Architectural Testing

TEST REPORT

Rendered to:

KEYLINK FENCING & KENNELS

For:

PRODUCT: ***6000 Series Arabian***

TYPE: Aluminum Guardrail Assembly and Structural Post Mounts

Report No: 78001.01-119-19
Report Date: 08/20/08

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

TEST REPORT

78001.01-119-19
August 20, 2008

TABLE OF CONTENTS

1.0 General Information 1
1.1 Product 1
1.2 Type 1
1.3 Project Description 1
1.4 Limitations 1
1.5 Product Description 2
1.6 Witnessing 2
2.0 Structural Performance Testing of Assembled Railing Systems 3
2.1 Test Equipment 3
2.2 Test Setup 3
2.3 Test Procedure 3
2.4 Test Results 4
3.0 Summary and Conclusions 7
4.0 Closing Statement 8
Revision Log 9
Appendix A - Drawings
Appendix B - Photographs

Architectural Testing

TEST REPORT

Rendered to:

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

Report No.:	78001.01-119-19
Test Date Started:	10/31/07
Test Date Completed:	03/19/08
Report Date:	08/20/08

1.0 General Information

1.1 Product

6000 Series Arabian Rail

1.2 Type

Aluminum Guardrail Assembly and Structural Post Mounts

1.3 Project Description

Architectural Testing was contracted by Keylink Fencing and Kennels to conduct structural performance tests on the 96 in wide by 42 in high *6000 Series Arabian* aluminum guardrail. The system was evaluated for the design load requirements of the following building codes:

IBC 2006, *International Building Code*®

IRC 2006, *International Residential Code*®

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

1.4 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 (pickets), 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.

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

1.5 Product Description

Keylink Fencing and Kennels provided the fully-assembled test specimens with the following details:

Top Rail: 2 in high by 1-3/4 in wide contoured aluminum extrusion with 0.07 in thick wall and an upside down **U**-shaped PVC insert for picket engagement

Bottom Rail: 1-1/4 in wide by 1-1/2 in deep aluminum rectangular extrusion with 0.07 in thick wall and a **U**-shaped PVC insert for picket engagement

Pickets (In-Fill): 3/4 in square aluminum extrusion with 0.06 in wall

Rail Brackets: Cast aluminum socket brackets contoured to shape of rails

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

#8 x 3/4 in self-drilling, pan-head, sheet metal screws (two in rail / bracket)

Post Sleeves: All post sleeves are attached to their respective post mounts by a friction fitting polypropylene cap located on top of the post mount. Three post sleeve types were tested:

1. 2-1/4 in square, 1/8 in thick wall and 38-1/2 in high
2. 3 in square, 1/8 in thick wall and 38 in high
3. 3 in square, 1/8 in thick wall and 44 in high

Post Mounts: All post mounts are capped with a polypropylene friction fitting cap. All post mounts were secured by four Grade 5, 5/16 in hex head bolts spaced 2-5/8 in apart for 3-1/2 in square base plates and spaced 3-5/8 in apart for 4-1/2 in square base plates through the 0.385 in thick base plate into the surface of a rigid steel channel (simulated concrete). Three types of post mounts were tested:

1. 1-1/2 in square by 10 in high 11 gage steel tube welded to a 3-1/2 in square base plate
2. 2 in square by 9-3/4 in high 11 gage steel tube welded to a 4-1/2 in square base plate
3. 2 in square by 24 in high 11 gage steel tube welded to a 4-1/2 in square base plate

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

1.6 Witnessing

A representative of Keylink Fencing and Kennels was present on October 31, 2007, to witness structural performance testing of assembled guardrail sections.

2.0 Structural Performance Testing of Assembled Railing Systems

2.1 Test Equipment

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.

2.2 Test Setup

The 96 in 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. For the concentrated load test on the stand-alone post mount, the post was directly secured into the surface of a rigid steel channel (to simulate anchorage into concrete) with four Grade 5, 5/16 in hex head bolts. 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 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 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.

2.4 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.

Test No. 1 - 10/31/07 Design Load: 50 lb / 1 Square Ft. at Center of In-Fill						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	15	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	100 - 103	00:13 - 00:26	0.64	0.85	0.54	0.26
Initial Load	15	01:54 - 02:17	0.03	0.02	0.02	0.00
100% Recovery from 2.0x Design Load						
2.5x Design Load	128 - 131	02:22 - 02:31	Achieved Load without Failure			

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

Test No. 2 - 10/31/07 Design Load: 50 lb / 1 Square Ft. at Bottom of In-Fill						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	16	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	102 - 106	00:12 - 00:27	0.07	0.90	0.09	0.82
Initial Load	16	02:32 - 02:46	0.00	0.04	0.00	0.03
96% Recovery from 2.0x Design Load						
2.5x Design Load	127 - 135	02:55 - 03:09	Achieved Load without Failure			

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

2.4 Test Results (Continued)

Test No. 3 - 10/31/07 Design Load: 50 lb x 8 ft Horizontal Uniform Load						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Rail Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	40	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	803 - 809	00:48 - 00:49	2.51	6.31	2.74	3.69
Initial Load	40 - 41	04:05 - 05:23	0.73	1.14	0.65	0.46
88% Recovery from 2.0x Design Load						
2.5x Design Load	1001 - 1004	05:57	Achieved Load without Failure			

Test No. 4 - 10/31/07 Design Load: 200 lb Concentrated Load at End of Top Rail (Bracket)			
Load Level [1]	**Test Load (lb)**	**E.T. (min:sec)**	**End of Rail Displacement (in)**
Initial Load	41	00:00	0.00
2.0x Design Load	400 - 407	00:20 - 00:22	1.53
Initial Load	41 - 43	02:36 - 02:49	0.11
93% Recovery from 2.0x Design Load			
2.5x Design Load	500 - 509	03:00 - 03:02	Achieved Load without Failure

2.4 Test Results (Continued)

Stand-Alone Post Mount Tests

Test No. 1 - 01/14/08 Design Load: 200 lb Concentrated Load at Top of Stand-Alone Post (36 in high) Utilizing the 1-1/2 in Square by 10 in High Post Mount			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Post Displacement (in)**
Initial Load	56	00:00	0.00
2.0x Design Load	412	00:57 - 01:03	1.74
Initial Load	55	03:15 - 04:07	0.35
80% Recovery from 2.0x Design Load			
2.5x Design Load	500 - 501	04:44	Achieved Load without Failure

Test No. 2 - 01/14/08 Design Load: 200 lb Concentrated Load at Top of Stand-Alone Post (36 in high) Utilizing the 2 in Square by 10 in High Post Mount			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Post Displacement (in)**
Initial Load	49	00:00	0.00
2.0x Design Load	400	01:51	1.53
Initial Load	49	04:44 - 05:30	0.32
79% Recovery from 2.0x Design Load			
2.5x Design Load	502	05:56	Achieved Load without Failure

Test No. 3 - 03/19/08 Design Load: 300 lb Concentrated Load at Top of Stand-Alone Post (42 in high) Utilizing the 2 in Square by 24 in High by Post Mount			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**End of Rail Displacement (in)**
Initial Load	00:00	00:00	0.00
2.0x Design Load	602	00:39	2.44
Initial Load	80	04:22	0.59
76% Recovery from 2.0x Design Load			
2.5x Design Load	750	05:12	Achieved Load without Failure

3.0 Summary and Conclusions

Using performance criteria of recovering 75% deflection from 2.0 times design load and withstanding an ultimate load of 2.5 times design load, the test results reported herein substantiate compliance with the design load requirements of the referenced building codes for the 96 in wide by 42 in high *6000 Series Arabian* railing assembly. The railing supports were included only for facilitating the rail to bracket to post connection and were not tested components. These conclusions would apply only for a railing that is provided with adequate supports that provide equal or better substrate material (1/8 in thick aluminum post sleeves) for the fasteners used to anchor the rail brackets.

Support posts are qualified as noted in the following table:

Post Mount Description	For Supporting Rail with Dimensions	Code Occupancy Classification
1-1/2 in Square by 10 in High	36 in high	IRC
2 in Square by 10 in High	36 in high	IRC
2 in Square by 24 in High	42 in high	IRC
	72 in wide* by 42 in high	IBC / IRC

** Length of rail was measured from center of post to center of post.*

***Note**: Anchorage of support posts to the supporting structure is not included in the scope of this test report and would need to be evaluated separately.*

4.0 Closing Statement

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report will be retained by Architectural Testing 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.

For ARCHITECTURAL TESTING:

Digitally Signed by: Joshua M. Casher

Joshua M. Casher
Technician II
Structural Systems Testing

Digitally Signed by: Justin M. Mann

Justin M. Mann
Laboratory Supervisor
Structural Systems Testing

JMC:jmc/alb

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (9)
Appendix B - Photographs (4)

Revision Log

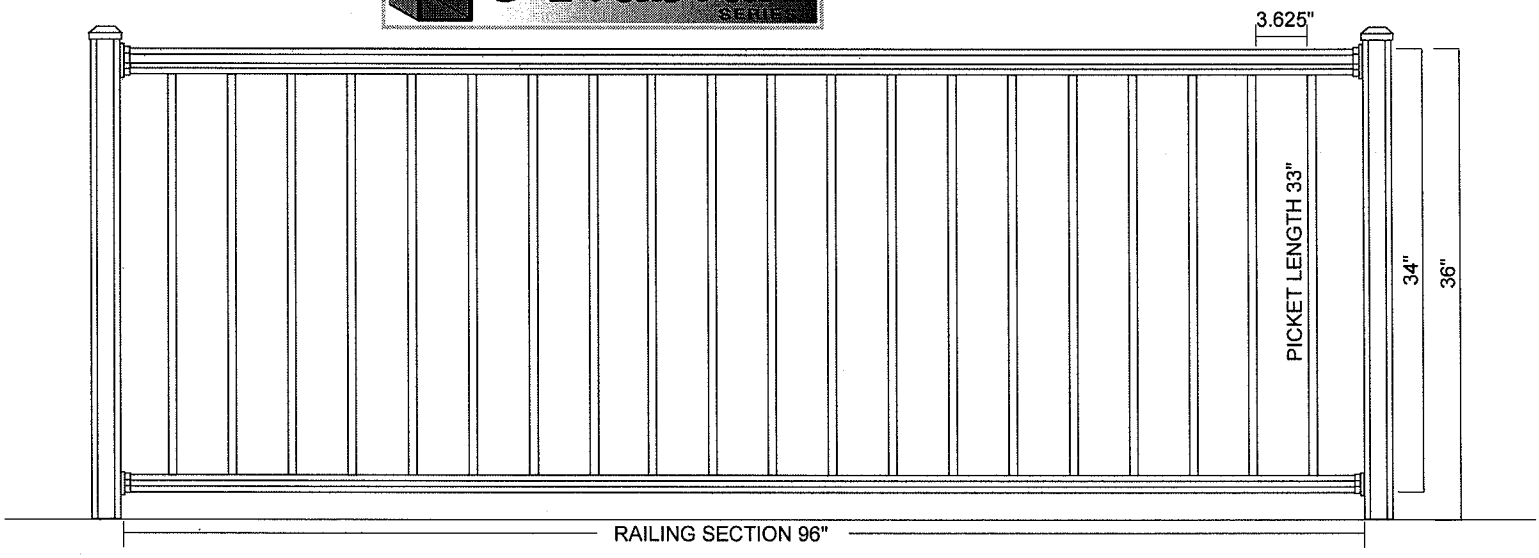
Rev. #	Date	Page(s)	Revision(s)
0	08/20/08	N/A	Original report issue

APPENDIX A

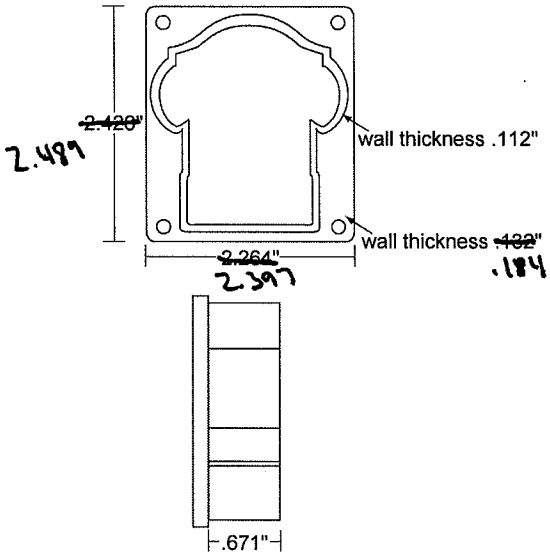
Drawings

78001.01

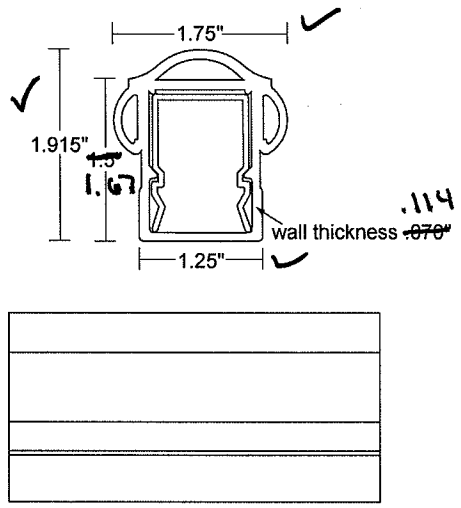
Arabian SERIES SPEC SHEET



TOP BRACKET



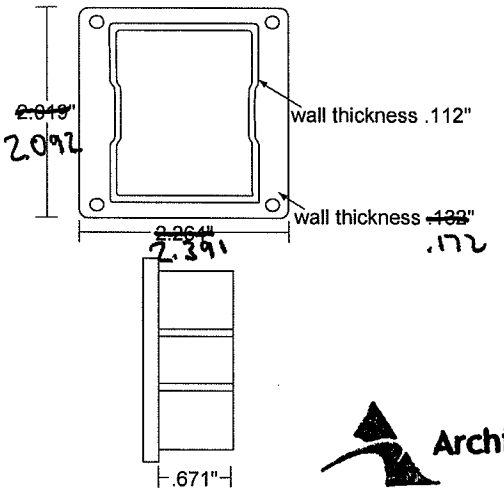
TOP RAIL



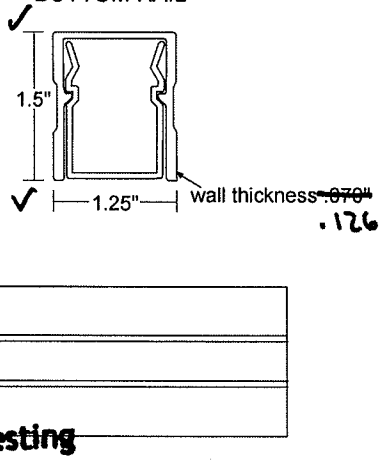
POSTS
2.5" sq. x 38" H
Wall thickness: .125"

PICKETS
.75" sq. x 33" H
Wall thickness: ~~.053~~" .055

BOTTOM BRACKET



BOTTOM RAIL

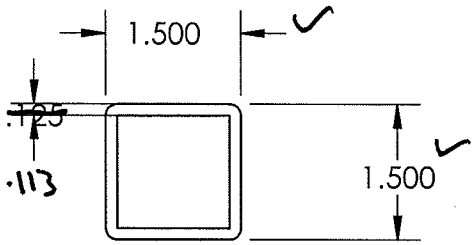


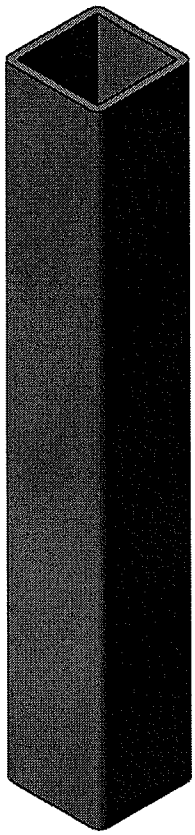
Architectural Testing

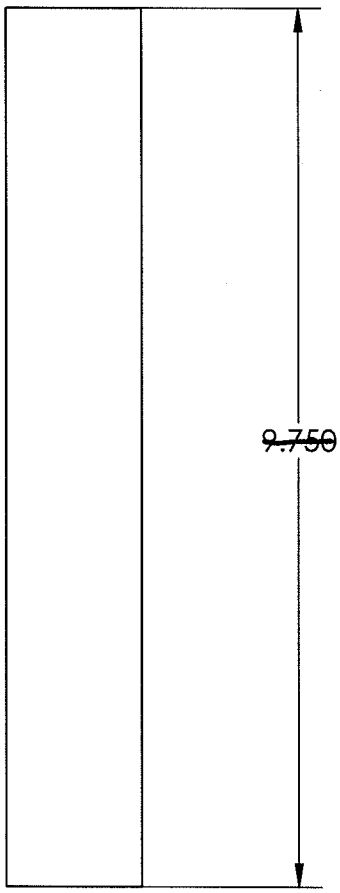
Test sample complies with these details.
Deviations are noted.

Report# 78001.01

Date 19 AUG 2008 Tech JMC







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 79001.01

Date 08/19/08 Tech JMC

Superior Plastic Products, LLC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

MATERIAL

FINISH

DO NOT SCALE DRAWING

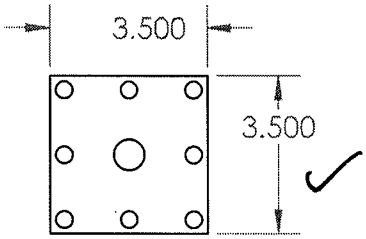
Superior Plastic

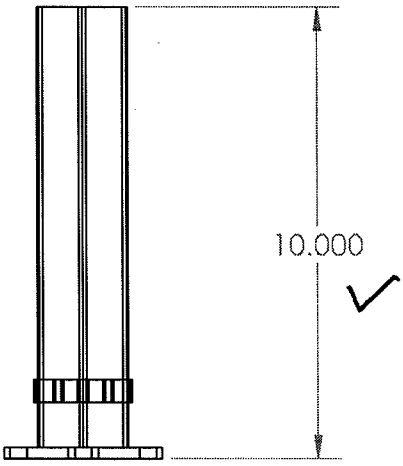
1.5 stainless sq. tube

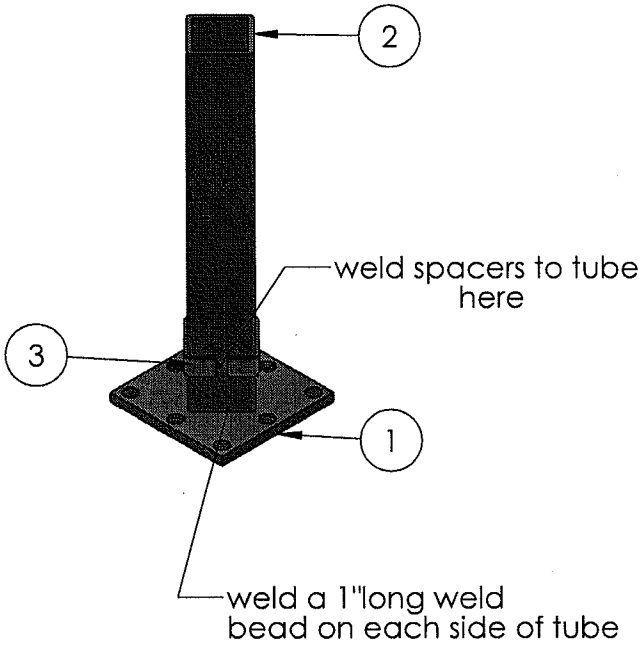
SIZE A | DWG. NO. | REV.

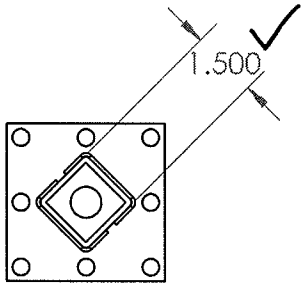
SCALE:1:2 | WEIGHT: | SHEET 3 OF 4

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	bottom plate	304 stainless	1
2	1.5 square tube	304 stainless	1
3	spacer	304 stainless	2









Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 78001.01

Date 04/19/08 Tech JMC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Superior Plastic Products, LLC

Superior Plastic

2.5x10in arabian bracket

MATERIAL

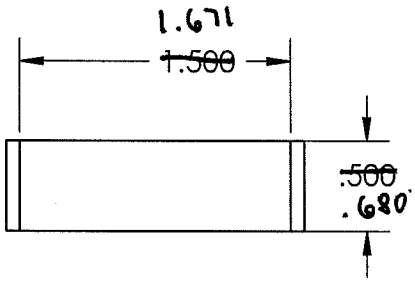
FINISH

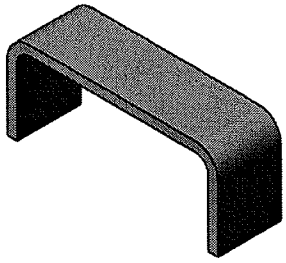
DO NOT SCALE DRAWING

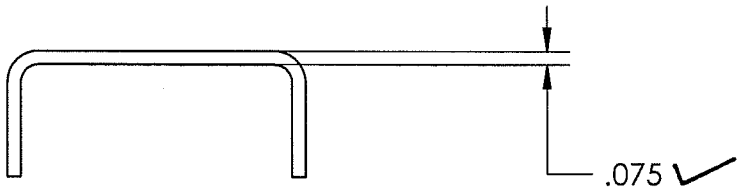
SIZE A | DWG. NO. | REV.

SCALE:1:4 | WEIGHT: | SHEET 1 OF 4

304 stainless







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 7400l.01

Date 08/19/08 Tech JMC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Superior Plastic Products, LLC

MATERIAL

FINISH

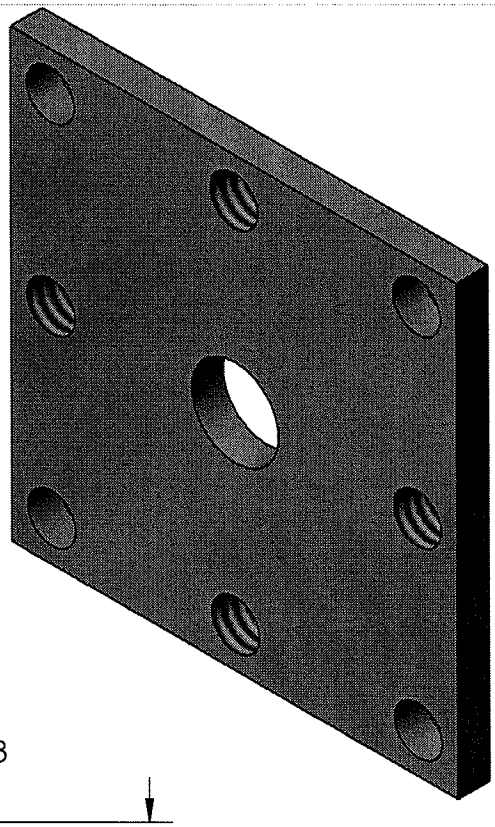
DO NOT SCALE DRAWING

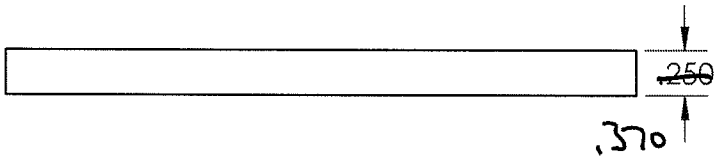
Superior Plastic

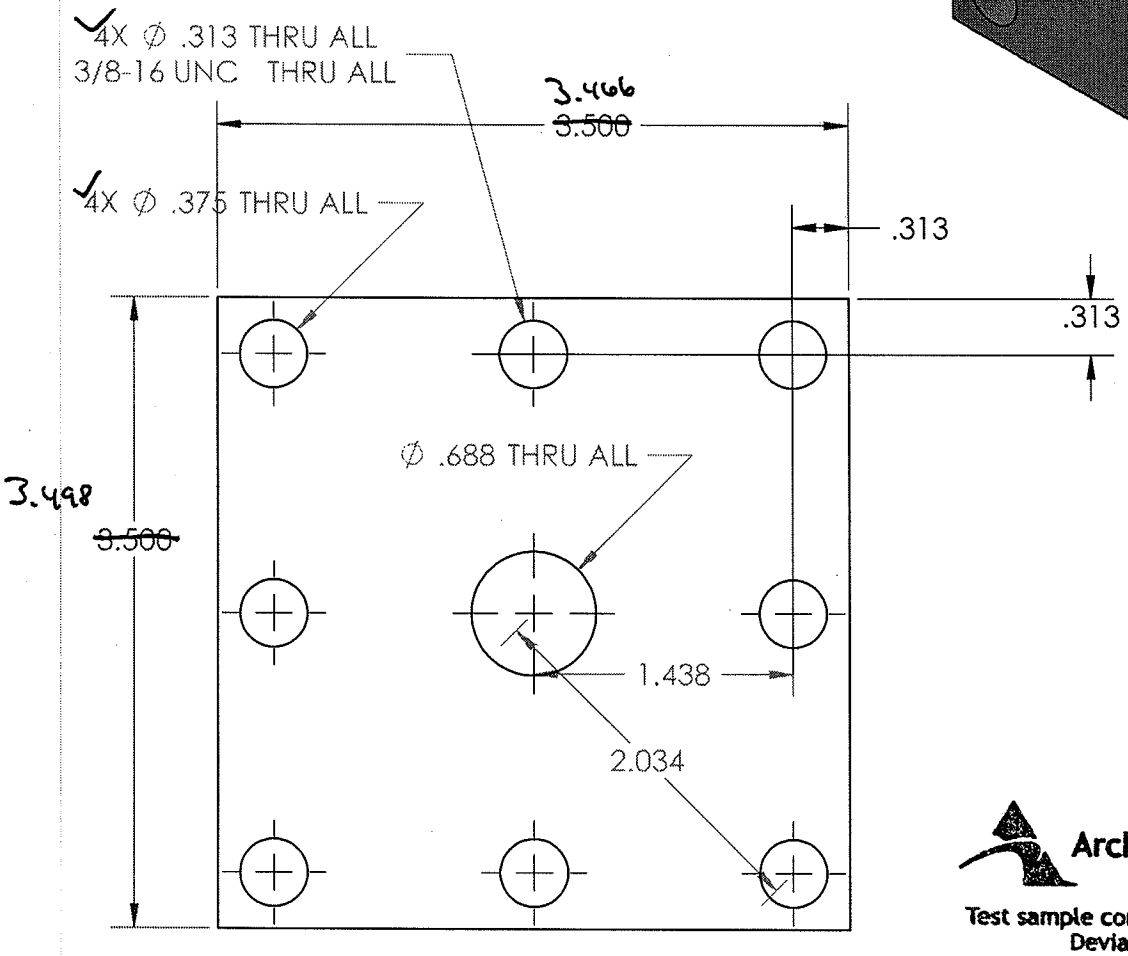
spacer
for 2.5

SIZE A | DWG. NO. | REV.

SCALE:1:1 | WEIGHT: | SHEET 2 OF 4







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 7800.01

Date 08/14/08 Tech JMC

Superior Plastic Products, LLC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

MATERIAL

FINISH

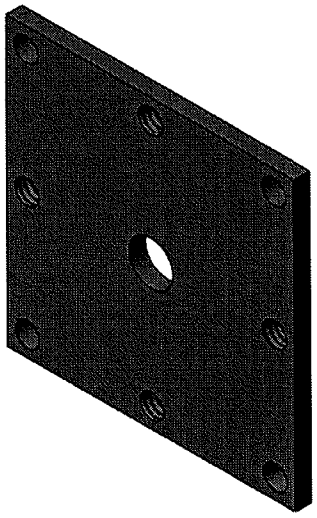
DO NOT SCALE DRAWING

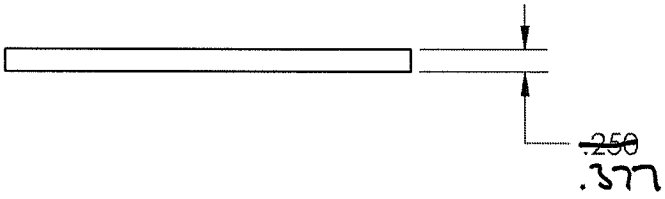
Superior Plastic

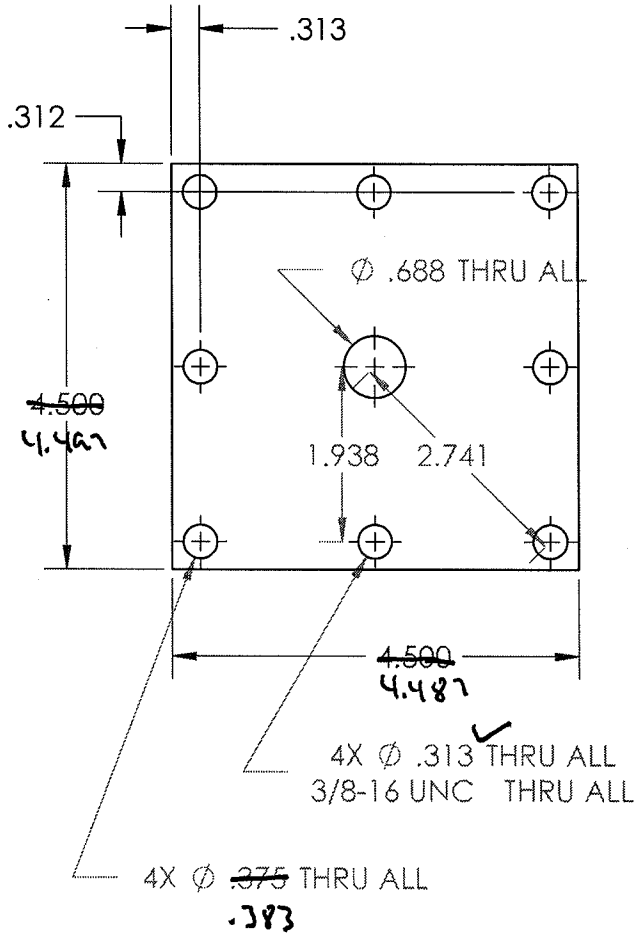
bottom plate for 2.5 Arabian bracket

SIZE A | DWG. NO. | REV.

SCALE:1:1 | WEIGHT: | SHEET 4 OF 4







Architectural Testing

Test sample complies with these details. Deviations are noted.

Report# 78601.01

Date 08/19/08 Tech Jmc

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Superior Plastic Products, LLC

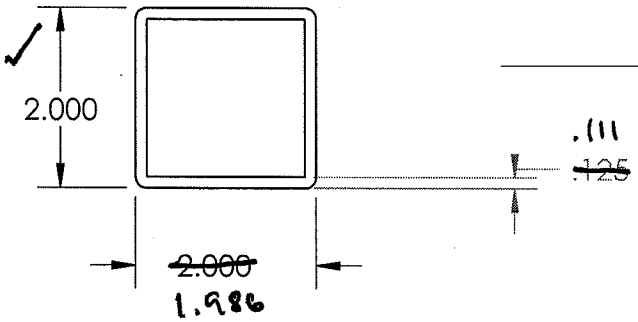
MATERIAL	
FINISH	
DO NOT SCALE DRAWING	

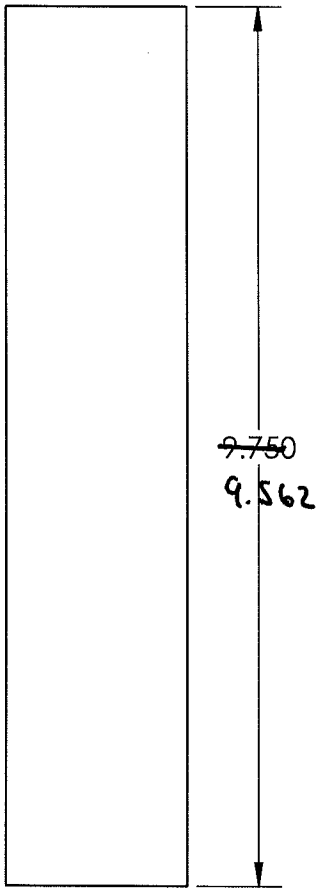
Superior Plastic

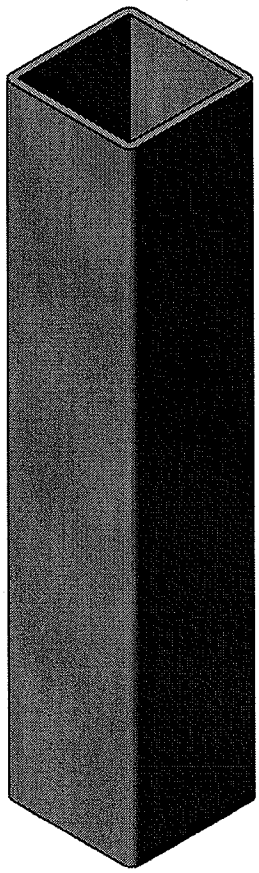
bottom plate for 3.25x10 bracket

SIZE	DWG. NO.	REV.
A		

SCALE:1:2 WEIGHT: SHEET 4 OF 4







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 78001.01

Date 08/19/08 Tech JMC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Superior Plastic Products, LLC

MATERIAL

FINISH

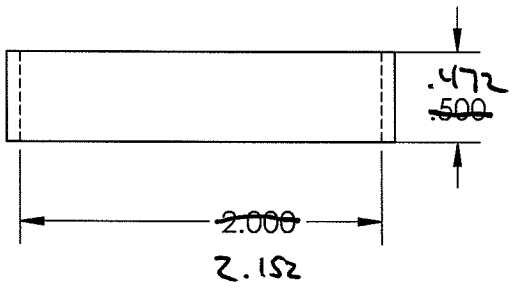
DO NOT SCALE DRAWING

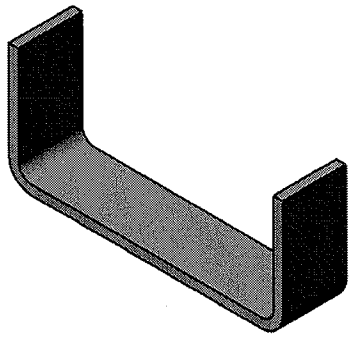
Superior Plastic

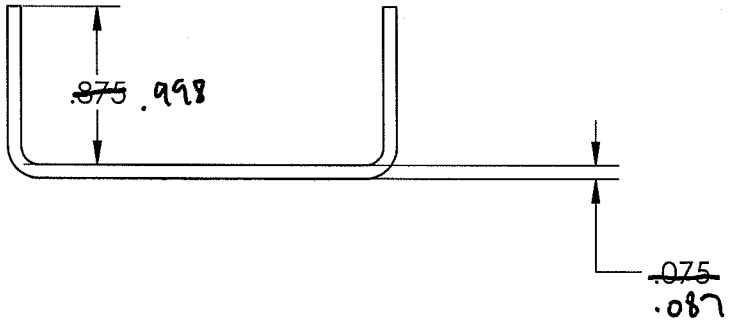
2" stainless tube for 3.25x10 arabian

SIZE A | DWG. NO. | REV.

SCALE:1:2 | WEIGHT: | SHEET 3 OF 4







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 78001.01

Date 08/19/08 Tech JMC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

Superior Plastic Products, LLC

MATERIAL

FINISH

DO NOT SCALE DRAWING

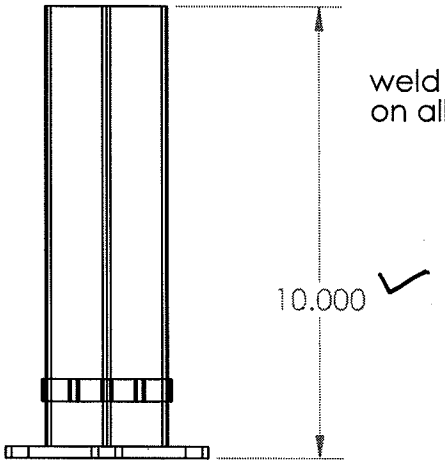
Superior Plastic

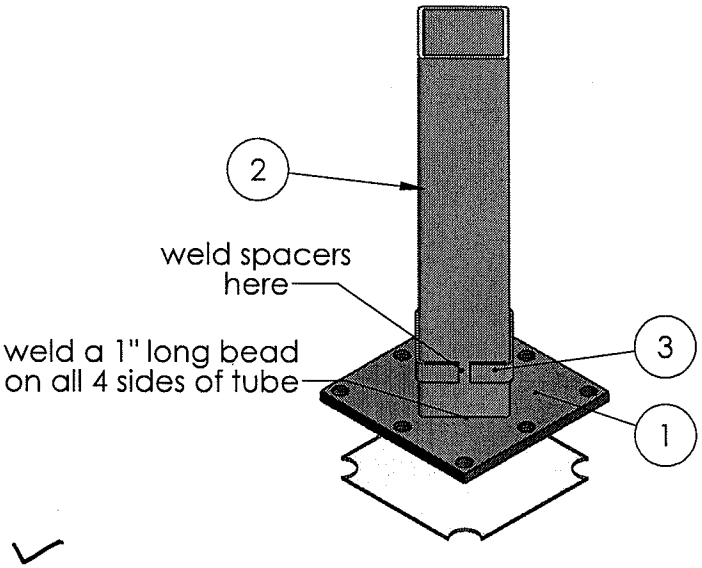
spacers for 3.25 bracket

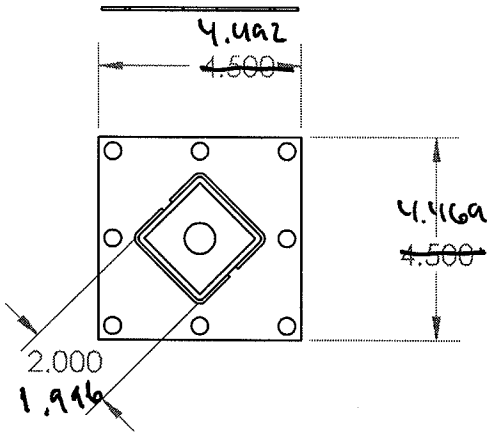
SIZE A | DWG. NO. | REV.

SCALE:1:1 | WEIGHT: | SHEET 2 OF 4

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	bottom plate	304 stainless	1
2	2 in sq. tube	304 stainless	1
3	spacer	304 stainless	2
4	levling plate ar.		1







Architectural Testing

Test sample complies with these details. Deviations are noted.

Report# 78001.01

Date 08/19/08 Tech Jmc

Superior Plastic Products, LLC

	NAME	DATE
DRAWN	Elmer	4/18/08
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

MATERIAL

FINISH

DO NOT SCALE DRAWING

Superior Plastic

3.25x10 arabian bracket

SIZE A | DWG. NO. | REV.

SCALE:1:4 | WEIGHT: | SHEET 1 OF 4

APPENDIX B

Photographs

Photo No. 1
In-Fill Load Test -Middle of Baluster

Photo No. 2
In-Fill Load Test- Bottom of Baluster

Photo No. 3
Concentrated Load Test at Mid-span of Top Rail

Photo No. 4
Concentrated Load Test at End of Top Rail (Bracket)

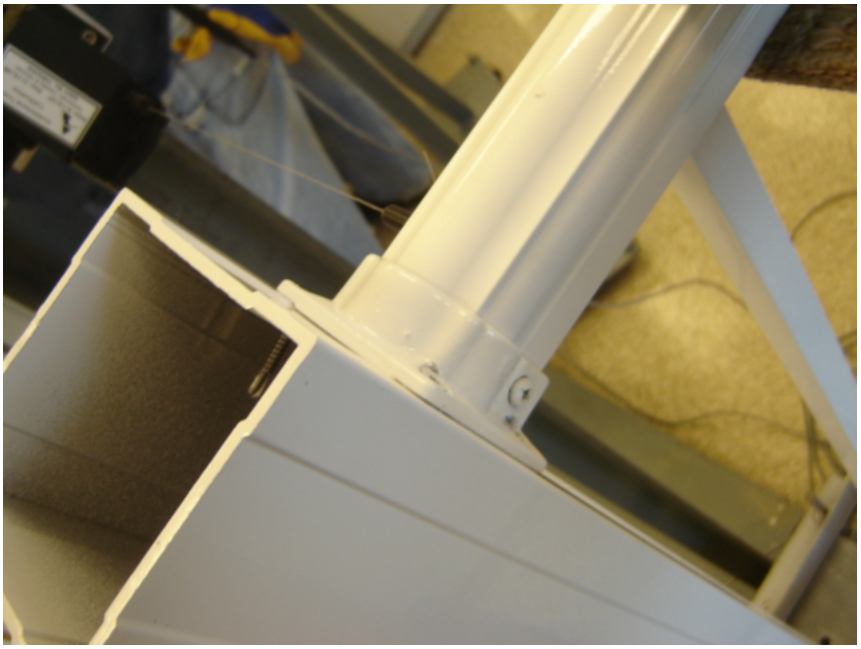


Photo No. 5
Bracket Close-Up After testing

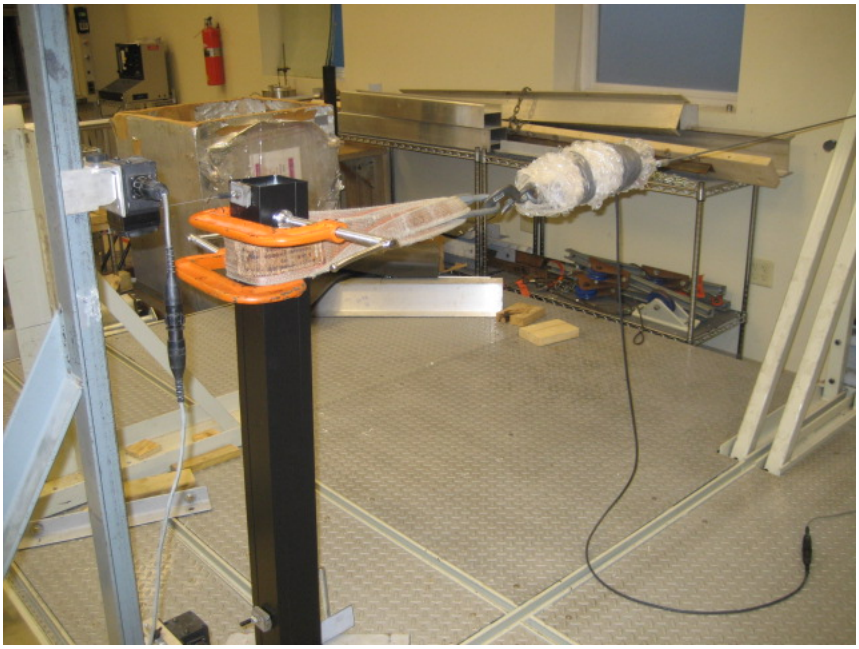


Photo No. 6
Post Mount at 2.5x Design Load

Photo No. 7
Post Mount Types

Photo No. 8
Post Sleeve Types