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Explanation of Load Testing Results

4/26/2007

The majority of enclosed test results relate to tests that were conducted on single-unit installed newel posts. It should be noted that this type of situation is not realized in practical finished applications.

In addition to the individual tests, tests were conducted on an entire balustrade system that had been constructed using several UBS fasteners. These hardware items include UBS items: #101 - Newel Fastening System, #201 - Baluster Fasteners, #301 - Rail & Post Fastener and #302 - Rail Bolt Kit. The intent of these tests was to establish a worst-case scenario of how a railing system assembled with these fasteners would perform under load. Therefore, the balustrade consisted of just a straight run. It did not make a corner and it was not attached to a wall on either side. Either of these measures would have added considerable strength to the balustrade system. Most current residential building codes requires that the railing is able to withstand 200 pounds of applied force (always check local building codes).

Failure was not realized in the balustrade system itself or with any of the fasteners that were used to construct the balustrade. Failure occurred in the floor system that the balustrade was attached to when a load of 685 pounds was applied to the railing (see test results labeled 2-F and 2-G). While it was not determined at exactly what point each of these fasteners would fail at on their own, it was established that none of the fasteners was the weakest link in the balustrade. Additionally, it was established that none of the fasteners failed when the balustrade system was under a lateral load of less than 685 pounds.

All of the tests referred to in the accompanying report were conducted by an ICBO / ICC approved laboratory. The fasteners were all installed in accordance with their respective installation instructions.

Any inquires regarding the test results may be forwarded to our corporate offices at 763-253-0215 or info@stairfasteners.com.

Respectfully Submitted,

Universal Building Systems, Inc.



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3013-60-7643

PAGE:

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DATE:

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MAXIM TECHNOLOGIES/TWIN CITY TESTING

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**LOAD TESTING OF
POST FASTENERS**

Prepared for:
UNIVERSAL BUILDING SYSTEMS
Attn: Mr. Dan O'Brien
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Project: Newel Post Fasteners

Client Purchase Order Number: Verbal

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The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.



Load Testing of Post Fasteners

INTRODUCTION:

This report presents the results of a series of lateral load tests conducted on samples of post fasteners. The samples were submitted at our laboratory on June 11, 1996 and July 10, 1996 by Mr. Dan O'Brien of Universal Building Systems.

The scope of our work was limited to conducting the series of load tests on Newel Post Fasteners to determine lateral strength characteristics. Most tests were conducted in floor sections where standard framing techniques with nominal two-inch framing were employed. A small portion of the tests were conducted in solid bracing.

A large variety of conditions was introduced to help give a true representation of actual field conditions and varying installation techniques. The variable conditions included single joist vs. double joist, post size (3" and 3-1/2"), wood species of the post, and positioning of post in relation to edge of floor and joist.

The tests were conducted by applying a constant lateral load to the posts 36" off the floor and in the direction of the floor edge. The loads were measured using an HBM - 2K load cell, MTI# MM110-030, calibrated 2-6-96 using standards traceable to the NIST, placed in line with the applied lateral load. In all tests except for two (2-F and 2-G), single freestanding posts were tested which employed no support of an additional balustrade or connections to any outside member.

We were also requested to provide a factual report of the results. The testing was conducted between June 18 and July 30, 1996.

SUMMARY OF RESULTS:

Sure-Tite™ Newel Post Fasteners Tests

Seven Sure-Tite™ Post Fasteners tests were conducted. Specific varying negative conditions were employed including the amount of threads that came in contact with the joist and the angle at which the lag was installed into the floor (90° - 60°).

The 2-F and 2-G test set-up consisted of a straight 30" balustrade with number 5015 softwood balusters spaced 6" on center and a number 6010 beech handrail. The load was applied to the handrail, halfway between the two posts and 36" off the floor.

SUMMARY OF RESULTS: (cont')**Sure-Tite™ Newel Post Fasteners Tests**

<u>Test I.D. Number</u>	<u>Type of Post Used</u>	<u>Joist Connection</u>	<u>Location and Mode of Failure</u>	<u>Applied Lateral Load, lbs</u>
2-D	3" Beech	Single	Floor at edge-post bent over.	195
2-H	3-1/2" Poplar	Double	Floor at edge-post bent over.	290
2-I	3" Poplar	Double	Post broke in half.	150
2-J	3-1/2" Poplar	Single	Floor at edge-Post bent over.	240
2-K	3-1/4" Poplar	Single	Threads of lag pulled out of joist.	180
2-F	3" Beech	Double	Floor at edge-posts bent over.	685
2-G	3" Beech	Double	Floor at edge-posts bent over.	685

The Sure-Tite™ fastener itself did not fail in any of the tests. An amount of measurable deflection occurred in all of the tests at between 140 and 180 pounds applied load.

In most cases, the floor section directly under the outside edge of the post began to fail. The result of this failure was an ability of the post to pivot or hinge itself over the edge of the floor at between 195 and 290 pounds applied load with the lag bending as it pivots.

In test 2-K where the lag was installed at a severe angle, the lag threads pulled out of the floor at 180 pounds applied load.

In test 2-I where a number 4010 poplar newel was used, failure occurred when the post itself broke in half at 150 pounds applied load.

Tests 2-F and 2-G, which give a more realistic representation of a balustrade, failed only after a load of 685 pounds was applied.

SUMMARY OF RESULTS: (cont')**Sure-Tite™ Post Fasteners in Unfavorable Conditions Tests**

Seven additional Sure-Tite™ Post Fasteners tests were conducted to see what the effects would be of unfavorable installation conditions. Specifically, one area of concern was the effect of installing the newel in a position where it would overhang the underlying framing and the edge of the newel would project past even the sheetrock. A second area of concern was the post position combined with an installation onto landing tread that was connected only by means of finish nails.

<u>Test I.D. Number</u>	<u>Post Used</u>	<u>Joist Constr</u>	<u>Landing Setback</u>	<u>Tread Secured</u>	<u>Location and Mode of Failure</u>	<u>Applied Lateral Load, lbs</u>
A-1	3-1/2" Oak	Single	2-1/2"	No	Threads of lag pulled from the floor.	210
A-2	3" Poplar	Single	1-1/2"	No	Tread board & post hinged together bending over edge.	112
A-3	3-1/4" Oak	Single	2-1/4"	No	Tread board & post hinged together bending over edge.	187
A-4	3" Poplar	Single	1-5/8"	Yes	Tread board failure. Fragments & post hinged over edge.	180
A-5	3" Beech	Single	2"	Yes	Tread bolt failure. Fragments & post hinged over edge.	210
A-6	3-1/4" Hemlock	Single	1-3/4"	Yes	Post bending over edge until lag bolt snapped.	220
A-7	3-1/2" Oak	Solid	N/A	N/A	Post bending over, threads of lag began to pull free.	225

Landing tread setbacks were measured from outside edge of sheetrock to center of newel location.

The results of the testing suggest that the farther the post is positioned over the edge of the floor section, the easier it is for the post to begin to hinge over the edge. This hinging effect is experienced particularly when extreme post position is coupled with unattached landing tread as seen in test A-2.

SUMMARY OF RESULTS: (cont')**L-Bracket™ Post Fastener Testing**

Five tests were performed on the L-Bracket post fastener to determine its maximum strength characteristics and to detect any possible weaknesses. One test was performed in a floor section constructed of nominal two-inch framing. The remaining tests were conducted in solid bracing which would not be commonly found in standard construction.

<u>Test I.D. Number</u>	<u>Type of Post Used</u>	<u>Joist Connection</u>	<u>Location and Mode of Failure</u>	<u>Applied Lateral Load, lbs</u>
2-E	3-1/2" Hemlock	Single	Screws pulled from floor.	270
2-L	3-1/2" Pine	Solid	Screws pulled from floor.	410
2-M	3-1/2" Pine	Solid	Screws pulled from floor.	435
2-N	3-1/2" Pine	Solid	Screws sheared at backside of post and pulled from floor.	436
2-O	3-1/2" Pine	Solid	Screws pulled from backside of post and pulled from floor.	407

The bracket portion itself did not fail in any of the tests. An amount of measurable deflection occurred at between 184 and 310 pounds of applied load. In all cases failure occurred in the screws going into the floor section. In test 2-E where standard framing was employed, failure occurred at 270 pounds load. The failure occurred when the screws pulled out of an area of floor section where bracing was not present.

In tests 2-L, 2-M, 2-N, and 2-O, where solid floor bracing was present, failure occurred with the screws either stripping out or shearing off at between 407 to 436 pounds applied load.

SUMMARY OF RESULTS: (cont')**Key-Lock™ Newel Post Fastener Test**

A single test was performed on a Key-Lock™ Newel Post Fastener. The test was conducted in a floor section using standard framing techniques. It is noted that because of the design of the fastener, it was necessary to install it where a double joist was present.

<u>Test I.D. Number</u>	<u>Type of Post Used</u>	<u>Joist Connection</u>	<u>Location and Mode of Failure</u>	<u>Applied Lateral Load, lbs</u>
2-A	3-1/2" Hemlock	Double	Base plate broke in half.	105

Failure occurred with the base portion of the Key-Lock fastener when the product broke in half.

Thread-Lock™ Newel Post Fastener Test

A single test was performed on a Thread-Lock™ Newel Post Fastener. The test was conducted in a floor section using standard framing techniques.

<u>Test I.D. Number</u>	<u>Type of Post Used</u>	<u>Joist Connection</u>	<u>Location and Mode of Failure</u>	<u>Applied Lateral Load, lbs</u>
2-C	3" Poplar	Single	Threaded rod separated from the coupler.	101

Failure occurred with Thread-Lock fastener when the threaded rod portion separated from the coupler section.

REMARKS:

One additional test was performed on the L.J. Smith #3004 Newel Mounting Kit. Failure occurred when the threads of the insert pulled out of the floor.

The "A" series test floor sections were returned to Universal Building Systems following the testing for evaluation. The "2" series floor sections will be retained for thirty days and then discarded unless otherwise notified.

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