TEST REPORT

Rendered to:

HOMELAND VINYL PRODUCTS, INC.

For:

PRODUCT:
***Gorilla® Column* PVC Porch Post System**
with PVC Base / Cap Plates, PVC Bushings and
2-3/8 in Diameter and 3-1/2 in Diameter Galvanized Steel Reinforcing Inserts

Report No.: E2328.01-119-16
Report Date: 01/22/15
Test Record Retention Date: 12/09/18

130 Derry Court
York, PA 17406

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TEST REPORT

E2328.01-119-16
January 22, 2015

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TEST REPORT

Rendered to:

HOMELAND VINYL PRODUCTS, INC.
3300 Pinson Valley Parkway
P.O. Box 170729
Birmingham, Alabama 35217-0729

Report No.:	E2328.01-119-16
Test Dates:	09/24/14
Through:	12/09/14
Report Date:	01/22/15
Test Record Retention Date:	12/09/18

1.0 General Information

1.1 Product

Gorilla® Column PVC base / cap plates and PVC bushings used in conjunction with 2-3/8 in diameter and 3-1/2 in diameter galvanized steel reinforcing inserts for PVC porch post systems

1.2 Project Description

Architectural Testing was contracted by Homeland Vinyl Products, Inc. to evaluate the structural performance of their *Gorilla® Column* PVC base / cap plates and PVC bushings used in conjunction with 2-3/8 in diameter and 3-1/2 in diameter galvanized steel reinforcing inserts for their PVC porch post systems. The evaluation was for concentric axial loads in compression, uplift loading and punching shear loading.

1.3 Product Description

All test specimens used for testing reported herein were supplied by Homeland Vinyl Products Inc. Each post assembly included a section of galvanized steel post reinforcing, 10-3/4 in by 10-3/4 in by 1-1/2 in (overall thickness) PVC base / cap plate and a 4-1/8 in by 4-1/8 in by 1-1/2 in (overall thickness) PVC bushing. Connection details for each test specimen were as follows:

2-3/8 in Diameter Steel Porch Post Reinforcing Insert:

- Axial Load and Uplift Load Testing:
  2-3/8 in O.D by 2-3/16" I.D. by 0.090 in thick wall (nominal 13 gauge) galvanized steel post attached to the PVC bushing with four #12-14 x 1-1/2" (0.160 in minor diameter) hex washer head, stainless steel self-drilling screws. The bushing attached to the PVC cap / base plate with four 1/4"-14 x 3/4" (0.184 in minor diameter) trim head, phillips drive, zinc coated carbon steel screw, type AB point.
- Punching Shear Load Testing:
  2-3/8 in O.D by 2-3/16" I.D. by 0.090 in thick wall (nominal 13 gauge) galvanized steel post attached to the PVC bushing with four #12-14 x 1-1/2" (0.160 in minor diameter) hex washer head, zinc coated carbon steel self-drilling screws using a 1/8 in pre-drill. The bushing attached to the PVC cap / base plate with four 1/4"-14 x 3/4" (0.184 in minor diameter) trim head, phillips drive, zinc coated carbon steel screw, type AB point.

3-1/2 in Diameter Steel Porch Post Reinforcing Insert:

- Axial Load and Uplift Load Testing:
  3-1/2 in O.D. by 3-5/16" I.D. by 0.091 in thick wall (nominal 13 gauge) galvanized steel post attached to the PVC bushing and cap / base plate with four #12-14 x 1-1/2" (0.160 in minor diameter) hex washer head, stainless steel self-drilling screws.
- Punching Shear Load Testing:
  3-1/2 in O.D. by 3-5/16" I.D. by 0.091 in thick wall (nominal 13 gauge) galvanized steel post attached to the PVC bushing and cap / base plate with four #12-14 x 1-1/2" (0.160 in minor diameter) hex washer head, zinc coated carbon steel self-drilling screws using a 1/8 in pre-drill. The galvanized steel post was attached to the bushing only with one #10-16 x 3/4" (0.138 in minor diameter) pan head, square drive, carbon steel self-drilling screw using a 1/8 in pre-drill.

See photographs in Appendix B for additional product information. Drawings are included in Appendix A to verify the overall dimensions and other pertinent information of the tested product, its components, and any constructed assemblies.

1.4 Qualifications

Architectural Testing in York, Pennsylvania has demonstrated compliance with ANS/ISO/IEC Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc.

1.5 Witnessing

Mr. Jeff Havercroft of Homeland Vinyl Products and Mr. Mike Burkart of Waymark Products were present to assemble test specimens and witness punching shear testing on 09/23/14.

Mr. Jeff Havercroft of Homeland Vinyl Products was present to assemble test specimens and witness concentric axial load and uplift load testing on 12/03/14 and 12/09/14, respectively.

2.0 Axial Load Compression Tests

2.1 Test Equipment

The test fixture consisted of a flat steel support attached to a rigid steel column at the top. The bottom consisted of a hydraulic jack positioned on a leveling fixture, fitted with a flat steel bearing plate and a 50,000 pound capacity load cell. Test duration, load, and deflection were recorded electronically throughout the test.

2.2 Test Setup

The columns were installed into the compression fixture with no physical connections between the column and fixture. The compression fixture was plumbed using a "PLS-5" laser plumbing device, and while applying a minimal preload to hold the test sample in place, the column was leveled with a 78 in level. An electronic linear displacement transducer was positioned at the mid-point of each of two axes on each column to measure lateral displacements about the X- and Y-Axes of the column. Reference photographs in Appendix B for test setups.

2.3 Test Procedure

Each test sample 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 the tests. Each test began with a small initial load and was loaded at a steady, uniform load rate until the test sample failed. Lateral displacements, test load, and time were electronically recorded throughout the test. The ultimate load and mode of failure were recorded for each test.

2.4 Test Results

Test loads were concentric axial compression. X- and Y-Axis displacements were measured at the column's mid-height.

Specimen No. 1
2-3/8 in O.D. by 108 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
13	0.00	0.00
1258	0.02	0.02
2200	0.04	0.05
3477	0.08	0.07
4132	0.09	0.10
5389	0.12	0.14
6589	0.14	0.20
9032	0.16	0.29
10106	0.16	0.31
11374	0.17	0.35
12049	0.20	0.40
13630	0.28	0.57
14197	0.30	0.79
14850	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 2
2-3/8 in O.D. by 108 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
42	0.00	0.00
1147	0.03	0.02
2237	0.03	0.02
3170	0.03	0.02
4118	0.03	0.03
5271	0.03	0.08
6158	0.03	0.13
7336	0.04	0.17
8200	0.04	0.19
9177	0.05	0.21
10202	0.05	0.24
11724	0.05	0.27
12423	0.05	0.30
13044	0.05	0.34
14480	0.05	0.48
15044	0.05	0.75
15488	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 3
2-3/8 in O.D. by 108 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
50	0.00	0.00
1209	0.05	0.04
2049	0.05	0.04
3018	0.05	0.09
4252	0.05	0.16
5172	0.05	0.18
6382	0.05	0.21
7059	0.05	0.21
8289	0.06	0.24
9523	0.07	0.26
10407	0.08	0.29
11708	0.08	0.34
12418	0.09	0.40
13046	0.11	0.48
14231	0.14	0.64
15201	0.21	1.02
15254	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 4
3-1/2 in O.D. by 120 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
70	0.00	0.00
1110	0.05	0.04
2073	0.06	0.06
3177	0.07	0.06
4276	0.07	0.06
5174	0.07	0.06
6529	0.09	0.06
7104	0.09	0.06
8262	0.09	0.06
9492	0.09	0.06
10110	0.09	0.06
11260	0.09	0.06
12169	0.09	0.06
13441	0.09	0.06
14291	0.09	0.06
15286	0.09	0.06
16225	0.09	0.06
17388	0.09	0.06
18201	0.09	0.06
19281	0.09	0.06
20009	0.09	0.06
21528	0.09	0.06
22352	0.09	0.06
23007	0.09	0.06
24363	0.09	0.06
26056	0.09	0.08
27326	0.09	0.10
28275	0.09	0.13
29232	0.09	0.13
30535	0.09	0.16
31029	0.16	0.20
32286	0.20	0.25
33169	0.33	0.44
34122	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 5
3-1/2 in O.D. by 120 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
240	0.00	0.00
1410	0.02	0.04
2229	0.02	0.04
3351	0.02	0.05
4047	0.02	0.05
5227	0.02	0.06
6357	0.02	0.07
7019	0.02	0.07
8232	0.02	0.08
9001	0.03	0.09
10229	0.03	0.11
11179	0.03	0.12
12029	0.03	0.12
13655	0.03	0.12
14075	0.03	0.13
15588	0.03	0.14
16155	0.03	0.14
17214	0.03	0.14
18043	0.03	0.15
19228	0.03	0.16
20642	0.04	0.16
21321	0.04	0.17
22377	0.04	0.18
23465	0.04	0.19
24393	0.04	0.20
25187	0.04	0.21
26109	0.04	0.22
27026	0.04	0.23
28160	0.04	0.25
29005	0.04	0.28
30380	0.04	0.34
31048	0.04	0.38
32216	0.04	0.47
33522	0.06	0.73
33671	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 6
3-1/2 in O.D. by 120 in Steel Reinforcing
Test Date: 12/03/14

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
94	0.00	0.00
1275	0.03	0.05
2282	0.03	0.05
3157	0.03	0.05
4273	0.03	0.05
5051	0.03	0.05
6210	0.03	0.05
7150	0.03	0.05
8240	0.03	0.05
9186	0.03	0.05
10031	0.03	0.05
11072	0.03	0.05
12232	0.03	0.05
13062	0.03	0.05
14223	0.03	0.05
15531	0.03	0.05
16378	0.03	0.05
17163	0.03	0.05
18172	0.03	0.05
19086	0.03	0.05
20028	0.03	0.05
21029	0.03	0.06
22564	0.03	0.06
23732	0.04	0.08
24006	0.05	0.08
25612	0.06	0.10
26225	0.06	0.12
27595	0.06	0.13
28385	0.07	0.15
29377	0.10	0.17
30906	0.11	0.21
31120	0.12	0.24
32343	0.14	0.32
33207	0.15	0.45
34694	*Ultimate Load*	

2.5 Test Summary

Results are ultimate load capacity of individual specimens and should not be used as safe working values or design load values.

2-3/8 in O.D. by 108 in Post

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	14850	-2.3%	Steel post reinforcing buckled and yielded to load
2	15488	+1.9%	
3	15254	+0.4%	
Average:	**15197**		

3-1/2 in O.D. by 120 in Post

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	34122	-0.1%	Steel post reinforcing buckled and yielded to load
2	33671	-1.4%	
3	34694	+1.6%	
Average:	**34162**		

3.0 Uplift Load Tests

3.1 Test Equipment

The specimens were tested to ultimate capacity in tension utilizing a SATEC Unidrive, Model MII 50 UD Universal Test Machine (ICN: Y002011).

3.2 Test Setup

Short sections of galvanized steel posts were attached at each end to a base / cap plate, bushing and double pressure treated Southern Yellow Pine (SYP) wood boards. The PVC cap / base plates were secured to the wood boards with six 1/4" by 2-1/2" FastenMaster® *TimberLOK*® (0.164 in minor diameter, 0.260 in major diameter, 0.19 in shank diameter, hex washer head) heavy duty wood screws with 3/4 in diameter washers. Tests were conducted at lab ambient temperature (68ºF ± 4ºF). Reference photographs in Appendix B for test setup.

3.3 Test Procedure

After securing each column into the test machine, the load was applied at a uniform rate of 0.05 in/min. until failure. The test duration, ultimate test load, and mode of failure were recorded for each test.

3.4 Test Results

Results are ultimate load capacity of individual specimens and should not be used as safe working values or design load values. Reference photographs in Appendix B for mode of failure.

2-3/8 in O.D. Post
Test Date: 12/09/14

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	1372	+0.3%	Base / cap plate fractured at the plate to bushing connection screws
2	1369	+0.1%	
3	1363	-0.4%	
Average:	**1368**		

3-1/2 in O.D. Post
Test Date: 12/09/14

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	2538	-4.5%	Base / cap plate fractured
2	2777	+4.5%	
3	2660	+0.1%	
Average:	**2658**		

4.0 Punching Shear Load Tests

4.1 Test Equipment

The specimens were tested to ultimate capacity in compression utilizing a SATEC Unidrive, Model MII 50 UD Universal Test Machine (ICN: Y002011).

4.2 Test Setup

Short sections of galvanized steel posts were attached at each end to a base / cap plate, bushing and double pressure treated Southern Yellow Pine (SYP) wood boards. The PVC cap / base plates were secured to the wood boards with six 1/4" by 2-1/2" FastenMaster® *TimberLOK*® (0.164 in minor diameter, 0.260 in major diameter, 0.19 in shank diameter, hex washer head) heavy duty wood screws with 3/4 in diameter washers. Tests were conducted at lab ambient temperature (68ºF ± 4ºF). Reference photographs in Appendix B for test setup.

4.3 Test Procedure

After securing each column into the test machine, the load was applied at a uniform rate of 0.05 in/min. until failure. The test duration, ultimate test load, and mode of failure were recorded for each test.

4.4 Test Results

Results are ultimate load capacity of individual specimens and should not be used as safe working values or design load values. Reference photographs in Appendix B for mode of failure.

***Note**: Punching shear testing was conducted on the original post base / cap plate design. The differences between the redesigned base / cap plate and the original were determined to be insignificant and would not affect the punching shear test results. Reference drawings in Appendix A for drawings of both the original and the redesigned base / cap plates.*

2-3/8 in O.D. Post
Test Date: 09/24/14

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	15256	+4.5%	Cap / base plate fractured under bushing
2	18464	+26.4%	
3	10088 [1]	-30.9%	The only visible damage was the #12 fasteners bent in a down-ward angle. There was no visible deformation of post mount base / cap or bushing.
Average:	**14603**		

[1] *This test was stopped at 10,000 lbs. per client's request.*

3-1/2 in O.D. Post
Test Date: 09/26/14

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	26598	+10.8%	Cap / base plate fractured just outside of the bushing
2	20407	-15.0%	
3	25032	+4.2%	Bushing fractured at bushing to post connection screw
Average:	**24012**		

5.0 Closing Statement

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period.

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, Inc.

For ARCHITECTURAL TESTING, INC.:

Digitally Signed by: Steve Neff

Steven A. Neff
Technician II
Structural Systems Testing

Digitally Signed by: Virgal Thomas Mickley, Jr.

V. Thomas Mickley, Jr., P.E.
Senior Project Engineer
Structural Systems Testing

SAN:vtm/jas

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (3)
Appendix B - Photographs (7)

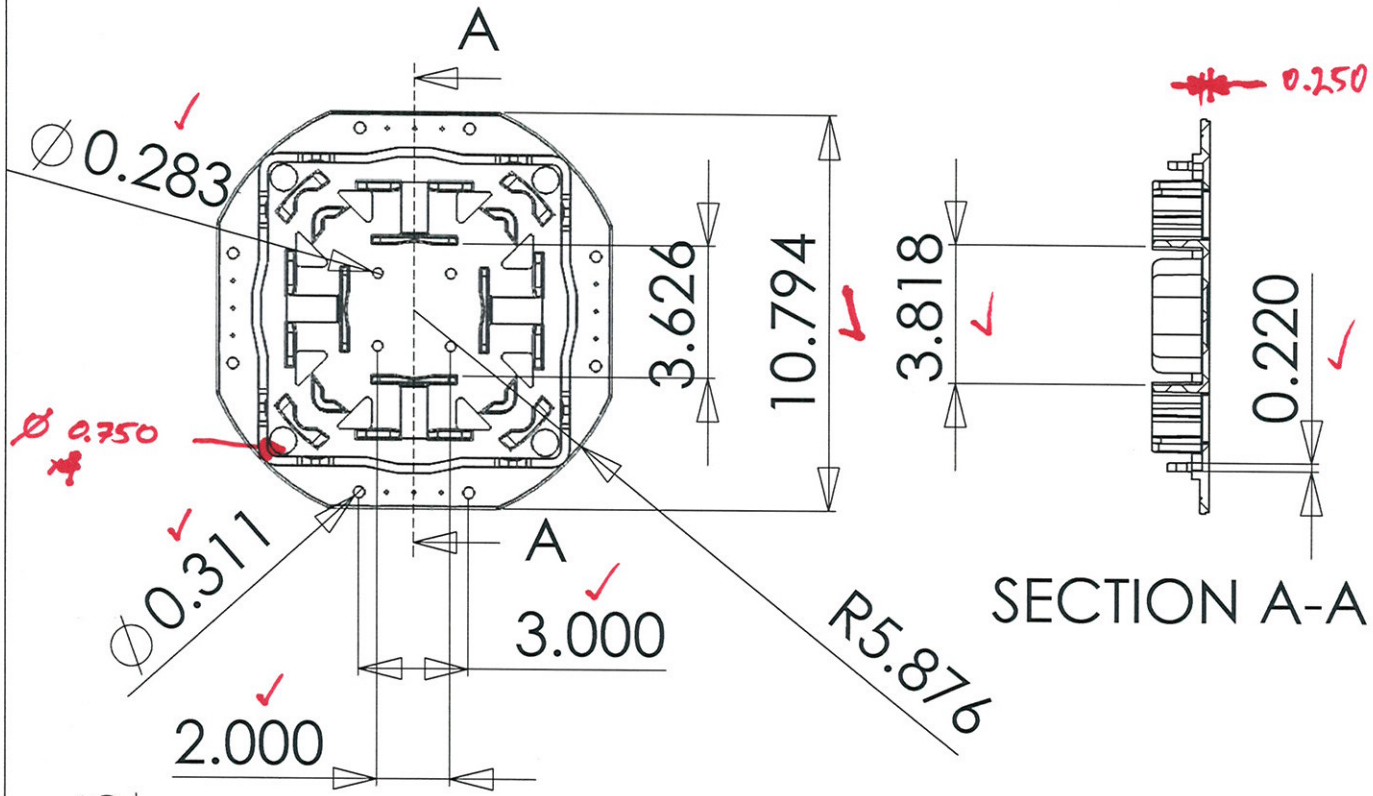
Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	01/22/15	N/A	Original report issue

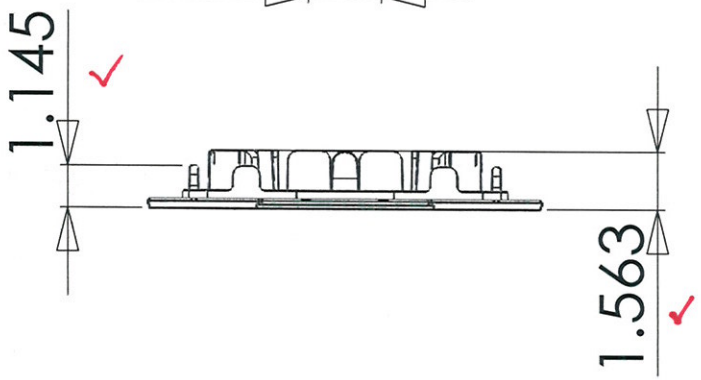
APPENDIX A

Drawings

Original!



SECTION A-A



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E2328.01-119-16

Date 1/21/15 Tech SAN

PROPRIETARY AND CONFIDENTIAL	DO NOT SCALE DRAWING
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HOMELAND VINYL PRODUCTS, INC.

Homeland Vinyl Products, Inc.
3300 Pinson Valley Pkwy
Birmingham, AL 35217

phone: 205-854-4330
fax: 205-854-3677
www.homelandvinyl.com

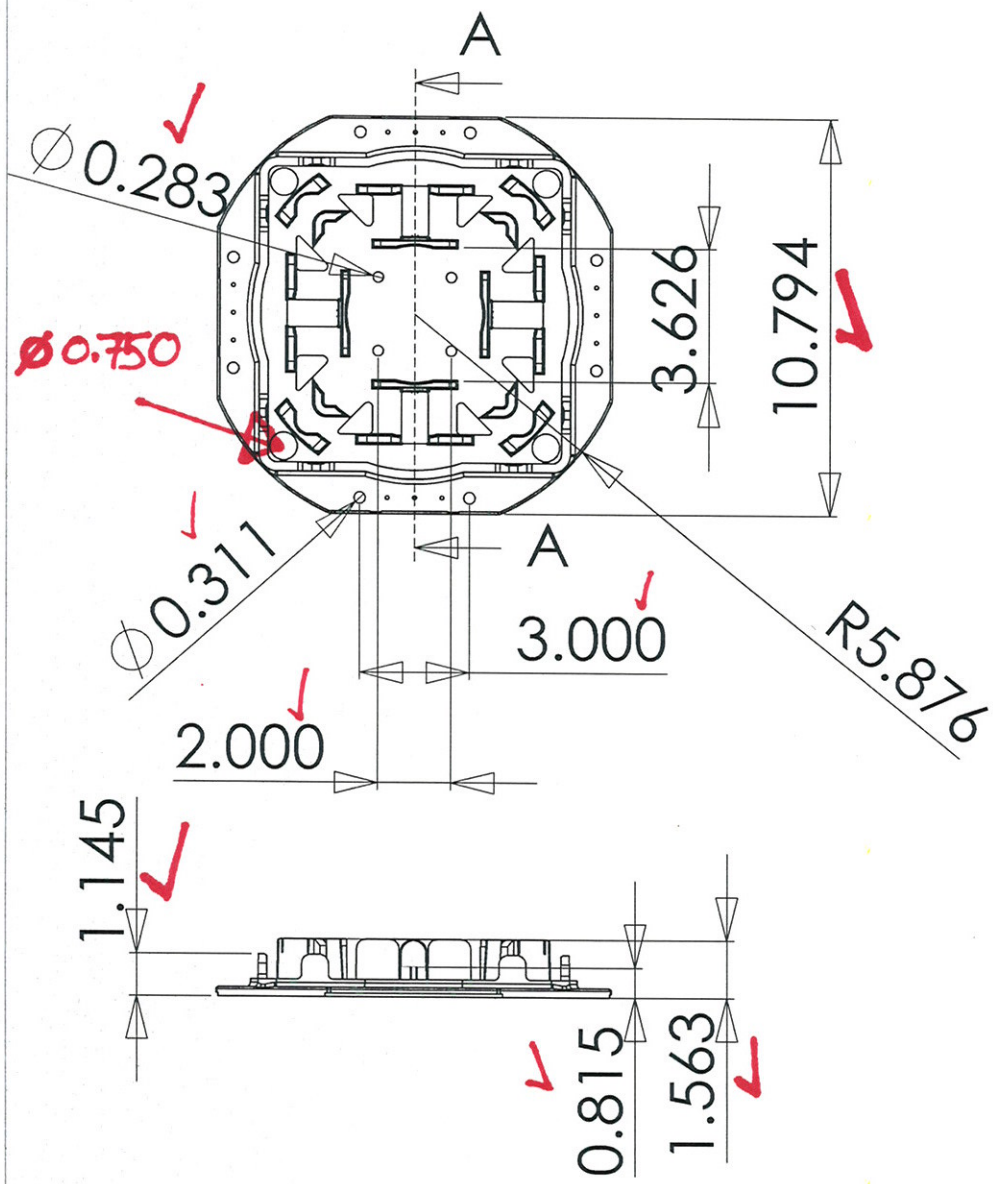
PART NUMBER	
DRAWN BY	
DRAWN DATE	
ENG APPR	
MATERIAL	
WEIGHT	

DESCRIPTION: Matrix Base

FILE NAME Tested base Sep 2014 REV.

C:\Users\jhavercroft\Dropbox (Homeland)\Engineering Share 2\Product Development\Matrix\

SHEET 1 OF 1



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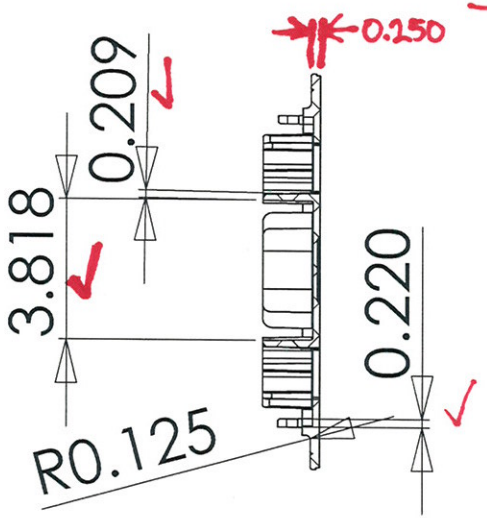

SECTION A-A

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E2328.01-119-16

Date 01/16/15 Tech SAN

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HOMELAND VINYL PRODUCTS, INC.

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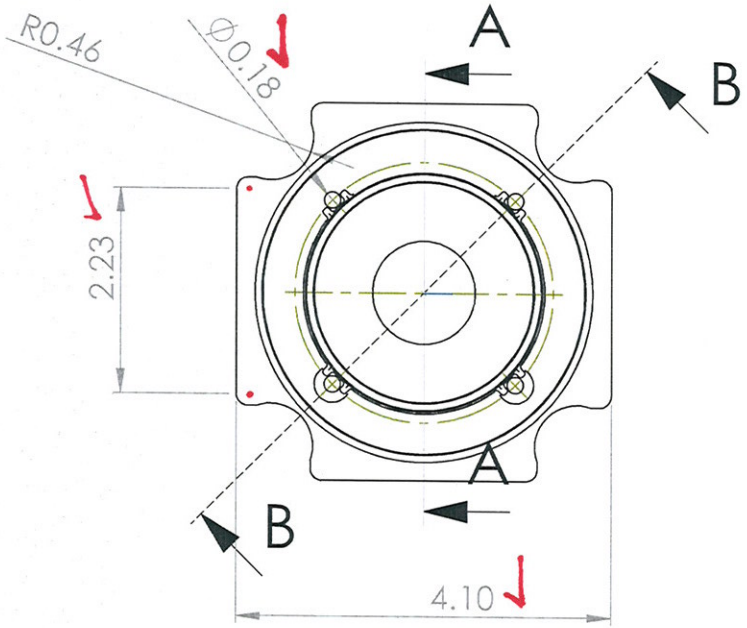
3300 Pinson Valley Pkwy
Birmingham, AL 35217
phone: 205-854-4330
fax: 205-854-3677
www.homelandvinyl.com

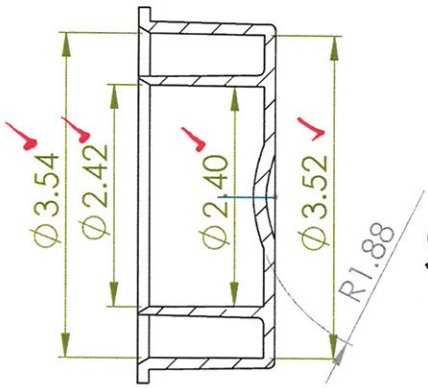
PART NUMBER	
DRAWN BY	
DRAWN DATE	
ENG APPR	
MATERIAL	
WEIGHT	

DESCRIPTION: Matrix Base

FILE NAME final base | REV.

SHEET 1 OF 1





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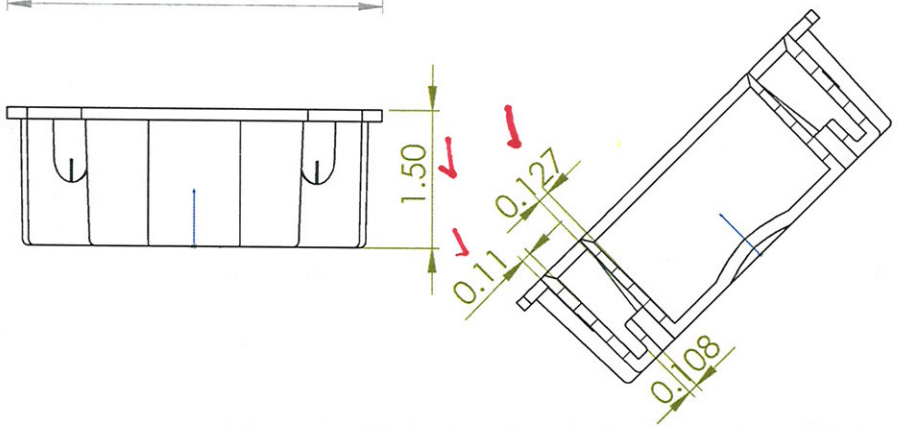

SECTION B-B

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E2328.01-119-16

Date 01/16/15 Tech SAN

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Matrix Bushing

SIZE	DWG. NO.	REV
A	Bushing	
SCALE: 1:2	WEIGHT:	SHEET 1 OF 1

5 4 3 2 1

APPENDIX B

Photographs

Photo No. 1
Typical Axial Load Compression Test Setup (108 in length post)

Photo No. 2
Typical Axial Load Compression Test Setup (120 in length post)

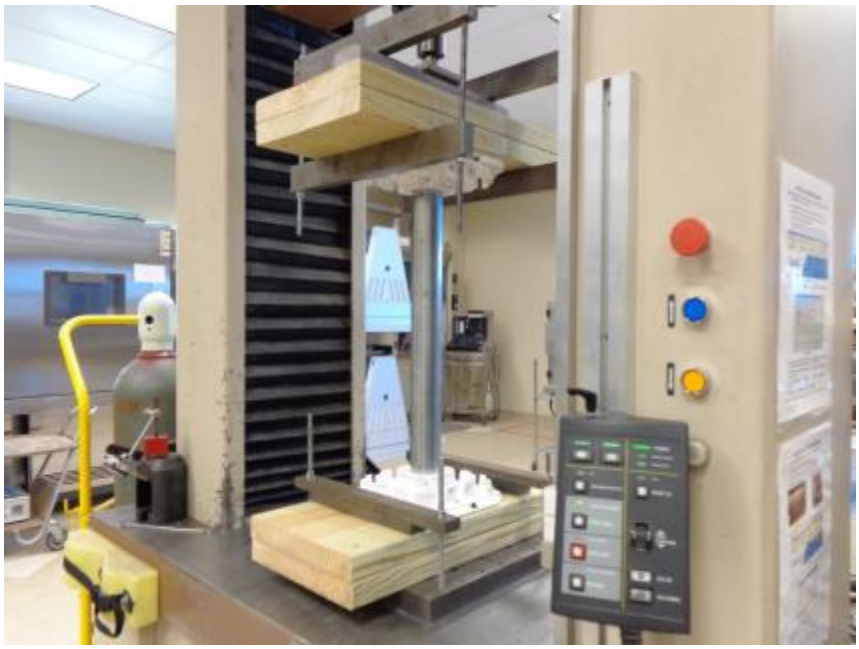

Photo No. 3
Typical Uplift Load Test Setup

Photo No. 4
Typical Uplift Load Test Failure - 2-3/8 in Diameter Post

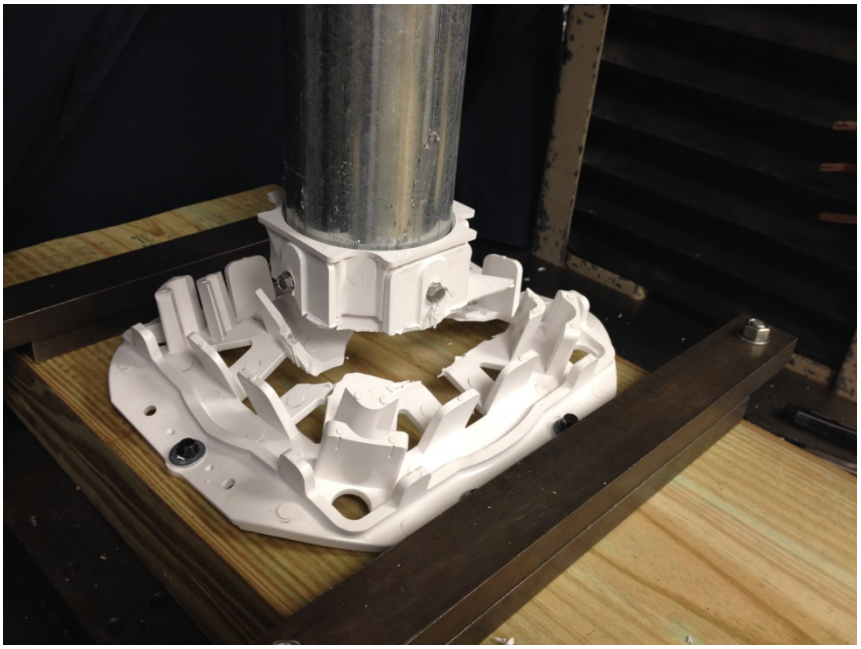

Photo No. 5
Typical Uplift Load Test Failure - 3-1/2 in Diameter Post

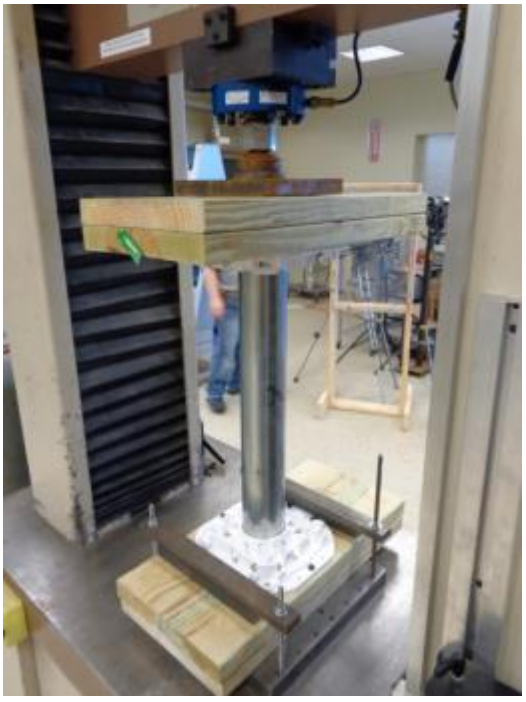

Photo No. 6
Typical Punching Shear Test Setup

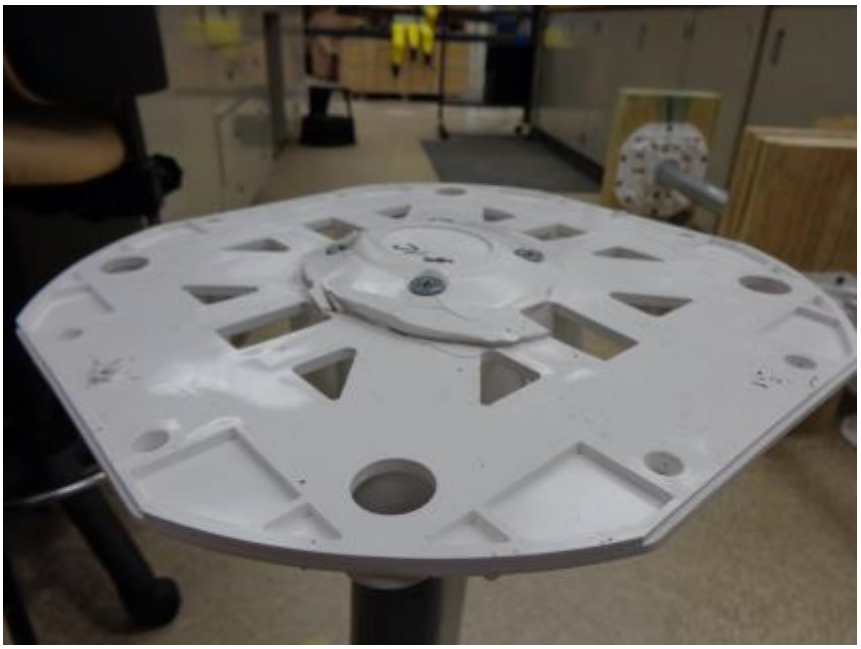

Photo No. 7
Punching Shear Test Failure - 2-3/8 in Diameter Post (Specimens 1 and 2)

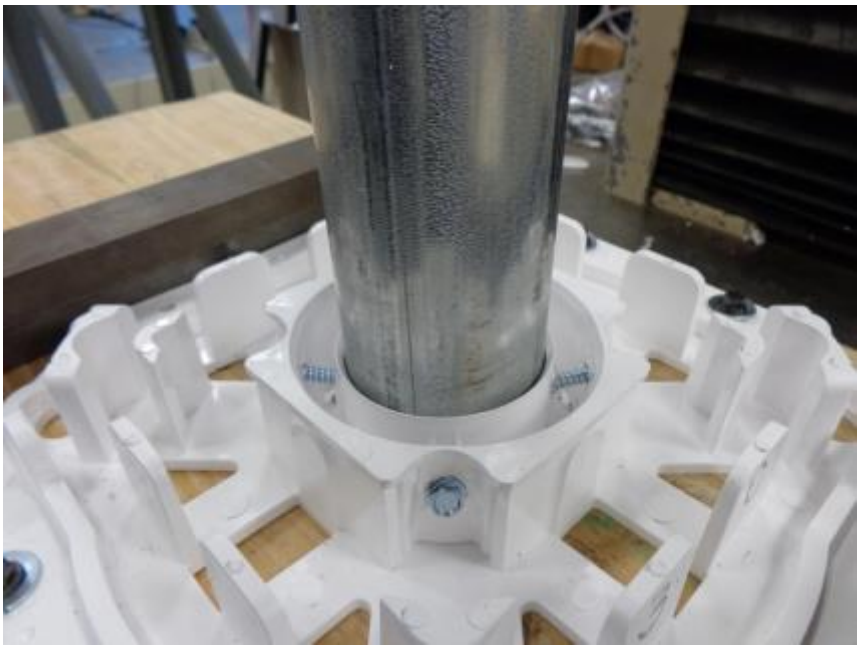

Photo No. 8
Punching Shear Test Results Following 10000 lbs of Load - 2-3/8 in Diameter Post (Specimen 3)

Photo No. 9
Punching Shear Test Results Following 10000 lbs of Load - 2-3/8 in Diameter Post
(Specimen 3 - Underside)

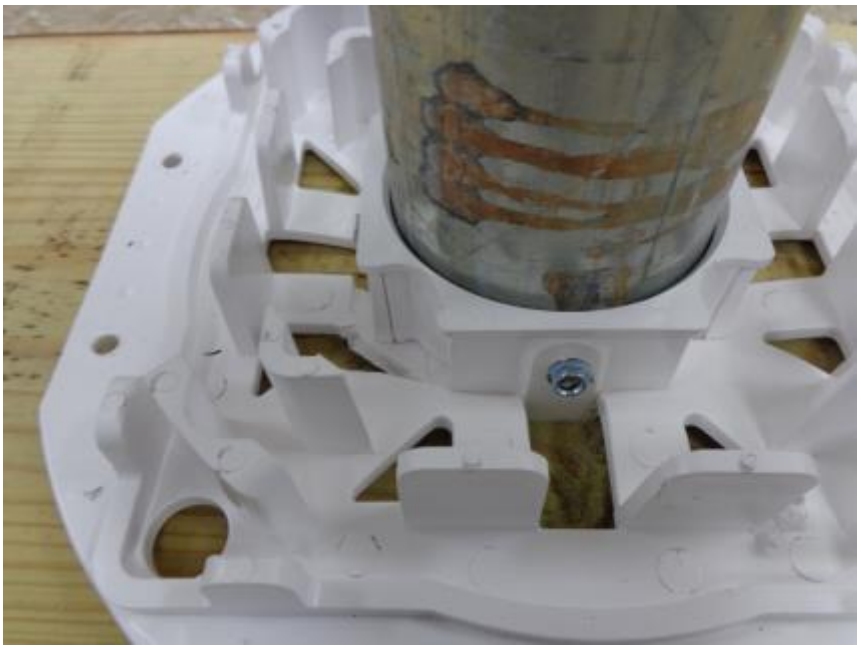

Photo No. 10
Punching Shear Test Failure - 3-1/2 in Diameter Post
(Specimens 1 and 2)

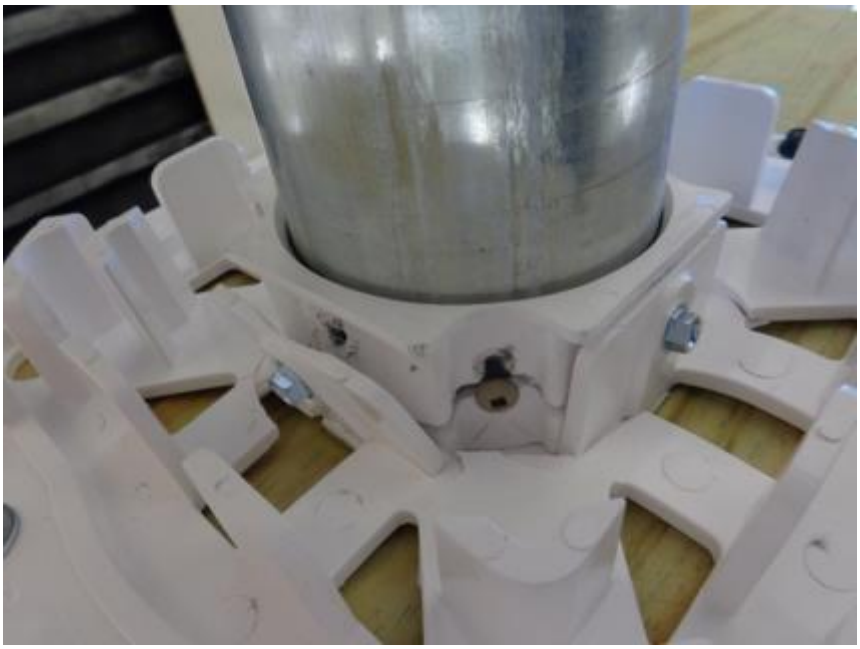

Photo No. 11
Punching Shear Test Failure - 3-1/2 in Diameter Post (Specimen 3)

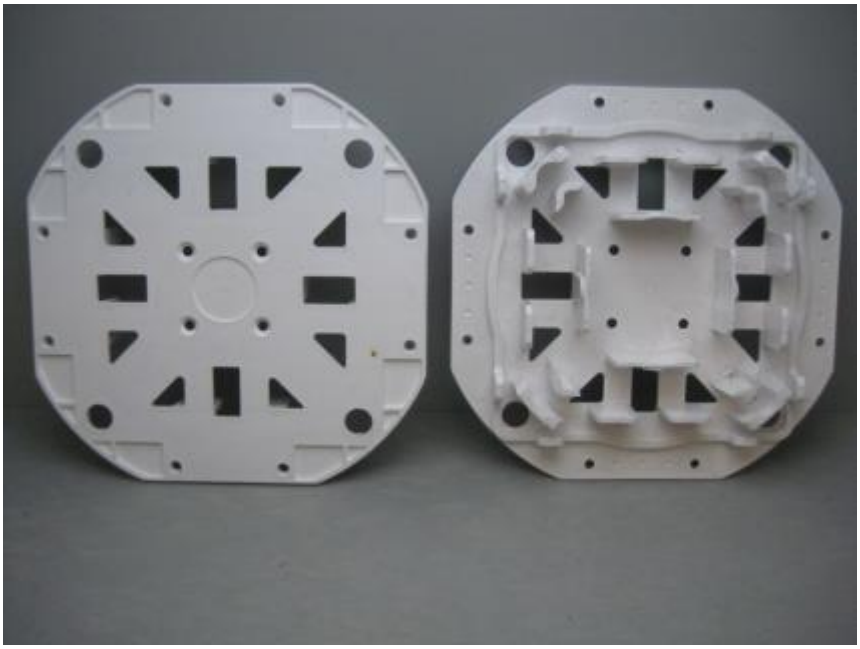

Photo No. 12
Original Base / Cap Plate (Bottom Surface Left; Top Surface Right)

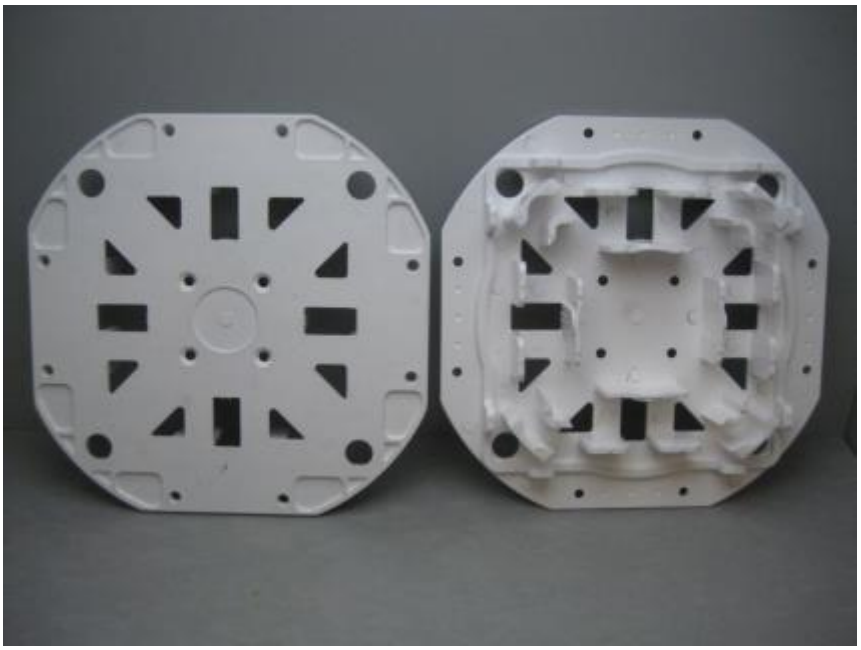

Photo No. 13
Redesigned Base / Cap Plate (Bottom Surface Left; Top Surface Right)

Photo No. 14
Bushing (Bottom Surface Left; Top Surface Right)