28357 Industrial Blvd
Hayward, CA 94545
1-800-227-9523
IronRidge.com

Attn: Sean McDonald, CEO, IronRidge Inc.
Date: July 18, 2025

Re: Structural Certification for QuickMount *All Tile Hook* Roof Attachment

This letter addresses the structural capacity of the QuickMount *All Tile Hook* for use as a tile roof attachment for flush mounted PV solar systems. The *All Tile Hook* assembly consists of a cold formed stainless-steel base and arm, a 5/16” carriage bolt and matching flange nut to secure the arm to the base, and an optional extruded aluminum flashing. The *All Tile Hook* base is attached to an underlying roof rafter using two (2) 5/16” stainless steel lag screws and the arm component is secured to the base by a 5/16" carriage bolt. Assembly of the arm, base, and accompanying hardware shall be installed in accordance with QuickMount’s *All Tile Hook* installation manual. Full assembly details are shown in Exhibit EX-0030.

The referenced uplift, compression and lateral capacities of the *All Tile Hook* tabulated below are based on mechanical load tests conducted along the four load directions shown in Figure 1, using a Universal Test Unit and full-scale system load tests, conforming to the structural requirements of the following standards:

ASTM D1761-20, Standard Test Methods for Mechanical Fasteners in Wood
ASTM A370-24, Standard Test Methods and Definitions for Mechanical Testing of Steel Products
NDS-2018, National Design Specification (NDS) for Wood Construction
AISC 360-16 Specification for Structural Steel Buildings
ICC-428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Modules

Please note the test investigation and its results described herein were based on the load tests performed on the *All Tile Hook* assembly as a stand-alone roof attachment. It is not the intention of the letter to rate or certify *All Tile Hook* system level performance or structural components other than those mentioned 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 system designer or engineer to verify the structural capacity and adequacy regarding the applied or resultant loads of the chosen array configuration.

Sincerely,

Nancy Schubert
Digitally signed by Nancy Schubert
Date: 2025.07.18 15:18:40 -04'00'

Nancy Schubert, P.E.

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The uplift, lateral parallel to rafter, and lateral perpendicular to rafter load testing was performed by installing the *All Tile Hook* assembly on a sample roof deck composed of 7/16" OSB board over 24" O.C. 2x4 Douglas Fir rafters, with load applied using the Universal Test Unit. Two *All Tile Hook* assemblies were used for the lateral perpendicular to rafter load testing. The compression load test was performed by installing the *All Tile Hook* as a system, including rails and PV modules, on a test roof composed of 7/16" OSB board over 24" O.C. 2x4 Douglas Fir rafters, with load applied using sandbags. The moisture content and specific gravity of the rafters was measured and recorded per ASTM D2395-17 "Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials." The recorded rafter Specific Gravity was 0.50 and moisture content in wood was less than 16%. For each test the loads were directly applied at the highest slot position along the center line of the arm as shown in Figure 1 to perform the tests at the worst configuration.

The ultimate failure mode found in uplift testing was withdrawal of the lag screws from the rafters. For the lag screw withdrawal failure mode, a safety factor of 3.0 per ASTM D7147 is used. The associated uplift deflection, measured concurrently with the failure load of 3457 lb., at the loading point was observed to be 3.5". To restrict system deformation under uplift loads, a deflection-based serviceability limit was applied, which consequently results in a reduced allowable capacity. Specifically, based on full scale uplift testing, a 1.5" vertical arm deflection is confirmed compatible with the full-scale system and presented as the serviceability limit for the uplift load direction. The serviceability limit determined **allowable uplift capacity is 377lb.**

The ultimate failure mode found in compression testing was yielding of the tile hook steel arm. The steel yielding failure mode with a safety factor of 1.67 per AISC 360 is applied to the peak failure load of 576lb, which provides an **allowable compression capacity of 345lb.**

The ultimate failure mode for lateral load parallel to the rafter was yielding of the tile hook steel arm. The steel yielding failure mode with a safety factor of 1.67 per AISC 360 is applied to the peak failure load of 151lb, which provides an **allowable lateral parallel to the rafter capacity of 90lb.**

The ultimate failure mode for lateral load perpendicular to the rafter was connection failure of the carriage bolt causing excessive rotation of the arm with respect to the base. For the connection failure mode, a safety factor of 2.0 per AISC 360-16 is used. To restrict system deformation under lateral loads, a deflection-based serviceability limit was applied, which consequently results in a reduced allowable capacity. Specifically, based on Instron lateral cross-slope testing of a pair of hooks, a 1" deflection is confirmed compatible with the full-scale system and presented as the serviceability limit for this load direction. The serviceability limit determined **allowable lateral perpendicular to the rafter capacity of 50lb.**

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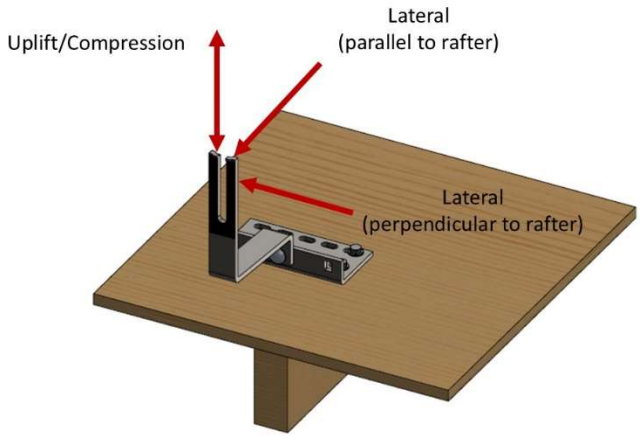


Figure 1

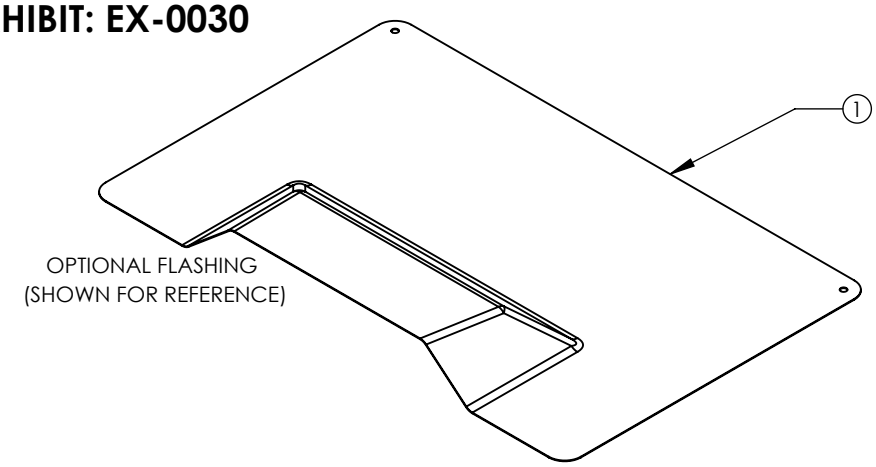
Observed test results and failure modes along with allowable capacities are summarized in Table 1.

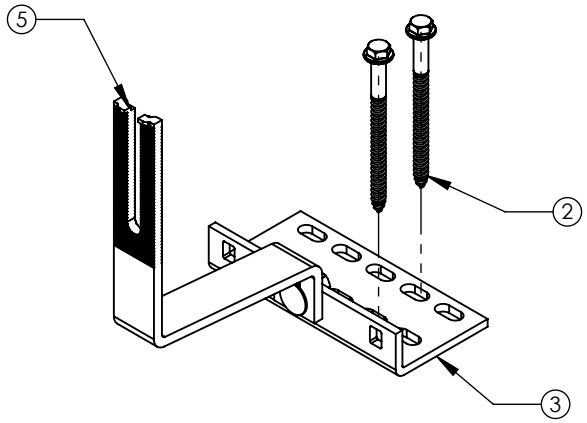
Table 1: All Tile Hook Assembly Allowable Capacities (1)

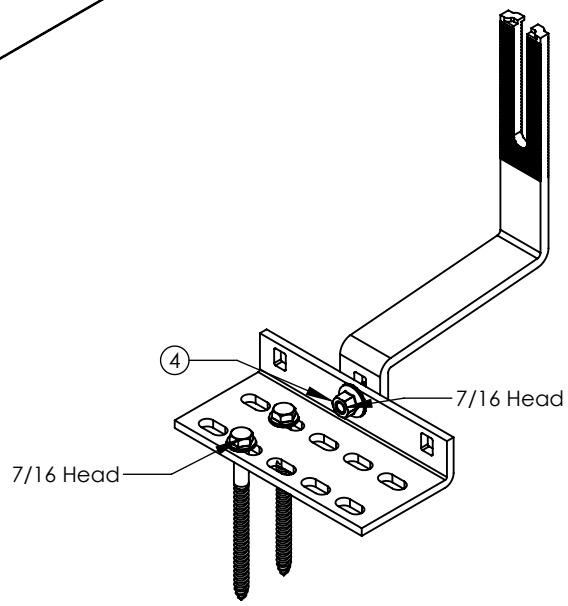
Load Direction	Test Quantity	Critical Failure Mode	Safety Factor (2)	Avg Ultimate Capacity (lb.)	Max deviation from mean (5)	Allowable Capacity (lb.) (6)
Uplift (3)	6	Lag Screw Withdrawal	3.0	3457	6.7%	377 (7)
Compression (4)	8	Hook Steel Yielding	1.67	576	4.8%	345
Lateral Parallel to Rafter	8	Hook Steel Yielding	1.67	151	11.3%	90
Lateral Perpendicular to Rafter	12	Carriage Bolt Connection Failure	2.0	124	47.7%	50(7)

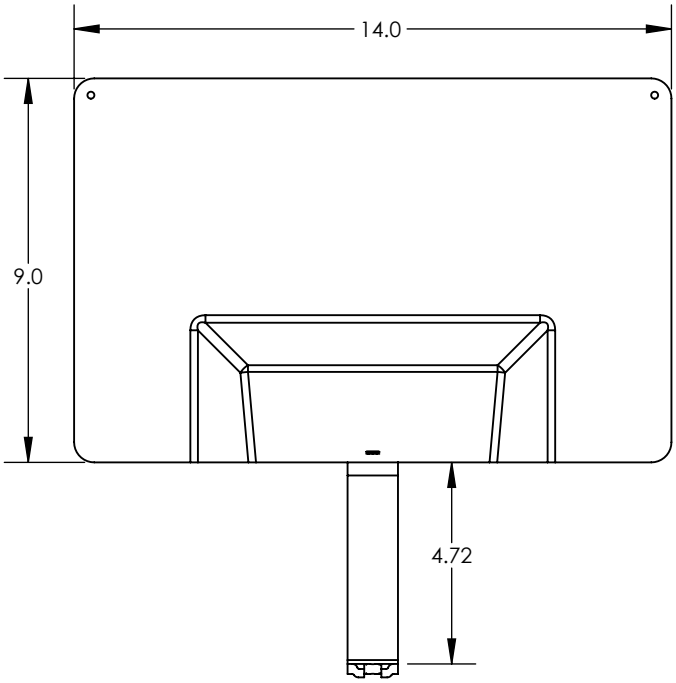
1) Capacities apply to a rafter size of 2x4 at 24” O.C or less, deck thickness of 7/16 or greater, rafter species having a Specific Gravity of 0.30 or greater. Values are based on securing the lag screws within the center 1/3 of rafter width and with a minimum 2.5” edge distance.
2) Safety factors are associated with the respective failure modes per ASTM 7147-21 and AISC 360-16.
3) Uplift load is upward perpendicular to the module surface.
4) Compression load is downward perpendicular to the module surface.
5) 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 were added per ADM-2020 Appendix 1.
6) Allowable Capacity is equal to Average Ultimate Capacity divided by its associated Safety Factor.
7) The provided Uplift and Lateral Perpendicular to Rafter Allowable Capacity is controlled by the specified serviceability limit.

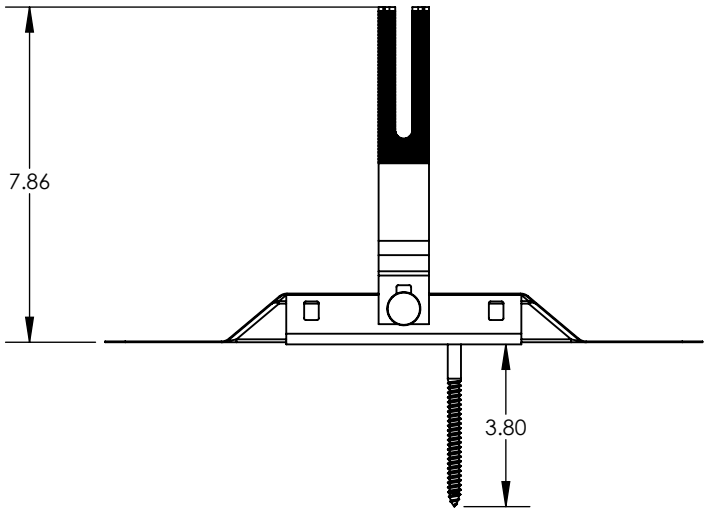
EXHIBIT: EX-0030











ITEM NO.	DESCRIPTION
1	ASSY, FLASHING (OPTIONAL)
2	BOLT, LAG 5/16 X 4"
3	ASSY, BASE
4	BOLT, CARRIAGE 5/16 x 1"
5	ARM, UNIVERSAL TILE HOOK

IRONRIDGE

Assy, QuickMount All Tile Hook

DWG. NO. EX-0030