



May 5, 2011

Mr. Stewart Wentworth  
**QUICK MOUNT PV**  
936 Detroit Avenue, Suite D  
Concord, CA 94518-2539

Project Number 111203C

**Subject:** Low Slope Mount QMLS-9 Hardware Load Testing

Dear Mr. Wentworth:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the QMLS-9 hardware. The purpose of our testing was to evaluate the shear load capacity of the QMLS-9 hardware attached to a commercially available 2"x4" Douglas Fir rafter.

### **SAMPLE DESCRIPTION**

Six (6) mockup samples were delivered to our laboratory on April 20, 2011. Mockup configuration consisted of three 16" long rafters at 7"o.c., screwed to 1/2" Structural 1 plywood. The 9" (finished height) Quick Mount Standoff (QMSO) hardware is attached through the plywood into the rafter with two 5/16"x3" lag bolts torqued to 15ft-lbs.

### **TEST PROCEDURES & RESULTS**

#### **1. Shear Strength Parallel to Rafter**

Three samples were tested for shear strength on May 2, 2011 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a shear load was applied to the 5/16"x1" machine bolt connected to the aluminum standoff. The samples were loaded parallel to rafter at a constant rate of axial deformation of 0.01 in./min. without shock until failure occurred. Based on the above testing, the average ultimate shear load, parallel to rafter, of the QMLS-9 hardware in Douglas Fir was determined to be 763 lbf.

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 was determined to be 0.456 and 12.5%, respectively. Detailed results are provided in Table I. Test setup and mode of failure are provided in Appendix A.

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## 2. Shear Strength Perpendicular to Rafter

Three samples were tested for shear strength on May 3, 2011 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a shear load was applied to the 5/16"x1" machine bolt connected to the aluminum standoff. The samples were loaded perpendicular to rafter at a constant rate of axial deformation of 0.01 in./min. without shock until failure occurred. Based on the above testing, the average ultimate shear load, perpendicular to rafter, of the QMLS-9 hardware in Douglas Fir was determined to be 579 lbf.

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 was determined to be 0.444 and 12.4%, respectively. Detailed results are provided in Table II. Test setup and mode of failure are provided in Appendix A.

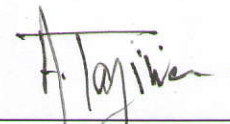
If you have any questions regarding the above, please do not hesitate to call the undersigned.

Respectfully Submitted,

**APPLIED MATERIALS & ENGINEERING, INC.**

**Reviewed By:**

  
Mohammed Faiyaz  
Laboratory Manager

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



**TABLE I**  
**LOW SLOPE MOUNT QMLS-9**  
**9" FINISHED HEIGHT**  
**SHEAR LOAD PARALLEL TO RAFTER TEST RESULTS**  
**PROJECT NUMBER 111203C**

<b>SAMPLE ID</b>	<b>ULTIMATE SHEAR LOAD PARALLEL TO RAFTER (LBF)</b>	<b>RAFTER MOISTURE CONTENT (%)</b>	<b>RAFTER SPECIFIC GRAVITY</b>	<b>FAILURE MODE<sup>1</sup>.</b>
9PARA-1	767	11.4	0.468	AL Base Collar Cracked
9PARA-2	753	13.7	0.403	Lag Bolt Pull-Out
9PARA-3	769	12.6	0.499	Lag Bolt Pull-Out
<b>AVERAGE</b>	<b>763</b>	<b>12.5</b>	<b>0.456</b>	<b>..</b>

<sup>1</sup>. Upper bolt.

**TABLE II**  
**LOW SLOPE MOUNT QMLS-9**  
**9" FINISHED HEIGHT**  
**SHEAR LOAD PERPENDICULAR TO RAFTER TEST RESULTS**  
**PROJECT NUMBER 111203C**

<b>SAMPLE ID</b>	<b>ULTIMATE SHEAR LOAD PERPENDICULAR TO RAFTER (LBF)</b>	<b>RAFTER MOISTURE CONTENT (%)</b>	<b>RAFTER SPECIFIC GRAVITY</b>	<b>FAILURE MODE</b>
9PERP-1	516	12.6	0.396	Plywood Buckled/Bent Machine Bolt
9PERP-2	631	11.9	0.487	Plywood Buckled/Bent Machine Bolt
9PERP-3	589	11.7	0.451	Plywood Buckled/Bent Machine Bolt
<b>AVERAGE</b>	<b>579</b>	<b>12.1</b>	<b>0.444</b>	<b>..</b>

## **APPENDIX A**

**LOW SLOPE MOUNT QMLS-9**  
**9" FINISHED HEIGHT**

**SHEAR TEST SETUP**

**PROJECT NUMBER 111203C**

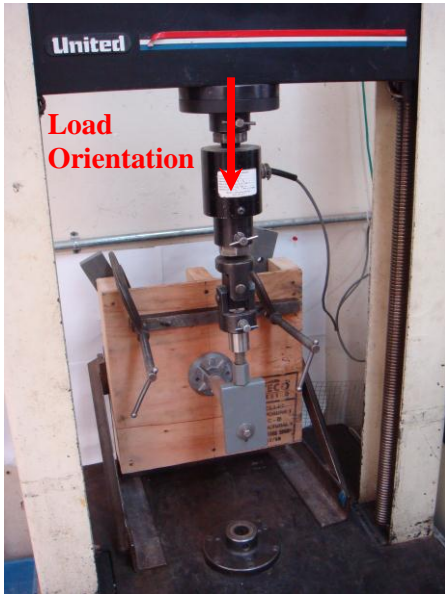


Figure 1a. Shear Parallel to Rafter

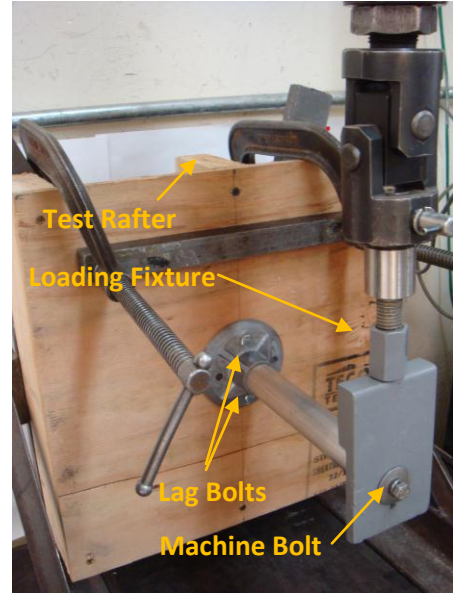


Figure 1b. Shear Test Close-up



Figure 2a. Shear Perpendicular to Rafter

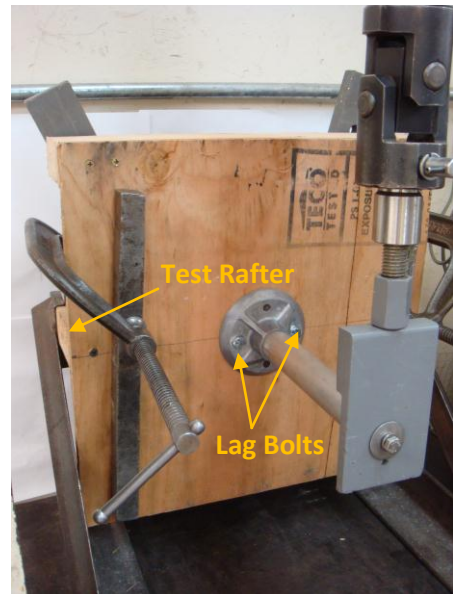


Figure 2b. Shear Test Close-up

**LOW SLOPE MOUNT QMLS-9**  
**9" FINISHED HEIGHT**

**FAILURE MODES**

**PROJECT NUMBER 111203C**



Figure 3. Cracked Aluminum Base Collar  
Shear Parallel to Rafter



Figure 4. Buckled Plywood  
Shear Perpendicular to Rafter