Architectural Testing

TEST REPORT

Rendered to:

KEYLINK FENCING & KENNELS

For:

PRODUCT: ***6000 Series Arabian***
TYPE: Aluminum Secondary Handrail Systems

Report No: 75387.01-119-19
Report Date: 10/16/07
Revision 1: 01/22/08

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TEST REPORT

75387.01-119-19
October 15, 2007
Revision 1: January 22, 2008

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Rendered to:

KEYLINK FENCING & KENNELS
150 Orlan Road
New Holland, Pennsylvania 17557

Report No.:	75387.01-119-19
Test Date Started:	07/23/07
Test Date Completed:	09/25/07
Report Date:	10/16/07
Revision 1:	01/22/08

1.0 General Information

1.1 Product

6000 Series Arabian

1.2 Type

Aluminum Handrail Systems

1.3 Project Description

Architectural Testing, Inc. was contracted by Superior Plastic Products, Inc. to conduct structural performance tests on the 8 ft long contour and 6 ft by 1-1/2 in diameter *6000 Series Arabian* aluminum handrail systems. The systems were evaluated for the design load requirements of the following building codes:

2006 International Building Code ® - *International Code Council*

2006 International Residential Code ® for One- and Two-Family Dwellings - *International Code Council*

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of 2006 IBC.

Exception: *The test load of two times the design load was not held for 24-hours. The rationale is that handrail systems are not subject to long term sustained loads such as snow loads and floor live loads.*

All samples used for the testing reported herein were provided by Keylink Fencing & Kennels.

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1.4 Limitations

All tests performed were to evaluate structural performance of the handrail assembly to carry and transfer imposed loads to the supporting structure. The support posts are not tested components and are included in the test specimen only to facilitate anchorage of the rail brackets. Anchorage of support posts to the supporting structure is not included in the scope of this testing and was previously evaluated under Architectural Testing, Inc. Report No. 71004.01-119-19-R1, dated 03/15/07.

1.5 Product Description

Keylink Fencing & Kennels provided the test specimens with the following details:

Round Handrail: 1-1/2 in diameter by 72 in long aluminum extrusion with 0.125 in wall thickness

Contour Handrail: 1-3/4 in wide by 1-7/8 in deep by 93-1/2 in long aluminum extrusion with 0.125 in wall thickness

Handrail Brackets: Die-cast aluminum brackets 2.444 in high by 2.119 in

Fasteners: #8 x 1-1/4 in self-drilling, flat head, sheet metal screws (three in bracket / post)

#14 x 1 in flat head, sheet metal screws (two in rail / bracket)

Support Post: 2-1/2 in square hollow aluminum extrusion with 0.125 in wall thickness

See drawings in Appendix A and photographs in Appendix B for additional details.

2.0 Structural Performance Testing of Assembled Handrail Systems

2.1 Test Equipment

The handrail was tested in a self-contained structural frame designed to accommodate anchorage of the handrail 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.

2.2 Test Setup

The handrail assemblies were installed and tested as a single railing section by directly securing the support 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 handrail system components (ends and mid-point) to determine net component deflections. See photographs in Appendix B for individual test setups.

2.3 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. 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 analyze recovery. Load was reapplied and 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.

2.4 Test Results

The following tests were performed on the handrail 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).

Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure.

2.4 Test Results (Continued)

8 ft Contour *6000 Series Arabian* Aluminum Handrail
Attached to 2-1/2 in Square Support Post

Test No. 1 - 09/25/07 **Design Load: 200 lb Concentrated Load at Midspan**						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	54	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	407	00:12	0.43	3.19	0.36	2.80
Recovery			81% [2]			
2.5x Design Load	504	00:16	Maximum Test Load - *Sustained without failure*			

[1] *Net displacement was mid-rail displacement relative to the ends of the handrail.*
[2] *Return to Initial Load was not captured during testing, therefore, linear regression analysis of test data was used to calculate percent recovery.*

Test No. 2 - 07/23/07 **Design Load: 200 lb Horizontal Concentrated Load at End (Bracket)** [1]			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
			Rail End
Initial Load	46	00:00	0.00
2.0x Design Load	401	00:22	0.28
Initial Load	50	01:21	0.04
Recovery			87%
2.5x Design Load	513	01:32	Maximum Test Load - Sustained without failure

[1] *Testing was conducted at one end of a 6 ft long section of the contour handrail.*

Test No. 3 - 07/23/07 **Design Load: 200 lb Vertical Concentrated Load at End (Bracket)** [1]			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
			Rail End
Initial Load	51	00:00	0.00
2.0x Design Load	417	00:16	0.12
Initial Load	53	00:54	0.00
Recovery			100%
2.5x Design Load	501	00:59	Maximum Test Load - Sustained without failure

[1] *Testing was conducted at one end of a 6 ft long section of the contour handrail.*

2.4 Test Results (Continued)

6 ft by 1-1/2 in Diameter *6000 Series Arabian* Aluminum Handrail Attached to 2-1/2 in Square Support Post

Test No. 1 - 07/23/07 Design Load: 200 lb Concentrated Load at Midspan						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	57	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	400	00:38	0.30	2.04	0.35	1.72
Initial Load	59	01:18	0.02	0.13	0.03	0.11
		Recovery	94%			
2.5x Design Load	504	01:37	Maximum Test Load - Sustained without failure			

[1] *Net displacement was mid-rail displacement relative to the ends of the handrail.*

Test No. 2 - 07/23/07 Design Load: 200 lb Horizontal Concentrated Load at End (Bracket) [1]			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
			Rail End
Initial Load	50	00:00	0.00
2.0x Design Load	402	00:29	0.34
Initial Load	67	01:25	0.04
		Recovery	88%
2.5x Design Load	514	01:33	Maximum Test Load - Sustained without failure

[1] *Testing was conducted at one end of a 6 ft long section of the 1-1/2 in diameter handrail.*

Test No. 3 - 07/23/07 Design Load: 200 lb Vertical Concentrated Load at End (Bracket) [1]			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
			Rail End
Initial Load	55	00:00	0.00
2.0x Design Load	408	00:17	0.10
Initial Load	59	00:52	-0.001
		Recovery	100%
2.5x Design Load	505	01:08	Maximum Test Load - Sustained without failure

[1] *Testing was conducted at one end of a 6 ft long section of the 1-1/2 in diameter handrail.*

3.0 Summary and Conclusions

Using a performance criteria of 75% recovery from 2.0 times design load and an ultimate load not less then 2.5 times design load, the test results, in our opinion, substantiate compliance with the design load requirements of the referenced building codes for only detached one- and two-family dwellings for the 8 ft long contour and 6 ft by 1-1/2 in diameter *6000 Series Arabian* aluminum handrail systems attached to the support post as reported herein. Anchorage of support post to the supporting structure is not included in the scope of this testing and was evaluated previously under Architectural Testing, Inc. Report No. 71004.01-119-19-R1, dated 03/15/07.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence 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, said materials shall be discarded without notice, and the service life of this report by Architectural Testing shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

Digitally Signed by: Matthew C. Holloway

Matthew C. Holloway
Technician

Digitally Signed by: Travis Hoover

Travis A. Hoover
Project Engineer / Manager
Structural Systems Testing

MCH:mch/alb
Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (3)
Appendix B - Photographs (4)

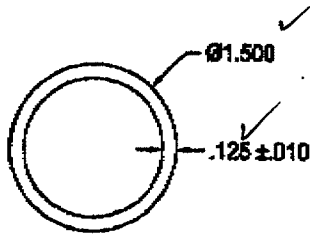
Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	10/16/07	N/A	Original report issue
1	01/22/08	2	Changed "post" to "support post" and corrected the dimension of the support post from 3-1/2 in to 2-1/2 in under the Product Description.
		3	
		4,5	Changed the heading of the test results to include "Attached to 2-1/2 in Square Support Post".
		6	Revised Summary and Conclusions section
		Appendix A	Replaced one drawing

APPENDIX A

Drawings

OC-4366



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Test sample complies with these details.
Deviations are noted.

Report# 75387.01-119-19

Date 9/26/07 Tech MDF

ACTUAL SIZE

Standard aluminum association tolerances apply unless otherwise specified.

Approval Signature _____ Approval Date _____

MI METALS, INC.
Millersburg, PA - Milton, GA - Oldsmar, FL
Smyrna, TN - Prescott Valley, AZ

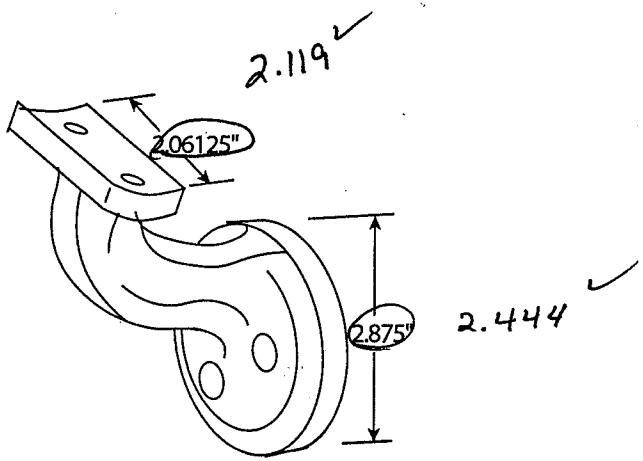
Title: Standard Tube	Drawn By: DLS	Scale: 1:1	Area: .540	Perimeter: 4.712	Est. Perimeter: 8.639	Die Number: OC-4366
	Date: 3/15/07	Alloy: Hollow	Weight/ft: .648	Temper Mod: 1-2	Alloy/Temper: 6105-T6	Thermal Area:
Customer Name: Quality Fence	Print Location: MI Metals - Millersburg, PA			Typical Wall: .125	Recrystallized Radius:	

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 75387.01-119-19

Date 9/26/07 Tech MDP



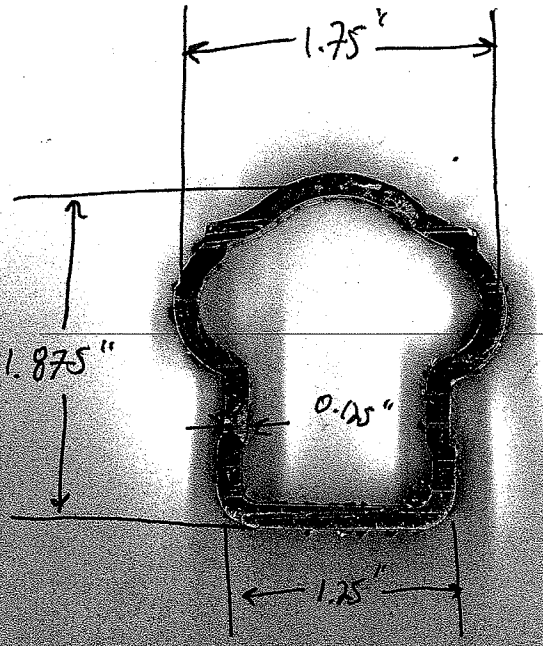
inline bracket

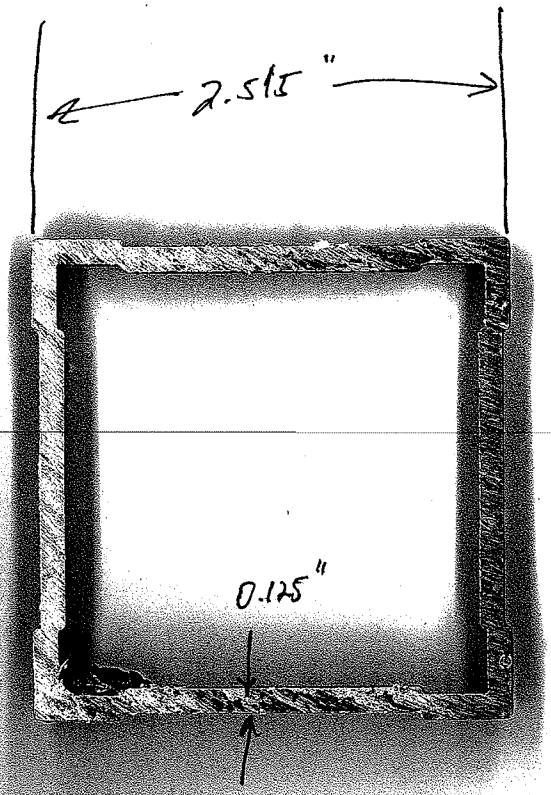
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 75387.01-119-19

Date 1/21/08 Tech MDF





APPENDIX B

Photographs

Photo No. 1
Concentrated Load at Midspan of Contour Handrail

Photo No. 2
Horizontal Concentrated Load Test at End of Contour Handrail (Brackets)

Photo No. 3
Vertical Concentrated Load Test at Ends of Contour Handrail (Brackets)

Photo No. 4
Concentrated Load at Midspan of 1-1/2" Diameter Handrail

Photo No. 5
Horizontal Concentrated Load Test at End of
1-1/2 in Diameter Handrail (Brackets)

Photo No. 6
Vertical Concentrated Load Test at End of
1-1/2 in Diameter Handrail (Brackets)

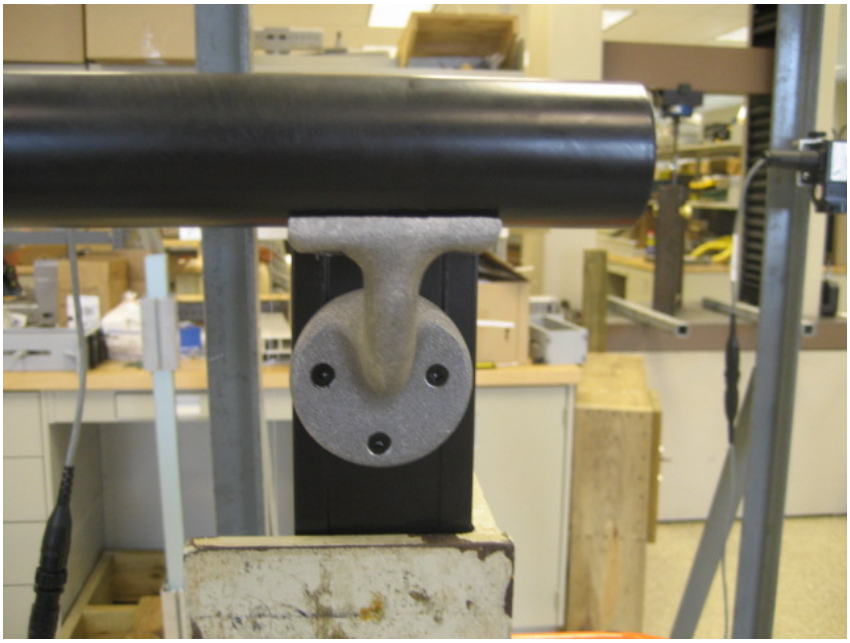


Photo No. 7
Typical Die-Cast Aluminum Bracket for
1-1/2 in Diameter Handrail