

Attn: Corey Geiger, COO, IronRidge Inc.

Date: September 5th, 2019

Re: Structural Certification for the IronRidge FlashFoot2

This letter addresses the structural capacity of the IronRidge FlashFoot2 (FF2) component for use as a roof attachment for PV solar systems. FF2 is composed of an aluminum Cap, a 9" x 12" aluminum flashing, and an aluminum stabilizing base. The flashing component is attached to an underlying roof rafter using a 5/16" lag bolt. The assembly details are shown in Exhibit EX-0013.

The referenced uplift and lateral resistance of FF2 is based on structural tests conforming to ASTM D1761-12 "Standard Test Methods for Mechanical Fasteners in Wood." Testing was performed by installing a FF2 component on a sample roof deck composed of composition shingles covering 1/2" OSB Board over a 2x4 Douglas Fir rafter as shown in Figure 1. The moisture content and specific gravity of the rafter was measured and recorded per ASTM D2395-14 "Standard Test Methods for Density and Specific Gravity (Relative Gravity) of Wood and Wood-Based Materials." The moisture content for uplift test samples was between 8% and 15% with an average specific gravity of 0.54. The moisture content for lateral test samples was 13% with an average specific gravity of 0.54.

The critical failure mode observed for both the uplift and lateral tests was pullout of the 5/16" lag screw from the rafter. The average peak loads recorded at the critical failure point for the uplift and lateral tests were 3203 lbs. and 1237 lbs., respectively. **A safety factor of 3.0 was applied to certify the allowable uplift capacity to 1067 lbs. and the allowable lateral capacity to 412 lbs. for a substrate with a specific gravity of 0.54.**

For rafter wood species with specific gravity other than 0.54, the allowable uplift capacity shall be adjusted by a factor of $\left(\frac{G}{0.54}\right)^{\frac{3}{2}}$ per AP&PA National Design Specification Eq. (12.2-1), and the allowable lateral capacities shall be adjusted per the equation $1 - (0.5 - G)$ from APA Engineering Wood Construction Guide APA 2011 (G is wood specific gravity). For the common wood species, the allowable capacities are provided in Table 1.

Wood Species	NDS Assigned Specific Gravity ⁽²⁾	Allowable Uplift Capacity (lbs) ⁽³⁾	Allowable Lateral Capacity (lbs) ⁽³⁾
Douglas Fir, Larch	0.50	951	396
Douglas Fir, South	0.46	839	380
Hem, Fir	0.43	758	368
Hem, Fir (North)	0.46	839	380
Southern Pine	0.55	1097	416
Spruce, Pine, Fir	0.42	732	364

(1) The minimum size rafter is 2x4.

(2) The listed specific gravities are per 2015 NDS Table 12.3.3A.

(3) Values are based on securing lag bolt within center 1/3 of rafter width with a minimum 2.5" end distance, and loading directions as shown in Figure 1.

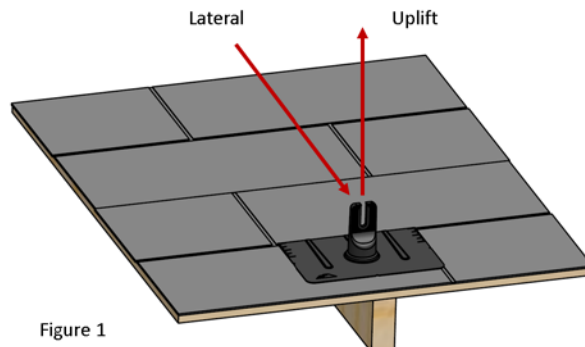


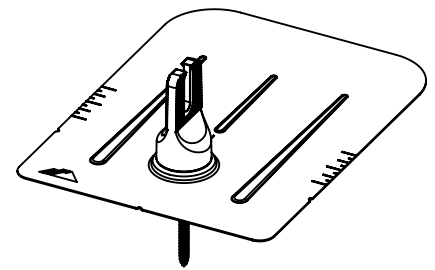
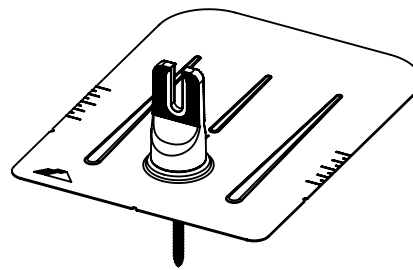
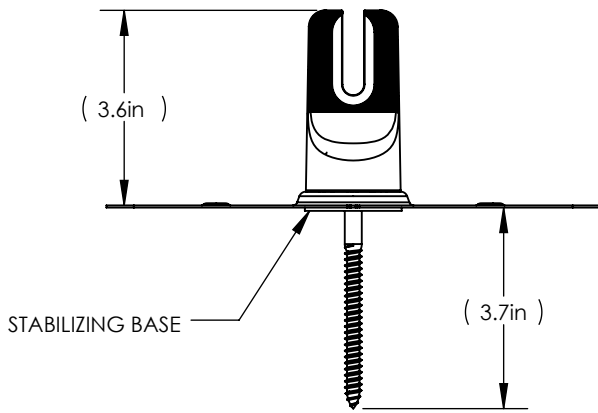
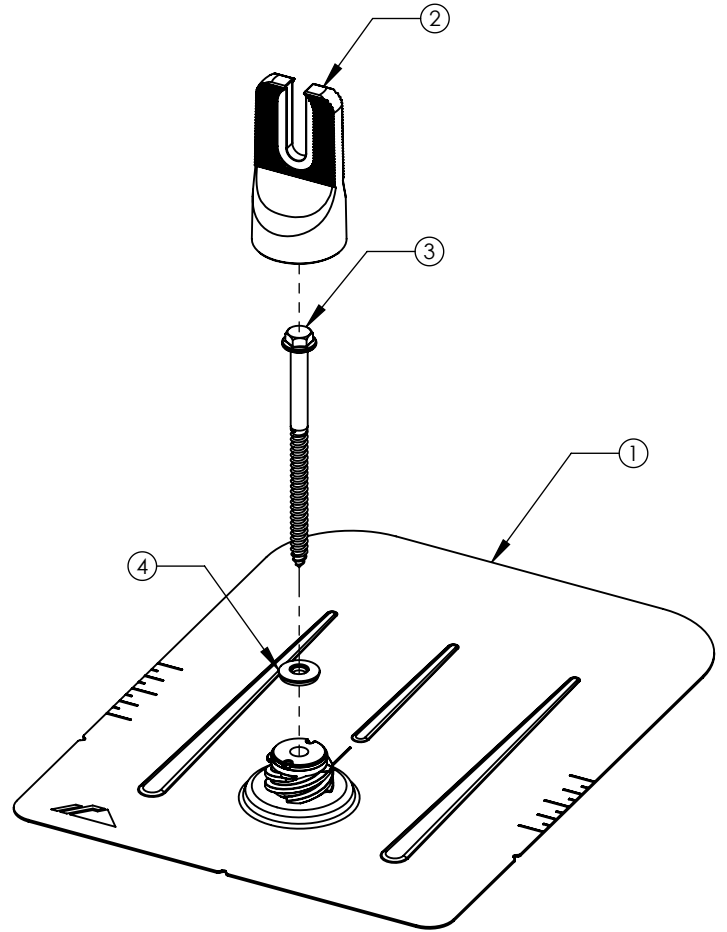
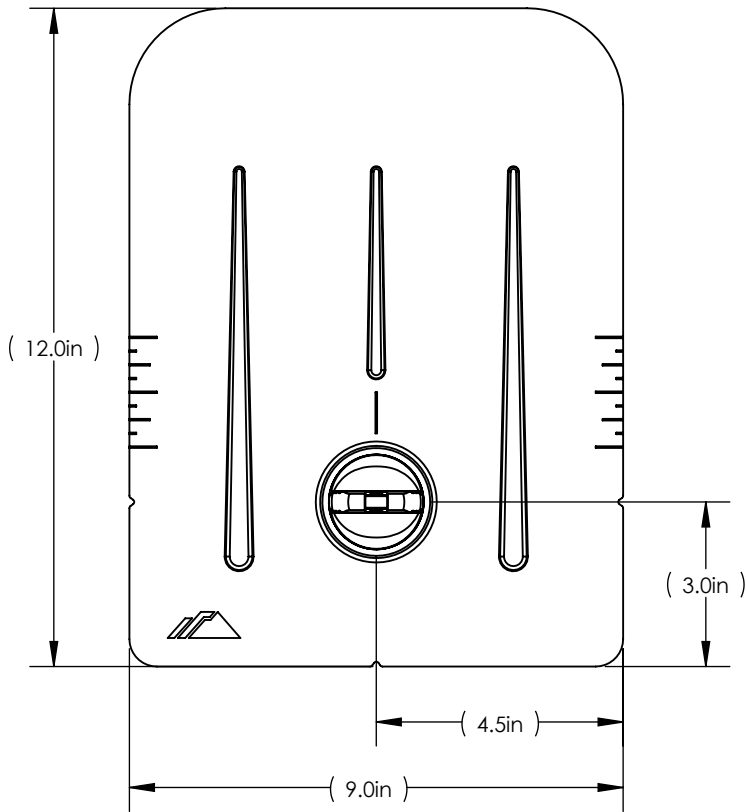
Figure 1

Sincerely,



Gang Xuan, SE
Senior Structural Engineer

EXHIBIT: EX-0013



FlashFoot2 Cap can be installed in either orientation shown

ITEM NO.	DESCRIPTION
1	ASSY, FLASHING, MILL OR BLACK
2	ASSY, CAP, MILL OR BLACK
3	BOLT LAG 5/16 X 4.75"
4	WASHER, EPDM BACKED



IRONRIDGE

ASSY, FLASHFOOT2
DWG. NO. EX-0013