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WESTERN SPINDLE LLC

TEST REPORT

SCOPE OF WORK
STRUCTURAL PERFORMANCE TESTING ON THE 12 FOOT BY 42 INCH URETHANE BALUSTRADE SYSTEM

REPORT NUMBER
80916.02-119-19 R0

TEST DATE
04/11/08

ISSUE DATE
09/24/18

RECORD RETENTION END DATE
04/11/13

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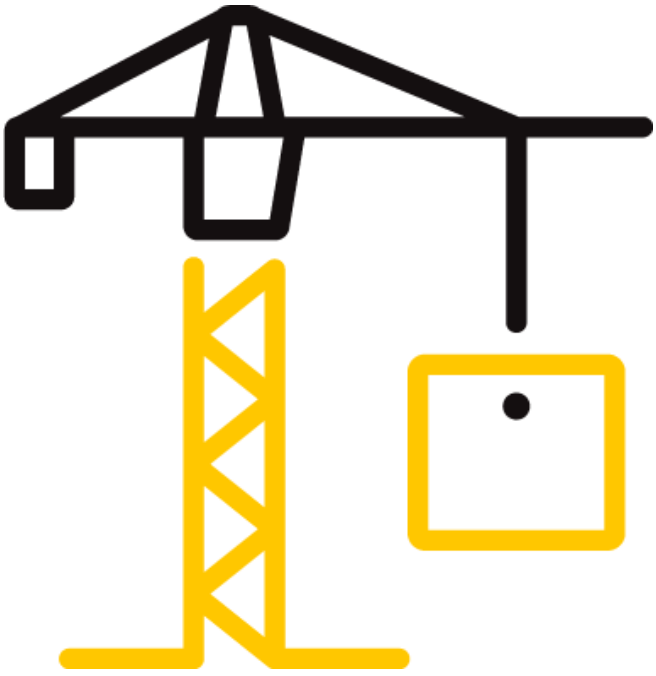

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TEST REPORT FOR WESTERN SPINDLE LLC
Report No.: 80916.02-119-19 R0
Date: 09/24/18

REPORT ISSUED TO

WESTERN SPINDLE LLC
310 6th Street
Townsend, MT 59644

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Haas Architectural Millwork, Inc., 165 South Orchard Street, Red Lion, Pennsylvania 17356 to perform structural performance testing in accordance with the 2006 IBC and 2006 IRC on the 12 foot by 42 inch urethane balustrade system. All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supporting structure. The test specimens evaluated included the infill, rails, rail brackets, and support posts. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

This report is reissued in the name of Western Spindle LLC through written authorization of Haas Architectural Millwork, Inc. to whom the original report was rendered. The original Haas Architectural Millwork, Inc. Report No. is 80916.01-119-19.

For INTERTEK B&C:

COMPLETED BY:	Scott T. Gladfelter	**REVIEWED BY:**	Travis A. Hoover
TITLE:	Project Engineer	**TITLE:**	Program Manager
SIGNATURE:	Digitally Signed by: Scott Gladfelter	**SIGNATURE:**	Digitally Signed by: Travis Hoover
DATE:	09/24/18	**DATE:**	09/24/18

STG:tah/aaa

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SECTION 2
SUMMARY OF TEST RESULTS

The specimens met the 2006 IBC design load performance requirements.

Limitations
All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supporting structure. The test specimens evaluated included the in-fill (balusters), rails, rail brackets, and support posts. The support posts were not a tested component and were included in the test specimen only to facilitate anchorage of the rail brackets.

SECTION 3
TEST METHODS

The specimen was evaluated in accordance with the following:

2006, *International Building Code®*, International Code Council

2006, *International Residential Code®*, International Code Council

SECTION 4
MATERIAL SOURCE/INSTALLATION

Haas Architectural Millwork, Inc. provided the fully-assembled PVC guardrail system test specimens: top rail, bottom rail, balusters (in-fill), rail brackets, fasteners, posts, and support blocks.

The guardrail was tested in a self-contained structural frame designed to accommodate anchorage of the guardrail assembly and application of the required test loads. The specimens were loaded using an electric winch mounted to a rigid steel test frame. High strength steel cables, nylon straps, and load distribution beams were used to impose test loads on the specimens. Applied load was measured using an electronic load cell located in-line with the loading system. Electronic linear motion transducers were used to measure deflections. See photographs in Section 10 for individual test setups.

Representative samples of the test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

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SECTION 5
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Keith A. Gurnee	Intertek B&C
Travis A. Hoover	Intertek B&C

SECTION 6
TEST SPECIMEN DESCRIPTION

Haas Architectural Millwork, Inc. provided the test components with the following details:

Top Rail: 5.550 in wide by 4 in high, low density, polyurethane foam contoured profile with 2.875 in O.D. by 0.225 in wall thickness PVC pipe internal support

Bottom Rail: 5.625 in wide by 4 in high, low density, polyurethane foam flat-top contoured profile with 2.875 in O.D. by 0.225 in wall thickness PVC pipe internal support

Brackets: 3 in wide by 2.5 in high aluminum "L" bracket with 0.188 in wall thickness

Balusters: 2.5 in square by 32 in long, low density, polyurethane foam spindle with 1.0 in O.D. by 0.125 in wall thickness PVC pipe internal support

Posts: 5.5 in square, low density, polyurethane foam newel profile with 4.5 in O.D. by 0.250 in wall thickness PVC pipe internal support

Fastening Schedule

Top Rail Bracket to Post [1]	Two 1/4-20 x 1-1/2 in hex-head bolts with washers and nuts
Bottom Rail Bracket to Post [1]	Two 1/4" x 2" pan-head, zinc-plated screws
Top Rail to Aluminum Bracket	Two 1/4" x 2" pan-head, zinc-plated screws
Bottom Rail to Aluminum Bracket	One 5/16-18 x 1-1/4" hex-head bolt

[1] *Rail to post fastener assemblies were reinforced with adhesive.*

See drawings in Section 11 and photographs in Section 10 for additional details.

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SECTION 7
TEST PROCEDURE

Each test specimen was inspected prior to testing to verify size and general condition of the materials, assembly, and installation. No potentially compromising defects were observed prior to testing.

The 12 ft wide by 42 in high guardrail assembly was installed and tested as a single railing section by directly securing the posts into a rigid steel test fixture, which rigidly restrained the posts from deflecting. Transducers mounted to an independent reference frame were located to record movement of reference points on the guardrail system components (ends and mid-point) to determine net component deflections. See photographs in Section 10 for individual test setups.

An initial load, not exceeding 50% of design load, was applied and transducers were zeroed. Load was then applied at a steady uniform rate until reaching 2.0 times design load in no less than 10 seconds. After reaching 2.0 times design load, the load was released. After allowing a minimum period of one minute for stabilization, load was reapplied to the initial load level used at the start of the loading procedure, and deflections were recorded and used to analyse recovery. Load was then increased at a steady uniform rate until reaching 2.5 times design load or until failure occurred. The testing time was continually recorded from the application of initial test load until the ultimate test load was reached.

SECTION 8
TEST RESULTS

The following tests were performed on the guardrail assemblies for the design load requirements of the codes referenced. Deflection and permanent set were component deflections relative to their end-points; they were not overall system displacements. All loads and displacement measurements were horizontal, unless noted otherwise.

Key to Test Results Tables:

Load Level:	Target test load
Test Load:	Actual applied load at the designated load level (target). Where more than one value is reported, the test load was the range (min.-max.) that was held during the time indicated in the test.
Elapsed Time (E.T.):	The amount of time into the test with zero established at the beginning of the loading procedure. Where more than one value is reported, the time was the range (start-end) that the designated load level was reached and sustained.

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Test No. 1 - 04/11/08 **Design Load: 50 lb / 1 Square Ft at Center of In-Fill (on Two Pickets)**						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	20	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	107	02:03	1.09	1.30	1.05	0.23
Initial Load	20	04:37	0.35	0.39	0.35	0.04
2.5x Design Load	125	07:07	83% Recovery			

[1] Net displacement was the picket displacement relative to its top and bottom.

Test No. 2 - 04/11/08 **Design Load: 50 lb / 1 Square Ft at Bottom of In-Fill (on Two Pickets)**						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	20	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	100	00:21	0.07	1.24	0.07	1.17
Initial Load	25	03:40	0.02	0.27	0.01	0.26
2.5x Design Load	125	04:38	78% Recovery			

[1] Net displacement was the bottom rail displacement relative to its ends.

Test No. 3 - 04/11/08 **Design Load: 50 plf x (144 in ÷ 12 in/ft) = 600 lb Horizontal Uniform Load on Top Rail [1]**						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Rail Displacement (in)**			
			End	**Mid**	**End**	**Net [2]**
Initial Load	140	00:00	0.00	0.00	0.00	0.00
1.67x Design Load	1008 [3]	03:55	0.39	10.78	0.46	10.36
Initial Load	154	06:26	0.06	2.16	0.08	2.09
2.5x Design Load	1534	08:09	80% Recovery			

[1] Uniform load is simulated with 1/4-point loads.
[2] Net displacement was mid-rail displacement relative to the rail at the support posts.
[3] The testing was stopped short of the 2.0x design load; therefore recovery value is based on 1.67x design load.

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SECTION 9
CONCLUSION

Using a performance criteria of 75% deflection recovery from 2.0 times design load (with exception as noted in Test No. 3) and withstanding an ultimate load of 2.5 times design load, the test results substantiate compliance with the design load requirements of the referenced building codes for the 12 ft wide by 42 in high railing assembly.

The railing supports were not included within the scope of this testing, and these conclusions would apply only for a railing that is provided with adequate supports that provide equal or better substrate material for the fasteners used to anchor the rail brackets.

Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

SECTION 10
PHOTOGRAPHS

Photo No. 1
In-Fill Load Test at Center of Two Balusters

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Photo No. 2
In-Fill Load Test at Bottom of Two Balusters

Photo No. 3
Horizontal Uniform Load Test of Top Rail

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Photo No. 4
Top and Bottom Rail Profiles

Photo No. 5
Top Rail - Bracket - Post Connection

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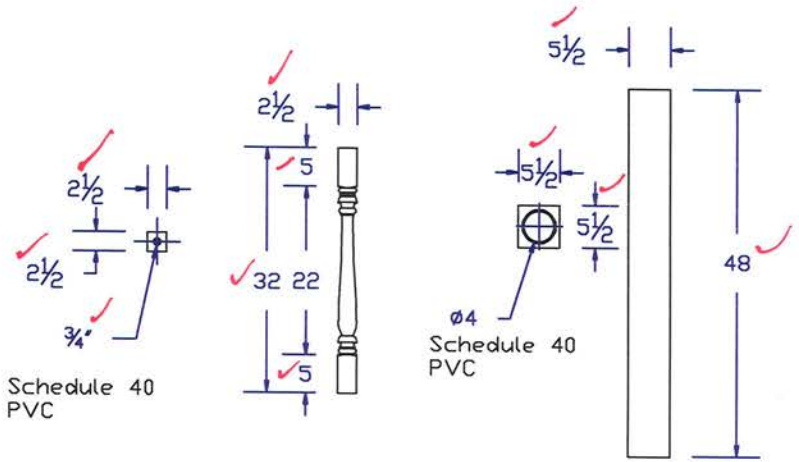
Photo No. 6
Bottom Rail - Bracket - Post Connection

SECTION 11
DRAWINGS

The "As-Built" drawings for the 12 foot by 42 inch urethane balustrade system; which follow have been reviewed by Intertek B&C and are representative of the project reported herein. Project construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.

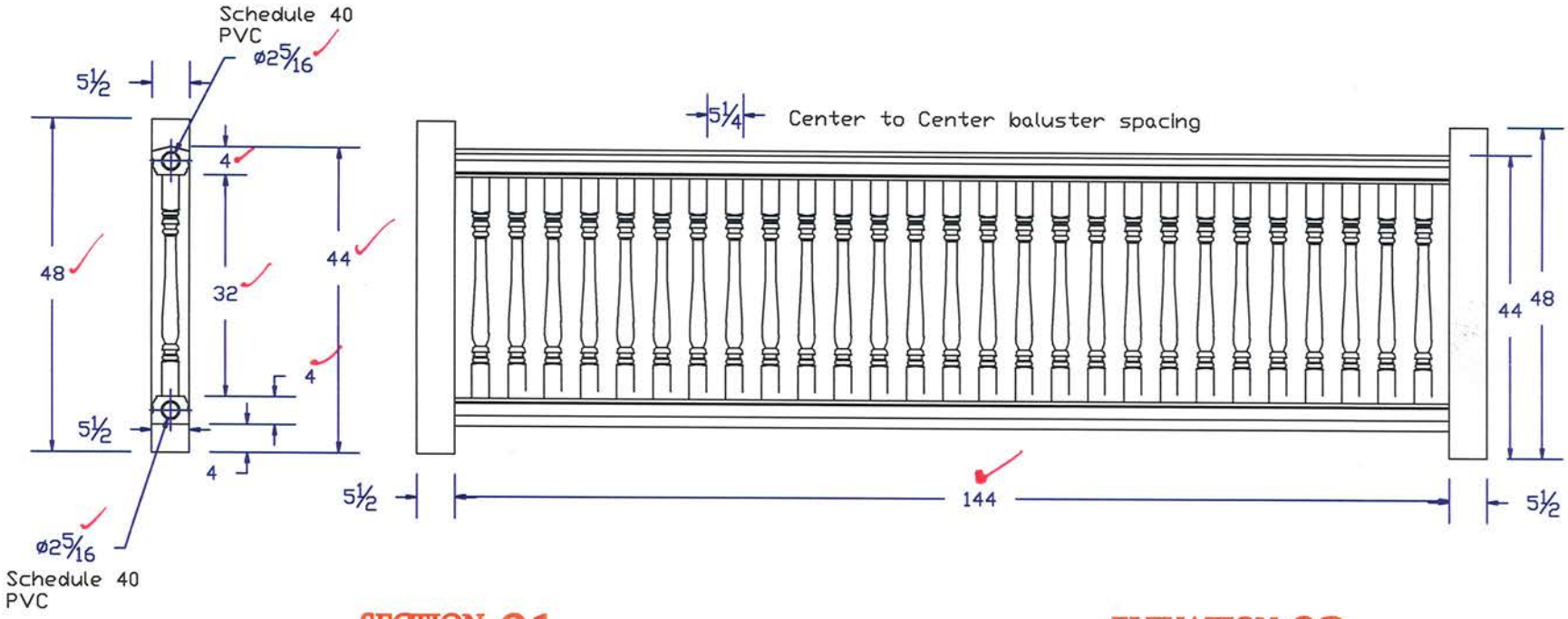


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 80916.01

Date 7/23/13 Tech TH



SECTION 01
SCALE: 1/2" = 1'-0"

ELEVATION 02
SCALE: 1/2" = 1'-0"

haas

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PART NAME	HTR 204-12; HBR 205-12; HNP 300-6; HBAL 103-32
PART NUMBER	
PROJECT	Haas Architectural Millwork

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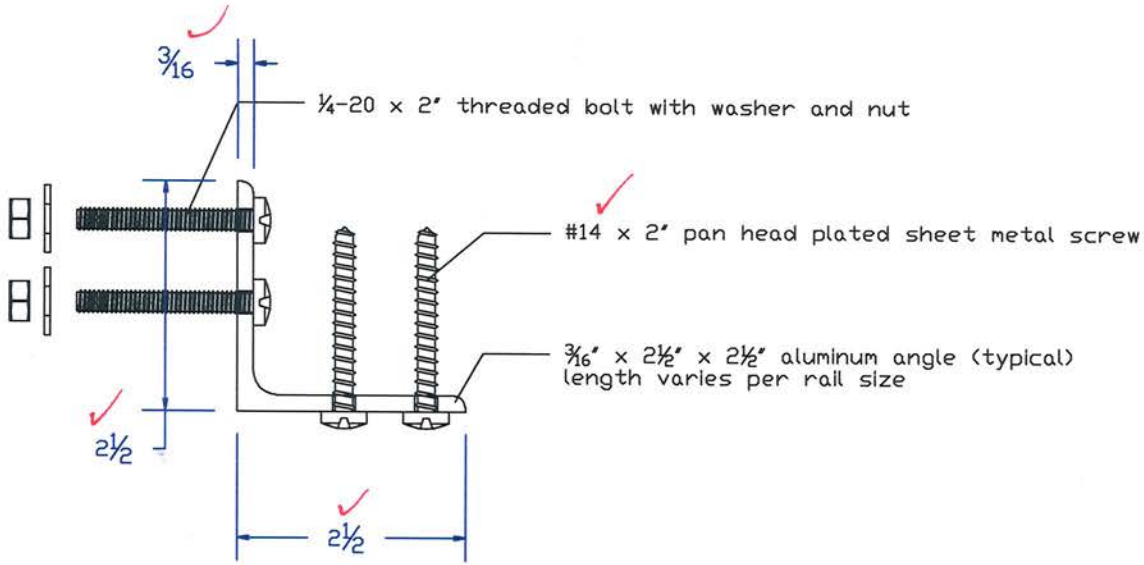
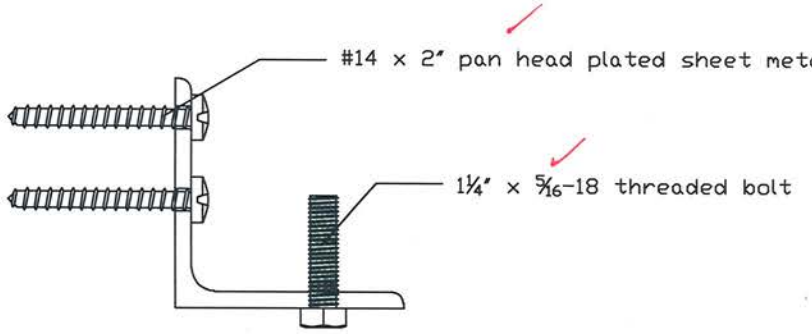
REV. 1	1-25-2013
REV. 2	7-18-2013
REV. 3	7-19-2013
REV. 4	
REV. 5	
REV. 6	

DRAWING NU
1.0

Top Bracket



Bottom Bracket



Width of bracket - 3"

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 80916.01

Date 7/23/13 Tech TH

SECTION 01
SCALE: 6" = 1'-0"

ELEVATION 02
SCALE: 6" = 1'-0"

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PART NAME	HRK Parts	REV. 1	1-25-2013	DRAWING NU
PART NUMBER		REV. 2		
PROJECT	Haas Architectural Millwork	REV. 3		1.0
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		REV. 5		
		REV. 6		

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SECTION 12
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	09/24/18	N/A	Original Report Issue - Changed Report No. 80916.01-119-19 to reflect company name change from Haas Architectural Millwork, Inc. to Western Spindle LLC.