



June 6, 2016

Mr. Connor Morrison
UNIRAC
1411 Broadway Blvd. NE
Albuquerque, NM 87102

Project Number 1160445C

Subject: Flat Tile Roof Hook (#KS-RH-AT2) Laboratory Load Testing

Dear Mr. Morrison:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the Flat Tile Roof Hook (#KS-RH-AT2); see Appendix A, Figure 1. The purpose of our testing was to evaluate the compressive and tensile (uplift) load capacity of the Flat Tile Roof Hook attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" hex head lag screws.

SAMPLE DESCRIPTION

Mockup samples were delivered to our laboratory on May 24th 2016. Mockup configuration consisted of three 12" long rafters at 6.5"o.c., screwed to 1/2" Structural I plywood. The Flat Tile Roof Hook is attached through the plywood into a rafter with two fasteners.

TEST PROCEDURES & RESULTS

1. Compressive Load Test

A total of three tests were conducted for compressive load capacity on June 3rd, 2016 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a compressive load was applied to the hook. The samples were loaded in compression at a constant rate of axial deformation of 0.10 in. /min. without shock until the hook was bent and came in contact with the test board; displacement at maximum load was recorded. Based on the above testing, the average maximum compression load of the Flat Tile Roof Hook attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 149 lbs. Detailed results are provided in Table I. Test setup and mode of failure are provided in Appendix B, Figure 1.

The specific gravity and moisture content of the rafter was tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and moisture content were determined to be 0.385 and 10.0%, respectively.

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2. Tensile (Uplift) Load Test

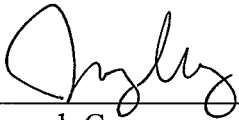
A total of three tests were conducted for tensile (uplift) load capacity on June 3rd, 2016 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the hook. The samples were loaded in tension at a constant rate of axial deformation of 0.10 in. /min. without shock until failure occurred; displacement at maximum load was recorded. Based on the above testing, the average maximum uplift load of the Flat Tile Roof Hook attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 1346 lbs. Detailed results are provided in Table II. Test setup and mode of failure are provided in Appendix B, Figure 2.

The specific gravity and moisture content of the rafter was tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and moisture content were determined to be 0.330 and 10.6%, respectively.

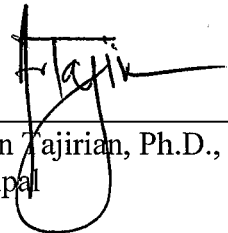
Respectfully Submitted,

APPLIED MATERIALS & ENGINEERING, INC.

Reviewed by:



Joseph Gapuz
Laboratory Manager



Armen Tajirian, Ph.D., P.E.
Principal

TABLE I
COMPRESSIVE LOAD TEST RESULTS
FLAT TILE ROOF HOOK # KH-RH-AT2
PROJECT NUMBER 1160445C

TEST NUMBER	MAXIMUM COMPRESSIVE LOAD (lbs)	DISPLACEMENT AT MAXIMUM LOAD (in.)	MODE OF FAILURE	RAFTER SPECIFIC GRAVITY	RAFTER MOISTURE CONTENT (%)
388	152	2.0	Hook Contacted Plywood	0.415	10.8
389	141	2.0		0.381	9.6
390	154	2.2		0.360	9.7
AVERAGE	149	2.1	..	0.385	10.0

TABLE II
TENSILE (UPLIFT) LOAD TEST RESULTS
FLAT TILE ROOF HOOK # KS-RH-AT2
PROJECT NUMBER 1160445C

TEST NUMBER	MAXIMUM TENSILE LOAD (lbs)	DISPLACEMENT AT MAXIMUM LOAD (in.)	MODE OF FAILURE	RAFTER SPECIFIC GRAVITY	RAFTER MOISTURE CONTENT (%)
392	1951	8.3	Lag Screw Pull-out	0.371	10.9
393	1274	7.5		0.350	10.8
394	814	7.0		0.270	10.2
AVERAGE	1346	7.6	..	0.330	10.6

REFERENCES

AC13-2010, “*Acceptance Criteria for Joist Hangers and Similar Devices*”, ICC Evaluation Service.

AC85-2008, “*Acceptance Criteria for Test Reports*”, ICC Evaluation Service.

ASTM D1761-2006, “*Standard Test Methods for Mechanical Fasteners in Wood*”, ASTM International.

ASTM D2395-2007, “*Standard Test Method for Specific Gravity of Wood and Wood-Based Materials*”,
ASTM International.

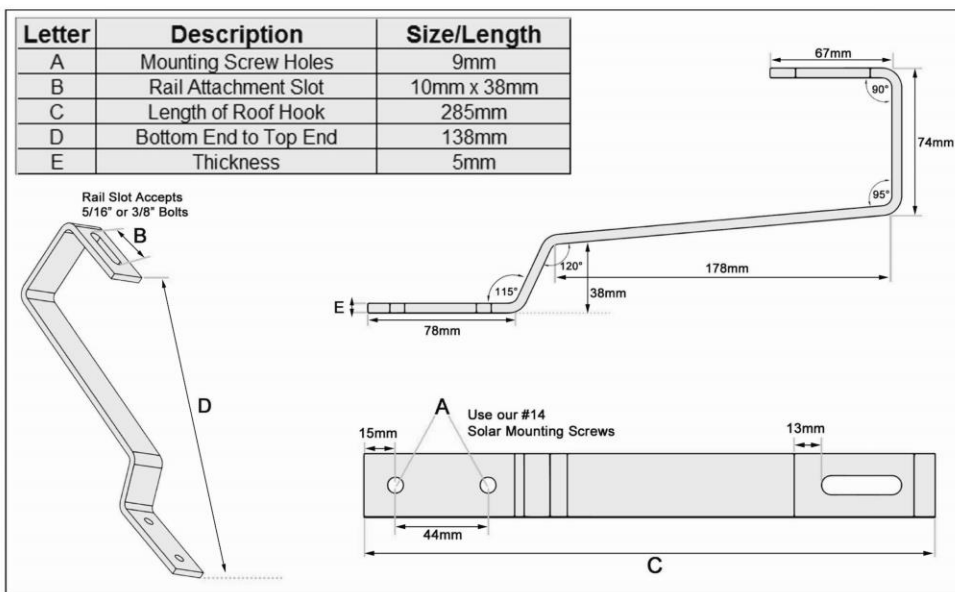
APPENDIX A

FIGURE 1

FLAT TILE ROOF HOOK # KS-RH-AT2

PROJECT NUMBER 1160445C

Part # KS-RH-AT2
 Type 304 Stainless Steel
 Flat tile hooks
 For bottom mount rails



www.solarhooks.com — 2975 E. Bidwell St, ste 100, Folsom, CA 95630 — sales@solarhooks.com

APPENDIX B

FIGURE 1
FLAT TILE ROOF HOOK # KS-RH-AT2
COMPRESSIVE LOAD TEST SETUP
PROJECT NUMBER 1160445C



Figure 1a. Test Setup



Figure 1b. Typical Failure Mode

FIGURE 2
FLAT TILE ROOF HOOK # KS-RH-AT2
UPLIFT LOAD TEST SETUP
PROJECT NUMBER 1160445C



Figure 2a. Test Setup



Figure 2b. Typical Failure Mode