



June 3, 2016

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

Project Number 1160446C

Subject: All Tile Roof Hook (#KS-RH-CT5) Laboratory Load Testing

Dear Mr. Morrison:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the All Tile Roof Hook (#KS-RH-CT5); see Appendix A, Figure 1. The purpose of our testing was to evaluate the compressive and tensile (uplift) load capacity of the All 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 All Tile Roof Hook is attached through the plywood into a rafter with two fasteners installed at the farthest end.

TEST PROCEDURES & RESULTS

1. Compressive Load Test

A total of three tests were conducted for compressive load capacity on June 2nd, 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 All Tile Roof Hook attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 401 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 0.376 and 13.6%, respectively.

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2. Tensile (Uplift) Load Test

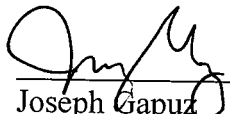
A total of three tests were conducted for tensile (uplift) load capacity on June 2nd, 2016 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the hook. The samples were loaded in tension at a constant rate of axial 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 All Tile Roof Hook attached to a 2"x4" Douglas Fir rafter using two 5/16"Øx3" lag screws was determined to be 1281 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 0.305 and 12.5%, respectively.

Respectfully Submitted,

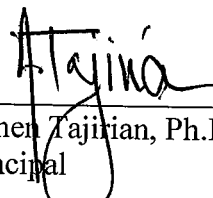
APPLIED MATERIALS & ENGINEERING, INC.

Reviewed by:



Joseph Gapuz
Laboratory Manager





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

TABLE I
COMPRESSIVE LOAD TEST RESULTS
ALL TILE ROOF HOOK # KH-RH-CT5
PROJECT NUMBER 1160446C

| TEST NUMBER | MAXIMUM COMPRESSIVE LOAD (lbs) | DISPLACEMENT AT MAXIMUM LOAD (in.) | MODE OF FAILURE | RAFTER SPECIFIC GRAVITY | RAFTER MOISTURE CONTENT (%) |
|--------------------|---------------------------------------|---|------------------------|--------------------------------|------------------------------------|
| 382 | 403 | 1.8 | Hook Contacted Plywood | 0.402 | 12.6 |
| 383 | 396 | 1.8 | | 0.358 | 14.4 |
| 384 | 403 | 2.1 | | 0.367 | 14.0 |
| AVERAGE | 401 | 1.9 | .. | 0.376 | 13.6 |

TABLE II
TENSILE (UPLIFT) LOAD TEST RESULTS
ALL TILE ROOF HOOK # KS-RH-CT5
PROJECT NUMBER 1160446C

| TEST NUMBER | MAXIMUM TENSILE LOAD (lbs) | DISPLACEMENT AT MAXIMUM LOAD (in.) | MODE OF FAILURE | RAFTER SPECIFIC GRAVITY | RAFTER MOISTURE CONTENT (%) |
|--------------------|-----------------------------------|---|------------------------|--------------------------------|------------------------------------|
| 385 | 754 | 4.1 | Lag Screw Pull-out | 0.290 | 12.0 |
| 386 | 1269 | 4.4 | | 0.296 | 12.5 |
| 387 | 1820 | 5.1 | | 0.328 | 12.9 |
| AVERAGE | 1281 | 4.5 | .. | 0.305 | 12.5 |

REFERNCES

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.

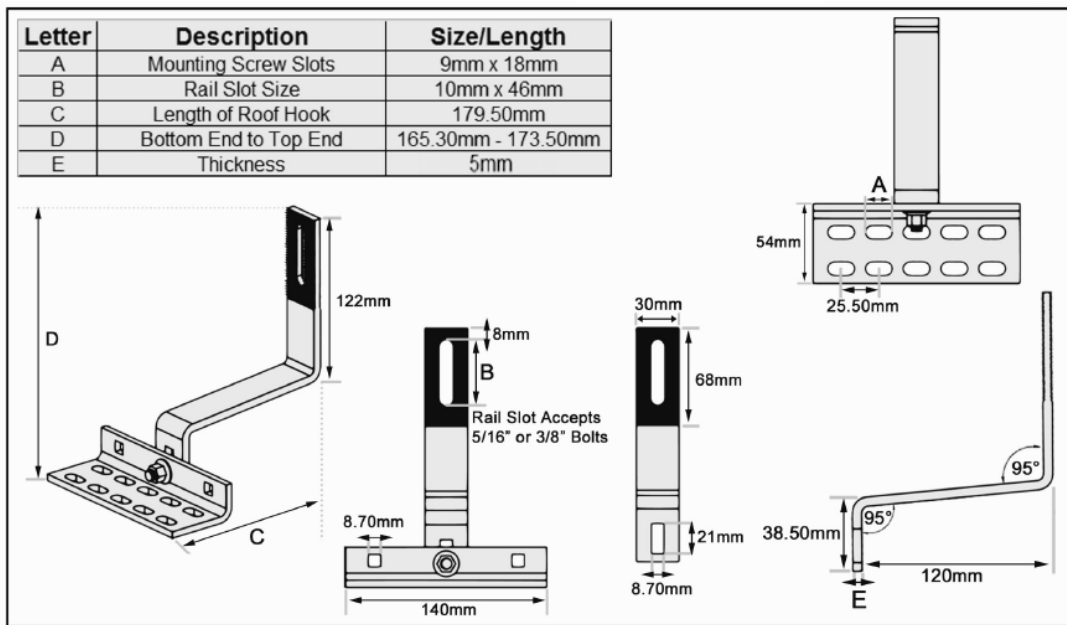
APPENDIX A

FIGURE 1

ALL TILE ROOF HOOK # KS-RH-CT5

PROJECT NUMBER 1160446C

Part # KS-RH-CT5
 Type 304 Stainless Steel
 All tile roof hook
 For side mount rails



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APPENDIX B

FIGURE 1
ALL TILE ROOF HOOK # KS-RH-CT5
COMPRESSIVE LOAD TEST SETUP
PROJECT NUMBER 1160446C



Figure 1a. Test Setup



Figure 1b. Typical Failure Mode

FIGURE 2
ALL TILE ROOF HOOK # KS-RH-CT5
UPLIFT LOAD TEST SETUP
PROJECT NUMBER 1160446C

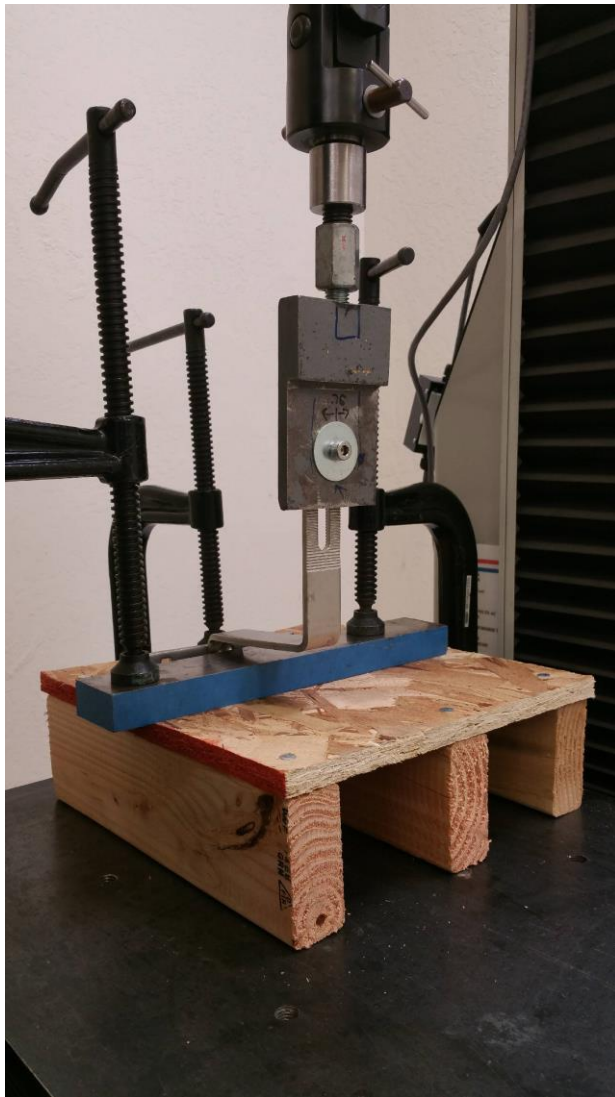


Figure 2a. Test Setup

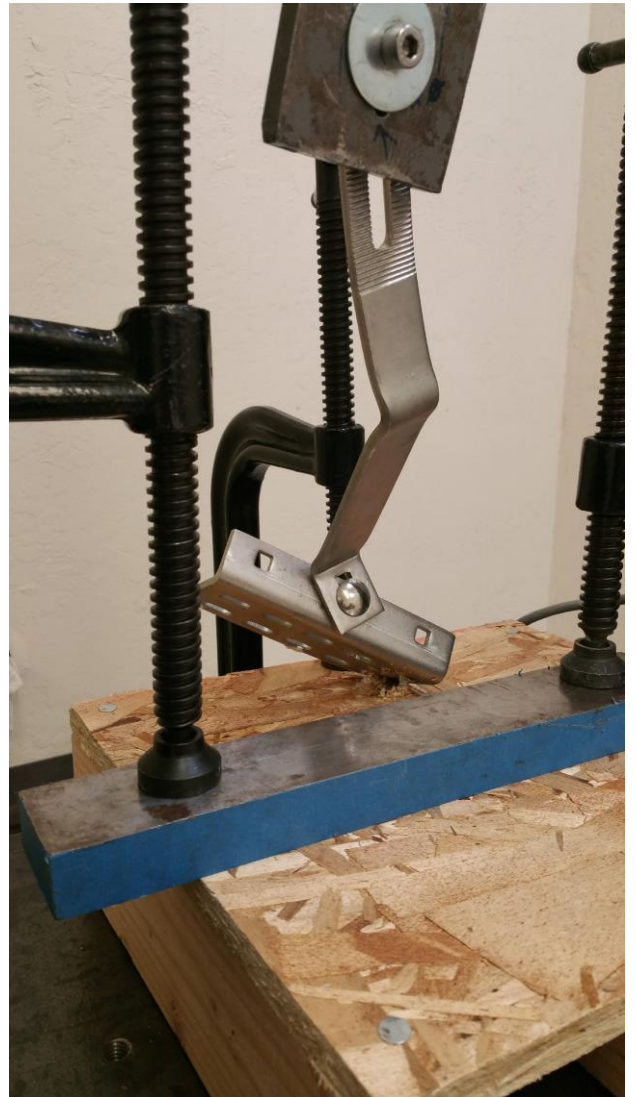


Figure 2b. Typical Failure Mode