

November 28, 2018

Mr. Milton P. Nogueira Jr.
Roof Tech Inc.
333 H Street, Suite 5000
Chula Vista, CA
91910

Dear Mr. Nogueira,

**Re: Roof Tech E Mount AIR – Structural Review
Project No: 15111-T1**

Thank you for retaining our office to carry out the structural review of the Roof Tech E Mount AIR rail-less photovoltaic (PV) panel roof mount system.

The purpose of the review was to assess the range of snow and wind loadings for which the Roof Tech E Mount AIR can be safely connected to roof structures according to Ontario Building Code 2012 requirements for various site conditions and arrangements.

The review consisted of calculating the factored connection resistance of the Roof Tech E Mount AIR for shear, downward force and tension based on load test results. These resistances were compared to the factored loading on the connection for various roof substrates, orientations of PV panel on roof, number of mounts per PV panel, wind roof zones, terrains, and roof slopes. The maximum corresponding wind and snow environmental site parameters were then determined.

Review parameters and results are summarized below:

1. Summary

Three roof substrates were reviewed: 7/16" thick OSB on 2x4 SPF No. 2 rafter, 7/16" thick OSB only, and 15/32" thick plywood. The Roof Tech E-Mount Air is connected at each mount to the substrates as per Table 1 on the following page. The number of mounts and their orientation are summarized in Appendix A. Load tests data from Western Technologies Inc. for each of these connection types was used to assess the allowable range of regional climatic parameters from the Ontario Building Code 2012.

Table 1: Roof Wood Substrates and Number of Screws per Mount

Wood Substrate	Number of 5.0 mm x 60 mm stainless steel wood screws per mount
7/16" thick OSB on 2x4 SPF No. 2 rafter	2
7/16" thick OSB only	4
15/32" thick plywood	4

2. System Description

The Roof Tech E Mount AIR system is composed of an aluminum E Mount Air base, middle clamp, end clamp, panel spacer, shim(s), and stainless steel bonding plate. The mounting system is fastened together with an 8 mm diameter bolt complete with nut and washer. The system is attached to the roof wood substrate with stainless steel (SS304) wood screws 5.0 mm x 60 mm.

3. Connection Load Tests

Load tests conducted by Western Technologies Inc. measured the failure capacity of the connection assembly with 3 different roof wood substrates. In these tests, failure occurred by pullout of the screws for OSB or plywood only cases, shear failure for the OSB or plywood only cases, or shear failure for OSB on rafter. The associated number of screws required for attachment to the wood substrate is shown on the previous page in Table 1.

In order to establish connection capacities, the average value of each failure mechanism for each wood substrate was multiplied by a material resistance factor of 0.55. The resistance factor was based on formulas presented in CAN/CSA-086-09 (Engineering Design in Wood) for similar proprietary wood connection products where the capacity is assessed through load testing. The material resistance factor of 0.6 is multiplied by a test reliability factor of 0.91 for a minimum of three tests. These values are shown in Table 2 below. The factored connection resistance was compared to factored loads as per Ontario Building Code 2012.

Table 2: Factored Test Resistance of Roof Wood Substrates

Orientation	Material	Factored test resistance = 0.55*(minimum test result), (kN)		
		Uplift	Shear	Downforce
Landscape	7/16" OSB sheathing over 2x4 SPF #2 rafter	4.0	2.83	-
	7/16" sheathing only	1.02	1.02	1.83
	15/32" plywood with 2 layers asphalt shingles	1.49	1.3	3.95
Portrait	7/16" sheathing over 2x4 SPF #2 rafter	3.47	1.03	-
	7/16" OSB sheathing only	1.278	0.76	1.83
	15/32" plywood with 2 layers asphalt shingles	2.02	0.95	3.95

The parameters and results of our review are summarized below. Refer to Appendix A for details of the roof mount attachment and mount orientation diagrams.

4. Connection Load Analysis

Codes:

- Design load and climatic data ranges as per Ontario Building Code 2012.
- Design codes as per Engineering Design in Wood (CSA 086-14) and Strength Design in Aluminum (CSA S157-05).

Test Data from Western Technologies Inc.:

- Job No. 2163XD260:
 - Event no. G260-3, dated January 3, 2014: OSB only and OBS on rafter, compression.
 - Event no. G260-4, dated April 1, 2014 (revised May 30, 2014): OSB only and OBS on rafter, tension and shear.
 - Event no. G260-5, dated June 14, 2014: plywood, tension and shear.
 - Event no. G260-6, dated May 30, 2014: plywood, compression.

Design Loads and Parameters:

- Importance Category: Normal importance
- Dead Loads: 0.14 kPa photovoltaic (PV) panel self-weight. Sheathing self-weight included within test result capacities.
- Wind Loads: 1 in 50 year wind pressure as per Tables 1 to 6.
 - 10 m maximum building height.
 - Single span gable and hipped roofs considered.
 - Topography assumed is flat (no increase in exposure factor due to hill or crest).
 - Solar panels not permitted to be installed on roof overhangs.
- Live Loads: 1 kPa live load on roof adjacent to PV cells; no live load on top of cells.
- Snow Loads: 1 in 50 year snow load as per Tables 4 to 9.
 - No obstructions or parapets causing snow accumulation.
 - No adjacent upper roofs causing snow drift or sliding snow.
- Seismic Loads: excluded; does not govern by inspection.

Materials and Geometry:

- Roof rafters to be SPF No. 2 spaced at 24" on center maximum.
- OSB to be minimum 7/16" (11.1 mm) thick, CSA O437 O1 grade with panel edges supported.
- Plywood to be minimum 15/32" (11.9 mm) thick, tongue and groove, Douglas Fir conforming to CSA O121 with panel edges supported.
- Solar panels maximum area = 1.75 square meters (1.727 meters by 1.016 meters).
- Solar panels to be compliant with UL 1703.

- A range of slopes were considered for the roof loads. A conversion table between slopes and angles is provided below for reference.

Table 3: Roof Slope to Roof Angle Conversion

Roof Slope (m/m)	Roof Angle (°)
0:12	0
1:12	4.8
2:12	9.5
3:12	14
4:12	18.4
5:12	22.6
6:12	26.6
7:12	30.3
8:12	33.7
9:12	36.9
10:12	39.8
11:12	42.5
12:12	45

5. Results

The tables below summarize the maximum allowable unfactored 1 in 50 year snow and wind pressures for each roof wood substrate that will produce factored reaction loads below the factored member capacity. It is the responsibility of the contractor to verify that the building conditions and material meet the minimum criteria specified in this report and that all members of the roof framing can safely support the maximum imposed connection loads for the PV cells as per Table 2 according to Ontario Building Code 2012 requirements.

Results in each table are summarized based on the location of the panels for the wind roof zone (refer to Fig. I-9 and I-11 in Ontario Building Code 2012), terrain, roof slope, orientation of PV panel on roof, and number of mounts per PV panel. Refer to Appendix A for roof mount attachment details. An individual who is competent and familiar with Ontario Building Code will be required for the use of the tables, prior to installation of the roof connections.

Table: RT3: RT-Air-Mount - Plywood Only - Landscape Orientation

ROOF SLOPE ALLOWED														
SNOW & RAIN LOAD (kPa)	TERRAIN	NO. of Mounts	ROOF ZONE	BASIC WIND PRESSURE q (1 IN 50) kPa										
				0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	
2.50 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables Suggested values Is = 1.2 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	
			S	0 TO 20	0 TO 20	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			C	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45	N/A	N/A
			C	0 TO 45	0 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	N/A	N/A
	ROUGH	4	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	
			C	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
3.00 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables Suggested values Is = 1.2 Note: Do not include Cs in Snow Calculations	OPEN	4	R	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A		
			S	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	45 TO 45	N/A	
			C	0 TO 45	0 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	N/A	
	ROUGH	4	R	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	
			S	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	
			C	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	45 TO 45	
3.50 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables Suggested values Is = 1.3 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	0 TO 5	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	N/A	
			C	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	0 TO 5	
			C	0 TO 20	0 TO 20	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	
4.00 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables Suggested values Is = 1.3 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	0 TO 5	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	N/A	
			C	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	0 TO 5	
			C	0 TO 20	0 TO 20	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	
4.50 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables Suggested values Is = 1.4 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	
			S	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	
			C	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	
			S	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	
			C	15 TO 15	15 TO 15	15 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	

Table: RT4: RT-Air-Mount - Plywood Only - Portrait Orientation

ROOF SLOPE ALLOWED														
SNOW & RAIN LOAD (kPa)	TERRAIN	NO. oF Mounts	ROOF ZONE	BASIC WIND PRESSURE q (1 IN 50) kPa										
				0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	
0.50 $S = Is(Ss \cdot Cb \cdot Cw \cdot Ca + Sr)$ Ss and Sr from Code Tables Suggested values Is = 1.0 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	N/A	N/A	
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45	N/A	N/A	N/A	
			C	0 TO 45	0 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
	ROUGH	4	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
1.00 $S = Is(Ss \cdot Cb \cdot Cw \cdot Ca + Sr)$ Ss and Sr from Code Tables Suggested values Is = 1.0 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	N/A	N/A	
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45	N/A	N/A	N/A	
			C	0 TO 45	0 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
	ROUGH	4	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
1.50 $S = Is(Ss \cdot Cb \cdot Cw \cdot Ca + Sr)$ Ss and Sr from Code Tables Suggested values Is = 1.1 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 5	0 TO 5	N/A	N/A	
			S	0 TO 25	0 TO 25	0 TO 25	0 TO 5	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	
			C	0 TO 25	0 TO 25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
	ROUGH	4	R	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 5
			S	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 25	0 TO 5	0 TO 5	0 TO 5	0 TO 5	0 TO 5	N/A
			C	0 TO 25	0 TO 25	0 TO 25	15 TO 25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
2.00 $S = Is(Ss \cdot Cb \cdot Cw \cdot Ca + Sr)$ Ss and Sr from Code Tables Suggested values Is = 1.1 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	N/A	N/A	
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	
			C	0 TO 20	0 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	30 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45
	ROUGH	4	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	0 TO 5	0 TO 5	N/A
			C	0 TO 20	0 TO 20	0 TO 20	15 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		6	R	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			S	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45
			C	0 TO 45	0 TO 45	0 TO 45	0 TO 45	0 TO 45	15 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45	30 TO 45

Table: RT4: RT-Air-Mount - Plywood Only - Portrait Orientation

ROOF SLOPE ALLOWED														
SNOW & RAIN LOAD (kPa)	TERRAIN	NO. of Mounts	ROOF ZONE	BASIC WIND PRESSURE q (1 IN 50) kPa										
				0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	
2.50 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables <i>Suggested values</i> Is = 1.2 Note: Do not include Cs in Snow Calculations	OPEN	4	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5	0 TO 5	N/A	N/A	
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 5	0 TO 5	0 TO 5	N/A	N/A	N/A	N/A	
			C	0 TO 15	0 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	
			C	0 TO 20	0 TO 20	0 TO 20	15 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5	0 TO 5	0 TO 5	0 TO 5	N/A	
			C	0 TO 15	0 TO 15	0 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5
			C	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	15 TO 20	N/A	N/A	N/A	N/A	
3.00 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables <i>Suggested values</i> Is = 1.2 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5	0 TO 5	0 TO 5	N/A	
			C	0 TO 20	0 TO 20	0 TO 20	15 TO 20	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20
			S	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 5
			C	0 TO 20	0 TO 20	0 TO 20	0 TO 20	0 TO 20	15 TO 20	N/A	N/A	N/A	N/A	
3.50 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables <i>Suggested values</i> Is = 1.3 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5	0 TO 5	0 TO 5	N/A	
			C	0 TO 15	0 TO 15	0 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5
			C	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	15 TO 15	N/A	N/A	N/A	N/A	
4.00 S = Is(Ss*Cb*Cw*Ca + Sr) Ss and Sr from Code Tables <i>Suggested values</i> Is = 1.3 Note: Do not include Cs in Snow Calculations	OPEN	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5	0 TO 5	0 TO 5	N/A	
			C	0 TO 15	0 TO 15	0 TO 15	15 TO 15	N/A	N/A	N/A	N/A	N/A	N/A	
	ROUGH	4	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
			C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		6	R	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15
			S	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 5
			C	0 TO 15	0 TO 15	0 TO 15	0 TO 15	0 TO 15	15 TO 15	N/A	N/A	N/A	N/A	

The capacities listed in the tables above are limited to the conditions as listed in the Analysis Parameters sections. The analyses consider that all connections and associated hardware are installed according to Roof Tech E Mount AIR Installation Manual and accepted standards of practice for construction. All materials used shall be free of defects and wood substrates shall be according to the minimum thicknesses and grades specified in this report. The contractor is responsible for verifying the strength of the roof framing for the maximum loads as per this document. Kassian Dyck & Associates assume no liability beyond what is specifically stated in this report.

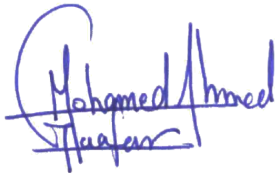
Refer to Appendix A for connection and panel mount orientations as prepared by Starling Madison Lofquist, Inc. for SML project report 471-13.

We trust this is the information you require and would be pleased to answer any questions you may have.

Respectfully,

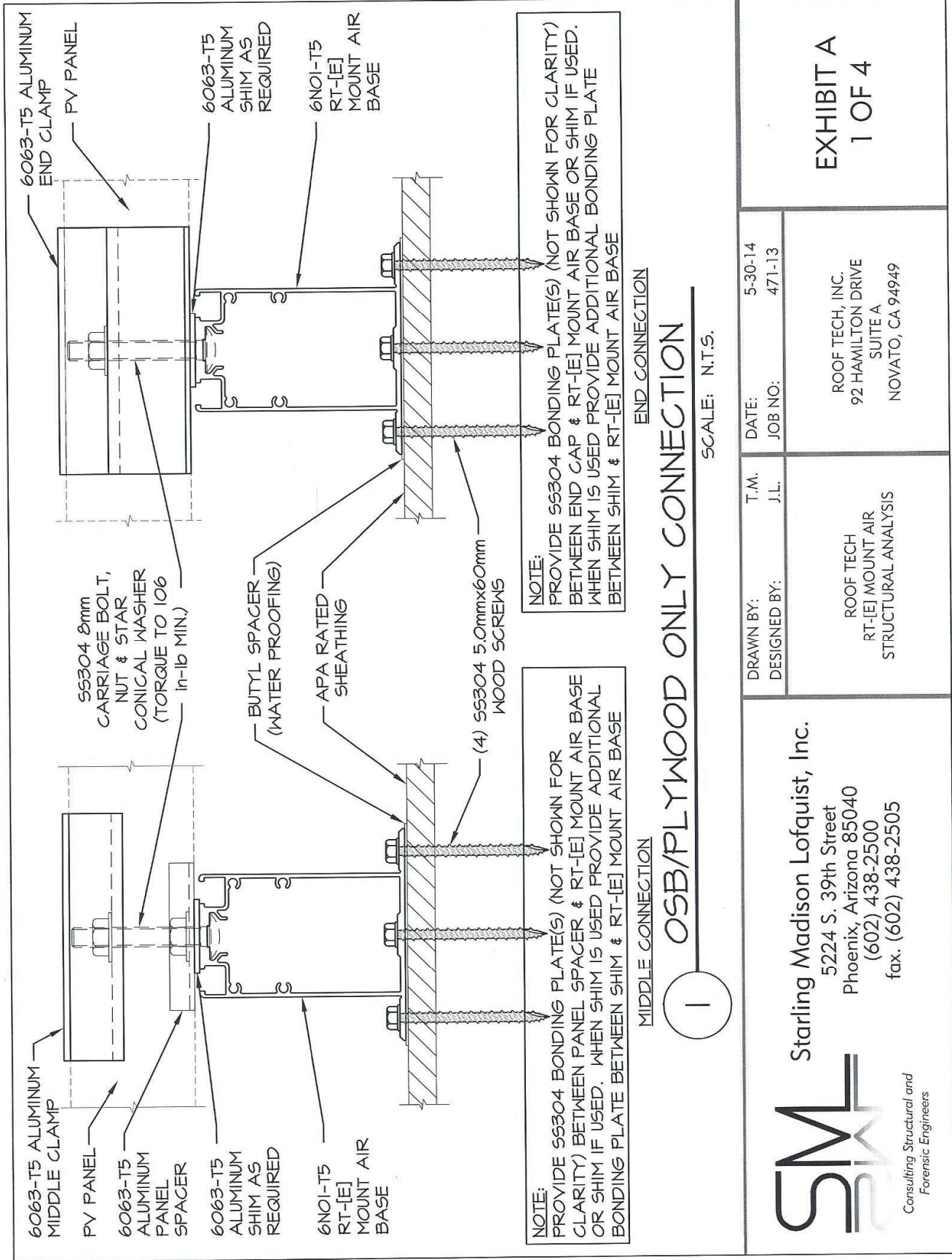
Kassian Dyck & Associates, Consulting Engineers
A Division of 594798 Alberta Ltd.

Prepared by:
Mohamed Gaafar, P.Eng.



Reviewed by:
Arno Dyck, P.Eng





Starling Madison Lofquist, Inc.
 5224 S. 39th Street
 Phoenix, Arizona 85040
 (602) 438-2500
 fax. (602) 438-2505

Consulting Structural and Forensic Engineers

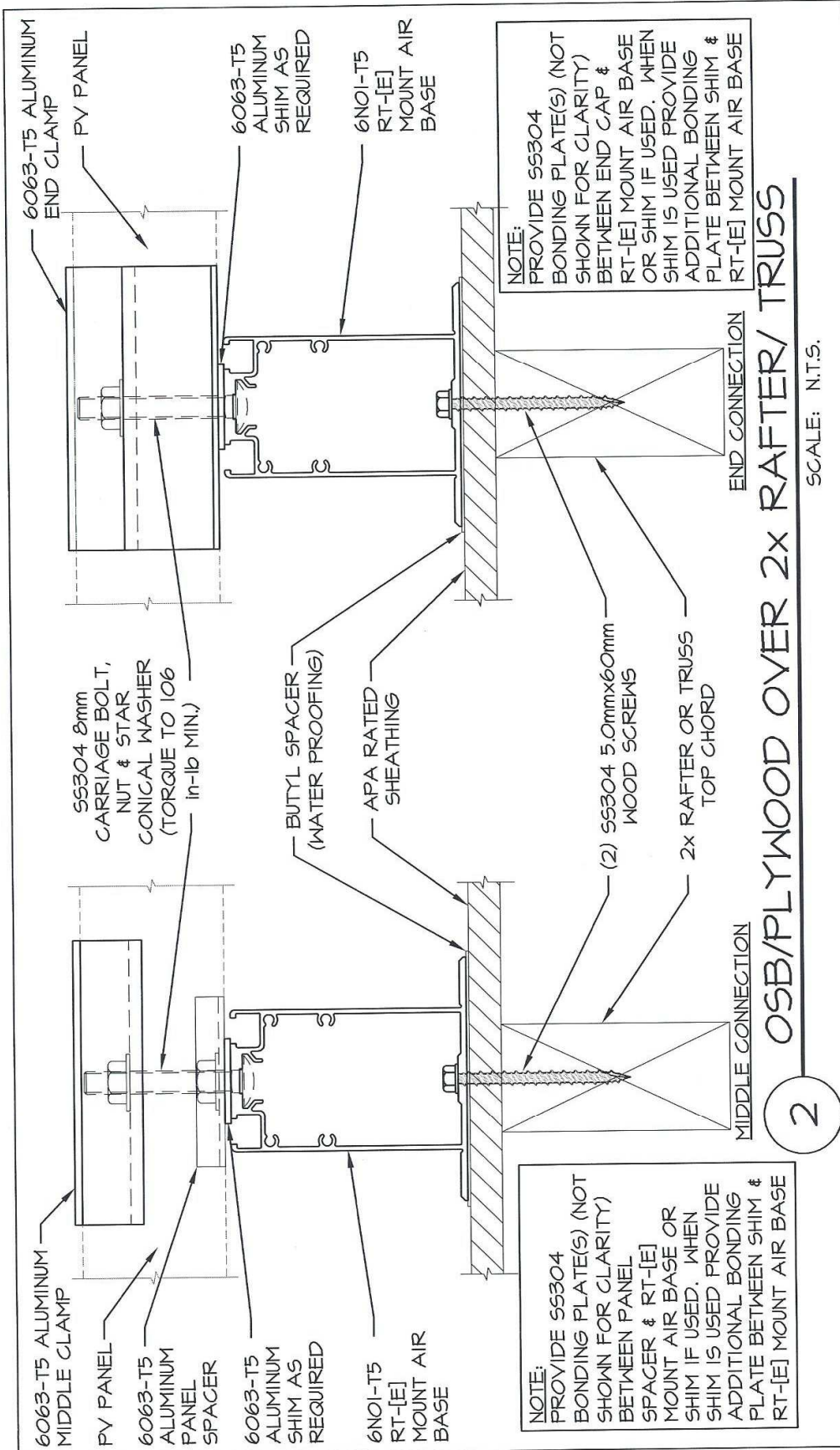
DRAWN BY: T.M. J.L.
 DESIGNED BY: J.L.

ROOF TECH
 RT-[E] MOUNT AIR
 STRUCTURAL ANALYSIS

DATE: 5-30-14
 JOB NO: 471-13

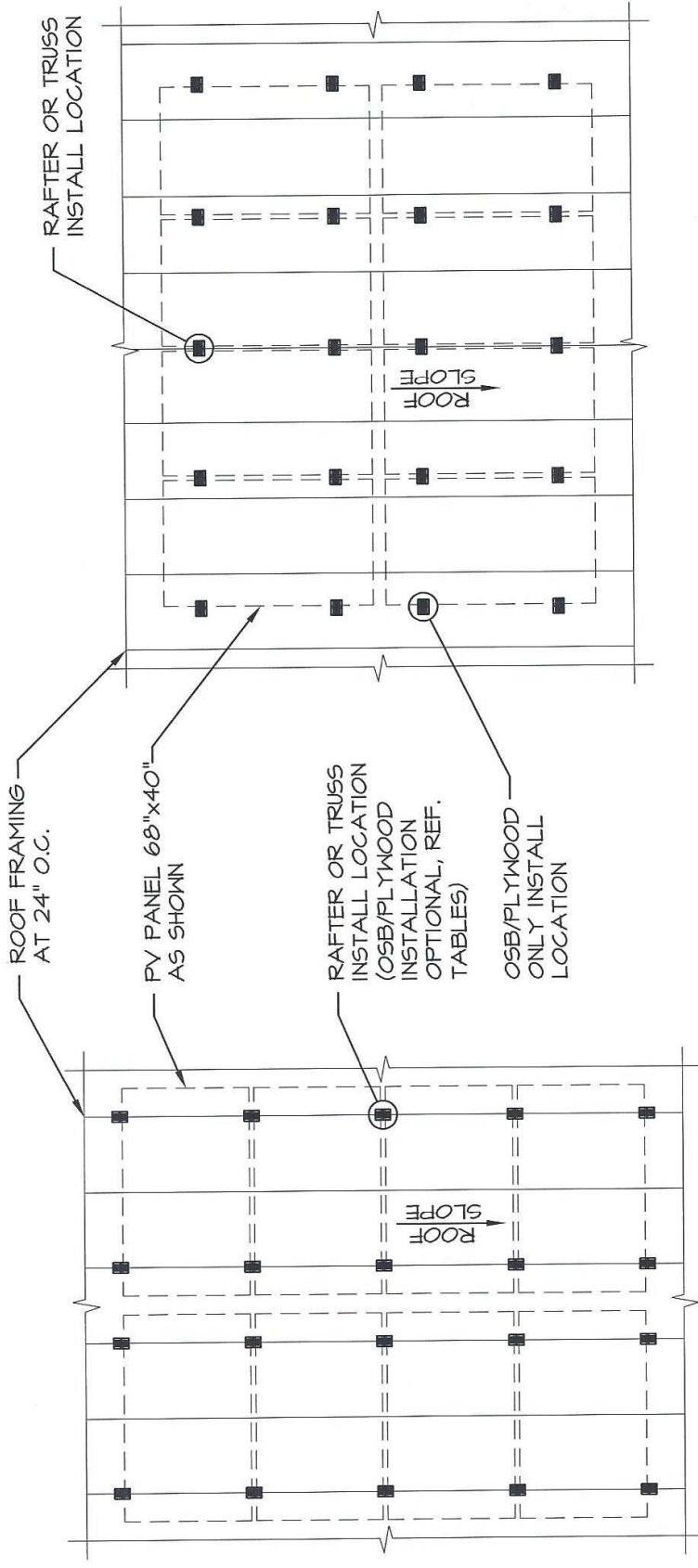
ROOF TECH, INC.
 92 HAMILTON DRIVE
 SUITE A
 NOVATO, CA 94949

EXHIBIT A
 1 OF 4



DRAWN BY: T.M. DESIGNED BY: J.L.		DATE: 5-30-14 JOB NO: 471-13	EXHIBIT A 2 OF 4
		ROOF TECH, INC. 92 HAMILTON DRIVE SUITE A NOVATO, CA 94949	
Starling Madison Lofquist, Inc. 5224 S. 39th Street Phoenix, Arizona 85040 (602) 438-2500 fax. (602) 438-2505		ROOF TECH RT-[E] MOUNT AIR STRUCTURAL ANALYSIS	





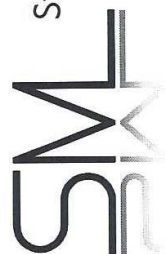
PV PANEL IN LANDSCAPE ORIENTATION

PV PANEL IN PORTRAIT ORIENTATION

PARTIAL FRAMING PLAN (4 MOUNTS PER PANEL)

3

SCALE: N.T.S.



Starling Madison Lofquist, Inc.
 5224 S. 39th Street
 Phoenix, Arizona 85040
 (602) 438-2500
 fax. (602) 438-2505

Consulting Structural and
 Forensic Engineers

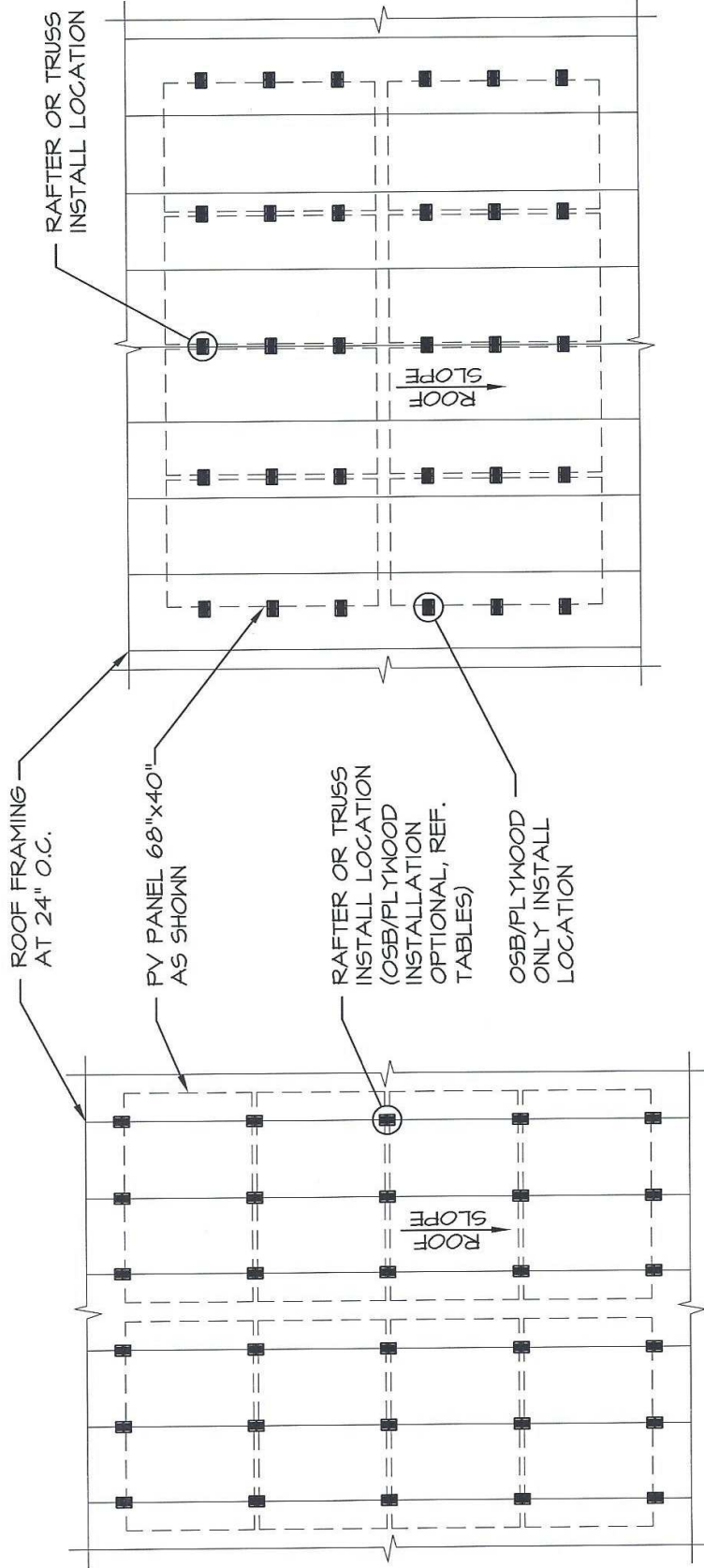
DRAWN BY: T.M.
 DESIGNED BY: J.L.

DATE: 5-30-14
 JOB NO: 471-13

ROOF TECH
 RT-(E) MOUNT AIR
 STRUCTURAL ANALYSIS

ROOF TECH, INC.
 92 HAMILTON DRIVE
 SUITE A
 NOVATO, CA 94949

EXHIBIT A
 3 OF 4



PV PANEL IN LANDSCAPE ORIENTATION

PV PANEL IN PORTRAIT ORIENTATION

PARTIAL FRAMING PLAN (6 MOUNTS PER PANEL)

3

SCALE: N.T.S.

<p>Starling Madison Lofquist, Inc. 5224 S. 39th Street Phoenix, Arizona 85040 (602) 438-2500 fax. (602) 438-2505</p>		<p>ROOF TECH RT-IEJ MOUNT AIR STRUCTURAL ANALYSIS</p>		<p>ROOF TECH, INC. 92 HAMILTON DRIVE SUITE A NOVATO, CA 94949</p>	
<p>DRAWN BY: T.M.</p>	<p>DATE: 5-30-14</p>	<p>EXHIBIT A 4 OF 4</p>			
<p>DESIGNED BY: J.L.</p>	<p>JOB NO: 471-13</p>				

