



June 8, 2016

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

Project Number 1160447C

Subject: Stone Coated Steel Roof Hook for Side Mount Rails (#KS-RH-ST1)
Laboratory Load Testing

Dear Mr. Morrison:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the Stone Coated Steel Roof Hook for side mount rails (#KS-RH-ST1); see Appendix A, Figure 1. The purpose of our testing was to evaluate the compressive and tensile (uplift) load capacity of the Stone Coated Steel Roof Hook for side mount rails 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 Stone Coated Steel Roof Hook for side mount rails 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 6th, 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 Stone Coated Steel Roof Hook for side mount rails attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 198 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 0.369 and 11.0%, respectively.

Mr. Connor Morrison

Project Number 1160447C

UNIRAC

1411 Broadway Blvd. NE

Albuquerque, NM 87102

Stone Coated Steel Roof Hook for Side Mount Rails (#KS-RH-ST1) Laboratory Load Testing

2. Tensile (Uplift) Load Test

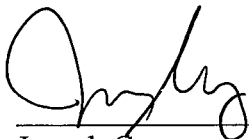
A total of three tests were conducted for tensile (uplift) load capacity on June 6th, 2016 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the hook. The samples were loaded in tension at a constant rate of axial 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 Stone Coated Steel Roof Hook for side mount rails attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 1180 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 0.358 and 12.4%, respectively.

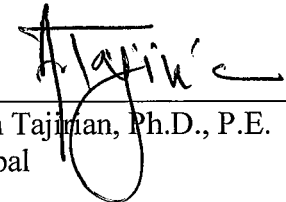
Respectfully Submitted,

APPLIED MATERIALS & ENGINEERING, INC.

Reviewed by:



Joseph Gapuz
Laboratory Manager



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

TABLE I

COMPRESSIVE LOAD TEST RESULTS

STONE COATED STEEL ROOF HOOK FOR SIDE MOUNT RAILS # KH-RH-ST1

PROJECT NUMBER 1160447C

TEST NUMBER	MAXIMUM COMPRESSIVE LOAD (lbs)	DISPLACEMENT AT MAXIMUM LOAD (in.)	MODE OF FAILURE	RAFTER SPECIFIC GRAVITY	RAFTER MOISTURE CONTENT (%)
432	206	1.2	Hook Contacted Plywood	0.415	9.6
433	192	1.1		0.355	13.3
434	197	1.1		0.338	10.1
AVERAGE	198	1.1	..	0.369	11.0

TABLE II

TENSILE (UPLIFT) LOAD TEST RESULTS

STONE COATED STEEL ROOF HOOK FOR SIDE MOUNT RAILS # KH-RH-ST1

PROJECT NUMBER 1160447C

TEST NUMBER	MAXIMUM TENSILE LOAD (lbs)	DISPLACEMENT AT MAXIMUM LOAD (in.)	MODE OF FAILURE	RAFTER SPECIFIC GRAVITY	RAFTER MOISTURE CONTENT (%)
435	1034	5.9	Lag Screw Pull-out	0.338	12.3
436	1186	6.3		0.344	12.4
437	1319	6.9		0.391	12.6
AVERAGE	1180	6.4	..	0.358	12.4

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.

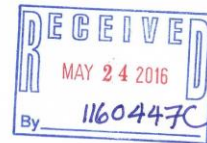
APPENDIX A

FIGURE 1

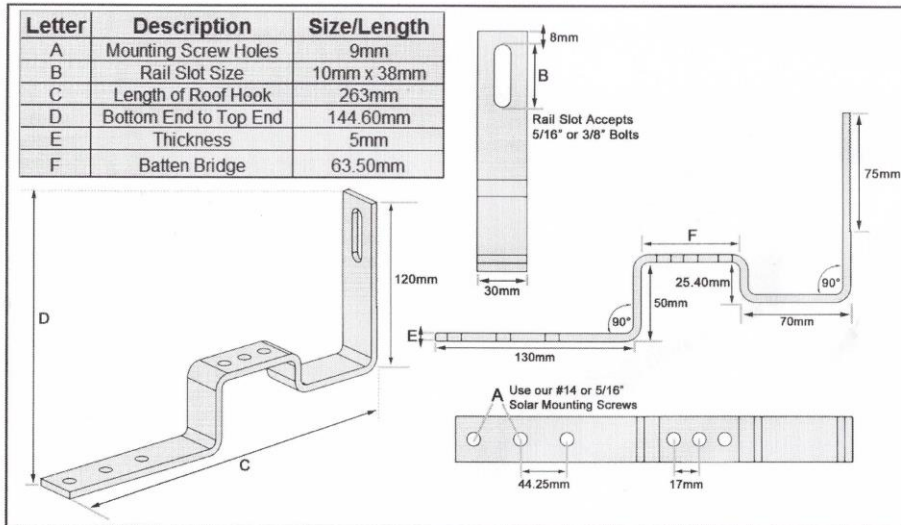
STONE COATED STEEL ROOF HOOK FOR SIDE MOUNT RAILS # KS-RH-ST1

PROJECT NUMBER 1160447C

Part # KS-RH-ST1
 Type 304 Stainless Steel
 Stone coated steel roof hook
 For side mount rails



solarHOOKS.com



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

APPENDIX B

FIGURE 1

STONE COATED STEEL ROOF HOOK FOR SIDE MOUNT RAILS # KS-RH-ST1

COMPRESSIVE LOAD TEST SETUP

PROJECT NUMBER 1160447C



Figure 1a. Test Setup



Figure 1b. Typical Failure Mode

FIGURE 2

STONE COATED STEEL ROOF HOOK FOR SIDE MOUNT RAILS # KS-RH-ST1

UPLIFT LOAD TEST SETUP

PROJECT NUMBER 1160447C

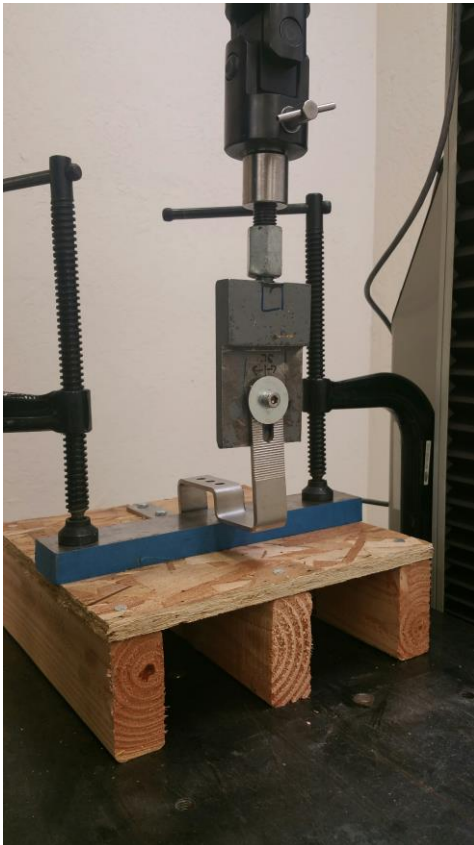


Figure 2a. Test Setup

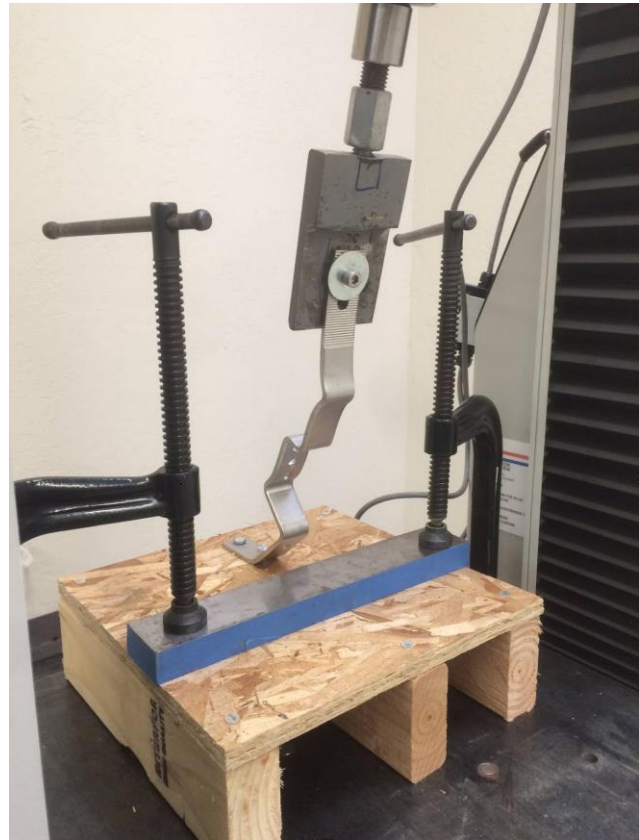


Figure 2b. Typical Failure Mode