Architectural Testing

TEST REPORT

Rendered to:

LMT-Mercer Group, Inc.

For:

PRODUCT: **4" x 4" and 5" x 5" PVC Porch Posts with Aluminum Reinforcing**

Report No.: **D3198.01-119-19**
Report Date: **01/28/14**
Test Record Retention Date: **12/20/17**

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

Architectural Testing

TEST REPORT

D3198.01-119-19
January 28, 2014

TABLE OF CONTENTS

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Architectural Testing

TEST REPORT

Rendered to:

LMT-MERCER GROUP, INC.
322 Lake Avenue
P.O. Box 1147
Hartville, Ohio 44632

Report No.:	D3198.01-119-19
Test Dates:	12/03/13
Through:	12/20/13
Report Date:	01/28/14
Test Record Retention Date:	12/20/17

1.0 General Information

1.1 Product

4" x 4" and 5" x 5" PVC Porch Post with Aluminum Reinforcing

1.2 Project Description

Architectural Testing was contracted by LMT-Mercer Group, Inc. to evaluate the structural performance of their 4" x 4" and 5" x 5" PVC porch posts with aluminum reinforcing. The evaluation was for concentric axial loads in compression, uplift loads as well as tensile testing of material specimens taken from the aluminum tube insert.

1.3 Product Description

All test samples were provided by the manufacturer for testing. The 4" x 4" hollow PVC column samples measured 108" long and had a 2-7/16" outside diameter aluminum tube through the center. The 5" x 5" hollow PVC column samples measured 108" long and had a 3-1/4" outside diameter aluminum tube through the center. Each sample was comprised of a molded PVC sleeve which surrounded an aluminum tube insert, four PVC filler strips, and two PVC mounting brackets.

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 Reference Standards

ASTM B 221-05, *Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes*

ASTM E 8 / E 8M-08, *Standard Test Methods for Tension Testing of Metallic Materials*

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" 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.

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
4" x 4" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1286	0.15	-0.02
2112	0.20	0.00
3382	0.26	0.02
4042	0.28	0.02
5155	0.31	0.04
6127	0.37	0.06
7086	0.42	0.07
8100	0.50	0.08
9274	0.67	0.13
10080	*Ultimate Load*	

Specimen No. 2
4" x 4" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1094	0.18	-0.03
2326	0.25	-0.02
3310	0.29	-0.01
4530	0.33	0.01
5176	0.35	0.03
6215	0.40	0.07
7322	0.45	0.10
8203	0.53	0.13
9261	0.73	0.21
9761	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 3
4" x 4" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1160	0.17	-0.01
2146	0.21	-0.01
3208	0.24	0.00
4400	0.27	0.01
5179	0.29	0.02
6235	0.32	0.04
7417	0.37	0.06
8376	0.45	0.10
9254	0.57	0.14
10269	*Ultimate Load*	

Specimen No. 4
4" x 4" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1389	0.12	0.07
2561	0.19	0.09
3262	0.21	0.11
4395	0.25	0.14
5152	0.27	0.17
6186	0.31	0.20
7163	0.36	0.24
8200	0.45	0.30
9275	0.60	0.41
9911	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 5
5" x 5" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1403	0.18	0.03
2369	0.24	0.04
3163	0.27	0.05
4260	0.31	0.06
5071	0.33	0.07
6105	0.36	0.07
7286	0.39	0.07
8270	0.41	0.07
9182	0.43	0.07
10253	0.46	0.08
11341	0.50	0.08
12121	0.55	0.09
13486	0.66	0.11
14328	0.87	0.14
14439	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 6
5" x 5" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1133	0.11	0.01
2191	0.16	0.02
3267	0.19	0.02
4246	0.21	0.02
5146	0.22	0.03
6509	0.24	0.04
7174	0.25	0.05
8372	0.27	0.06
9370	0.30	0.07
10122	0.32	0.08
11222	0.36	0.09
12247	0.41	0.12
13204	0.49	0.15
14407	0.66	0.23
14853	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 7
5" x 5" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1477	0.18	0.06
2148	0.23	0.07
3095	0.27	0.07
4088	0.29	0.08
5033	0.31	0.08
6302	0.34	0.09
7222	0.35	0.09
8319	0.38	0.10
9080	0.41	0.10
10161	0.45	0.11
11136	0.49	0.13
12315	0.57	0.15
13337	0.70	0.18
14123	0.91	0.24
14398	*Ultimate Load*	

2.4 Test Results (Continued)

Specimen No. 8
5" x 5" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/03/13

Test Load (lb)	Displacement (inches)	
	X-Axis	Y-Axis
0	0.00	0.00
1368	0.12	0.02
2301	0.17	0.02
3170	0.20	0.02
4267	0.22	0.02
5052	0.24	0.02
6238	0.26	0.02
7422	0.29	0.03
8190	0.30	0.03
9235	0.33	0.04
10272	0.36	0.05
11172	0.39	0.07
12187	0.45	0.08
13372	0.58	0.11
14249	0.80	0.13
14676	*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.

4" x 4" PVC Porch Post with Aluminum Reinforcing

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	10080	+0.7%	Lateral Buckling at Midspan
2	9761	-2.4%	
3	10269	+2.6%	
4	9911	-0.9%	
Average:	**10005**		
Standard Deviation:	**219**		
Coefficient of Variation:	**2.2%**		

5" x 5" PVC Porch Posts with Aluminum Reinforcing

Specimen No.	Ultimate Load (lb)	Deviation From Average	Failure Mode
1	14439	-1.0%	Lateral Buckling at Midspan
2	14853	+1.8%	
3	14398	-1.3%	
4	14676	+0.6%	
Average:	**14592**		
Standard Deviation:	**213**		
Coefficient of Variation:	**1.5%**		

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

The testing machine was fitted with pressure treated Southern Yellow Pine (SYP) 2x8 wood boards at the top and bottom to accommodate anchorage of the column brackets. The mounting brackets were secured to the 2x8 with four #10-12 x 1-1/2" (0.132" minor diameter) philips drive, trim head, zinc plated, carbon steel screws. Each mounting bracket attached to the aluminum insert with four #10-16 x 1" (0.136" minor diameter) philips drive, pan head, zinc plated, self-starting, carbon steel screws and the PVC sleeve was attached to each mounting bracket with two #10-16 x 1" (0.136" minor diameter) philips drive, pan head, zinc plated, self-starting, carbon steel screws. Tests were conducted at lab ambient temperature (68°F ± 4°F). 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.

4" x 4" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/19/13

Specimen No.	Ultimate Load (lb)	Percent Deviation From Average	Failure Mode
1	1544	+0.8%	Bracket Failure
2	1501	-2.0%	
3	1552	+1.3%	
Average:	**1532**		
Standard Deviation:	**27**		
Coefficient of Variation:	**1.8%**		

3.4 Test Results (Continued)

5" x 5" PVC Porch Post with Aluminum Reinforcing
Test Date: 12/19/13 and 12/20/13

Specimen No.	Ultimate Load (lb)	Percent Deviation From Average	Failure Mode
1	1405	+5.8%	Bracket Failure
2	1386	+4.4%	
3	1193	-10.2%	
Average:	**1328**		
Standard Deviation:	**117**		
Coefficient of Variation:	**8.8%**		

Reference photographs in Appendix B for mode of failure.

4.0 Tensile Testing

Re: ICC-ES™ AC273 - Section 4.1

4.1 General

Tensile tests were performed on dog-bone specimens machined from the aluminum tube inserts used in the column assemblies for the purpose of verifying the material specification.

4.2 Test Specimens

Tensile test specimens were machined from aluminum tube used in the axial compression tests. Specimen size was per FIG 13 of ASTM E 8 / E 8M - 08 for large-diameter tubular products.

4.3 Test Procedure

The specimens were tested using an Instron® Model 3369 Universal Test Machine with Instron® "T" grips and operating at a uniform cross-head speed of 0.2 in/min. Strain was measured using an Instron® Model 2630-100 Series Clip-on Extensometer with a 2 inch gage length.

4.4 Test Results

4" x 4" PVC Porch Post Aluminum Tube Insert
Test Date: 12/19/13

Sample ID	Width (in)	Thickness (in)	Modulus of Elasticity (ksi)	Yield Strength (ksi)	Tensile Strength (ksi)	Elongation (%)
S1-A	0.501	0.079	10206	36.0	41.0	9.8
S1-B	0.500	0.082	10018	36.4	40.8	12.2
S1-C	0.500	0.083	9977	35.2	40.5	13.9
S2-A	0.500	0.081	10373	35.0	39.6	12.4
S2-B	0.500	0.081	10427	35.5	39.8	11.9
S2-C	0.500	0.082	10727	35.3	39.9	13.5
		Minimum:	9977	35.0	39.6	9.8
		Maximum:	10727	36.4	41.0	13.9
		Mean:	10288	35.6	40.2	12.3
		Standard Deviation:	281	0.5	0.6	1.4
		Coefficient of Variation:	2.7%	1.5%	1.4%	11.8%

5" x 5" PVC Porch Post Aluminum Tube Insert
Test Date: 12/19/13

Sample ID	Width (in)	Thickness (in)	Modulus of Elasticity (ksi)	Yield Strength (ksi)	Tensile Strength (ksi)	Elongation (%)
L1-A	0.502	0.072	11807	35.5	39.5	12.7
L1-B	0.500	0.074	9857	35.0	39.2	16.5
L1-C	0.501	0.070	11719	36.0	39.8	11.5
L2-A	0.501	0.071	9810	37.3	41.1	13.8
L2-B	0.500	0.069	10973	36.1	40.5	13.9
L2-C	0.502	0.069	10806	37.0	41.0	14.5
		Minimum:	9810	35.0	39.2	11.5
		Maximum:	11807	37.3	41.1	16.5
		Mean:	10829	36.2	40.2	13.8
		Standard Deviation:	866	0.9	0.8	1.7
		Coefficient of Variation:	8.0%	2.4%	2.0%	12.2%

4.5 Analysis of Test Results

Per LMT Mercer Group, Inc., the material used to reinforce their 4" x 4" and 5" x 5" PVC porch post tested and reported herein was specified as extruded 6005-T5 aluminum. The following criteria are listed under ASTM B 221, Table 2 - *Mechanical Property Limits*, for 6005-T5:

- Tensile strength, min, psi - 38,000
- Yield strength, min, psi - 35,000
- Elongation in 2 in., min, % - N/A (applies only to tests performed prior to shipment)

	Min. Tensile Strength (psi)	**Min. Yield Strength (psi)**
6005-T5	38,000	35,000
4" x 4" PVC Porch Post Aluminum Tube Insert	40252	35580
5" x 5" PVC Porch Post Aluminum Tube Insert	40191	36155

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: Adam J. Schrum

Adam J. Schrum
Technician I
Structural Systems Testing

Digitally Signed by: Virgal Thomas Mickley, Jr.

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

AJS:vtm/jas

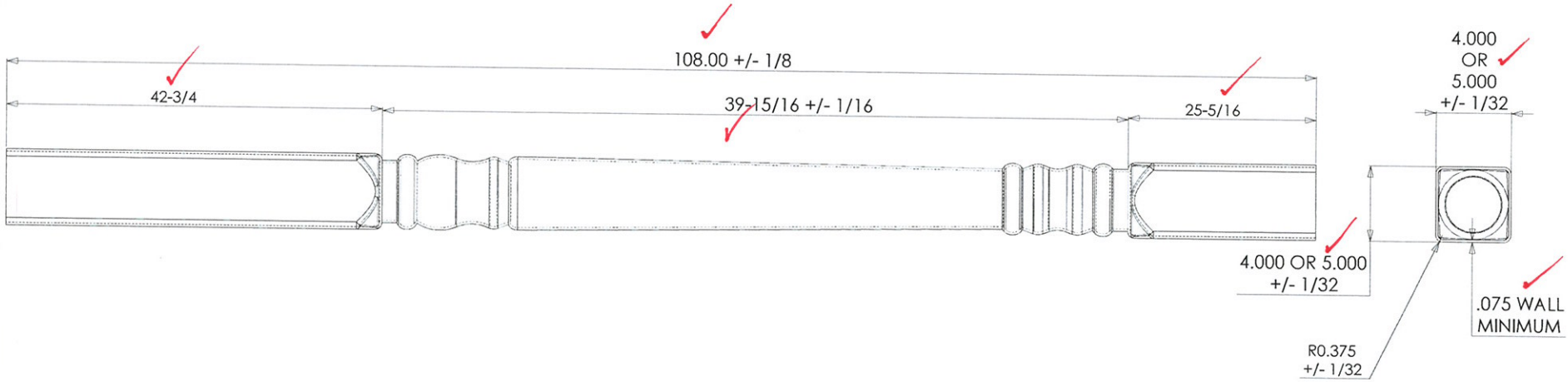
Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (7)
Appendix B - Photographs (2)

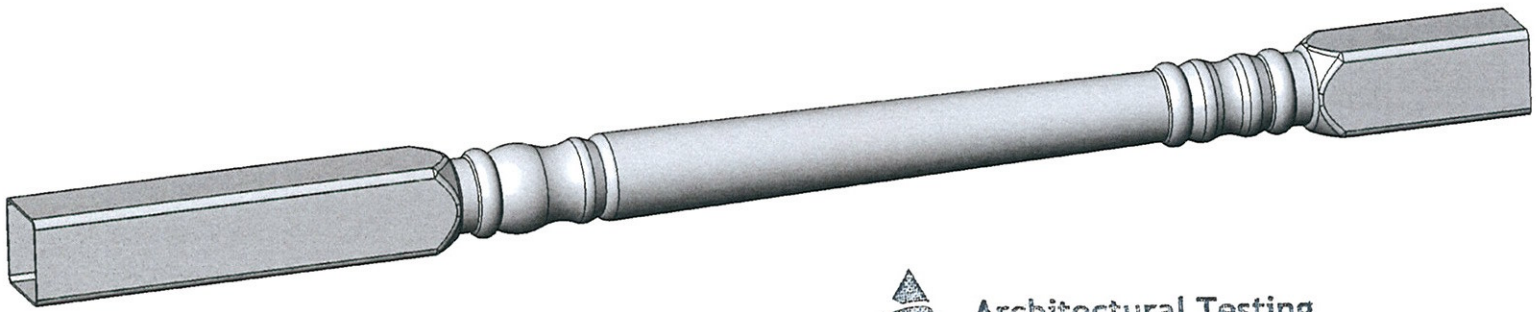
Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	01/28/14	N/A	Original report issue

APPENDIX A

Drawings





Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01-119-19

Date 1/17/14 Tech AJS

LMT-MERCER GROUP

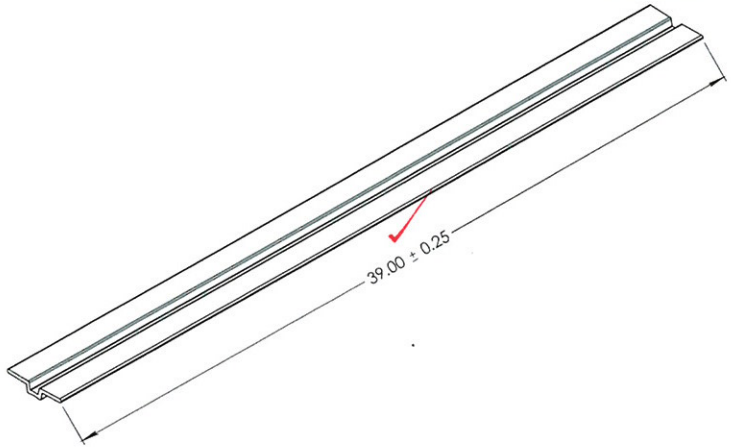
ZONE	REV	REVISIONS DESCRIPTION	DATE	APPROVED

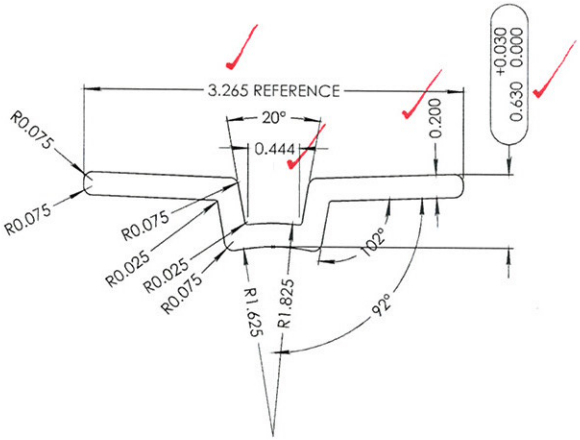
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01 - 119 - 19

Date 1/17/14 Tech AJS





VOLUME: 30.69 CUBIC INCHES

TOLERANCES UNLESS SPECIFIED
FRACTIONAL ± 1/64
ANGULAR ± 1/2°
.XX ± .010
.XXX ± .002
.XXXX ± .0005

LMT-MERCER GROUP

LMT-MERCER GROUP INC.
690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

REV A

SHEET DESCRIPTION:

THIRD ANGLE PROJECTION

DESIGN: JGF 5/29/13

CUSTOMER: LMT
PART NUMBER: 25697

4 X 4 Porch Post Filler Strip.drw

APPROVED: MM/DD/YY

MOLD NUMBER: 1049

RELEASE DATE: MM/DD/YY

SCALE: NONE | MATERIAL: HDPE | SHRINKAGE: N/A | SHEET 1 OF 1

REVISIONS

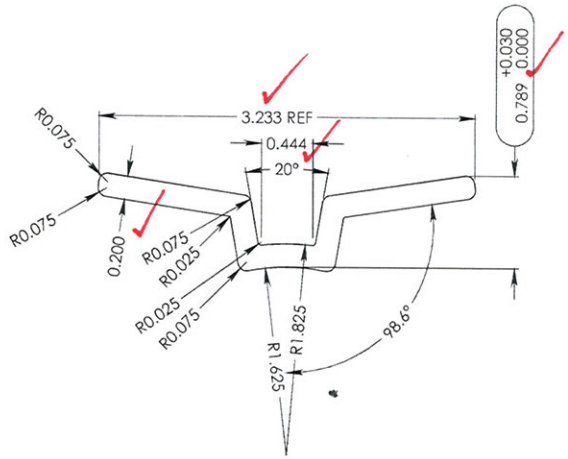
ZONE	REV	DESCRIPTION	DATE	APPROVED
	B	INCREASED ANGLE FROM 97 TO 98.6DEG & CORRECTED MOLD NUMBER	9/9/13	JF

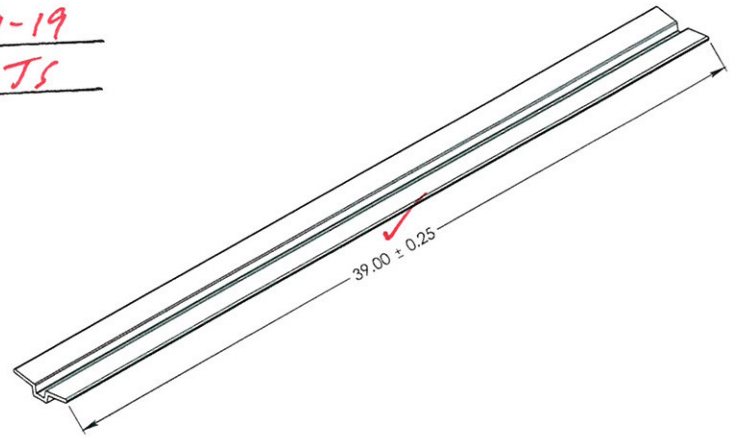
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01-119-19

Date 1/17/14 **Tech** AJS





TOLERANCES UNLESS SPECIFIED

FRACTIONAL	± 1/64
ANGULAR	± 1/2°
.XX	± .010
.XXX	± .002
.XXXX	± .0005

LMT-MERCER GROUP

LMT-MERCER GROUP INC.
690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

REV B

SHEET DESCRIPTION:

THIRD ANGLE PROJECTION

DESIGN: JGF 9/9/2013

CUSTOMER: LMT
PART NUMBER: 25698

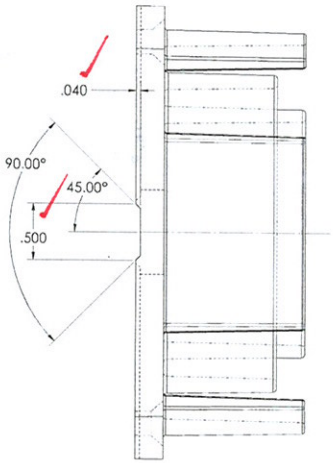
5 X 5 Porch Post Filler Strip - Rev B - 6 9 2013.
drw

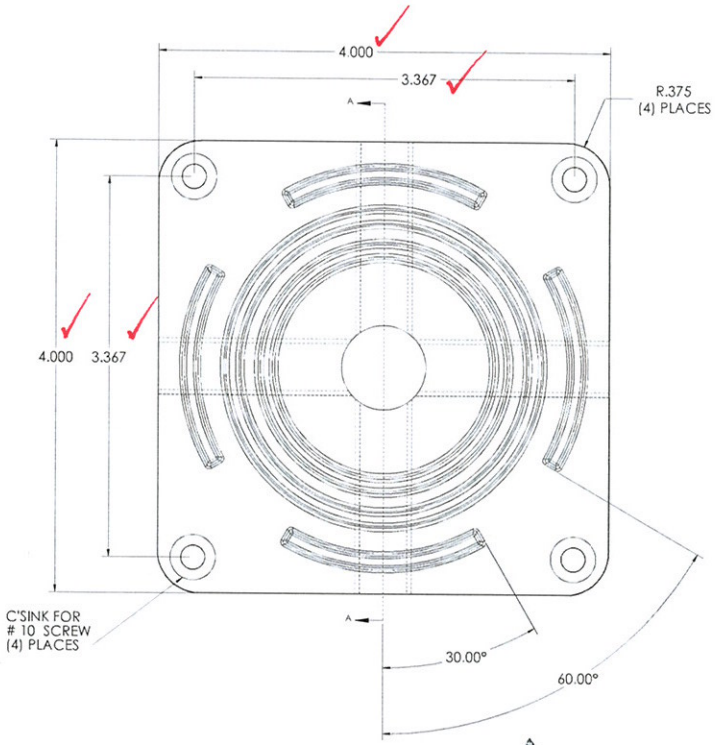
APPROVED: MM/DD/YY

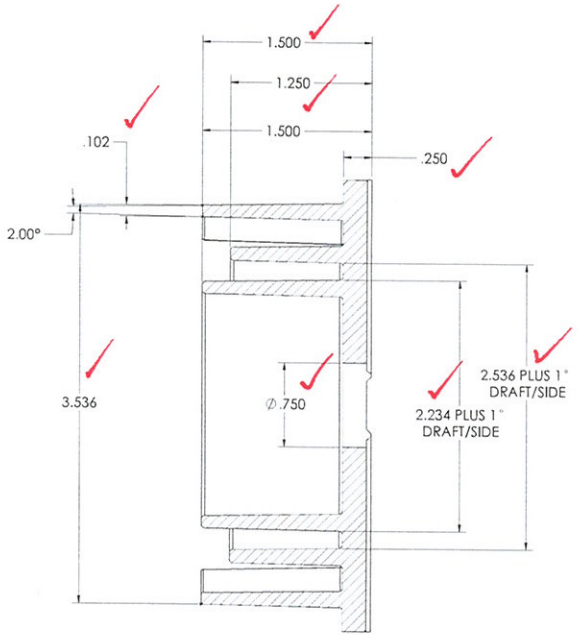
MOLD NUMBER: 1049

RELEASE DATE: MM/DD/YY

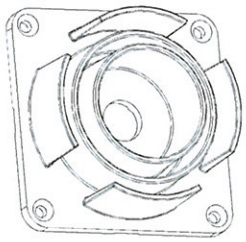
SCALE: NONE | MATERIAL: PP | SHRINKAGE: N/A | SHEET 1 OF 1







SECTION A-A



ISOMETRIC SCALE 1:1

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01-119-19

Date 1/17/14 **Tech** AJS

TOLERANCES UNLESS SPECIFIED
FRACTIONAL ± 1/64
ANGULAR ± 1/2°
XX ± .02
XXX ± .005
XXXX ± .001

LMT-MERCER GROUP
LMI-MERCER GROUP INC.
100 PERIN AVENUE
LAWRENCEVILLE, NJ 08648

FORCH MOUNT 4 INCH

THIRD ANGLE PROJECTION

DESIGN: W. FORD

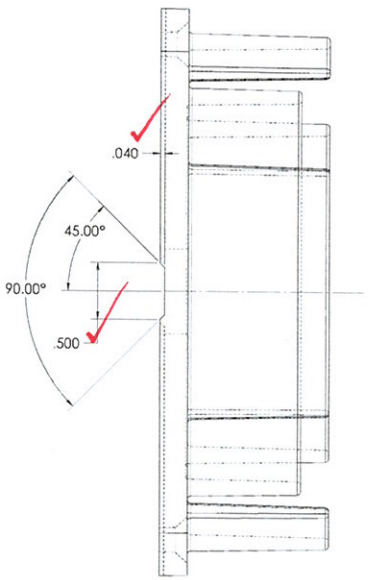
CUSTOMER / LMI PART NUMBER

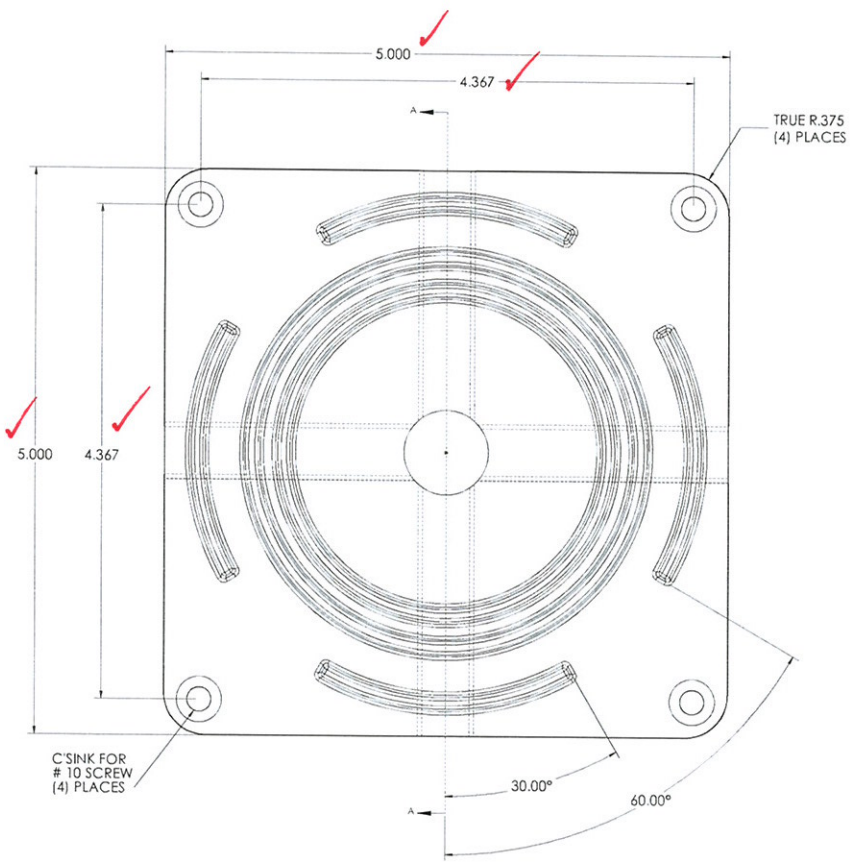
APPROVED:

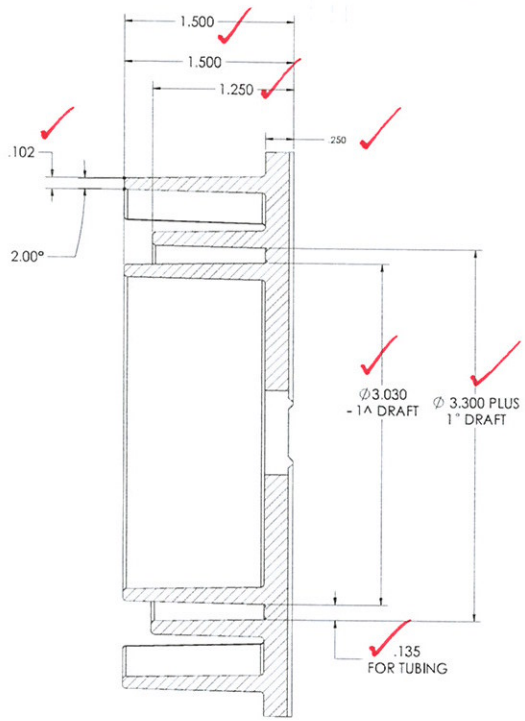
RELEASE DATE: MM/DD/YY

SCALE: 2:1 MATERIAL: PVC SHRINKAGE: N/A SHEET 1 OF 1

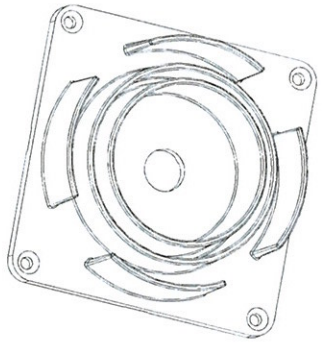
REV A







SECTION A-A



ISOMETRIC SCALE 1:1

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 03198.01-119-19

Date 1/17/14 **Tech** AJS

TOLERANCES UNLESS SPECIFIED
FRACTIONAL ± 1/64
ANGULAR ± 1/2°
.XX ± .02
.XXX ± .005
.XXXX ± .001

LMT-MERCER GROUP
LMI-MERCER GROUP INC.
490 PIERSON AVENUE
LAWRENCEVILLE, NJ 08648

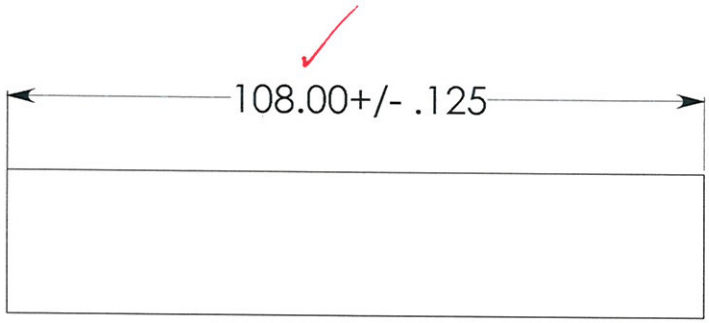
REV A

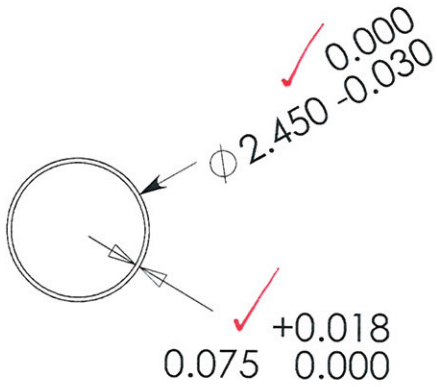
FORCE MOUNT 3 INCH

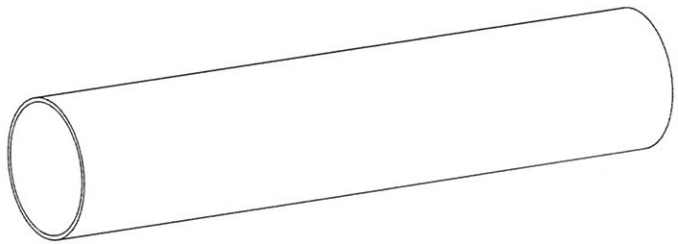
THIRD ANGLE PROJECTION

DESIGN: W. FORD 01/20/04
CUSTOMER: LMI
PART NUMBER:
APPROVED: 1/17/2014
RELEASE DATE: MM/DD/YY
SCALE: 2:1 MATERIAL: PVC SHRINKAGE: N/A SHEET 1 OF 1

ZONE	REV	REVISIONS DESCRIPTION	DATE	APPROVED







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01-119-19

Date 1/17/14 Tech A JS

TOLERANCES UNLESS SPECIFIED
FRACTIONAL ± 1/64
ANGULAR ± 1/2°
.XX ± .010
.XXX ± .002
.XXXX ± .0005

LMT-MERCER GROUP

LMT-MERCER GROUP INC.
690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

REV A

SHEET DESCRIPTION:
4 PORCH POST ALUM TUBE

THIRD ANGLE PROJECTION

DESIGN: J. FATTORI 1/15/2014

CUSTOMER: LMT
PART NUMBER: 25667

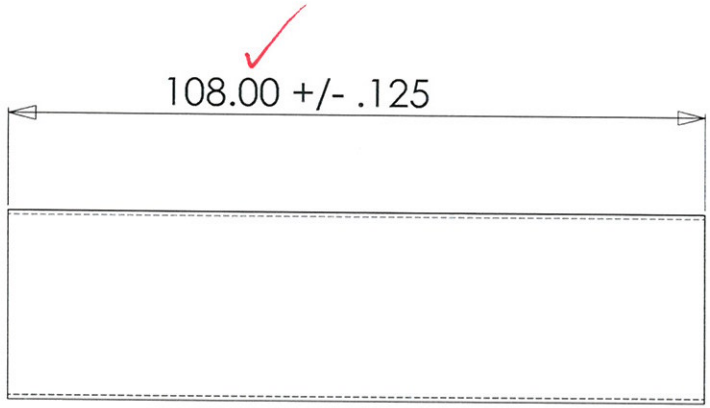
APPROVED: B. LYNN 1/15/2014

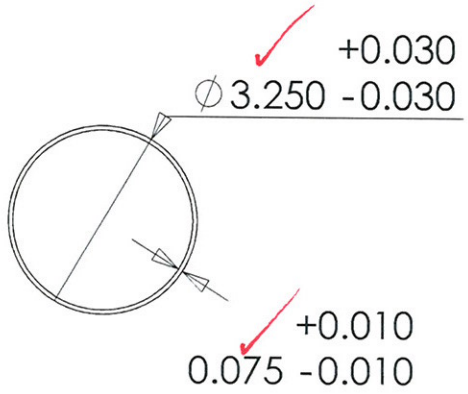
RELEASE DATE: 3/1/09

SCALE: NONE | MAT: SEE NOTE | SHRINKAGE: N/A | SHEET 1 OF 1

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
B1	B	CHANGED WALL THICKNESS	12/2013	J F



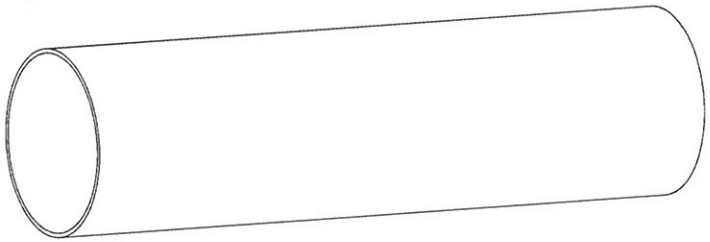


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D3198.01-119-19

Date 1/17/14 Tech AJS



MATERIAL : 6005 T5 ALUMINUM

TOLERANCES UNLESS SPECIFIED	
FRACTIONAL	± 1/64
ANGULAR	± 1/2°
.XX	± .010
.XXX	± .002
.XXXX	± .0005

LMT-MERCER GROUP

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690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

REV A

SHEET DESCRIPTION:
5 PORCH POST ALUM TUBE

THIRD ANGLE PROJECTION

DESIGN: F.LOFTUS 2/10/09

CUSTOMER: LMT
PART NUMBER: 25515

APPROVED: J. FATTORI 3/1/09

RELEASE DATE: 3/1/09

SCALE: 1=2 MAT: SEE NOTE SHRINKAGE: N/A SHEET 1 OF 1

APPENDIX B

Photographs

Photo No. 1
Axial Load Compression Test Setup

Photo No. 2
Typical Uplift Test Setup

Photo No. 3
Typical Uplift Load Test Failure