

PERFORMANCE EVALUATION TEST REPORT

Rendered to:

GREENFIELD MANUFACTURING COMPANY

PRODUCT: Hanger Screws

Report No: A6162.01-106-31
Report Date: 01/12/11
Expiration Date: 12/28/14

PERFORMANCE EVALUATION TEST REPORT

Rendered to:

GREENFIELD MANUFACTURING COMPANY
920 Levick Street
Philadelphia, Pennsylvania 19111-5498

Report No:A6162.01-106-31
Test Dates: 12/17/10
Through: 12/28/10
Report Date: 01/12/11
Expiration Date: 12/28/14

Product: Hanger Screws

Project Summary: Architectural Testing, Inc. was contracted by Greenfield Manufacturing Company to perform withdrawal testing and evaluation services for their hanger screws in wood (Fir) substrates. Based upon the lowest performing fastener embedment orientation specimen series and a safety factor of 4, the withdrawal load limit was determined to be was 445 lb_f.

Test Methods: The test specimen was evaluated in accordance with the following:

ASTM D 1761 - 06, *Standard Test Methods for Mechanical Fasteners in Wood*

ASTM D 2395 - 07a, *Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials.*

ASTM D 4442 - 07, *Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood Base Materials.*

Test Procedures: Testing was performed on materials which were provided by Greenfield Manufacturing Company in ready to test condition (16 total fastener withdrawal specimens).

Each specimen consisted of one 2.7 in. long hanger screw embedded into the long edge of a douglas fir prism (nominal prism dimensions: 12.0 in. x 3.5 in. x 1.5 in.) to depth of 1.7 in. Specimens were secured to the test stage of an Instron 3369 universal test machine (005740) and tensile load was applied to the hanger screw at a rate of 0.1 in/min until failure was observed.

Three specimens (nominal dimensions: 3.5 in. x 1.5 in. x 1.0 in.) were prepared from the tested fir prisms for moisture content evaluation in accordance with the procedures detailed in ASTM D 2395, Section 7.2. The initial volume and mass of each specimen was determined on a digital balance (003449) prior to oven-drying per ASTM D 4442, Method A. Oven-dry mass was determined and moisture content calculated per Section 5.5.1.

Test Results: The results are reported in the following tables.

ASTM D 1761 - Fastener Withdrawal ¹

Specimen		Failure Load (lbf)	Mode of Failure
Fastener Embedment Orientation	No.		
Radial	4	1,676	Withdrawal
	5	1,801	Withdrawal
	6	1,749	Withdrawal
	9	1,670	Withdrawal
	10	1,676	Withdrawal
	12	1,920	Withdrawal
	13	1,837	Withdrawal
	14	1,725	Withdrawal
	15	1,959	Withdrawal
Mean		1,779	Withdrawal

Specimen		Failure Load (lbf)	Mode of Failure
Fastener Embedment Orientation	No.		
Tangential	1	2,476	Withdrawal
	2	2,552	Fastener Rupture
	3	2,583	Fastener Rupture
	7	2,467	Withdrawal
	8	2,648	Fastener Rupture
	11	2,590	Fastener Rupture
	16	2,581	Fastener Rupture
Mean		2,557	Fastener Rupture

Tensile Load Limit ²	445
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¹ Due to variations between substrate prisms in grain orientation relative to fastener embedment, specimen results as presented are grouped by embedment orientation

² Tensile Load Limit as presented above is based on the lowest performing embedment orientation series (Radial) mean with an applied safety factor of 4.

D 4442 - Prism Wood Moisture Content Data

Specimen	Mass (g)		Moisture		Volume (cm ³)	Density (kg/m ³)	Specific Gravity
	Initial	Oven-Dry	Mass (g)	%			
1	53.437	49.519	3.918	7.91	89.821	594.93	0.59
2	47.221	43.744	3.477	7.95	89.109	529.92	0.53
3	47.194	43.636	3.558	8.15	88.105	530.84	0.53
Mean	49.284	45.633	3.651	8.00	89.278	551.90	0.55

Data sheets, representative samples of test specimens, a copy of this test report will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing will expire. Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

Scott D. Scallorn - Technician I
Components / Materials Testing

Gary Hartman, P.E. - Director
Components / Materials Testing

SDS:sds/nlb

Attachments (pages) This report is complete only when all attachments listed are included.
Appendix A - Photographs (3)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	01/12/11	N/A	Original report issue.

APPENDIX A

Photographs



Photo No. 1
Typical Hanger Screw Detail



Photo No. 2
Depiction of Typical Pretest Condition Test Specimens with Embedded Hanger Screw
(Tangential Face Embedment Specimen [Front] Radial Face Embedment Specimen [Rear])



Photo No. 3
Fastener Withdrawal Test Setup



Photo No. 4
Typical Pretest Condition Fastener Embedment Detail

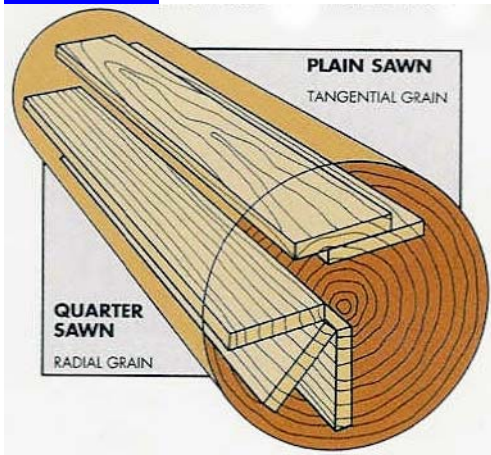


Photo No. 5
Typical Fastener Withdrawal Failure Mode Detail
(Radial Face Fastener Embedment Depicted)



Photo No. 6
Typical Fastener Rupture Failure Mode Detail
(Tangential Face Fastener Embedment Depicted)

As a note:



With regards to the terminology clarification, I have adapted these designations from characteristics inherent to “saw direction”. As you can see in the diagram below, fastener embedment through a plain sawn “tangential grain” (primarily *through* the growth rings) is representative of what we observed in the higher performing specimen group while the quarter sawn “radial grain” (primarily *with* the growth rings) is indicative of the lower specimen performance.