

March 13, 2023

EcoFasten

4141 West Van Buren St.

Phoenix, AZ 85009

Attn.: John Hudson, Senior Director of Engineering, EcoFasten

Re: EcoFasten *SimSupport* Roof Attachment Capacities

This letter provides details on the mechanical load test and certifies the structural capacity of the EcoFasten *SimSupport* for use as a roof attachment for flush mount railed solar systems. *SimSupport* consists of an aluminum extrusion pedestal and a 3/8" stainless-steel stud with matching stainless-steel nut used to connect compatible EcoFasten brackets. *SimSupport* is secured to the rafter through a pair of 4" long 5/16" diameter lag screws. Full assembly details and component dimensions are shown in Exhibit A.

The structural capacity of the EcoFasten *SimSupport* is reviewed along the uplift and lateral load directions. The stated capacities in this letter apply to *SimSupport* with a selected EcoFasten L-foot with no consideration of the roof deck substructure. The capacity is based on mechanical load testing using a Universal Instron Test Unit. This certification conforms to the structural requirements of the following reference documents:

1. 2015/2018 International Building Code, by International Code Council, Inc
2. Aluminum Design Manual 2020, by the Aluminum Association, Inc.
3. ASTM B 557-15, Standard Test Method for Tension Testing Wrought and Cast Aluminum and Magnesium-Alloy Products
4. ASTM A370-21, Standard Test Methods and Definitions for Mechanical Testing of Steel Products
5. 2018 National Design Specification for Wood Construction

Testing investigated whether the *SimSupport* would limit the capacity of the connection. The *SimSupport* was fixed to a rigid substructure for testing with the load applied on the steel stud to simulate the attachment of an EcoFasten L-foot. Tables 1 and 2 summarizes the test results and allowable capacities of the *SimSupport* Assembly along each rated load direction.

The failure observed during uplift load testing was yielding of the aluminum extrusion. The average of the uplift peak load from eight (8) uplift load tests is 4294 lbs and with a safety factor of 1.65 for aluminum yielding per ADM 2020 applied to this failure mode, **the allowable uplift capacity is 2602 lbs**. It should be noted that lag screw withdrawal at the point of rafter attachment is likely to control the design in normal use, which is reflected in the tables below by the provided calculation per NDS. Lag screw withdrawal capacities assume a specific gravity of 0.42 for the rafter.

To determine the allowable lateral capacity, the *SimSupport* was compared analytically to EcoFasten parts that are attached to *SimSupport* via the 3/8" stud. It was noted that the L-foot selected for use with *SimSupport* would control the lateral capacity of the connection rather than withdrawal of the lag screws in lateral load or failure of the aluminum extrusion. The lateral capacity for various products is listed in the table below. The lateral capacity perpendicular to the rafter, cross slope lateral, was determined analytically and is limited by lag screw withdrawal.

Please note the provided test investigation and its associated results described herein were based on the load tests performed on the *SimSupport* as a stand-alone roof attachment. It is not the intention of this letter to rate or certify the selected rail system level performance or structural components other than those specifically delineated in this letter. This evaluation excludes the structural adequacy of the chosen PV modules, or underlying roof supporting members. For

those, it shall be the responsibility of the designated system designer or project engineer to verify the structural capacity and adequacy regarding the applied or resultant loads of the chosen array configuration.

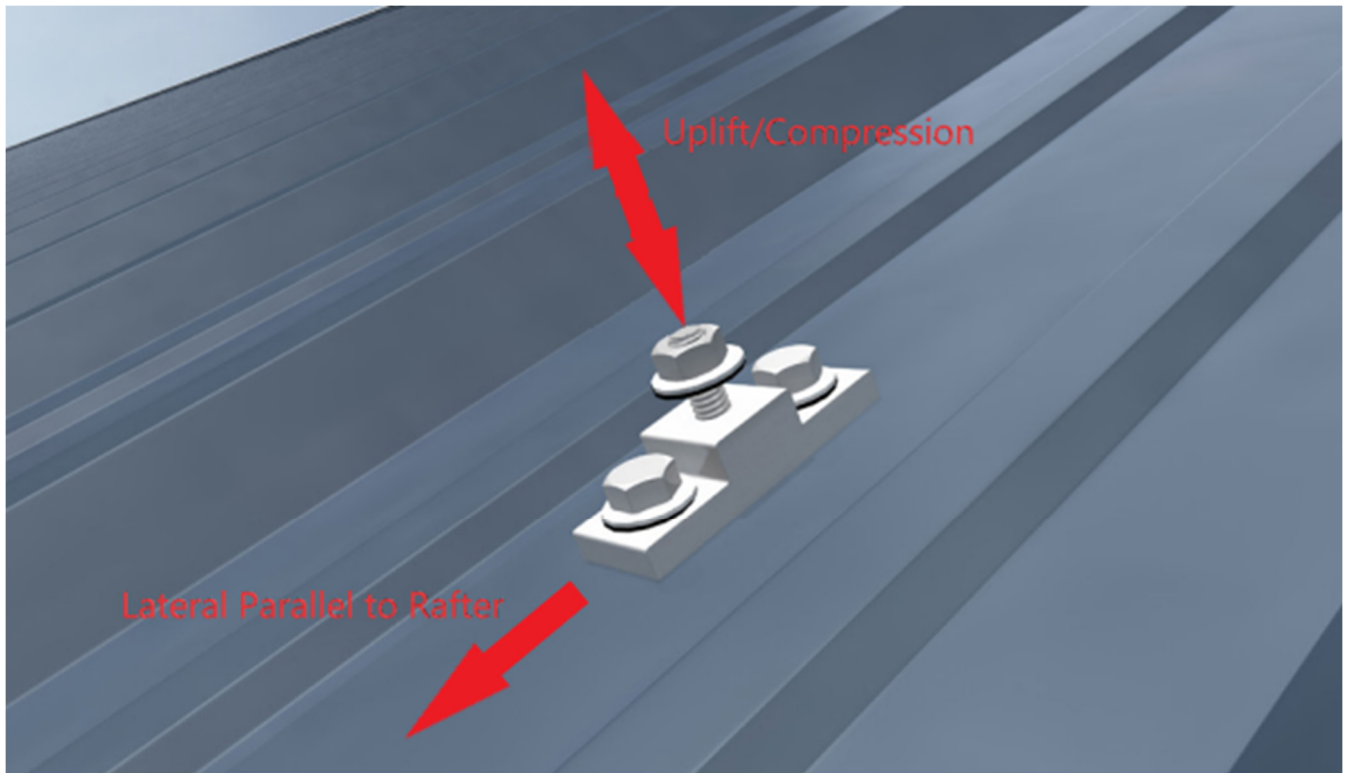


Figure 1: EcoFasten SimSupport and Applied Loading Directions

Table 1: EcoFasten <i>SimSupport</i> Allowable Capacities ⁽¹⁾						
Load Direction	Test Quantity	Critical Failure Mode	Safety Factor ⁽⁵⁾	Avg Ultimate Capacity (lbs.)	Max deviation from mean ⁽⁴⁾	Allowable Capacity (lbs) ⁽⁶⁾
Uplift ⁽²⁾⁽⁷⁾	8	Aluminum Yielding	1.65	4294	11%	2602
Lateral 3" L-Foot ⁽³⁾	5	Aluminum Rupture	1.95	717	1.80%	368
Lateral ClickFit L-Foot ⁽³⁾	5	Aluminum Rupture	1.95	571	2.33%	293

Table 2: Reference 5/16" Lag Screw Capacities (per pair)	
Load Direction	Allowable Capacity (lbs) ^{(7) (8)}
Uplift	1223
Cross Slope Lateral	204

Table Notes:

- (1) Capacities apply to the EcoFasten SimSupport used with listed compatible EcoFasten brackets per the installation manual.
- (2) The Uplift direction is upward perpendicular to the roof surface.
- (3) The allowable lateral capacity is applicable to the relevant L-foot in both parallel and perpendicular orientation with respect to the rafter.
- (4) Deviation reflects the variance of the highest or the lowest test value from the group mean for the respective load direction. For load directions where deviation was larger than 10% after 5 tests, 3 additional tests are added per *ADM-2020* Appendix 1.
- (5) Safety Factor is associated with the respective failure mode recorded and determined by the specific code reference document as listed on Page 1.
- (6) Allowable capacity is equal to Average Peak Load at Failure divided by its associated Safety Factor.
- (7) Allowable uplift capacity of part/assembly may exceed the withdrawal capacity of the lag screws used. Capacities for lag screw options using two screws of the same threaded length were calculated per NDS and are provided in Table 2. Rafters and roof deck should be in sound structural conditions with no sign of rot, decay, previous installation, or pre-existing damages.
- (8) Allowable capacities were calculated using a specific gravity of 0.42 assuming a sheathing thickness of 7/16in. For rafters with a different specific gravity, the allowable uplift capacity shall be adjusted using a factor of $(G/0.42)^{3/2}$ per National Design Specification (NDS-2018) Eq. (12.2-2).

Sincerely,

Matthew S Kuzila, PE

Digitally Signed 3.13.2023

APPENDIX A: ENGINEERING DRAWING

