



March 23, 2011

Revised on 12/13/2011 to Include Tensile Strength Tests

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

Project Number 111114C

Subject: New Construction Composition Mount (QMNC 3-3/4" Finished Height) Load Testing

Dear Mr. Wentworth:

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

SAMPLE DESCRIPTION

Nine (9) mockup samples were delivered to our laboratory on March 9, 2011. Mockup configuration consisted of three 16" long rafters at 7" o.c., screwed to 1/2" Structural 1 plywood. The 3-3/4" (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. Product hardware details are provided in Appendix B.

TEST PROCEDURES & RESULTS

1. Shear Strength Parallel to Rafter

Three samples were tested for shear strength on March 18, 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 QMNC hardware in Douglas Fir was determined to be 1972 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 0.417 and 17.4%, respectively. Detailed results are provided in Table I. Test setup and mode of failure are provided in Appendix A.

2. Shear Strength Perpendicular to Rafter

Three samples were tested for shear strength on March 18, 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 QMNC hardware in Douglas Fir was determined to be 1466 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 0.494 and 17.2%, respectively. Detailed results are provided in Table II. Test setup and mode of failure are provided in Appendix A.

3. Tensile Strength

Three samples were tested for tensile strength on June 29, 2011 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a tensile load was applied to the 5/16"x1" machine bolt connected to the aluminum post. The samples were loaded in tension at a constant rate of axial deformation of 0.05 in./min. without shock until failure occurred. Based on the above testing, the average ultimate tensile load of the QMNC hardware in Douglas Fir was determined to be 3031 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 0.436 and 20.9%, respectively. Detailed results are provided in Table III. Test setup is shown in Appendix C.

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



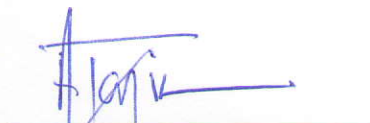

Armen Tajirian, Ph.D., P.E.
Principal

TABLE I

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)

3-3/4" FINISHED HEIGHT

SHEAR LOAD PARALLEL TO RAFTER TEST RESULTS

PROJECT NUMBER 111114C

SAMPLE ID	ULTIMATE SHEAR LOAD PARALLEL TO RAFTER (LBF)	RAFTER MOISTURE CONTENT (%)	RAFTER SPECIFIC GRAVITY	FAILURE MODE¹.
PARA-1	1904	18.3	0.419	Lag Bolt Pull-Out
PARA-2	1848	17.5	0.449	Lag Bolt Pull-Out
PARA-3	2165	16.5	0.384	Lag Bolt Pull-Out
AVERAGE	1972	17.4	0.417	..

¹. Upper bolt.

TABLE II

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)

3-3/4" FINISHED HEIGHT

SHEAR LOAD PERPENDICULAR TO RAFTER TEST RESULTS

PROJECT NUMBER 111114C

SAMPLE ID	ULTIMATE SHEAR LOAD PERPENDICULAR TO RAFTER (LBF)	RAFTER MOISTURE CONTENT (%)	RAFTER SPECIFIC GRAVITY	FAILURE MODE
PERP-1	1627	17.6	0.549	Plywood Buckled/Bent Machine Bolt
PERP-2	1484	18.1	0.533	Plywood Buckled/Bent Machine Bolt
PERP-3	1286	16.0	0.400	Plywood Buckled/Bent Machine Bolt
AVERAGE	1466	17.2	0.494	..

TABLE III

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)

3-3/4" FINISHED HEIGHT

TENSILE LOAD TEST RESULTS

PROJECT NUMBER 111114C

SAMPLE ID	ULTIMATE TENSILE LOAD (LBF)	RAFTER MOISTURE CONTENT (%)	RAFTER SPECIFIC GRAVITY	FAILURE MODE
7PULL-1	2807	20.7	0.402	Lag bolt pull-out
7PULL -2	3283	22.0	0.476	Lag bolt pull-out
7PULL -3	3003	20.0	0.430	Lag bolt pull-out
AVERAGE	3031	20.9	0.436	..

APPENDIX A

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)
3-3/4" FINISHED HEIGHT
SHEAR TEST SETUP

PROJECT NUMBER 111114C



Figure 1a. Shear Parallel to Rafter

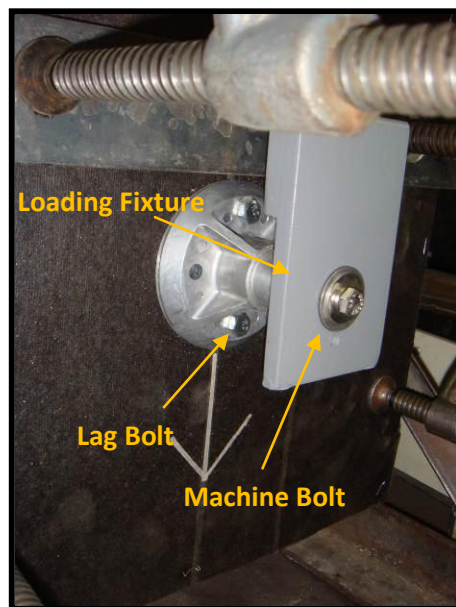


Figure 1b. Shear Test Close-up

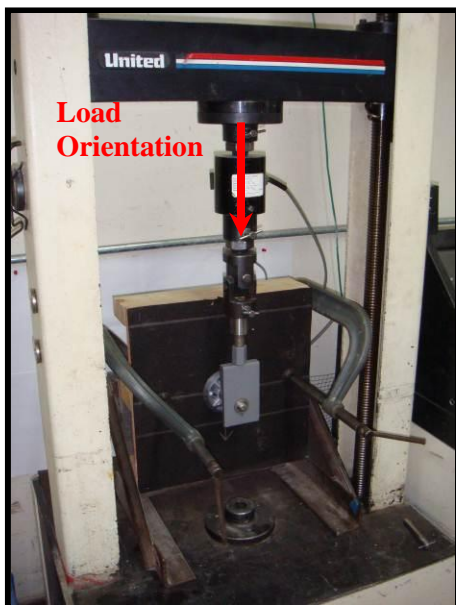


Figure 2a. Shear Perpendicular to Rafter



Figure 2b. Shear Test Close-up

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)
3-3/4" FINISHED HEIGHT
TYPICAL FAILURE MODE

PROJECT NUMBER 111114C



Figure 3. Lag Bolt Pull-Out
Shear Parallel to Rafter



Figure 4a. Buckled Plywood
Shear Perpendicular to Rafter

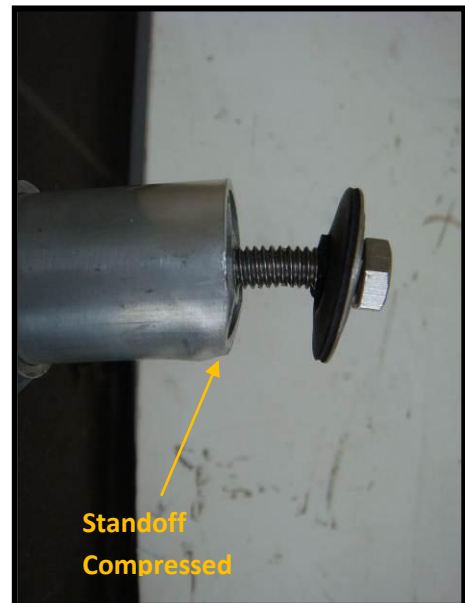


Figure 4b. Bent Bolt
Shear Perpendicular to Rafter

APPENDIX B

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)
3-3/4" FINISHED HEIGHT

HARWARE SPECIFICATION

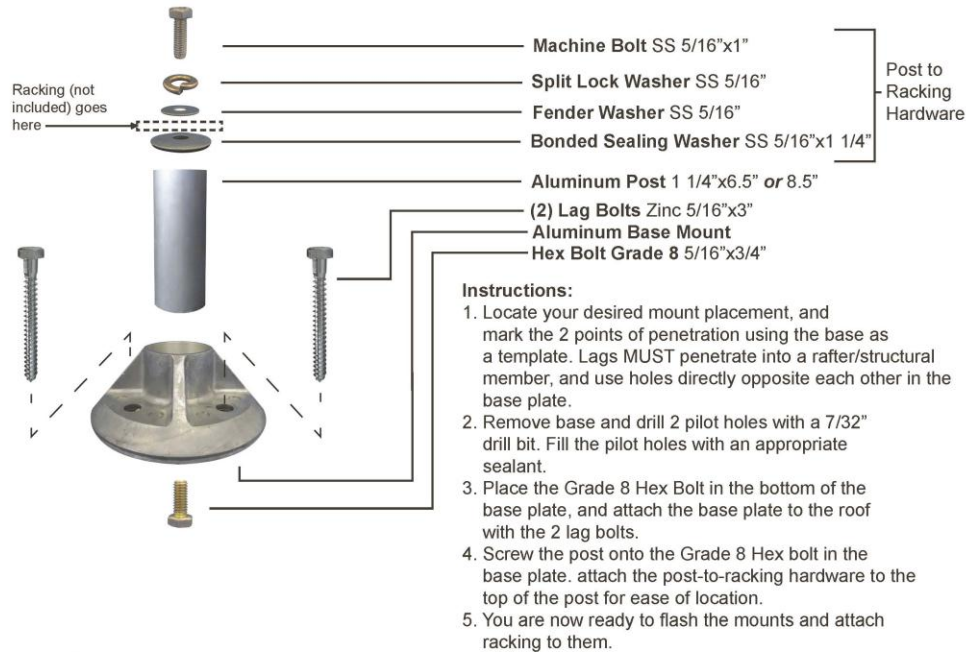
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Quick Mount PV[®]

Your ***Solution*** in Mounting Products

Solar • H₂O • Conduit • HVAC • Custom

Low Slope Mount Specifications



IMPORTANT-PLEASE READ:

This product DOES NOT include flashing, and therefore is not waterproof by itself. As the installer, it is your responsibility to make sure all roof penetrations are flashed properly!

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

Lag Bolt Specifications

	Specific Gravity	2/ea 5/16" shaft per 2.5" thread depth	5/16" shaft per 1" thread depth	
Douglas Fir, Larch	.50	1330	266	
Douglas Fir, South	.46	1175	235	
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	.46	1175	235	Sources: Uniform Building Code; American Wood Council
Hem, Fir	.43	1060	212	Notes: 1) Thread must be embedded in a rafter or other structural roof member.
Hem, Fir (North)	.46	1175	235	2) Pull-out values incorporate a 1.6 safety factor recommended by the American Wood Council.
Southern Pine	.55	1535	307	3) See IBC for required edge distances.
Spruce, Pine, Fir	.42	1025	205	
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and MEL)	.50	1330	266	

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APPENDIX C

NEW CONSTRUCTION COMPOSITION MOUNT (QMNC)
3-3/4" FINISHED HEIGHT

LOAD TEST SETUP

PROJECT NUMBER 11114C



Tensile Test

Report Revision History

12/13/2011

Pages 1 & 2: Editorial revision

Page 2: Tensile strengths tests added

Page 5: Table III added

Page 11: Appendix C added