographic coefficient (K_{zt}) is taken as 1.0.

4. The snow load used in the charts is the ground snow load and shall conform to ASCE 7-05 Fig. 7-1 where 2009 IBC applies, or to ASCE 7-10 Fig. 7-1 where 2012 IBC applies and refer to state & local county/city amendments to IBC, if any. No roof snow drift or unbalanced snow load conditions are included.
5. Roof zone size and definition conforms to ASCE 7-05 Fig. 6-11B or ASCE 7-10 Fig. 30.4-2A.
6. It has been calculated that the seismic load is not in control of the Tilt Mount System allowable span compared to the wind or snow loads, or their combinations.
7. Allowable span length in the charts may be multiplied by a factor of 1.08 if the rails are continuous over a minimum of three spans.
8. An array to roof clearance of 2 inches minimum must be provided.
9. The maximum cantilever allowed at the end of a rail is 40% of the maximum span shown in the tables included in this letter.
10. No splices are allowed in the end spans or the middle 1/3 of interior spans.
11. For load and tilt conditions associated with shaded cells in the span charts below, UFO Mid Clamps shall not be installed less than 20 inches from Roof Zone 3.

The IronRidge Tilt Mount System span charts are developed without considering the structural adequacy of roof attachments or underlying roof members. The structural performance of those components shall be analyzed or verified by a third party engineer. Also, it is the responsibility of the installer or building owner to verify the capacity of the chosen PV module in regards to the applied or resultant loads of any chosen array configuration.

Sincerely,



Gang Xuan, PE, LEED AP
Senior Structural Engineer

Expires : 03/31/2019

XR1000 Tilt Mount Allowable Span Chart (inches)

No Anchor		Wind Exposure Category B																													
Wind Speed (mph)	Tilt (deg. from roof)	Snow: 0 PSF			10 PSF			20 PSF			30 PSF			40 PSF			50 PSF			60 PSF			70 PSF			80 PSF			90 PSF		
		Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
110	5	145	133	107	123	123	107	104	104	104	100	100	100	88	88	88	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	138	122	99	116	116	99	97	97	97	90	90	90	80	80	80	72	72	72	66	66	66	62	62	62	58	58	58	54	54	54
	15	131	111	90	110	110	90	92	92	90	85	85	85	75	75	75	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	20	123	102	83	106	102	83	89	89	83	83	83	83	75	75	75	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	25	116	97	79	103	97	79	88	88	79	82	82	79	75	75	75	69	69	69	63	63	63	59	59	59	55	55	55	52	52	52
	30	109	109	109	101	101	101	87	87	87	82	82	82	76	76	76	70	70	70	65	65	65	61	61	61	57	57	57	54	54	54
115	5	141	127	102	121	121	102	103	103	102	99	99	99	88	88	88	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	133	117	95	114	114	95	96	96	95	89	89	89	80	80	80	72	72	72	66	66	66	62	62	62	58	58	58	54	54	54
	15	127	107	86	108	107	86	91	91	86	84	84	84	75	75	75	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	20	118	98	79	104	98	79	88	88	79	82	82	79	75	75	75	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	25	112	93	76	101	93	76	87	87	76	81	81	76	74	74	74	69	69	69	63	63	63	59	59	59	55	55	55	52	52	52
	30	106	106	106	98	98	98	86	86	86	81	81	81	75	75	75	70	70	70	65	65	65	61	61	61	57	57	57	54	54	54
120	5	136	122	98	119	119	98	102	102	98	98	98	98	88	88	88	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	129	112	91	112	112	91	95	95	91	88	88	88	80	80	80	72	72	72	66	66	66	62	62	62	58	58	58	54	54	54
	15	123	102	82	106	102	82	89	89	82	83	83	83	75	75	75	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	20	115	94	76	102	94	76	87	87	76	81	81	76	74	74	74	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	25	108	89	72	99	89	72	85	85	72	80	80	72	74	74	72	68	68	68	63	63	63	59	59	59	55	55	55	52	52	52
	30	102	102	102	96	96	96	84	84	84	80	80	80	74	74	74	69	69	69	65	65	65	61	61	61	57	57	57	54	54	54
130	5	128	113	90	114	113	90	99	99	90	96	96	90	87	87	87	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	121	103	84	108	103	84	92	92	84	86	86	84	79	79	79	72	72	72	66	66	66	62	62	62	58	58	58	54	54	54
	15	115	94	77	102	94	77	87	87	77	81	81	77	74	74	74	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
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	25	101	82	67	95	82	67	83	82	67	78	78	67	72	72	67	67	67	67	63	63	63	59	59	59	55	55	55	52	52	52
	30	96	95	95	92	92	92	82	82	82	77	77	77	72	72	72	67	67	67	63	63	63	60	60	60	57	57	57	54	54	54
140	5	120	105	84	110	105	84	96	96	84	94	94	84	86	86	84	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
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	30	90	89	89	88	88	88	79	79	79	75	75	75	70	70	70	66	66	66	62	62	62	59	59	59	56	56	56	54	54	54
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	15	102	82	67	95	82	67	82	82	67	77	77	67	71	71	67	66	66	66	62	62	62	58	58	58	54	54	54	51	51	51
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170	5	102	86	69	99	86	69	89	86	69	88	86	69	81	81	69	75	75	69	71	71	69	67	67	67	63	63	63	59	59	59
	10	96	79	65	93	79	65	82	79	65	78	78	65	72	72	65	68	68	65	64	64	64	60	60	60	58	58	58	54	54	54
	15	92	73	59	88	73																									

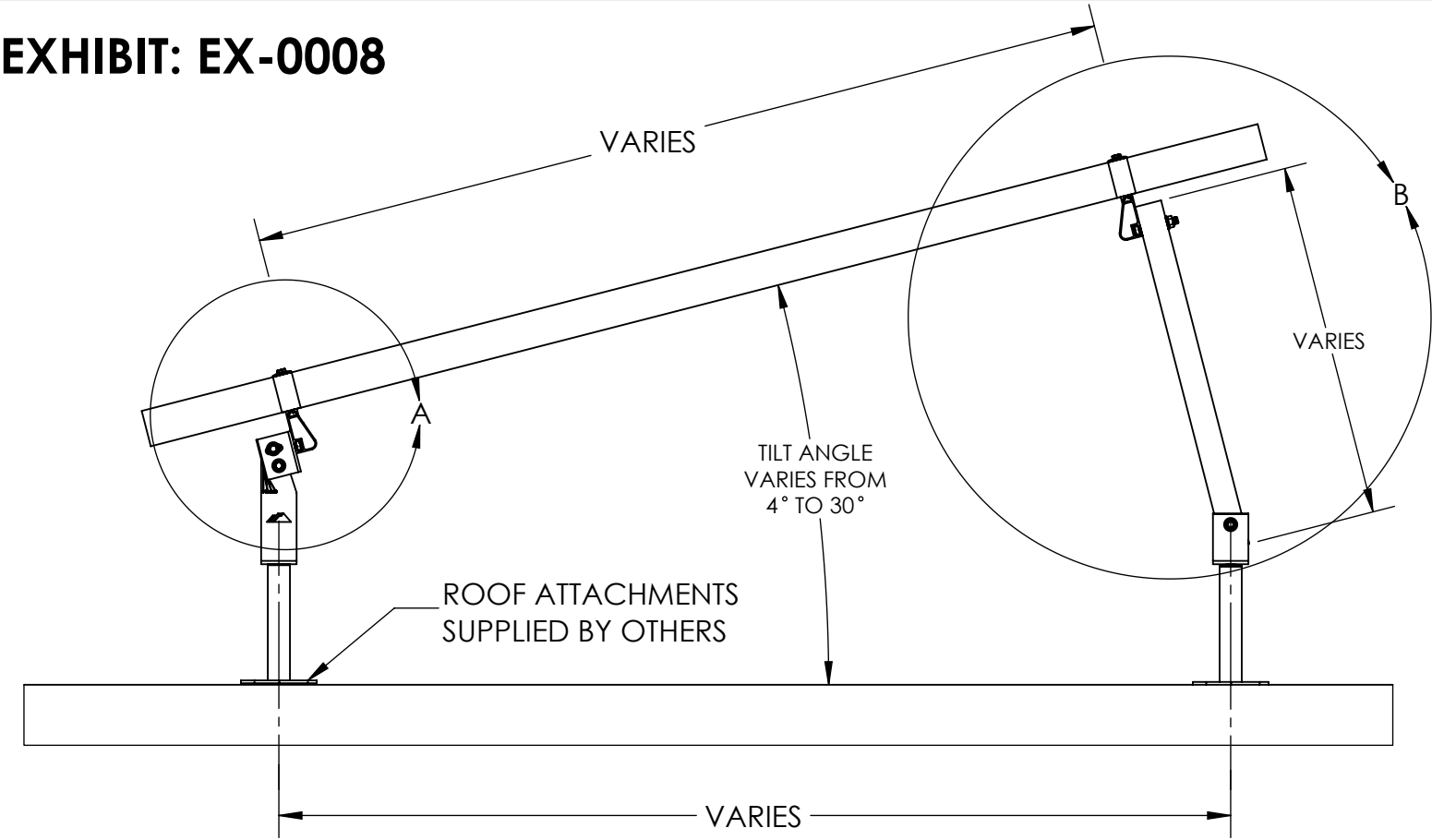
XR1000 Tilt Mount Allowable Span Chart (inches)

No Anchor		Wind Exposure Category C																													
Wind Speed (mph)	Tilt (deg. from roof)	Snow: 0 PSF			10 PSF			20 PSF			30 PSF			40 PSF			50 PSF			60 PSF			70 PSF			80 PSF			90 PSF		
		Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
110	5	128	112	90	114	112	90	99	99	90	96	96	90	87	87	87	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	121	103	84	108	103	84	92	92	84	86	86	84	79	79	79	72	72	72	66	66	66	62	62	62	58	58	58	54	54	54
	15	115	94	76	102	94	76	87	87	76	81	81	76	74	74	74	68	68	68	62	62	62	58	58	58	54	54	54	51	51	51
	20	107	86	70	98	86	70	84	84	70	79	79	70	72	72	70	67	67	67	62	62	62	58	58	58	54	54	54	51	51	51
	25	101	82	67	94	82	67	83	82	67	78	78	67	72	72	67	67	67	67	63	63	63	59	59	59	55	55	55	52	52	52
115	5	96	95	95	92	92	92	82	82	82	77	77	77	72	72	72	67	67	67	63	63	63	60	60	60	57	57	57	54	54	54
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	25	103	83	67	95	83	67	83	83	67	78	78	67	72	72	67	67	67	67	62	62	62	58	58	58	54	54	54	51	51	51
120	25	97	79	64	92	79	64	81	79	64	77	77	64	71	71	64	66	66	64	62	62	62	59	59	59	55	55	55	52	52	52
	30	92	91	91	90	90	90	80	80	80	76	76	76	71	71	71	66	66	66	63	63	63	59	59	59	57	57	57	54	54	54
	5	119	103	83	110	103	83	96	96	83	93	93	83	85	85	83	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	112	95	77	103	95	77	89	89	77	84	84	77	77	77	77	71	71	71	66	66	66	62	62	62	58	58	58	54	54	54
	15	107	87	70	98	87	70	84	84	70	79	79	70	72	72	70	67	67	67	62	62	62	58	58	58	54	54	54	51	51	51
130	20	100	79	64	93	79	64	81	79	64	77	77	64	71	71	64	66	66	64	62	62	62	58	58	58	54	54	54	51	51	51
	25	94	76	61	90	76	61	80	76	61	75	75	61	70	70	61	65	65	61	61	61	61	58	58	58	55	55	55	52	52	52
	30	89	88	88	87	87	87	78	78	78	75	75	75	69	69	69	65	65	65	62	62	62	59	59	59	56	56	56	54	54	54
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	10	105	88	71	99	88	71	86	86	71	81	81	71	75	75	71	70	70	70	66	66	66	62	62	62	58	58	58	54	54	54
140	15	100	80	65	93	80	65	81	80	65	77	77	65	71	71	65	66	66	65	62	62	62	58	58	58	54	54	54	51	51	51
	20	93	73	60	89	73	60	79	73	60	74	73	60	69	69	60	64	64	60	60	60	60	57	57	57	54	54	54	51	51	51
	25	88	70	57	86	70	57	77	70	57	73	70	57	68	68	57	63	63	57	60	60	57	57	57	57	54	54	54	52	52	52
	30	83	81	81	83	81	81	75	75	75	72	72	72	67	67	67	63	63	63	60	60	60	57	57	57	55	55	55	53	53	53
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	25	82	65	53	82	65	53	74	65	53	70	65	53	66	65	53	62	62	53	59	59	53	56	56	53	53	53	53	51	51	51
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160	5	99	83	66	97	83	66	87	83	66	86	83	66	79	79	66	74	74	66	70	70	66	66	66	66	63	63	63	59	59	59
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	15	88	70	56	86	70	56	76	70	56	72	70	56	67	67	56	63	63	56	59	59	56	56	56	56	54	54	54	51	51	51
	20	82	64	52	81	64	52	73	64	52	70	64	52	65	64	52	61	61	52	58	58	52	55	55	52	53	53	52	50	50	50
	25	77	61	49	77	61	49	71	61	49	68	61	49	64	61	49	60	60	49	57	57	49	54	54	49	52	52	49	50	50	49
170	30	73	71	71	73	71	71	69	69	69	66	66	66	63	63	63	60	60	60	57	57	57	55	55	55	52	52	52	50	50	50
	5	93	77	62	93	77	62	84	77	62	84	77	62	78	77	62	73	73	62	69	69	62	65	65	62	62	62	62	59	59	59
	10	87	72	58	87	72	58	78	72	58	74	72	58	69	69	58	65	65	58	62	62	58	59	59	58	56	56	56	54	54	54
	15	83	65	53	82	65	53	74	65	53	70	65	53	65	65	53	61	61	53	58	58	53	55	55	53	53	53	53	51	51	51
	20	77	60	49	77	60	49	70	60	49	67	60	49	63	60	49	60	60	49	56	56	49	54	54	49	52	52	49	49	49	49
180	25	73	57	46	73	57	46	68	57	46	65	57	46	62	57	46	58	57	46	56	56	46	53	53	46	51	51	46	49	49	46
	30	69	67	67	69	67	67	66	66	66	64	64	64	61	61	61	58	58	58	55	55	55	53	53	53	51	51	51	49	49	49
	5	89	73	59	89	73	59	81	73	59	81	73	59	76	73	59	71	71	59	67	67	59	64	64	59	61	61	59	59	59	59
	10	82	68	55	82	68	55	75	68	55	72	68	55	67	67	55	63	63	55</												

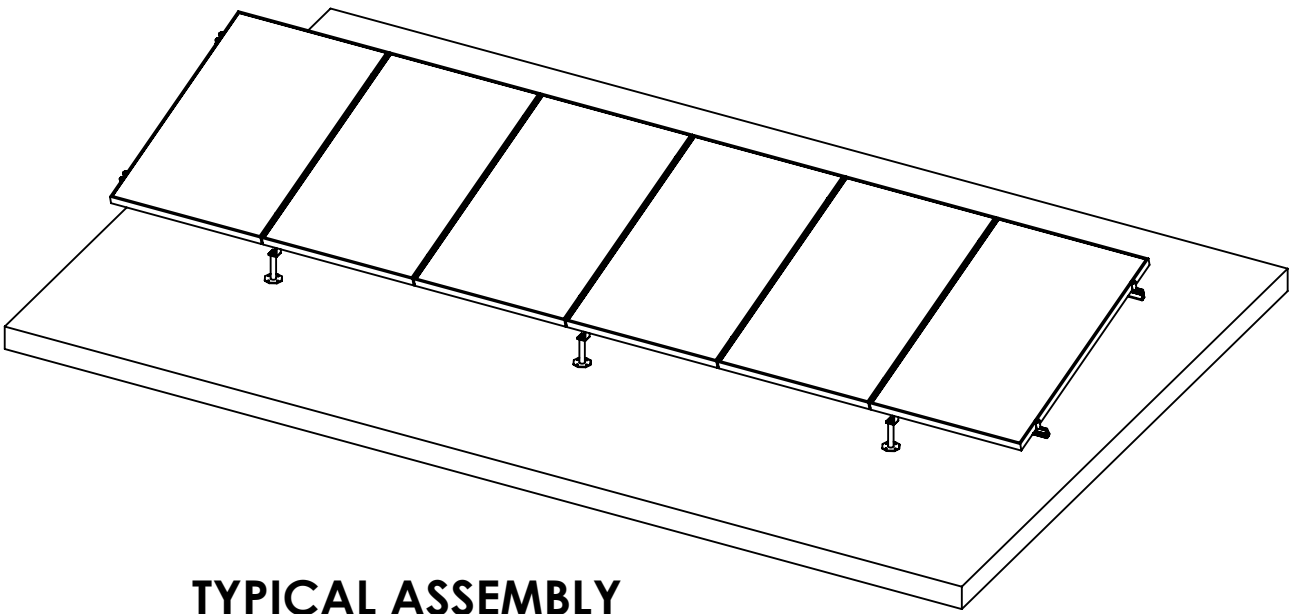
XR1000 Tilt Mount Allowable Span Chart (inches)

No Anchor		Wind Exposure Category D																													
Wind Speed (mph)	Tilt (deg. from roof)	Snow: 0 PSF			10 PSF			20 PSF			30 PSF			40 PSF			50 PSF			60 PSF			70 PSF			80 PSF			90 PSF		
		Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
110	5	119	103	83	110	103	83	96	96	83	94	94	83	85	85	83	79	79	79	72	72	72	67	67	67	63	63	63	59	59	59
	10	113	95	77	103	95	77	89	89	77	84	84	77	77	77	77	71	71	71	66	66	66	62	62	62	58	58	58	54	54	54
	15	107	87	70	98	87	70	84	84	70	79	79	70	72	72	70	67	67	67	62	62	62	58	58	58	54	54	54	51	51	51
	20	100	80	65	93	80	65	81	80	65	77	77	65	71	71	65	66	66	65	62	62	62	58	58	58	54	54	54	51	51	51
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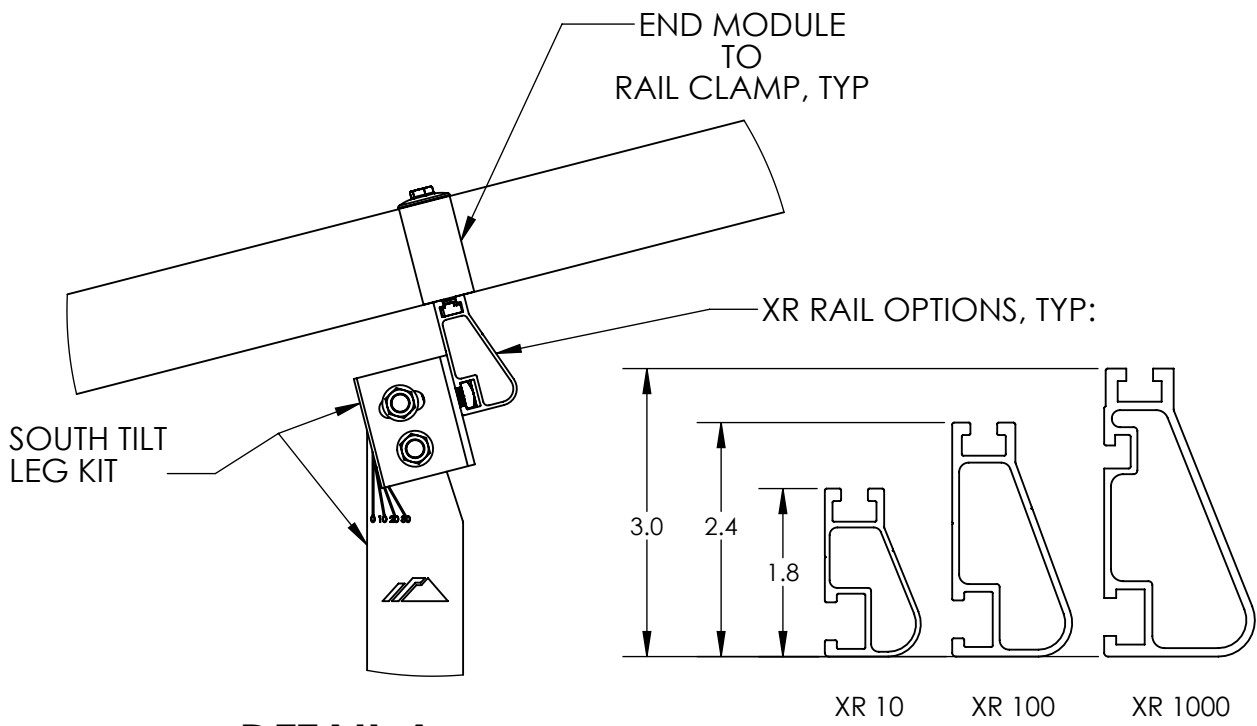
EXHIBIT: EX-0008



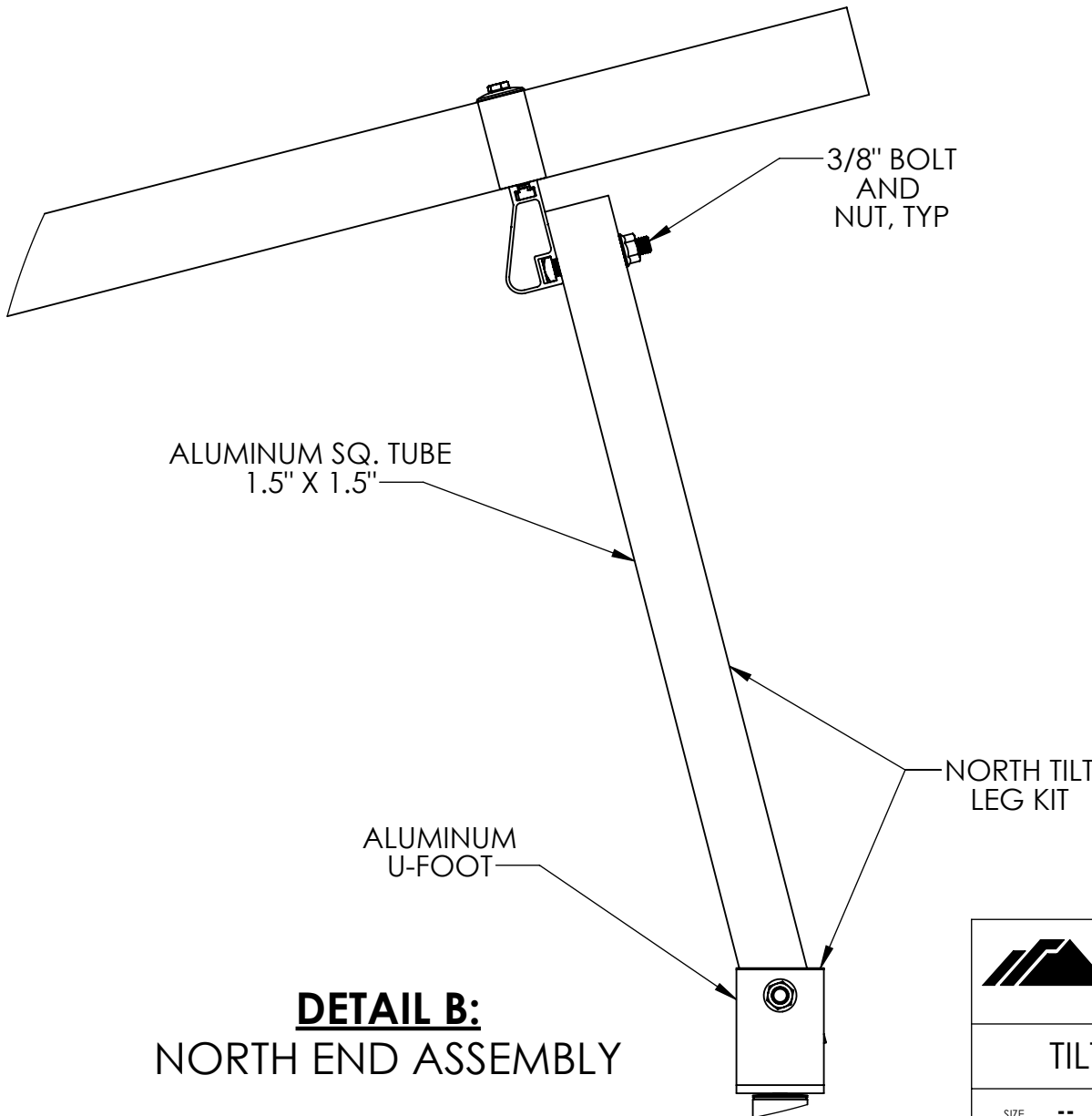
TYPICAL SIDE VIEW



TYPICAL ASSEMBLY



DETAIL A:
SOUTH END ASSEMBLY



DETAIL B:
NORTH END ASSEMBLY

TILT MOUNT SYSTEM			
SIZE	--	DWG. NO.	EX-0008
SCALE:	NTS	WEIGHT:	N/A
		SHEET 1 OF 1	