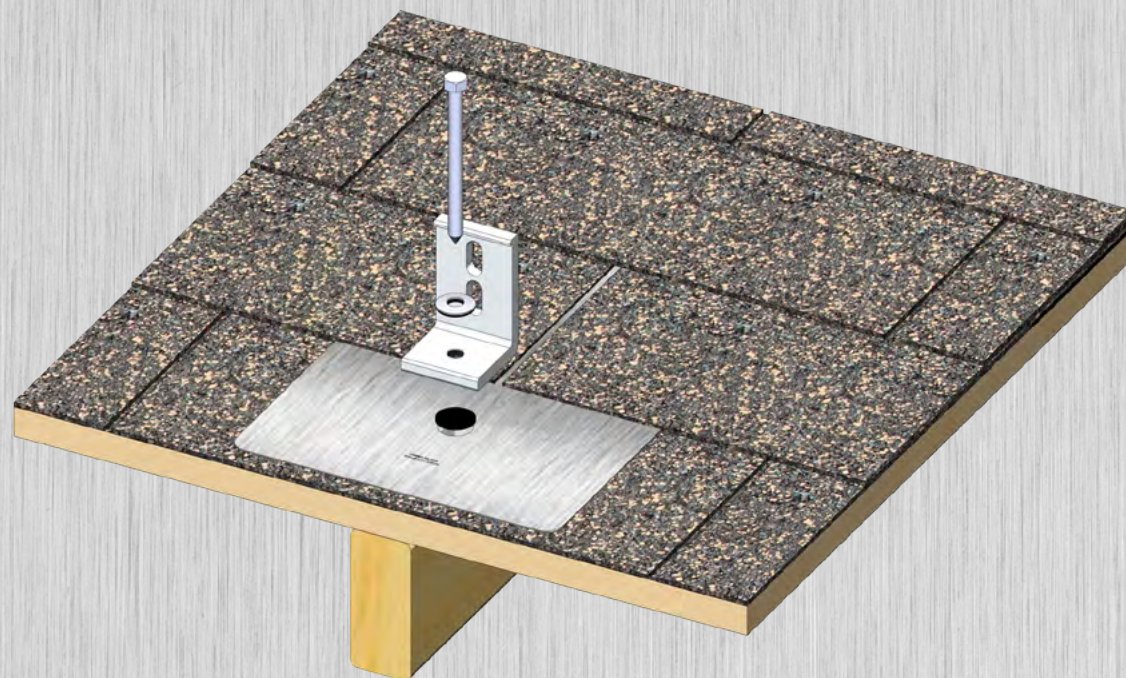
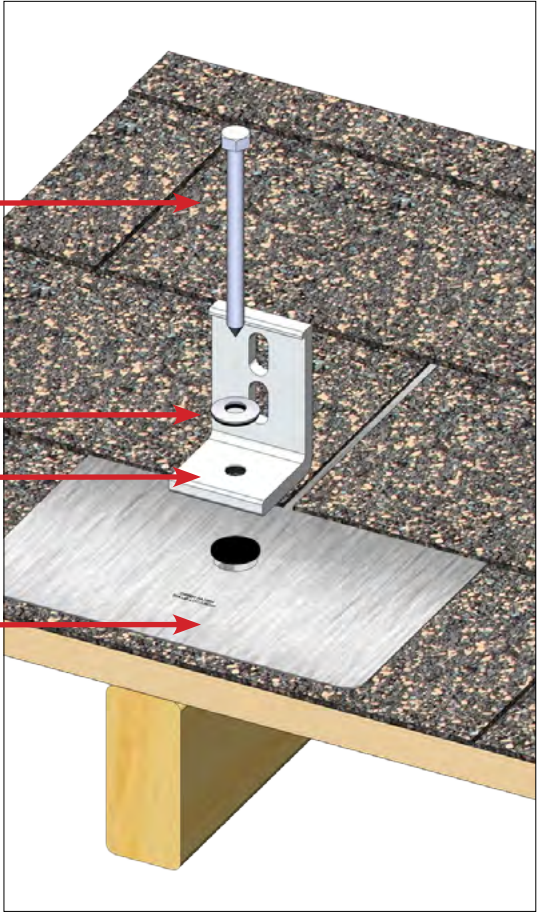


STEEP-SLOPE APPLICATIONS

GreenFasten™ GF1 PRODUCT GUIDE

- Exploded Product View/B.O.M. – 1
- Installation Instructions – 2
- Cut Sheets – 3
- Specifications – 4
- Test Data – 5
- Price List – 6

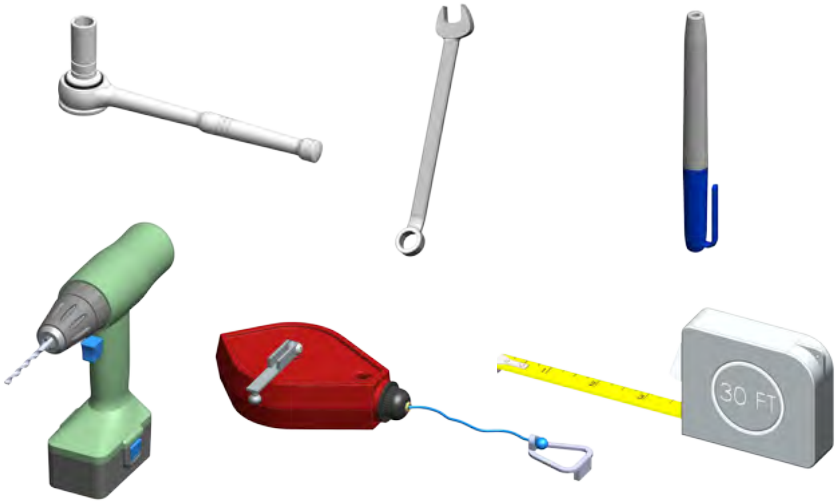




Materials Needed for Assembly

| Item No. | Description of Material/Part | Quantity |
|----------|--|----------|
| 1 | GF-1 Flashing | 1 |
| 2 | L-102-3" Bracket * (other options available) | 1 |
| 3 | 5/16" EPDM Bonded 304-18.8 SS Washer | 1 |
| 4 | Lag Bolt 5/16" | 1 |

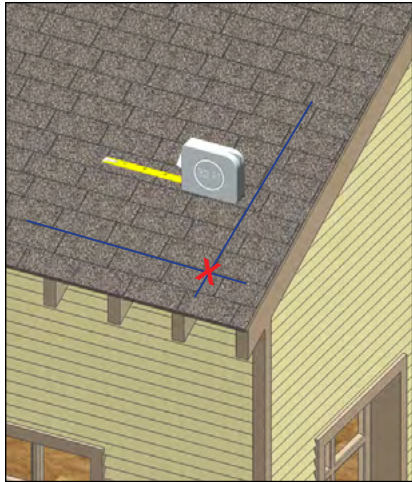
Required Tools



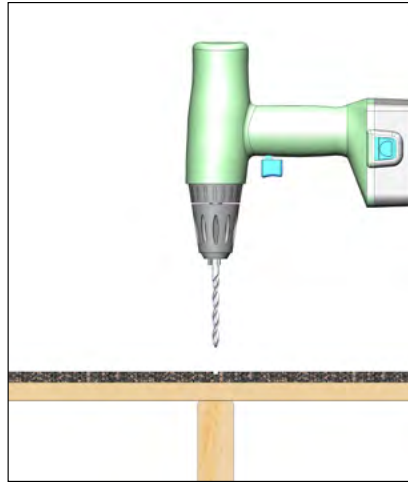
EcoFasten Solar



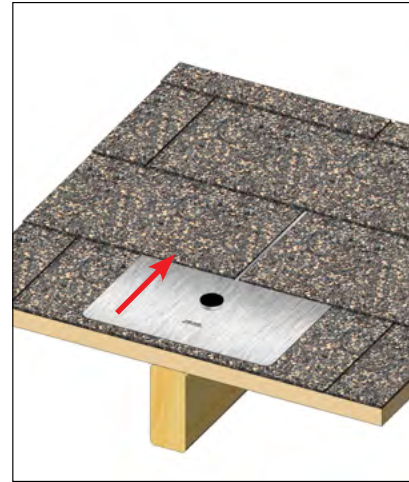
EcoFasten Solar



1



2



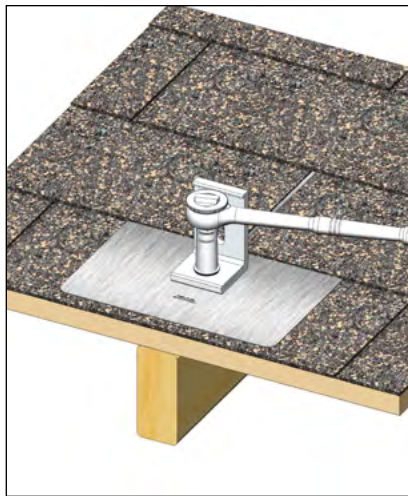
3



4



5



6

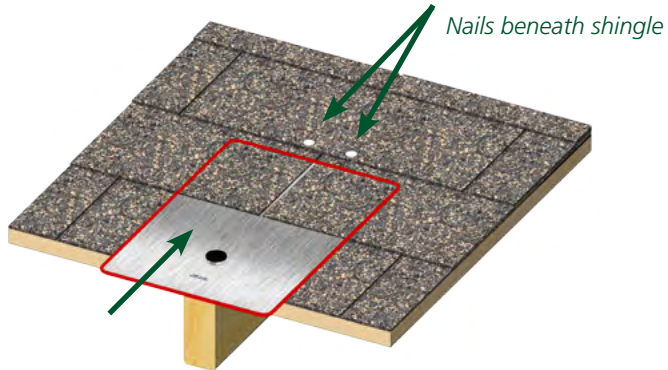
1. Locate the rafters and snap horizontal and vertical lines to mark the installation position for each GreenFasten flashing.
2. Drill a pilot hole (1/4" diameter) for the lag bolt. Backfill with sealant.*
3. Insert the flashing so the top part is under the next row of shingles and pushed far enough up slope to prevent water infiltration through vertical joint in shingles.
4. Line up pilot hole with GreenFasten hole.
5. Insert the lag bolt through the EPDM washer, the top compression component (L-Bracket pictured) and the gasketed hole in the flashing and into the rafter.
6. Torque to 140 inch-pounds

Consult an engineer or go to www.ecofastensolar.com for engineering data.

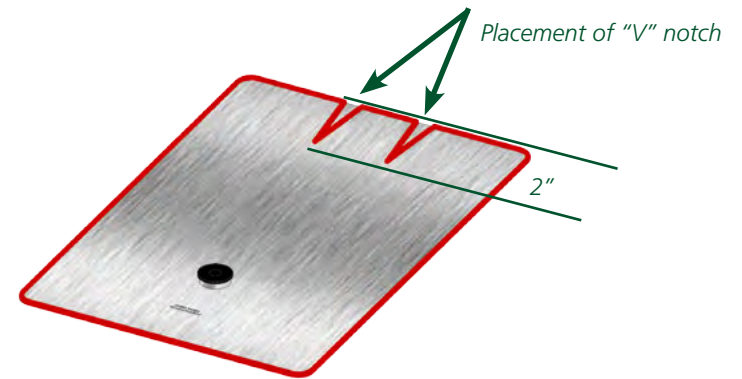
*EcoFasten recommends an EPDM mastic.

* Use for vertical adjustment when leading edge of flashing hits nails in upper shingle courses

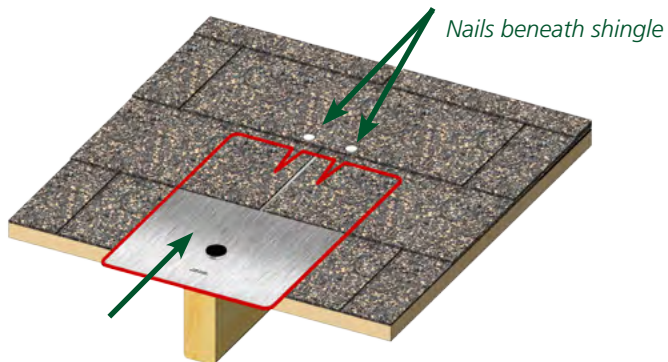
1. Slide flashing up under shingles until leading edge engages nails. Measure remaining distance to adjust upslope.



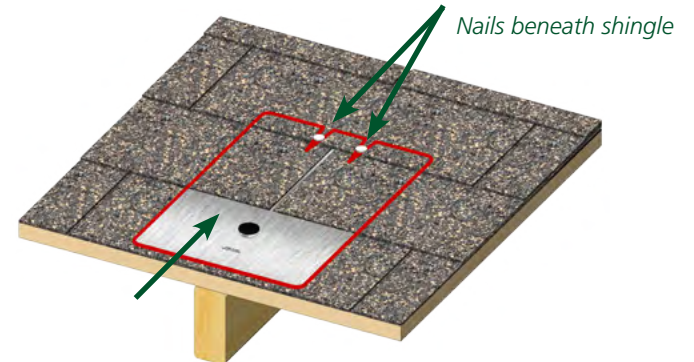
2. Remove flashing and cut "V" notch at marks where nail shafts engaged leading edge of flashing the distance desired in Step 1. Notch depth not to exceed 2" length by 1/2" width.

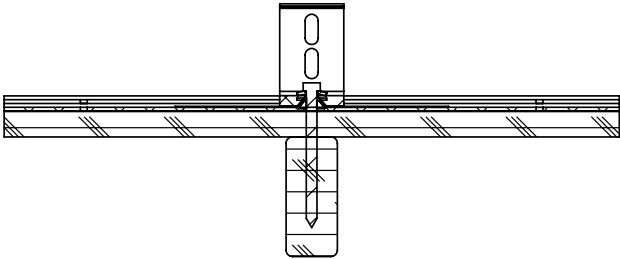
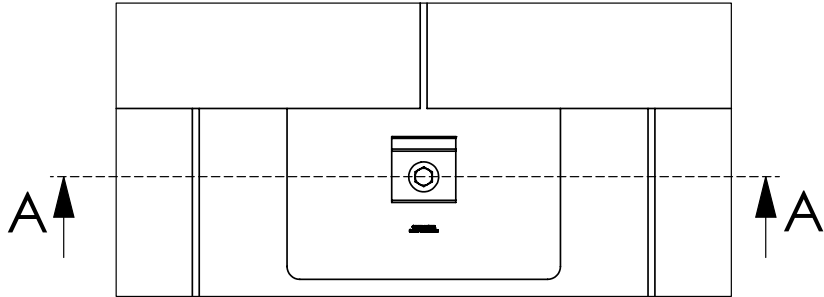


3. Reinstall flashing with notched area upslope.



4. Position notched leading edge underneath nail heads as shown.



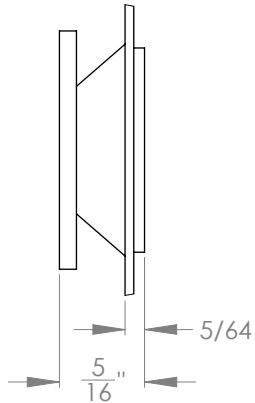
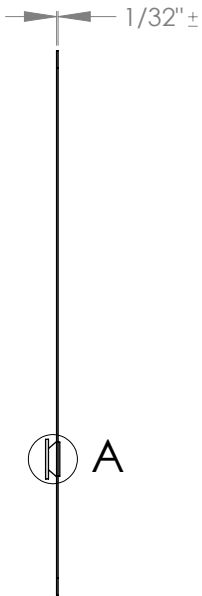
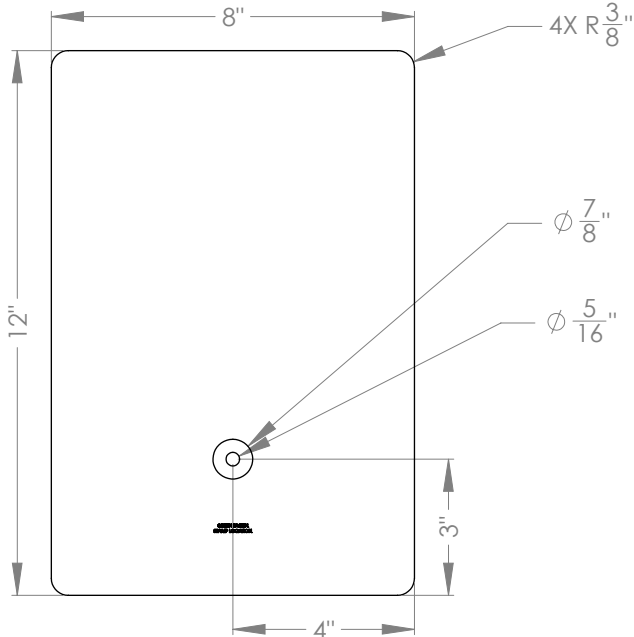


SECTION A-A

EcoFasten Solar



EcoFasten Solar

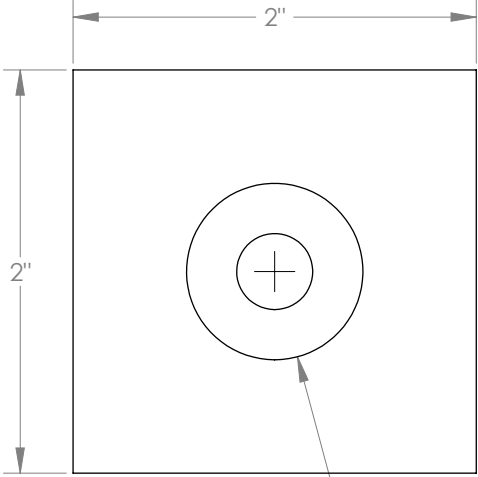
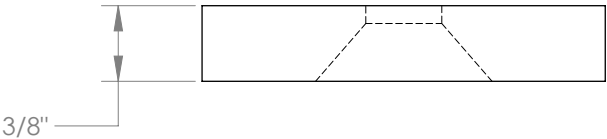


DETAIL A
SCALE: 2:1

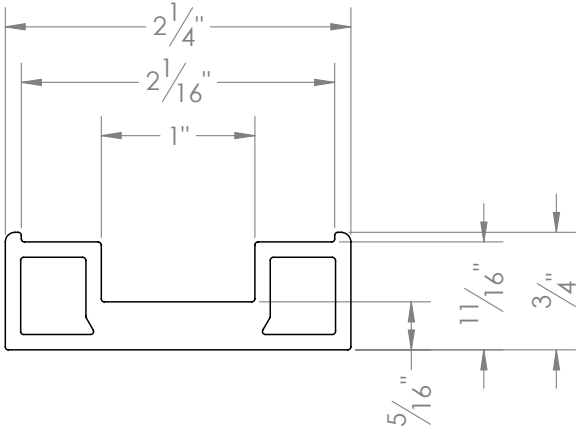
Finish Options
 BLK = Matte Black
 MLL = Mill Finish



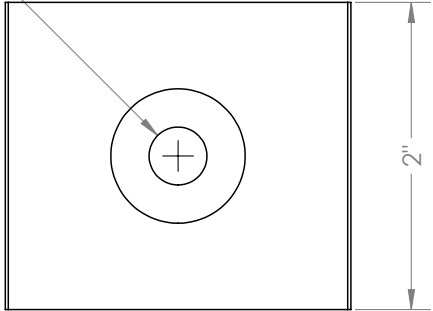
EcoFasten Solar



∅ 3/8" ^{+0.01}/_{-.00} THRU ALL
∇ ∅ 7/8" ±.01 X 82°, NEAR SIDE



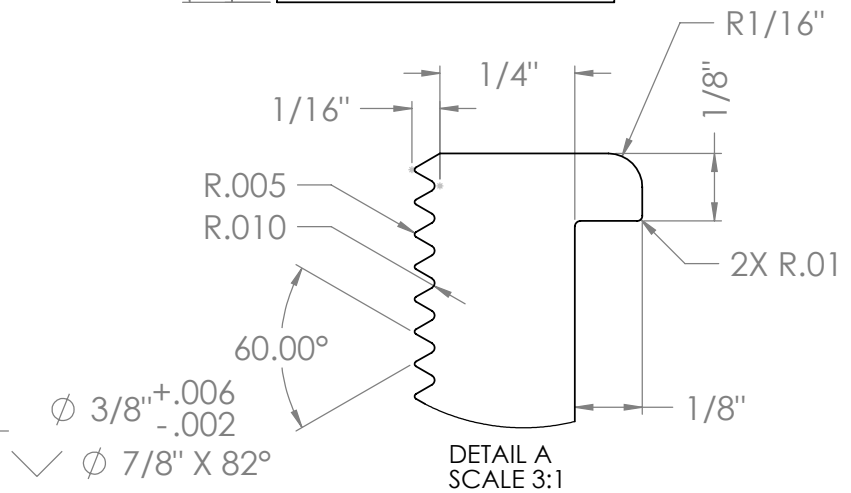
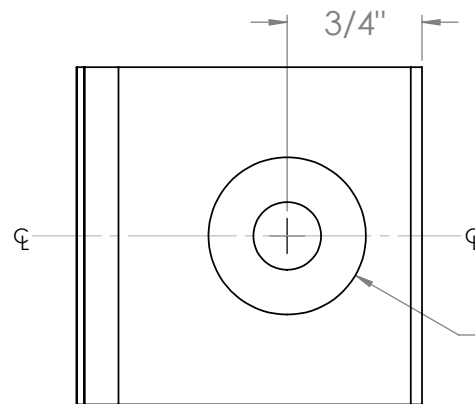
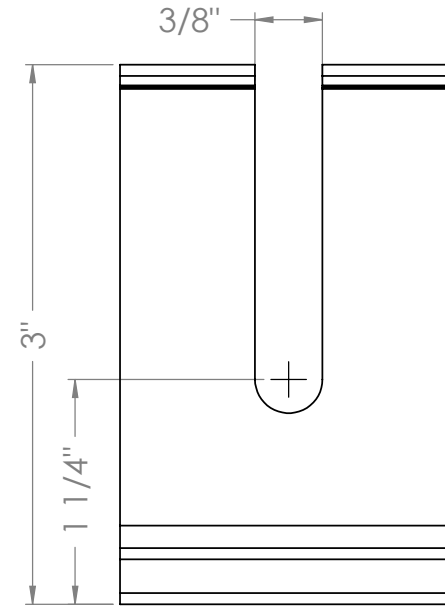
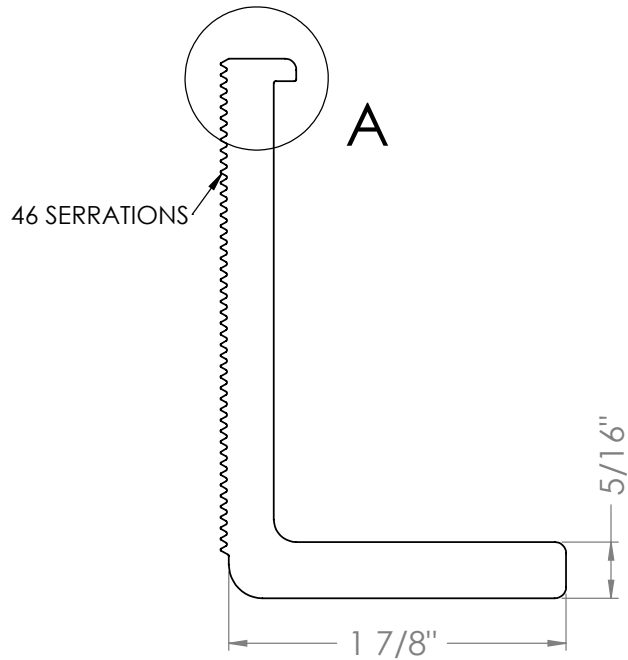
$\phi \frac{3}{8}$ " THRU ALL
 $\checkmark \phi \frac{7}{8}$ " X 82°, NEAR SIDE



EcoFasten Solar



EcoFasten Solar

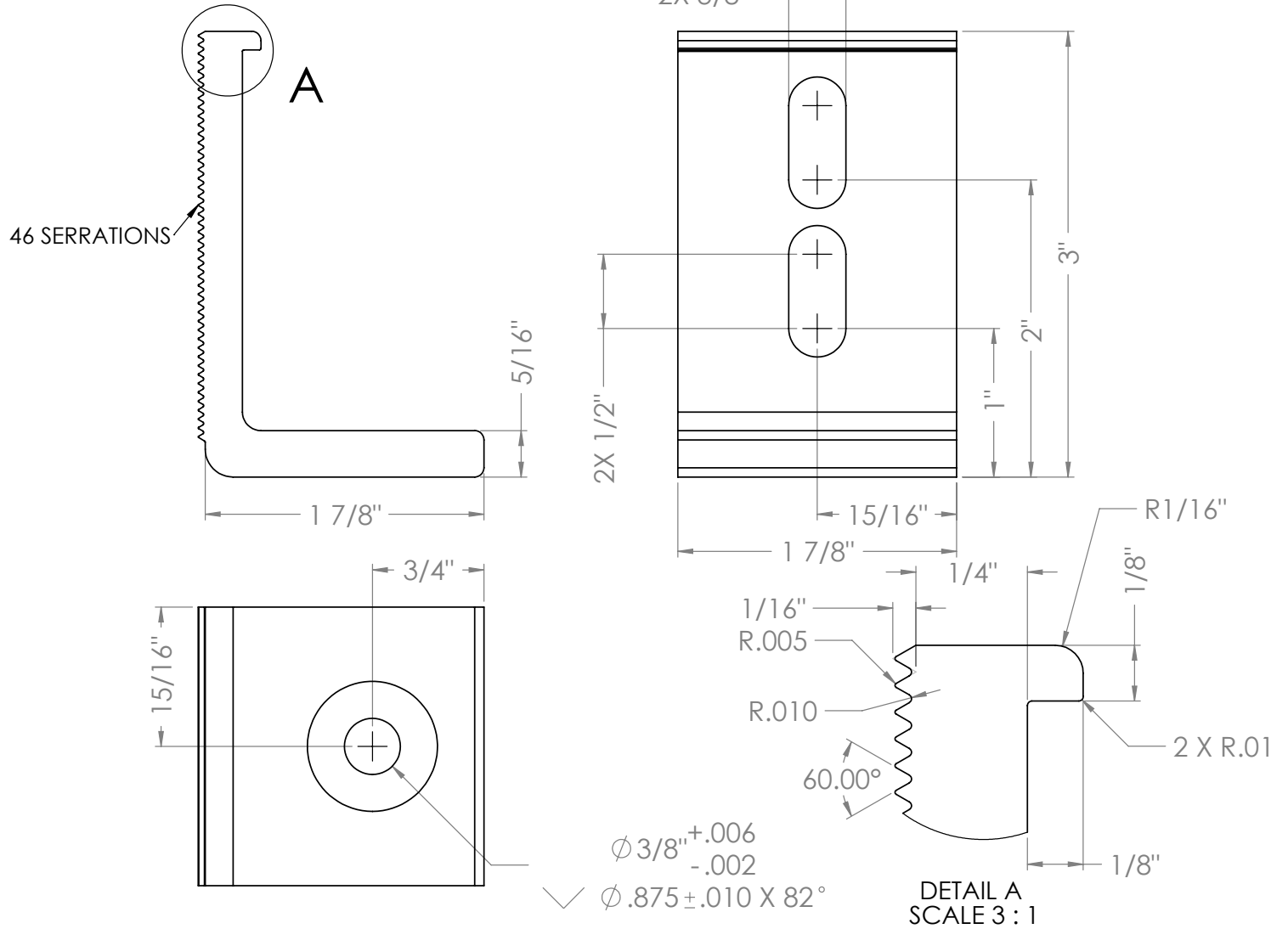


Ø 3/8" +.006
-.002

✓ Ø 7/8" X 82°

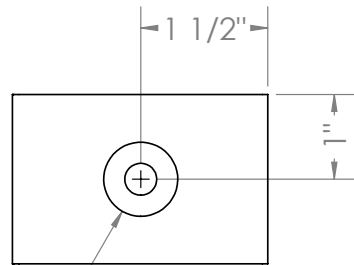
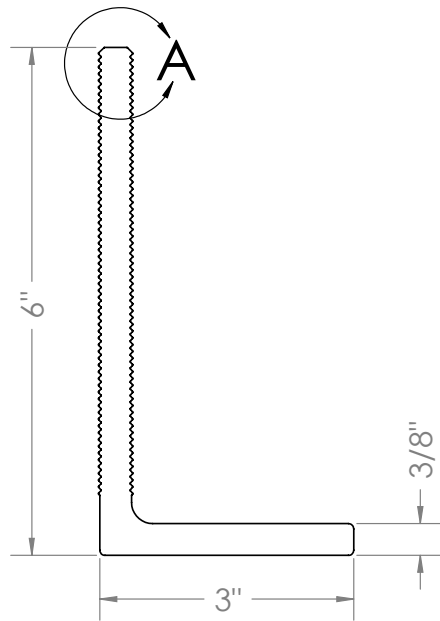


EcoFasten Solar

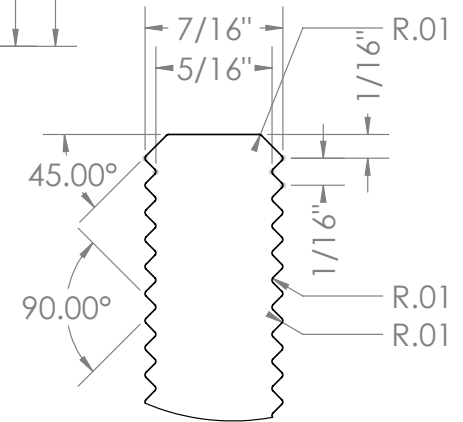
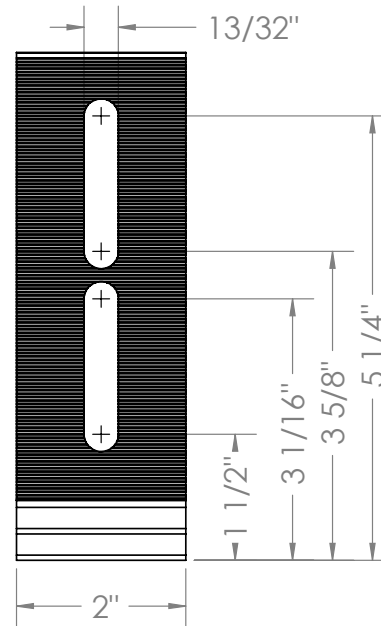




EcoFasten Solar



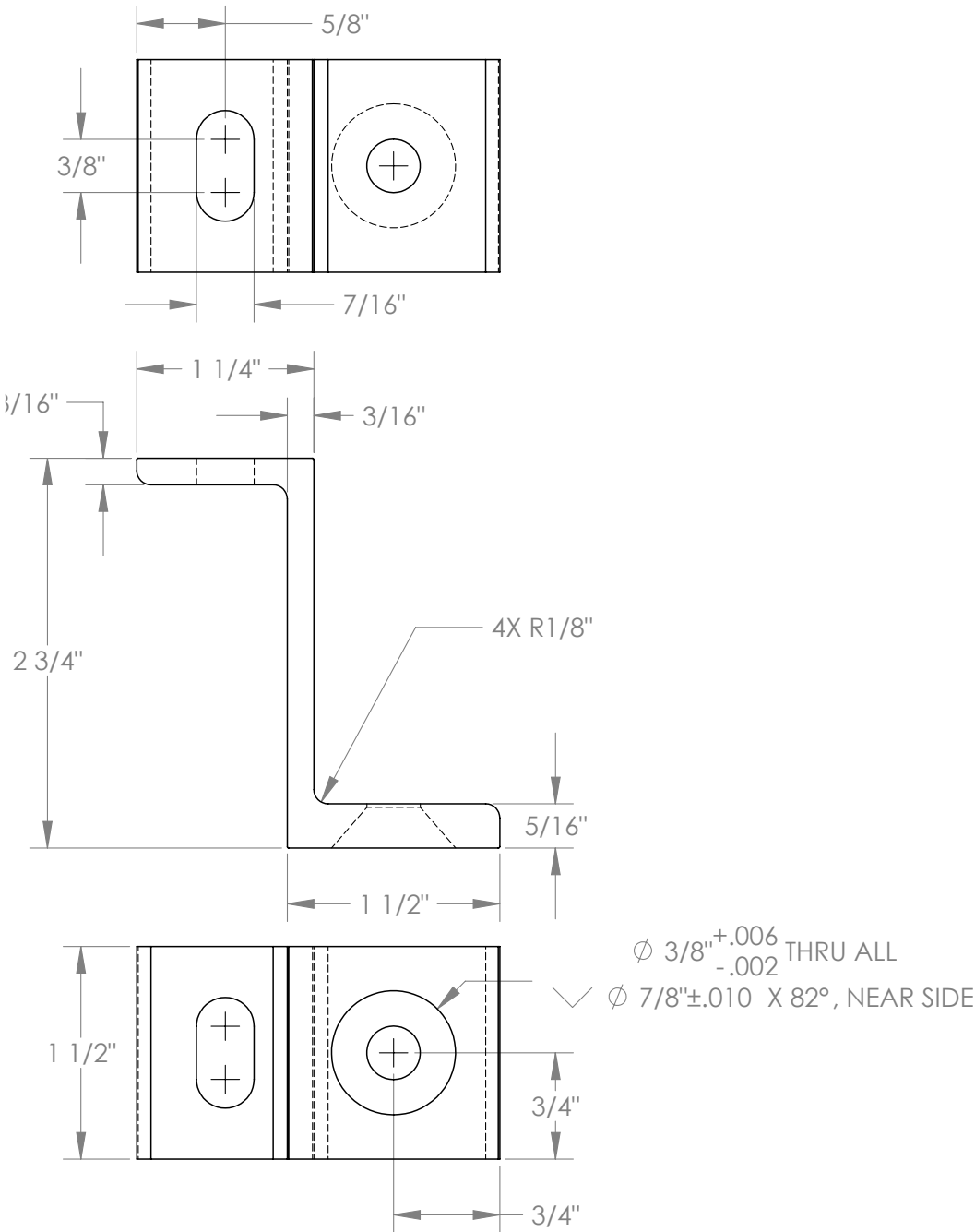
$\phi 3/8^{+.01}_{-.00}$ THRU ALL
 $\checkmark \phi 7/8^{(\pm.01)} \times 82^\circ$, NEAR SIDE



DETAIL A
 SCALE 2 : 1



EcoFasten Solar



PART 1 – GENERAL

1.1 SUMMARY

- A. WORK INCLUDES
- GreenFasten solar attachment bracket that attaches directly to the roof deck.
 - Provide appropriate bracket and fasteners for the roof system.

B. RELATED SECTIONS

- Section 07600: Flashing and Sheet Metal
- Section 07500: Roofing
- Division 1: Administrative and Procedural Requirements
- Division 7: Thermal and Moisture Protection

1.2 SYSTEM DESCRIPTION

A. COMPONENTS:

- GreenFasten GF1 system consists of aluminum flashing with integral EPDM bushing and one bonded stainless steel and EPDM washer.
- Fasteners
 - To be of metal compatible with aluminum GreenFasten components.
 - Fasteners should be selected for compatibility with the roof deck.
 - Fastener strength should exceed or be equal to that of the allowable load of the system. See test data at www.ecofastensolar.com
- Sealant (if required by roof manufacturer): to be roof manufacturer approved.
- Aluminum compression bracket

B. DESIGN REQUIREMENTS:

- Bracket spacing to be recommended by project engineer.
- Install a minimum of one fastener per assembly.
- It is important to design new structures or assess existing structures to make sure that they can withstand retained loads.

1.3 SUBMITTAL

- Submit manufacturer's written specifications.
- Submit standard product cut sheets.
- Submit installation instructions.
- Submit product specific load test data, showing ultimate and allowable load values.

1.4 QUALITY ASSURANCE

Installer to be experienced in the installation of specified roofing material for no less than 5 years in the area of the project.

1.5 DELIVERY / STORAGE / HANDLING

Inspect material upon delivery. Notify manufacturer within 24 hours of any missing or defective items. Keep material dry, covered, and off the ground until installed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

EcoFasten Solar®
289 Harrel Street, Morrisville, VT 05661
(877) 859-3947
www.ecofastensolar.com

2.2 MATERIALS

- A. Attachment Bracket
6000 Series Aluminum (choose one)
- CP-SQ
 - F-111-A
 - L-102-3"
 - L-102-6"
 - SCL-101-3"
 - Z-101
 - Custom
- B. Fasteners (may be supplied by others) to be compatible with chosen roof application and meet specified pull out values as shown in load test data.

- Base flashing is .032 gauge aluminum embossed to accept EPDM bushing.
- Bushing is EPDM.
- Stainless steel bonded washer is 304 18.8 stainless and EPDM.

2.3 FINISH – Mill Finish

- A. Bracket is mill finish aluminum
- B. Base flashing (choose one)
- Mill Finish
 - Black - kynar painted

PART 3 - EXECUTION

3.1 EXAMINATION

- Substrate: Inspect structure on which brackets are to be installed and verify that it will withstand any additional loading that may be incurred.
- Notify General Contractor of any deficiencies before installing EcoFasten Solar brackets.
- Verify that roofing material has been installed correctly prior to installing solar attachment brackets.

3.2 INSTALLATION

- Comply with architectural drawings and project engineer's recommendations for location of system. Comply with Manufacturer's written installation instructions for installation and layout.



Lag pull-out (withdrawal) capacities (lbs) in typical roof lumber (ASD)

| | Specific Gravity | Lag screw specifications | |
|---|------------------|---------------------------------------|--|
| | | 5/16" shaft* per inch thread depth | |
| Douglas Fir, Larch | .50 | 266 | |
| Douglas Fir, South | .46 | 235 | |
| Engelmann Spruce, lodge pole Pine (MSR 1650 f & higher) | .46 | 235 | |
| Hem, Fir, Redwood (close grain) | .43 | 212 | |
| Hem, Fir (North) | .46 | 235 | |
| Southern Pine | .55 | 307 | |
| Spruce, Pine, Fir | .42 | 205 | |
| Spruce, Pine, Fir (E of 2 million PSI and higher grades of MSR and MEL) | .50 | 266 | |

EcoFasten Solar

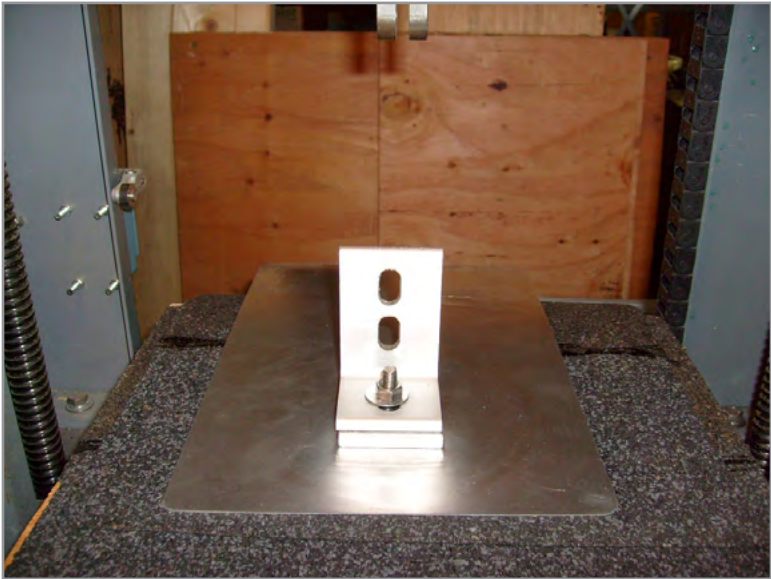
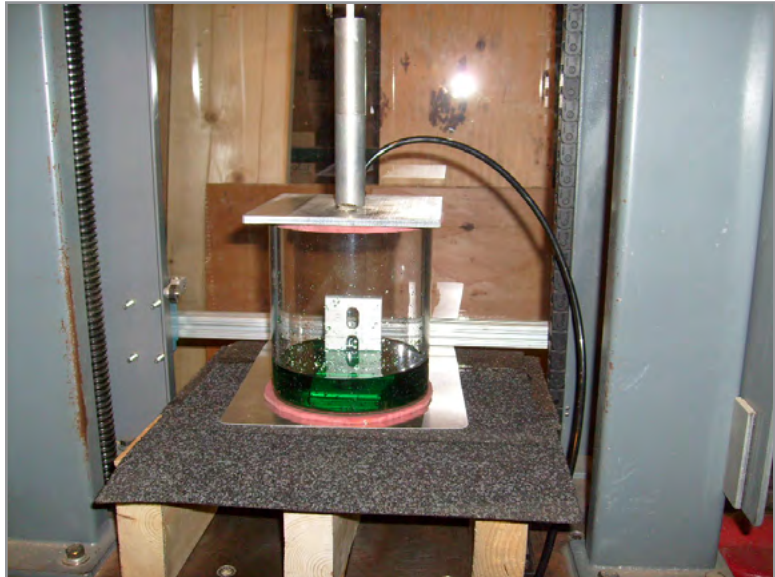


Wood Blocking Leak Test

EcoFasten Solar® tested the GreenFasten roof mount system so you can be sure your roof penetrations won't leak, even when under standing water.

Our test apparatus encapsulates the entire bracket and seals against the flashing which allows us to flood the bracket and pressurize the system.

After the apparatus is flooded it's pressurized to 30psi and left to stand for over 10 minutes. This is equivalent to nearly 70ft of standing water.



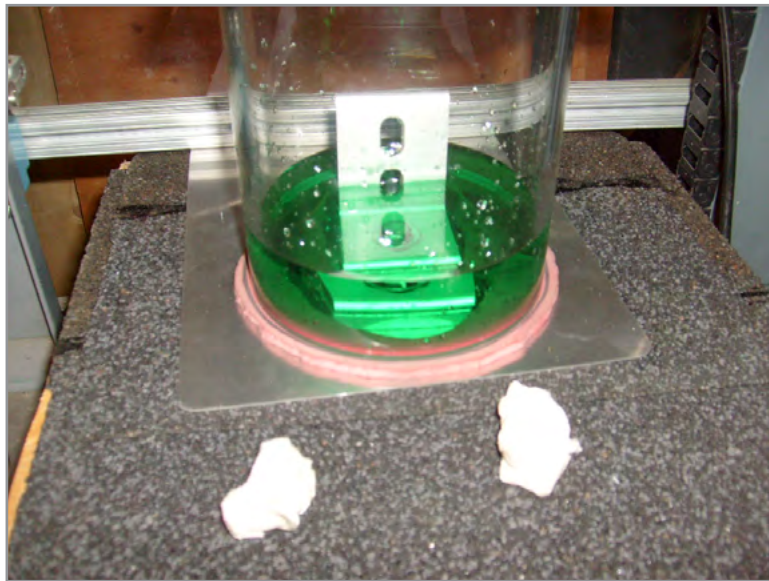
EcoFasten Solar



Wood Blocking Leak Test (continued)

If there were a leak, an oversized hole in the roof deck and notch in the rafter would allow unrestricted flow to two paper towels that are stuffed around the fastener. To make it clear if there was a leak, the water is dyed green.

Neither of the paper towels show any indication of leaking. The GreenFasten system is 100% water tight.





EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

DIVISION: 06—WOOD AND PLASTICS
Section: 06060—Connections and Fasteners

REPORT HOLDER:

EcoFasten Solar®
 289 Harrel Street
 Morrisville, Vermont 05661
 Phone: 888-766-4273
brian@alpinesnowguards.com

EVALUATION SUBJECT:

EcoFasten Solar, GreenFasten-1-812 Roof Mount Assembly

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes

- 2009 International Building Code® (IBC)
- 2009 International Residential Code (IRC)
- 2006 International Building Code® (IBC)
- 2006 International Residential Code (IRC)

1.2 Evaluated in accordance with

- IAPMO ES Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors, (EC002-2011).

1.3 Property Evaluated

- Structural
- Water Penetration

2.0 USES

The EcoFasten Solar, GreenFasten-1-812 Roof Mount is a mounting assembly used to attach solar panels and other types of equipment to the rafters of roofs with asphalt shingle roof coverings.

3.0 DESCRIPTION

3.1 Product Information

3.1.1 EcoFasten Solar, GreenFasten-1-812: The GreenFasten-1-812 Roof Mount has four basic components: an aluminum flashing with pre-installed

EPDM grommet (GF-1), one-hole bracket (L-101-3), slotted bracket (SCL-101-3) or two-hole brackets (L-102-3), 5/16" Lag bolt, and EPDM bonded 18.8 washers. See published installation instructions for more detailed dimensional information.

3.2 Materials

The GreenFasten-1-812 Roof Mount component material standards are specified in Table 2.

Fasteners used to secure the flashing to the roof rafter must be 5/16-inch-diameter (7.9 mm) lag bolts complying With ANSI/AMSE B18.2.1-B1. The lag bolt must be long enough to penetrate the rafter a minimum of 2.5 inches (64 mm). The lag bolts must be corrosion-resistant, see table 12 QSM for pull out capacities for typical roof lumber (ADS).

4.0 DESIGN AND INSTALLATION

4.1 Design

Compliance to the following will be provided by the Designer/Engineer if requested by the jurisdiction having authority: The tabulated allowable loads shown in this report are based on allowable stress design (ASD) and include the load duration factor, C_D , corresponding with the applicable loads in accordance with NDS.

Where the roof mounts are exposed to temperatures exceeding 100°F (37.8°C), uplift allowable loads must be adjusted by the temperature factor, C_t , in accordance with Section 10.3.4 of the NDS temperature factor, C_t , which applies to the roof mount connected to supporting wood members where sustained temperatures are greater than 100°F (37.8°C). When products are attached to wood framing having a moisture content greater than 19 percent (16 percent for engineered wood products), or where wet service is expected, the allowable loads must be adjusted by the wet service factor, C_M , specified in Section 10.3.3 of the NDS. Connected wood members must be analyzed for load-carrying capacity at the connection in accordance with the NDS.

4.2 Installation

The EcoFasten Solar, GreenFasten-1-812 Roof Mount must be installed to the rafter using one lag screw at each bracket location as described in the published

Page 1 of 5

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EcoFasten Solar

EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

installation instructions. The minimum specific gravity of the wood member 0.42. The flashing must be placed underneath the shingle far enough up slope to prevent water infiltration. Installation of the EcoFasten, GreenFasten-1-812 Roof Mount is limited to roofs having minimum and maximum slopes of 3:12 (14 percent) and 12:12 (45 percent), respectively.

5.0 CONDITIONS OF USE

The EcoFasten Solar, GreenFasten-1-812 Roof Mount described in this report complies with the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The EcoFasten Solar, GreenFasten-1-812 Roof Mount must be installed in accordance with this report the manufacturer's published installation instructions, codes listed in Section 1.1 and the supplement.

5.2 Calculations (If requested) showing compliance with this report must be submitted to the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Fasteners used in contact with fire-retardant-treated or preservative-treated lumber must comply with IBC Section 2304.9.5 or the 2009 IRC Section R317.3 (2006 IRC Section R319.3), as applicable. The report holder or lumber treater should be contacted for recommendations on minimum corrosion resistance and connection capacities of fasteners used with the specific proprietary preservative-treated or fire-retardant treated lumber.

5.4 When required by the jurisdiction having authority a licensed design professional shall provide calculations to verify that imposed loads on the assembly do not exceed the allowable loads contained in Table 1 of this report.

5.5 When required by the jurisdiction having authority a licensed design professional shall provide calculations for the assembly support framing.

6.0 EVIDENCE SUBMITTED

Testing and analysis data submitted is in conformance with IAPMO ES Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors, (EC002-2011). Rain test data is in conformance with the Underwriters Laboratory Standard for Gas Vents, (UL 441-96 Section 25). Test results are from laboratories in compliance with ISO/IEC 17025.

7.0 IDENTIFICATION

The EcoFasten Solar, GreenFasten-1-812 Roof Mount is identified with a label bearing the Manufacturers name and address, product designation, IAPMO ES Mark of Conformity, this evaluation report number (Evaluation Report 0216), compliance code, and inspection agency.



IAPMO #0216

Director of Evaluation Services



EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

Table 1: Allowable Load Tables based on Specific Gravity

| Load Direction | Part | Specific Gravity of Lumber | Allowable Load (lb.) |
|----------------|-----------|----------------------------|----------------------|
| Uplift | L-101-3 | 0.52 | 741 |
| Uplift | L-102-3 | 0.42 | 653 |
| Uplift | SCL-101-3 | 0.47 | 642 |
| Lateral | L-101-3 | 0.52 | 298 |
| Lateral | L-102-3 | 0.42 | 293 |
| Lateral | SCL-101-3 | 0.47 | 297 |

Table 2: Material Properties

| | | |
|----------------------------------|---|------------------|
| Hex Lag screw | ANSI/AMSE B18.2.1-B1 see table 12 QSM for pull out capacities for typical roof lumber (ADS) | Figure 1 |
| Aluminum Bracket | AAS-6061 | Figure 2 , 5 & 6 |
| EPDM Metal roof bushing (washer) | Type 304 stainless steel complying with ASTM A 240 | Figure 3 |
| EPDM Grommet | ASTM D412, D297, D2240, and ASTM D624, with a durometer rating of 60 | Figure 4 |
| Flashing | ASTM B-209, ASTM E-1251, and ASTM B-557 | Figure 4 |

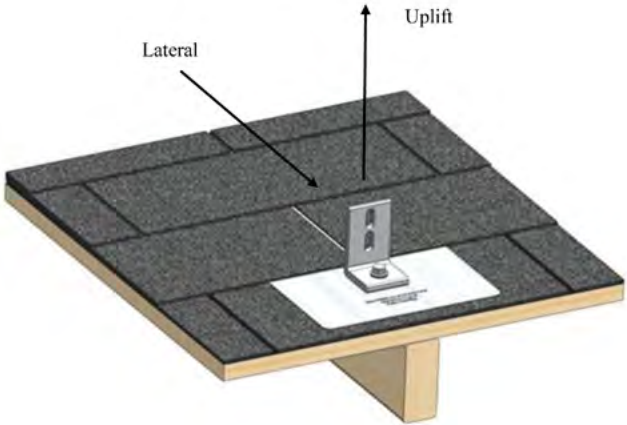


EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

Load Orientation/Direction Detail



Building Green with EcoFasten Solar®

EcoFasten Solar



EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

EcoFasten Solar Components



Figure 1:
Lag Screw



Figure 2: L-102-3



Figure 3:
EPDM
Metal roof
bushing



Figure 4:
EPDM
Grommet



Figure 5: L-101-3



Figure 6: SC L-101-3



Building Green with EcoFasten Solar®

EcoFasten Solar



EcoFasten Solar

EVALUATION REPORT



Report Number: 0216
Issued: 04/2011
Expires: 04/2012

SUPPLEMENT

DIVISION: 06—WOOD AND PLASTICS
Section: 06060—Connections and Fasteners

REPORT HOLDER:

EcoFasten Solar®
289 Harrel Street
Morrisville, Vermont 05661
Phone: 888-766-4273
brian@alpinesnowguards.com

EVALUATION SUBJECT:

EcoFasten Solar, GreenFasten 1-812 Roof Mount Assembly

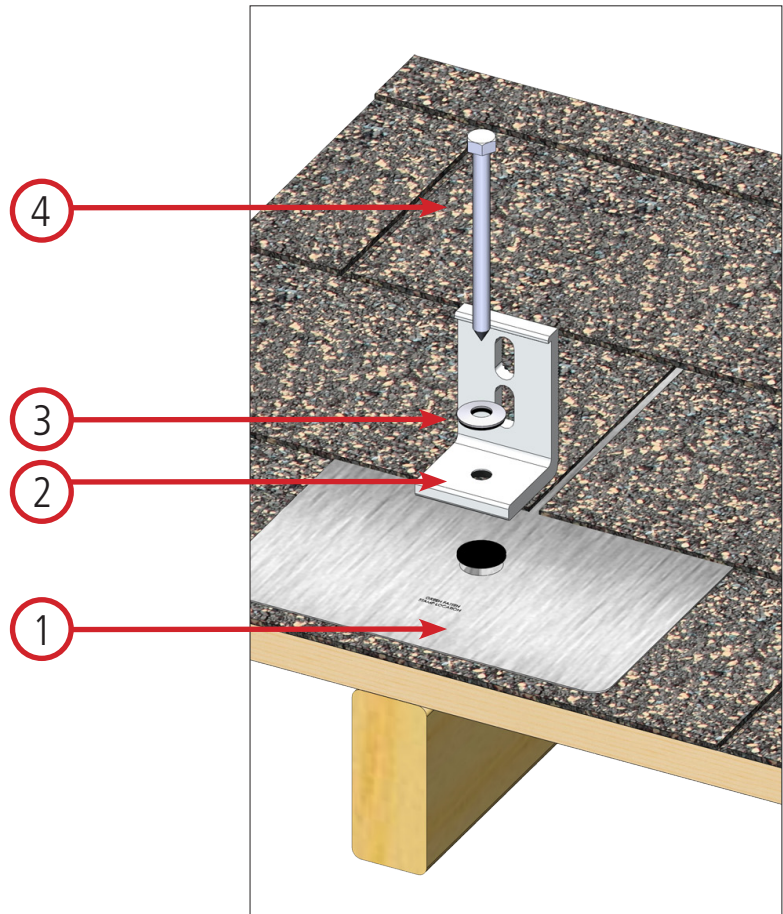
1.0 EVALUATION SCOPE

1.1 Compliance with the following codes

- 1997 Uniform Building Code (UBC)

2.0 SUBSTANTIATING DATA

Testing and analysis data submitted is in conformance with IAPMO ES Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors, (EC002-2011). Rain test data is in conformance with the Underwriters Laboratory Standard for Gas Vents, (UL 441-96 Section 15). Test results are from laboratories in compliance with ISO/IEC 17025.



① Flashing - required, includes one 5/16" ID bonded washer (No. 3 shown)

| | | |
|--------------------|----------------------------------|----------------|
| GF1-MLL-812 | Uncoated aluminum (shown) | \$ 4.32 |
| GF1-BLK-812 | Matte black Kynar painted | \$ 4.53 |
| GF1-BRZ-812 | Dark bronze Kynar painted | \$ 4.53 |

② Compression bracket- stand alone, includes one 3/8-16" x 1-1/4" bolt and one 3/8" flange nut

| | | |
|----------------|----------------------------------|----------------|
| L-102-3 | Uncoated aluminum (shown) | \$ 4.59 |
| L-102-6 | Uncoated aluminum | \$13.94 |
| Z-101 | Uncoated aluminum | \$ 5.68 |
| SCL-101-3 | Uncoated aluminum | \$ 5.22 |

Compression brackets - adaptor plates

| | |
|---------|---------|
| CP-SQ | \$ 3.24 |
| F-111-A | \$ 3.49 |

③ Bonded washer included with flashing (shown)

④ Fasteners

| | | |
|--|--------------------------------------|----------------|
| Lag bolts - 5/16" diameter stainless steel | | |
| D145/16 x 3 | 3" stainless lag bolt | \$ 0.71 |
| D145/16 x 4 | 4" stainless lag bolt (shown) | \$ 1.10 |
| D145/16 x 5 | 5" stainless lag bolt | \$ 1.64 |

Self-drilling screws- 5/16" diameter stainless steel

| | | |
|------------|---------------------|---------|
| GRK-Pherss | 5/16 x 4" stainless | \$ 0.85 |
|------------|---------------------|---------|

Hanger bolt - for use with F-111-A

| | |
|---------------|---------|
| HB-D565-16x6P | \$ 1.99 |
|---------------|---------|

List cost of assembly shown above

| | | |
|-------------|-----------------------|---------|
| GF1-MLL-812 | Uncoated aluminum | \$ 4.32 |
| L-102-3 | Uncoated aluminum | \$ 4.59 |
| D145/16 x 4 | 4" stainless lag bolt | \$ 1.10 |

\$10.01