

## Pallet Design Evaluation

Test Report-No: 2014-FQA102

### Client

**Company:** Universal Fastener Outsourcing

**Contact Name:** Jim Boyd

**Phone:** (479) 283-0526

**Email:** jboyd@911-nails.com

### Purpose of the Test

Determination of the fastener quality using MIBANT test.

### Test Program

**ASTM F680 – Standard Test Method for Nails**

### Test Period

**04/1/2014-04/11/2014**

### Test Performed By

The Center for Packaging and Unit Load Design,  
Virginia Polytechnic Institute & State University,  
1650 Research Center Dr, Blacksburg, Virginia 24061.  
Phone: (540) 231-7673 Fax: (540) 231-8868 email: lhorvat@vt.edu

## Fastener Specifications

The 2.25” x 0.120” fastener was investigated in this study. The specifications of the investigated fastener design are presented in Table 1.

**Table 1** Specifications of investigated fastener designs.

<b>Component</b>	<b>Fastener Design</b>
<b>Fastener type</b>	Helical
<b>Wire diameter (in)</b>	0.120
<b>Thread crest diameter (in)</b>	0.135
<b>Nominal fastener length (in)</b>	2.25
<b>Thread length (in)</b>	1.71

## MIBANT Test

Morgan Impact Bend-Angle-Nail Tester (MIBANT) was used to test the quality of the fastener design. During the test the fastener was secured into the MIBANT tester and a 3.5 lbs. weight was dropped to exert 3.33 ft-lbf energy to the head of the fastener. The bending of the fastener was measured and the Fastener Withdrawal Index (FWI) and Fastener Shear Index (FSI) was calculated based on calculation method published in ANSI MH1 (2005). The experimental setup is presented in Figure 1 while the results of the test are published in Figure 2.



Figure 1 Experimental setup for the MIBANT test.

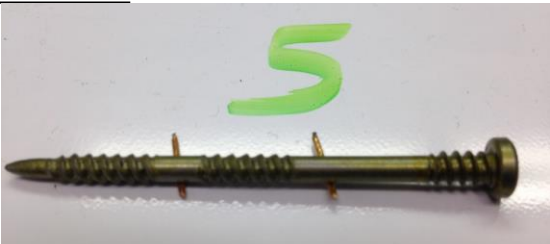
<b>Customer:</b> Jim Boyd Universal Fastener Outsourcing Cell: (479) 283-0526 Email: jboyd@911-nails.com		<b>Prepared by:</b> Virginia Tech, Center for Packaging and Unit Load Design 1650 Research Center Dr. Blacksburg, VA 24061																													
<b>File Date:</b>		4/2/14																													
<b>Fastener Specifications</b> Customer's Fastener ID: _____ Fastener ID: <u>2014-FQA-102-D5</u>																															
Fastener Type:	Helical																														
Fastener Length:	2.21 inches																														
Thread Length:	1.20 inches																														
Thread Diameter:	0.137 inches																														
Wire Diameter:	0.120 inches																														
Head Diameter:	0.270 inches																														
Flutes:	#DIV/0!																														
Helixes:	19																														
Thread Angle:	25																														
Calculated Thread Angle:	#DIV/0!																														
MIBANT Angle:	20																														
FWI:	210			<table border="1"> <thead> <tr> <th colspan="2">Minimum Fastener Withdrawal Index (FWI)</th> <th colspan="2">Minimum Fastener Shear Index (FSI)</th> </tr> <tr> <th>Multiple Use</th> <th>Limited Use</th> <th>Multiple Use</th> <th>Limited Use</th> </tr> </thead> <tbody> <tr> <td>65</td> <td>50</td> <td>55</td> <td>40</td> </tr> </tbody> </table>		Minimum Fastener Withdrawal Index (FWI)		Minimum Fastener Shear Index (FSI)		Multiple Use	Limited Use	Multiple Use	Limited Use	65	50	55	40														
Minimum Fastener Withdrawal Index (FWI)		Minimum Fastener Shear Index (FSI)																													
Multiple Use	Limited Use	Multiple Use	Limited Use																												
65	50	55	40																												
FSI:	108																														
<b>Fastener Sample Measurement Data</b>																															
<b>Thread Diameter (in.):</b> <table border="1"> <tr><td>0.136</td><td>0.137</td><td>0.137</td><td>0.137</td></tr> <tr><td>0.137</td><td>0.137</td><td>0.137</td><td>0.137</td></tr> <tr><td>0.137</td><td>0.137</td><td>0.137</td><td>0.137</td></tr> <tr><td>0.136</td><td>0.136</td><td>0.136</td><td>0.137</td></tr> <tr><td>0.136</td><td>0.136</td><td>0.136</td><td>0.136</td></tr> <tr><td>0.136</td><td>0.137</td><td>0.137</td><td>0.135</td></tr> <tr><td>0.136667</td><td></td><td></td><td></td></tr> </table>				0.136	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.136	0.136	0.136	0.137	0.136	0.136	0.136	0.136	0.136	0.137	0.137	0.135	0.136667			
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0.136667																															
<b>MIBANT Angle (Degrees):</b> <table border="1"> <tr><td>21.0</td><td>20.0</td><td>22.0</td><td>20.0</td></tr> <tr><td>20.0</td><td>21.0</td><td>20.0</td><td>22.0</td></tr> <tr><td>23.0</td><td>21.0</td><td>22.0</td><td>21.0</td></tr> <tr><td>19.0</td><td>20.0</td><td>19.0</td><td>20.0</td></tr> <tr><td>19.0</td><td>20.0</td><td>21.0</td><td>20.0</td></tr> <tr><td>20.0</td><td>20.0</td><td>19.0</td><td>20.0</td></tr> <tr><td>20</td><td></td><td></td><td></td></tr> </table>				21.0	20.0	22.0	20.0	20.0	21.0	20.0	22.0	23.0	21.0	22.0	21.0	19.0	20.0	19.0	20.0	19.0	20.0	21.0	20.0	20.0	20.0	19.0	20.0	20			
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Minimum: 0.135 Maximum: 0.137 Average: 0.137 CV(%): 0.39		Minimum: 19.0 Maximum: 23.0 Average: 20.4 CV(%): 5.10																													
Partial Shank Failures: 0 Complete Shank Failures: 0 Head Failures: 3 MIBANT Drop Weight: 3.5 **Average adjusted to standard 3.50lb drop weight: 20																															

Figure 2 Results of the fastener quality evaluation of investigated fastener design using MIBANT test according to ASNI MH1 (2005).

The fastener was classified as **Multiple Use** based on the criteria defined by ANSI MH1 standard as listed in Table 2.

**Table 2** Industry Recommended Minimum Fastener Quality Levels Based on Pallet Service

	<b>FWI</b>	<b>FSI</b>
<b>Repair</b>	40	30
<b>Limited Use</b>	50	40
<b>Multiple Use</b>	65	55

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