![EcoFasten - An ESDEC Company]

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April 1st , 2021

EcoFasten
4141 West Van Buren St.
Phoenix, AZ 85009

Attn: John Hudson, Senior Director of Product, EcoFasten

Re: Ecofasten *ClickFit L-Foot Assembly* Roof Attachment Allowable Capacities

This letter certifies the structural capacity of EcoFasten *ClickFit L-Foot Assembly* for use as a roof attachment for flush mounted PV solar systems. The *ClickFit L-Foot Assembly* consists of an extruded aluminum L bracket with a close-end vertical slot and a shelf kit. The shelf kit secures the *ClickFit* rail bottom flanges via its top channel slots and is fastened onto the L bracket vertical leg using a 5/16" bolt. The L bracket is positioned above a metal flashing and fastened to an underlying roof rafter via a 5/16" x 4" lag bolt with a 3" threaded length. Full assembly details and component dimensions are shown in Exhibit 850071.

The structural capacities of the *ClickFit L-Foot Assembly* are reviewed along four respective load directions including uplift, compression, lateral parallel to the rafter, and lateral perpendicular to the rafter. The capacity ratings are based on structural load tests performed using a Universal Instron Test Unit according to ASTM D1761-20 *"Standard Test Methods for Mechanical Fasteners in Wood and Wood Based Materials"*. For each load test a *ClickFit L-Foot Assembly* was installed onto a sample roof deck composed of 7/16" OSB Board over 2x4 rafters as shown in Figure 1. The moisture content and the specific gravity of the rafters were measured per ASTM D2395-17 *"Standard Test Methods for Density and Specific Gravity (Relative Gravity) of Wood and Wood-Based Materials"*. The recorded moisture content of the rafters among all sample roof decks is between 12% and 14%. For each load test, as depicted in Figure 1, the point load was placed at the top center of a small *ClickFit* rail section, which was included in the tests to facilitate the loading.

The failure observed under the uplift load was the rupture of the aluminum L bracket vertical section at the peak load of 1745 lbs., which is the average of five (5) tests provided. With a safety factor of 1.95 applied per ADM to the aluminum rupture-based failure, **the allowable uplift capacity is 895 lbs**. The above allowable capacity is applicable to roof decks with a rafter specific gravity greater than or equal to 0.42, which was the average wood specific gravity recorded in the uplift load tests.

The failure under the compression load was recorded as the rupture of the rail bottom flange within the shelf kit section on the L bracket side. The average of peak loads from five (5) compressive tests is 1783 lbs. With a safety factor of 1.95 applied per ADM to the aluminum rupture-based failure, **the allowable compression capacity is 914 lbs**.

For the lateral load tests, two load directions, parallel and perpendicular to the rafter, were tested. Under each lateral load, the *ClickFit L-Foot Assembly* was tested in two orientations, the vertical face of its L bracket normal to the rafter or parallel to the rafter. For the lateral load parallel to the rafter, the critical failure mode which results in the lowest allowable capacity was observed to be the fracture of the L bracket at its horizontal leg. The average of the fracture loads from five (5) lateral load tests is 615 lbs and with a safety factor of 1.95 per ADM for the aluminum fracture, **the allowable capacity for a lateral load parallel to the rafter is 315 lbs.** The critical failure mode for the lateral load perpendicular to the rafter is the same as the other lateral direction. The average of the fracture loads from five (5) tests is 571 lbs and with a safety factor of 1.95 per ADM for the aluminum fracture, **the allowable capacity for a lateral load perpendicular to the rafter is 293 lbs.** For each lateral load direction, the average of the rafter specific gravity was measured to be 0.42. The specified allowable lateral capacities above shall be used when the supporting rafter has a specific gravity of 0.42 or greater.

Table 1 summarizes the test results and allowable capacity of *Clickfit L-Foot Assembly* along each rated load direction. Please note the test investigation and its results described herein were based on the load tests performed on the *ClickFit L-Foot Assembly*, both at the component and combined assembly level, as a stand-alone roof attachment. It is not the intention of the letter to rate or certify *ClickFit* rail structural performance. Additionally, this evaluation excludes the structural adequacy of the underlying roof supporting members.
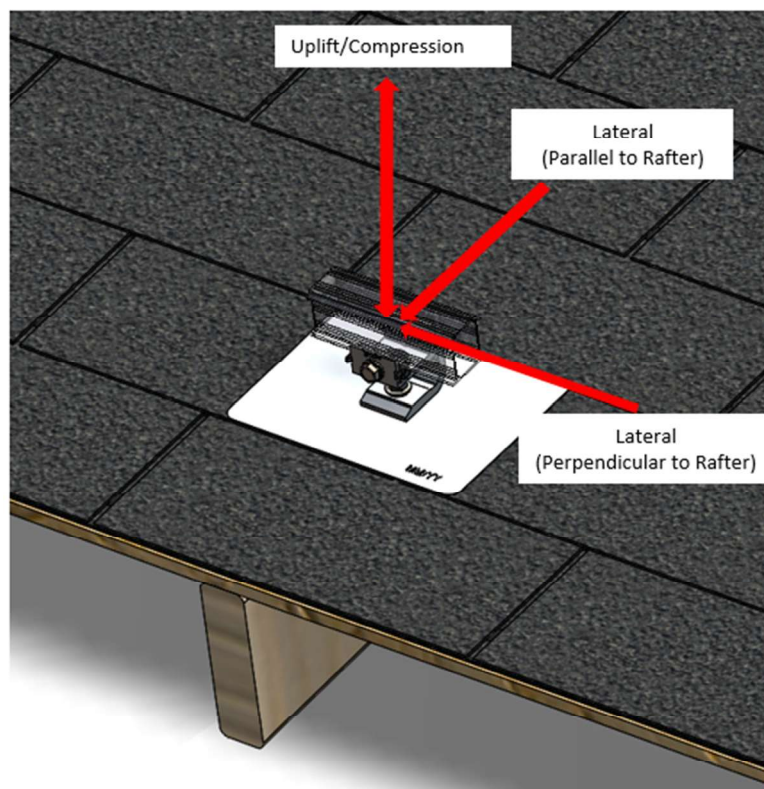

Figure 1: *ClickFit L Foot Assembly* and Applied Loading Directions

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Table 1 Ecofasten *ClickFit L Foot* Allowable Capacities [1]						
Load Direction	Test Quantity	Average Peak Failure Load (lbs)	Deviation of Test Results [5]	Critical Failure Mode	Safety Factor [6]	Allowable Capacity (lbs) [7]
Uplift [2]	5	1745	8.68%	Aluminum Rupture	1.95	895
Compression [3]	5	1783	3.55%	Aluminum Rupture	1.95	914
Lateral Parallel to Rafter [4]	5	615	4.45%	Aluminum Rupture	1.95	315
Lateral Perpendicular to Rafter [4]	5	571	2.33%	Aluminum Rupture	1.95	293

Table 1 Footnotes:

(1) Capacities apply to a minimum rafter size of 2x4, a deck thickness of 7/16" or greater and lag bolt secured within the center 1/3 of the rafter width with a minimum 2.5" edge distance. Rafters should be in a sound structural condition with no sign of rot, decay or pre-existing damages.

(2) The uplift direction is upward perpendicular to the roof surface. The uplift capacity shall be used when the direct supporting rafter has a specific gravity 0.42 or greater

(3) The compression direction is downward perpendicular to the roof surface.

(4) The allowable lateral capacity is applicable when the vertical face of the L bracket is normal or parallel to the rafter.

(5) Deviation reflects the variance of the highest or the lowest test value from the group mean for the respective loading direction.

(6) Safety Factor is associated with respective failure mode recorded and determined per ADM-2015 , NDS-2018 and ASTM-7147

(7) The Allowable Capacity is equal to the Average Peak Failure Load divided by its safety factor.

Sincerely,

Matthew S Kuzila, PE
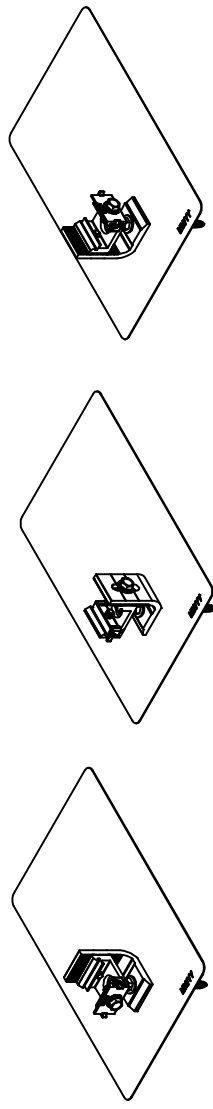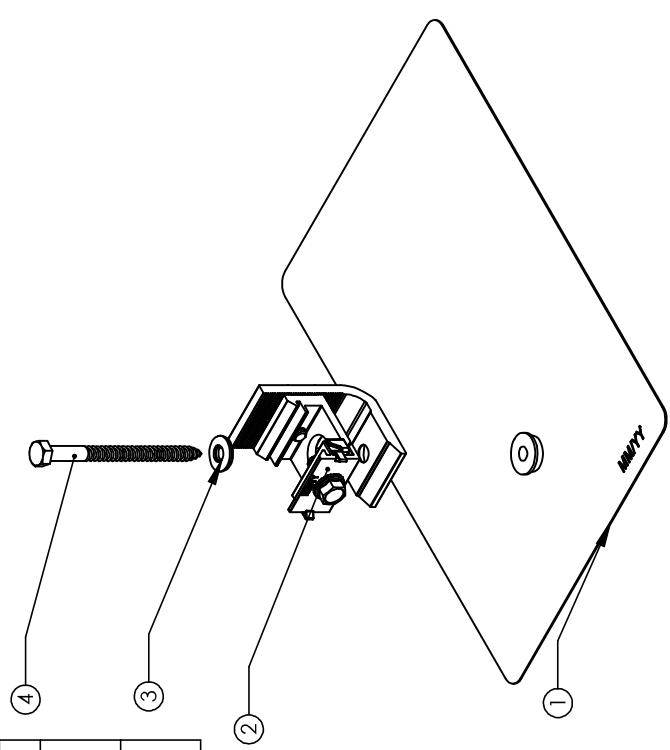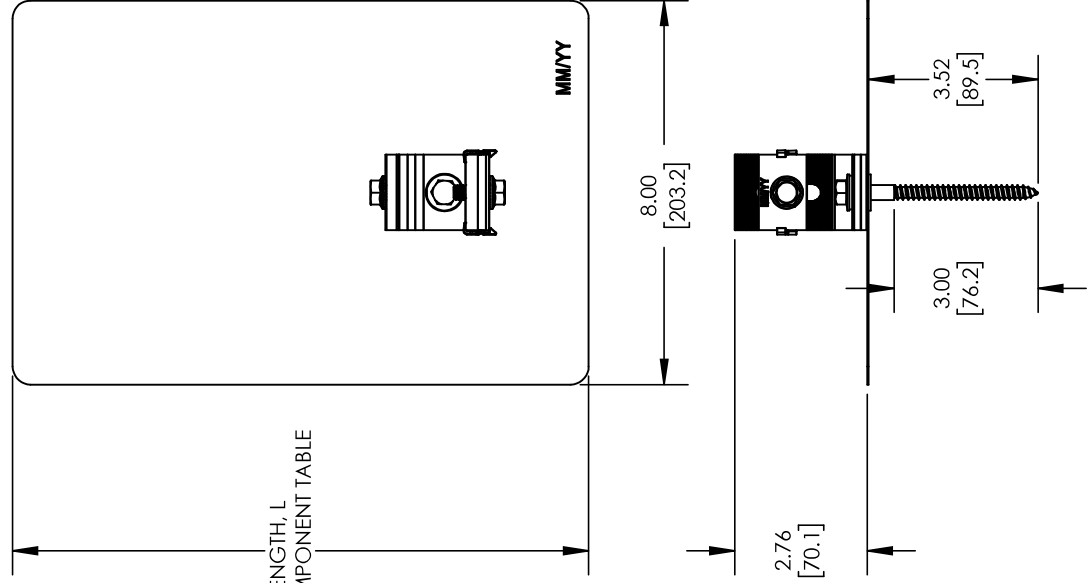Structural Engineer

Date:
2021.04.01
18:49:35 -07'00'

Gang Xuan, SE
Senior Structural Engineer

COMPONENT TABLE

LENGTH, L	DESCRIPTION
10 IN.	GF1 FLASHING, 10 IN.
12 IN.	GF1 FLASHING, 12 IN.

ITEM NO.	DESCRIPTION
1	GF1 FLASHING
2	CLICKFIT L FOOT ASSEMBLY
3	5/16 STAINLESS STEEL AND EPDM BONDED SEALING WASHER
4	SCREW, LAG, HEX, 5/16, 4.0L

CLICKFIT L-FOOT CAN BE INSTALLED IN THE ORIENTATIONS SHOWN ABOVE

LENGTH, L
SEE COMPONENT TABLE

MM/YY

8.00
[203.2]

2.76
[70.1]

3.52
[89.5]

3.00
[76.2]

DRAWN	T. RAY	03/31/21
CHECKED	–	–
ENG APPR.	–	–
MFG APPR.	–	–
Q.A.	–	–

INTERPRET DIM AND TOLERANCE
PER ASME Y14.5[M]-2009

DIMENSIONS TOLERANCES ARE IN:
[MILLIMETERS]

INCHES.   N/A   N/A
N/A

ANGLES: +/- 1°

ESDEC
INNOVATIVE MOUNTING SYSTEMS

CLICKFIT L-FOOT ASSEMBLY

SIZE
A

DWG. NO.
850071

REV.
A

SCALE: 1:4   WEIGHT: SHEET 1 OF 1