

November 5, 2018

Attn: Mr. Marshall Green  
Quick Mount PV  
Director of Engineering  
2700 Mitchell Dr., Bldg 2  
Walnut Creek, CA 94598

RE: Quick Mount PV Shared Rail Composition Mount  
State of California Compliance Letter

SEI Project No.: 18445.00

Dear Mr. Green:

Structural Enginuity Inc. (SEI) submits this letter regarding our review of the test data for the Quick Mount PV (QMPV) Shared Rail Composition Mount (QMSRC) photovoltaic (PV) array mounting system. The test data is from Construction Testing Services (CTS) Project Number QMPV #20180904-Revision A, titled, "Quick Mount PV Load Testing – Shared Rail Composition Mount", dated October 30, 2018 and is available upon request from QMPV.

CTS is a licensed testing and engineering firm located in California, where the testing of the Shared Rail Composition Mount assembly was performed. The Shared Rail Composition Mount assembly is designed to support and fasten rails and PV modules manufactured by others to the structural roof framing through plywood or OSB sheathing and roofing material consisting of composition shingles. Figure 1 below delineates the components of the Shared Rail Composition Mount assembly.

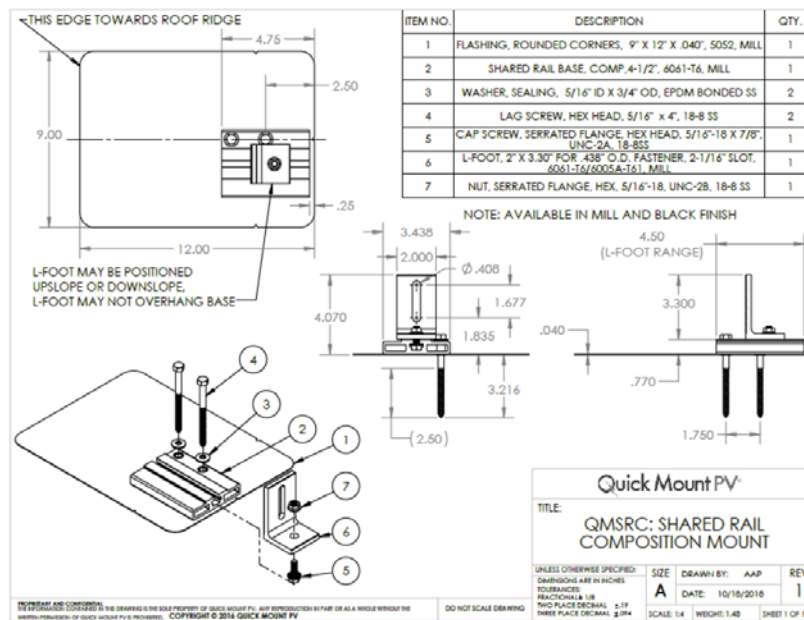


Figure 6: Installation Drawing  
**FIGURE 1: Shared Rail Composition Mount Assembly**

Testing of the Shared Rail Composition Mount assembly consisted of test specimens that were made up of the following:

- a wood test bed representing a composition shingle roof, wood framed roof that is comprised of 1/2" OSB APA rated Structural I sheathing over 13" long 2"x4" Douglas Fir rafters covered with felt paper and composition shingles,
- a QPMV Shared Rail Composition Mount attached to rafters using two 5/16"Ø x 4" lag screws with a minimum screw embedment of 2-1/2" into the structural member,

The test procedures were created to simulate the reactions that would be applied to the Shared Rail Composition Mount assembly due to the environmental loads projected on a PV solar roof array that is fastened to a roof by the Shared Rail Composition Mount system. The tests were simulated for the environmental loads as follows:

- Tension load test simulated wind uplift that was normal to the slope of the roof minus self-weight of the PV modules,
- Compression load test simulated a low-slope roof condition with snow and array self-weight vertically down plus wind down normal to the slope of the roof.
- Lateral load parallel to rafter simulated parallel to roof force component of downward snow and self-weight loads,
- Lateral perpendicular to rafter test simulated seismic loads on the cross-slope direction of the roof.

The tension, compression, and lateral load parallel to rafter tests were conducted such that the applied load acted at the highest point of the slot in the L-Foot component of the Shared Rail Composition Mount in order to create the largest stresses on the mount. The load for the lateral load perpendicular to rafter test was applied 2.692" above the base of the mount. In order to account for the possibility of the load being applied at the highest point of 3.599" above the base of the mount, the test data was reduced to obtain an equivalent value for this condition. In addition, two (2) mounts with a rail spanning between them were used for this test in order to more accurately replicate the loading that the Shared Rail Composition Mount would see in practice, therefore the test load values were reduced by half in order to account for using two mounts when used to obtain the allowable loads.

The evaluation was limited to the components of the Shared Rail Composition Mount that is manufactured by Quick Mount PV with test specimens installed in conformance with Quick Mount PV's product installation manual and specifications. Elements of the test specimen that are not manufactured by Quick Mount PV, such as the roof rafters, rails, and PV modules, were not analyzed in SEI's evaluation of the QMPV Shared Rail Composition Mount product; therefore, load capacities of these external elements should be determined by others or referenced by test data provided by the manufacturers of these elements. The following tables attached to this letter list the combined results of the four applied test load directions from the CTS Test Report, allowable stress design (ASD) capacities extrapolated from the test results using ASD load combinations listed in ASCE 7-10 for conformance with the 2015 International Building Code, 2015 International Residence Code, and 2016 California Building Code for verifying capacity of the Quick Mount PV Shared Rail Composition Mount to be used as a fastener for roof mounted PV Solar Arrays in the state of California.

Should you have any questions relating to this matter please contact me at your convenience.

Sincerely,



Allan T. Myket, P.E.  
President/Founder  
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**Structural Engenuity Inc.**



11/12/2018

**Table 1: Summary of Allowable Loads for Quick Mount PV Shared Rail Composition Mount (QMSRC)**

**CTS Test Report Results**

| Loading Condition                       | Mean Tested Peak Load (lbs) | Minimum Tested Peak Load (lbs) | No. of Tests | Rafter Avg Specific Gravity | Type of Failure         | FS: Method of Calculation       | Factor of Safety | Allowable Load (lbs) |
|---|-----------------------------|--------------------------------|--------------|-----------------------------|-------------------------|---------------------------------|------------------|----------------------|
| Tension                                 | 1841                        | 1648                           | 8            | 0.439                       | Lag Screw Withdrawal    | NDS for Wood Construction, 2012 | 4.00             | 736<br>(Note 1, 4)   |
| Compression                             | 2455                        | 1964                           | 7            | 0.445                       | L-Foot Bending          | Aluminum Design Manual, 2015    | 2.73             | 898                  |
| Shear (Lateral) Parallel to Rafter      | 611                         | 567                            | 4            | 0.445                       | L-Foot Bending          | Aluminum Design Manual, 2015    | 2.54             | 240                  |
| Shear (Lateral) Perpendicular to Rafter | 602                         | 502                            | 7            | 0.453                       | Rail Fracture at T-Bolt | Aluminum Design Manual, 2015    | 2.55             | 235<br>(Note 2a, 3)  |

Factor of Safety Calculation Methods:

Aluminum Design Manual, 2015, Appendix 1: Testing, 1.3.2 Tests for Determining Structural Performance, Eq. 1.3-3  
NDS for Wood Construction, 2015, Commentary Section C12.2.1 Lag Screw Withdrawal Design Values, Eq C12.2.1-1

Material Notes:

The Quick Mount PV Shared Rail Composition Mount Parts observed in tests to failure modes as noted above.

Shared Rail Base = 6061-T6 (60054-T6 & 6005-T5 are also acceptable)

L-Foot = 6061-T6 (6005A-T61 is also acceptable)

Test Loading Notes:

1. The average Specific Gravity of the Rafters used in the testing are given in the above table. Wood species and grade used that differs from this may cause lag screw pull-out to occur sooner; therefore, adjustment of the tabulated allowable values is done based on the specific gravity of the other species of wood following Equation 12.2-1 of the NDS for Wood Construction. The adjustment factors for various wood species are shown below. In no circumstance shall the allowable loads given in the above table be increased due to a higher value of Specific Gravity than what was present in the test data.
  - Alaska Yellow Cedar (G=0.46) - Multiply allowable Tension values by 1.0
  - Hem-Fir and Spruce-Pine-Fir (G=0.42) - Multiply allowable Tension values by 0.93
  - Open-Grained Redwood and Western Cedar (G=0.36) - Multiply allowable Tension values by 0.74
2. All loads were applied at the highest point of the slot in the L-Foot, unless noted otherwise.
- 2a. During testing, the load was applied at a height of 2.692" above the base of the mount. Tested loads were reduced to account for a worst case load location of 3.599" above the base.
3. Tested loads were reduced by a factor of 2 to account for the testing applying load over (2) mounts.
4. The allowable values determined through testing have been multiplied by a load duration factor of 1.6 for Wind and Seismic load conditions per section 10.3.2 in the NDS for Wood Construction. No further factors may be applied to the allowable load
5. Allowable load tables are based on a minimum screw embedment of 2-1/2" into the structural member for each screw. If less embedment is achieved, loads should be adjusted accordingly.