

## Introduction

The Composite Materials and Engineering Center (CMEC), at Washington State University in Pullman, WA, performed a screw head pull-through test on two siding products and three different fasteners (Figure 1). The siding products were a solid rectangular product with a textured surface on one side and were two different thicknesses. The tests were conducted according to the guidelines of the ASTM D1037 *Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Material*, section 15 .



Figure 1. Typical fasteners used for pull-through testing (1.5 inch PPG Flathead, 1.5 inch PPG Combo TH and 2.5 inch PPG Flathead, left to right)

## Test Methods and Results

### Direct Screw Pull-Through

Direct screw pull-through testing was performed according to the guidelines of the ASTM D1037-06a standard (Figure 2). The direct screw pull-through was conducted using three different ballistic screws: A 1.5 inch PPG Combo TH, a 1.5 inch PPG Flathead and 1 2.5 inch PPG Flathead. The rate of crosshead motion was 0.06 in/min. Five specimens of each siding thickness were cut to six inches in length and four inches in width. The screws were inserted flush with the surface immediately prior to testing. The maximum loads and fastener dimensions are shown in Table 1. Failure occurred with the screw heads partially pulling through the siding. Figure 3 shows a typical failure for a thin siding product. Figure 4 shows a typical failure for a thick siding product.



Figure 2. Typical Screw Pull Through Setup

Table 1. Results of Direct Screw Head Pull-Through

Thin Siding								
Specimen #	Fastener					Siding		Max. Load (lbf)
	Type	Head Dia. (in)	Shank Dia. (in)	Thread Dia. (in)	Screw Length (in)	Thickness 1 (in)	Thickness 2 (in)	
1	1.5 PPG Flathead	0.214	0.124	0.127	1.593	0.271	0.279	105.7
2	1.5 PPG Flathead	0.242	0.122	0.124	1.596	0.281	0.284	165.8
3	1.5 PPG Flathead	0.242	0.121	0.130	1.557	0.276	0.282	173.4
4	1.5 PPG Flathead	0.243	0.124	0.130	1.559	0.281	0.287	181.6
5	1.5 PPG Flathead	0.242	0.128	0.127	1.587	0.264	0.272	141.4
<b>Average</b>		<b>0.237</b>	<b>0.124</b>	<b>0.127</b>	<b>1.578</b>	<b>0.275</b>	<b>0.281</b>	<b>153.6</b>
<b>COV</b>		<b>5.3%</b>	<b>2.0%</b>	<b>2.0%</b>	<b>1.2%</b>	<b>2.6%</b>	<b>2.0%</b>	<b>20.0%</b>
6	1.5 PPG Combo TH	0.246	0.106	0.118	1.495	0.279	0.286	161.9
7	1.5 PPG Combo TH	0.250	0.108	0.119	1.484	0.258	0.282	145.0
8	1.5 PPG Combo TH	0.250	0.107	0.119	1.483	0.279	0.282	175.8
9	1.5 PPG Combo TH	0.244	0.106	0.117	1.503	0.280	0.280	133.4
10	1.5 PPG Combo TH	0.243	0.100	0.119	1.501	0.291	0.284	213.4
<b>Average</b>		<b>0.247</b>	<b>0.105</b>	<b>0.118</b>	<b>1.493</b>	<b>0.277</b>	<b>0.283</b>	<b>165.9</b>
<b>COV</b>		<b>1.4%</b>	<b>2.8%</b>	<b>0.8%</b>	<b>0.6%</b>	<b>4.4%</b>	<b>0.8%</b>	<b>18.7%</b>
11	2.5 PPG Flathead	0.234	0.105	0.124	2.476	0.290	0.292	186.1
12	2.5 PPG Flathead	0.237	0.110	0.123	2.477	0.276	0.273	158.2
13	2.5 PPG Flathead	0.242	0.104	0.123	2.477	0.277	0.273	140.4
14	2.5 PPG Flathead	0.240	0.104	0.124	2.477	0.275	0.282	130.5
15	2.5 PPG Flathead	0.234	0.108	0.122	2.474	0.282	0.288	185.5
<b>Average</b>		<b>0.237</b>	<b>0.106</b>	<b>0.123</b>	<b>2.476</b>	<b>0.280</b>	<b>0.281</b>	<b>160.1</b>
<b>COV</b>		<b>1.6%</b>	<b>2.7%</b>	<b>0.5%</b>	<b>0.0%</b>	<b>2.2%</b>	<b>3.1%</b>	<b>15.9%</b>

Table 1. cont.

Thick Siding								
Specimen #	Fastener				Screw Length (in)	Siding		Max. Load (lbf)
	Specimen #	Head Dia. (in)	Shank Dia. (in)	Thread Dia. (in)		Thickness 1 (in)	Thickness 2 (in)	
1	1.5 PPG Flathead	0.242	0.115	0.126	1.595	0.397	0.391	245.7
2	1.5 PPG Flathead	0.243	0.122	0.123	1.595	0.380	0.377	196.4
3	1.5 PPG Flathead	0.242	0.122	0.123	1.584	0.381	0.389	221.0
4	1.5 PPG Flathead	0.243	0.123	0.125	1.590	0.395	0.380	273.1
5	1.5 PPG Flathead	0.242	0.122	0.122	1.589	0.393	0.402	221.4
<b>Average</b>		<b>0.242</b>	<b>0.121</b>	<b>0.124</b>	<b>1.590</b>	<b>0.389</b>	<b>0.388</b>	<b>231.5</b>
<b>COV</b>		<b>0.3%</b>	<b>2.9%</b>	<b>1.3%</b>	<b>0.3%</b>	<b>2.0%</b>	<b>2.5%</b>	<b>12.5%</b>
6	1.5 PPG Combo TH	0.243	0.108	0.118	1.496	0.396	0.395	237.7
7	1.5 PPG Combo TH	0.247	0.103	0.117	1.493	0.397	0.403	282.3
8	1.5 PPG Combo TH	0.242	0.102	0.117	1.499	0.392	0.398	234.5
9	1.5 PPG Combo TH	0.245	0.101	0.118	1.501	0.390	0.398	284.7
10	1.5 PPG Combo TH	0.241	0.103	0.116	1.497	0.392	0.388	225.4
<b>Average</b>		<b>0.244</b>	<b>0.103</b>	<b>0.117</b>	<b>1.497</b>	<b>0.393</b>	<b>0.396</b>	<b>252.9</b>
<b>COV</b>		<b>1.0%</b>	<b>2.7%</b>	<b>0.7%</b>	<b>0.2%</b>	<b>0.8%</b>	<b>1.4%</b>	<b>11.2%</b>
11	2.5 PPG Flathead	0.235	0.104	0.124	2.483	0.393	0.395	268.0
12	2.5 PPG Flathead	0.234	0.104	0.126	2.479	0.393	0.392	295.5
13	2.5 PPG Flathead	0.232	0.105	0.122	2.478	0.395	0.394	220.1
14	2.5 PPG Flathead	0.233	0.103	0.124	2.475	0.387	0.402	250.2
15	2.5 PPG Flathead	0.236	0.104	0.123	2.477	0.378	0.382	230.0
<b>Average</b>		<b>0.234</b>	<b>0.104</b>	<b>0.124</b>	<b>2.478</b>	<b>0.389</b>	<b>0.393</b>	<b>252.8</b>
<b>COV</b>		<b>0.7%</b>	<b>0.7%</b>	<b>1.2%</b>	<b>0.1%</b>	<b>1.8%</b>	<b>1.8%</b>	<b>12.0%</b>



Figure 3. Typical Screw Pull Through Failure for thin siding.



Figure 4. Typical Screw Pull Through Failure for thick siding.

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