Architectural Testing

TEST REPORT

Rendered to:

OZCO BUILDING PRODUCTS

For:

Mechanical Connectors for Wood Members

Report No.: D6706.01-119-16
Report Date: 06/13/14
Test Record Retention Date: 04/30/18

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TEST REPORT

Rendered to:

OZCO BUILDING PRODUCTS
216 N. Interurban
Richardson, Texas 75081

Report No.:	D6706.01-119-16
Test Dates:	04/16/14
Through:	04/30/14
Report Date:	06/13/14
Test Record Retention Date:	04/30/18

1.0 General Information

1.1 Product

Mechanical Connectors for Wood Members

1.2 Project Description

Architectural Testing, Inc. was contracted by OZCO Building Products to perform load testing on their mechanical connectors for wood members in accordance with limited sections of ICC-ES™ AC13-2010, *Acceptance Criteria for Joist Hangers and Similar Devices*. AC13 was developed by the ICC Evaluation Service, Inc. (ICC-ES™) as acceptance criteria to evaluate compliance with the following building codes:

2009 *International Building Code*®, International Code Council

2009 *International Residential Code*®, International Code Council

1.3 Qualifications

Architectural Testing, Inc. 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.

1.4 Product Description

The mechanical connectors for wood members are comprised of powder coated, hot dipped galvanized steel post-base connecters, post-beam connectors, and joist hangers that are to be installed with wood posts and 2x lumber, which are considered part of the system. Refer to drawings in Appendix A and photographs in Appendix B for additional joist hanger details.

1.5 Product Sampling

In lieu of an independent sample selection by an accredited testing laboratory or inspection agency, OZCO Building Products provided the components used in the testing mentioned herein.

1.6 Witnessing

There were no representatives present for the testing conducted herein.

1.7 Conditions of Testing

Unless otherwise indicated, all testing reported herein was conducted in a laboratory set to maintain temperature in the range of 68 ±4ºF and humidity in the range of 50 ±5% RH. All test specimen materials were stored in the laboratory environment for no less than 40 hours prior to testing.

2.0 Referenced Standards

ASTM D 1761-88, *Standard Test Methods for Mechanical Fasteners in Wood*

ASTM D 4444-08, *Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters*

3.0 Direct Vertical Load (Down) Capacity Testing - Joist Hanger

3.1 General

The purpose of this testing was to determine the direct vertical downward load capacity of the joist hanger specimens in accordance with ASTM D 1761, *Standard Test Methods for Mechanical Fasteners in Wood*, as modified by Section 3.2 of ICC-ES™ AC13.

3.2 Product Information

Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

3.3 Test Specimens

Three test specimens were constructed of a joist, two joist hangers, two headers and two end blocks. The joist was a single 2 x 8 by 18 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The headers were 2 x 8 by 14 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The end blocks were 2 x 8 by 18-1/4 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The joist was centered between the two headers with a gap of 1/8 in at each joist end. The joist hanger was connected to the header with (4) #12-10 x 1-1/4 in (0.134 in minor dia., 0.389 in head dia.) Phillips head screws. The joist hanger was connected to the joist with (5) #12-10 x 1-1/4" (0.134 in minor dia., 0.389 in head dia.) Phillips head screws. The end blocks were attached between the header ends with 3 in dry-wall screws to maintain 18-1/4 in spacing (1/8 in gap on each end). Refer to drawings in Appendix A and photographs in Appendix B.

3.4 Test Setup

The headers were continuously supported on metal bars during testing with an inner edge overhang of 1/8 in per Figure 7 of ASTM D 1761. A 2-1/2 in wide by 5-1/2 in long by 3/4 in thick steel bearing block was placed at joist mid-span. A dial indicator, accurate to 0.001 in, was attached vertically by a steel fixture to each header with the dial indicator tips resting on the joist centerline, 1-1/2 in from each end of the joist. Refer to photographs in Appendix B for test setup.

3.5 Test Procedure

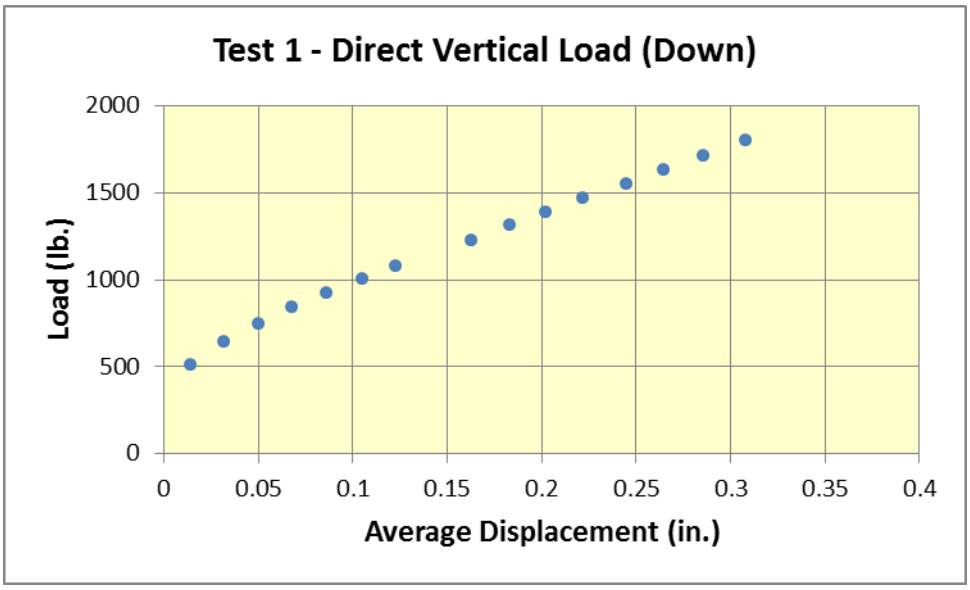
Testing was performed on 04/17/14 and 04/23/14, in a SATEC Unidrive, Model MII 50 UD Universal Testing Machine (ICN: Y002011). Test speed was 0.05 in/min. Vertical load was applied to the bearing block through a swivel joint, load cell and the testing machine crosshead. Load and deflection (dial indicator readings) were recorded manually. Ultimate load was the maximum load the test assembly would carry. Mode of failure for all specimens involved the withdrawal of the fasteners connecting the joist hanger to the header. The moisture content of each joist and header specimen was measured during testing with a hand-held Delmhorst Model BD-2100 moisture meter according to ASTM D 4444, *Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters*.

3.6 Test Results

Test No. 1
Direct Vertical Load (Down)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joist Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
509	0.020	0.008	0.014
640	0.040	0.024	0.032
744	0.060	0.040	0.050
845	0.080	0.056	0.068
925	0.100	0.072	0.086
1004	0.120	0.089	0.105
1078	0.140	0.105	0.123
--	0.160	--	--
1224	0.180	0.145	0.163
1310	0.200	0.165	0.183
1387	0.220	0.184	0.202
1469	0.240	0.204	0.222
1549	0.260	0.230	0.245
1628	0.280	0.250	0.265
1714	0.300	0.271	0.286
1798	0.320	0.295	0.308

[1] *Load for one joist hanger*

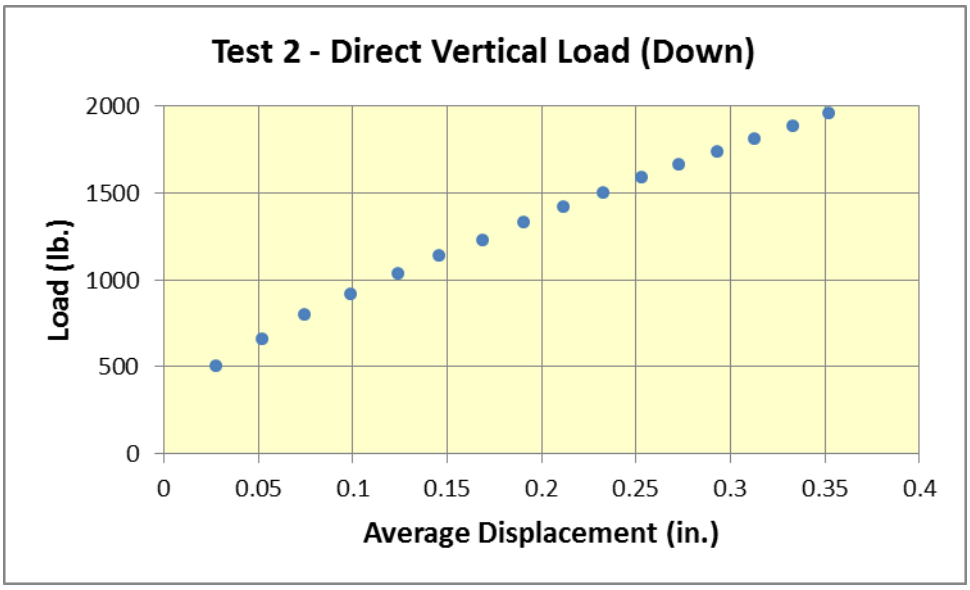


3.6 Test Results (Continued)

Test No. 2
Direct Vertical Load (Down)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joist Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
500	0.020	0.035	0.028
660	0.040	0.063	0.052
795	0.060	0.089	0.075
915	0.080	0.118	0.099
1030	0.100	0.147	0.124
1135	0.120	0.172	0.146
1228	0.140	0.197	0.169
1327	0.160	0.221	0.191
1415	0.180	0.244	0.212
1500	0.200	0.266	0.233
1585	0.220	0.286	0.253
1663	0.240	0.305	0.273
1735	0.260	0.325	0.293
1808	0.280	0.345	0.313
1883	0.300	0.365	0.333
1954	0.320	0.384	0.352

[1] *Load for one joist hanger*

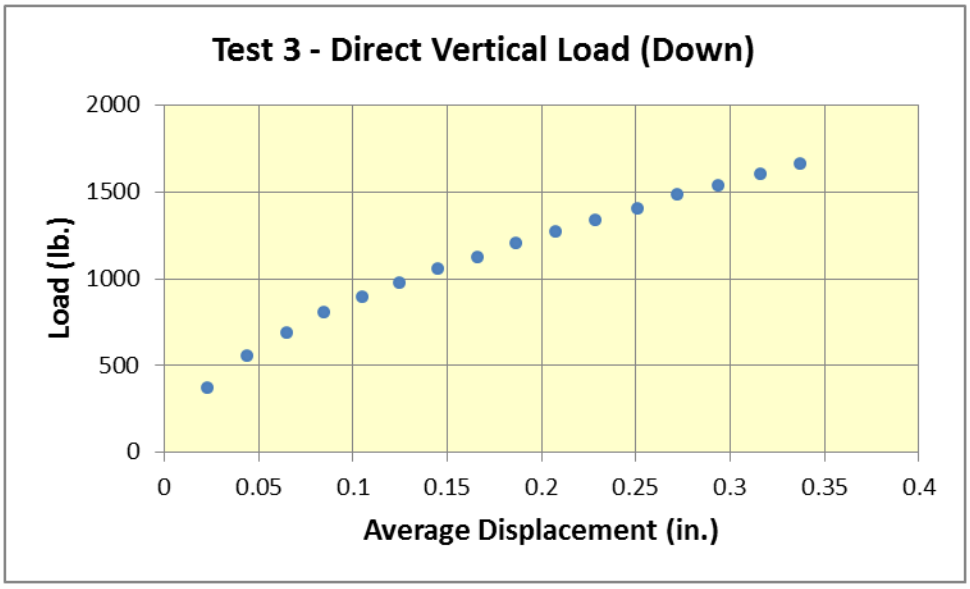


3.6 Test Results (Continued)

Test No. 3
Direct Vertical Load (Down)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joist Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
373	0.020	0.025	0.023
550	0.040	0.048	0.044
684	0.060	0.069	0.065
805	0.080	0.089	0.085
894	0.100	0.109	0.105
975	0.120	0.129	0.125
1053	0.140	0.149	0.145
1125	0.160	0.171	0.166
1204	0.180	0.193	0.187
1270	0.200	0.216	0.208
1335	0.220	0.238	0.229
1406	0.240	0.262	0.251
1480	0.260	0.284	0.272
1538	0.280	0.308	0.294
1600	0.300	0.332	0.316
1660	0.320	0.353	0.337

[1] *Load for one joist hanger*



3.7 Test Summary

Direct Vertical Load (Down)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Test No.	Ultimate Load [2] (lb)	Variance From Average	Load @ 1/8 in Displacement [1, 2] (Joist to Headers) (lb)	Average Joist and Header Moisture Content (%)
1	2444	+7.5%	1085	15
2	2359	+3.7%	1035	17
3	2018	-11.3%	975	18
Average:	**2274**		1032	16.7
	Standard Deviation:		55.1	1.5
	Coefficient of Variation:		5.3%	9%

[1] *Determined by linear interpolation*

[2] *Load for one joist hanger*

4.0 Direct Vertical Load (Uplift) Capacity Testing - Joist Hanger

4.1 General

The purpose of this testing was to determine the direct vertical uplift load capacity of the joist hanger specimens in accordance with ASTM D 1761, *Standard Test Methods for Mechanical Fasteners in Wood*, as modified by Section 3.2 of ICC-ES™ AC13.

4.2 Product Information

Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

4.3 Test Specimens

Three test specimens were constructed of a joist, two joist hangers, two headers and two end blocks. The joist was a single 2 x 8 by 18 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The headers were 2 x 8 by 14 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The end blocks were 2 x 8 by 18-1/4 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The joist was centered between the two headers with a gap of 1/8 in at each joist end. The joist hanger was connected to the header with (4) #12-10 x 1-1/4 in (0.134 in minor dia., 0.389 in head dia.) Phillips head screws. The joist hanger was connected to the joist with (5) #12-10 x 1-1/4" (0.134 in minor dia., 0.389 in head dia.) Phillips head screws. The end blocks were attached between the header ends with 3 in dry-wall screws to maintain 18-1/4 in spacing (1/8 in gap on each end). Refer to drawings in Appendix A and photographs in Appendix B.

4.4 Test Setup

The headers were continuously supported on rectangular metal tubes during testing with an inner edge overhang of 1/8 per Figure 7 of ASTM D 1761. A 2-1/2 in wide by 5-1/2 in long by 3/4 in thick steel bearing block was placed at joist midspan. A dial indicator, accurate to 0.001 in, was attached vertically by a steel fixture to each header with the dial indicator tips resting on the joist centerline, 3-1/2 in from each end of the joist. Refer to photographs in Appendix B for test setup.

4.5 Test Procedure

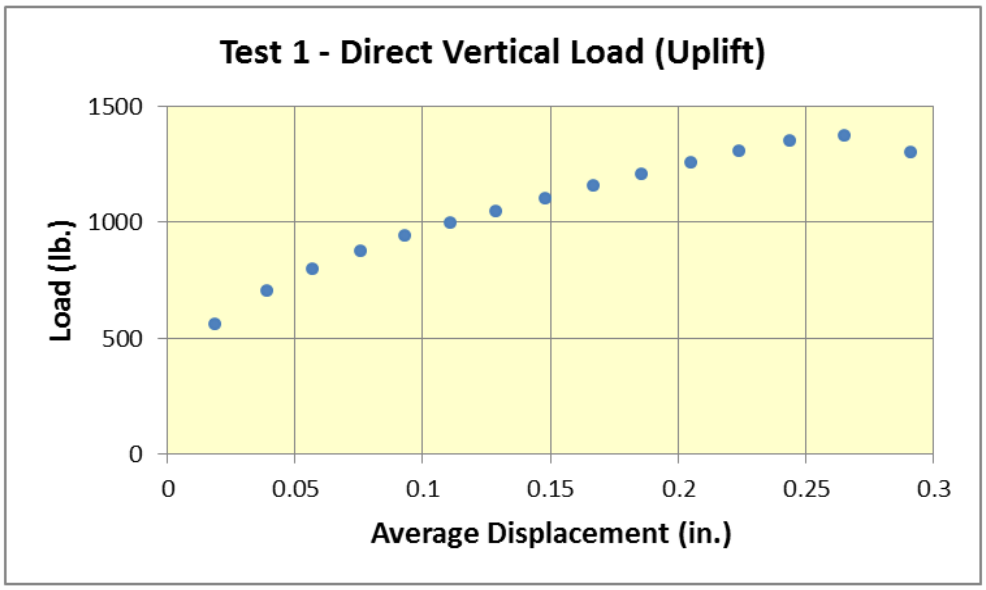
Testing was performed on 04/23/14, in a SATEC Unidrive, Model MII 50 UD Universal Testing Machine (ICN: Y002011). Test speed was 0.05 in/min. Vertical load was applied to the bearing block through a swivel joint, load cell and the testing machine crosshead. Load and deflection (dial indicator readings) were recorded manually. Ultimate load was the maximum load the test assembly would carry. Mode of failure for all specimens involved splitting of the joist member parallel to the grain with the split originating from at one of the joist to hanger screw locations. The moisture content of each joist and header specimen was measured during testing with a hand-held Delmhorst Model BD-2100 moisture meter according to ASTM D 4444, Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters.

4.6 Test Results

Test No. 1
Direct Vertical Load (Uplift)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joist Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
558	0.020	0.017	0.019
701	0.040	0.037	0.039
795	0.060	0.054	0.057
875	0.080	0.071	0.076
940	0.100	0.086	0.093
997	0.120	0.101	0.111
1048	0.140	0.117	0.129
1102	0.160	0.135	0.148
1155	0.180	0.153	0.167
1207	0.200	0.171	0.186
1257	0.220	0.189	0.205
1305	0.240	0.207	0.224
1350	0.260	0.228	0.244
1375	0.280	0.250	0.265
1300	0.300	0.282	0.291

[1] *Load for one hanger*

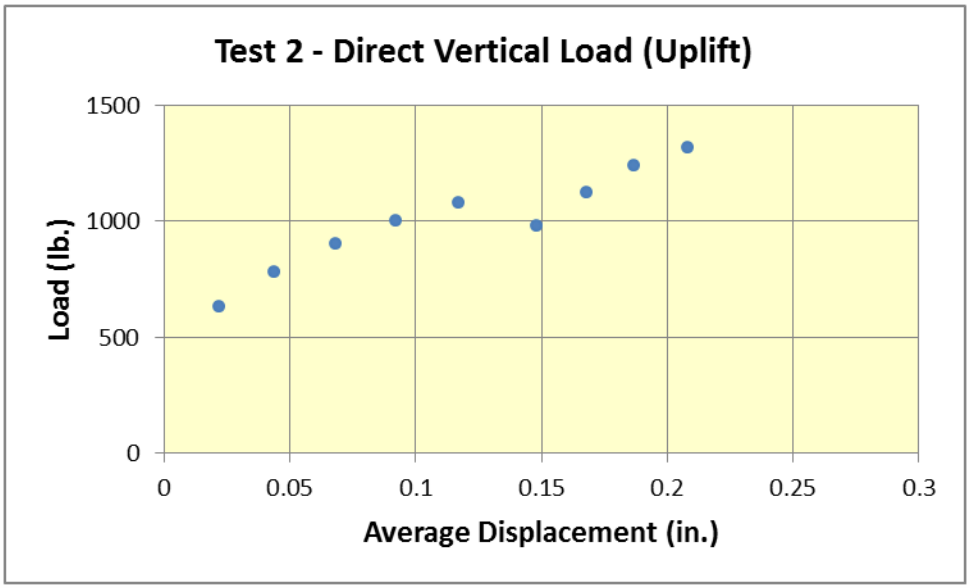


4.6 Test Results (Continued)

Test No. 2
Direct Vertical Load (Uplift)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joist Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
629	0.020	0.024	0.022
778	0.040	0.048	0.044
903	0.060	0.076	0.068
1003	0.080	0.104	0.092
1080	0.100	0.134	0.117
980	0.120	0.176	0.148
1125	0.140	0.196	0.168
1240	0.160	0.213	0.187
1320	0.180	0.235	0.208

[1] *Load for one hanger*

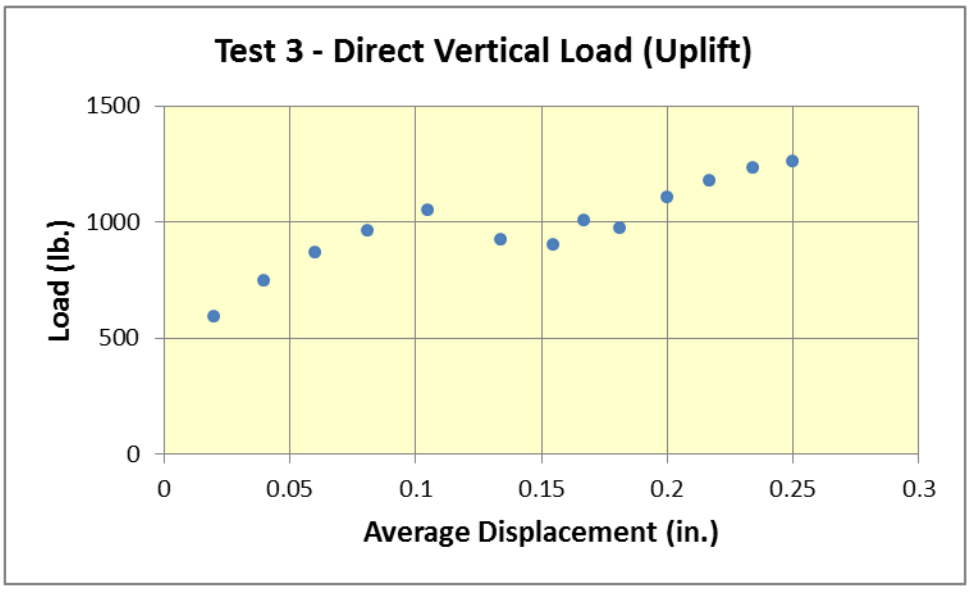


4.6 Test Results (Continued)

Test No. 3
Direct Vertical Load (Uplift)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Vertical Joint Displacement Relative to Header (in)		
	Indicator A	Indicator B	Average
593	0.020	0.020	0.020
749	0.040	0.039	0.040
870	0.060	0.060	0.060
965	0.080	0.082	0.081
1050	0.100	0.109	0.105
925	0.120	0.147	0.134
900	0.140	0.169	0.155
1010	0.160	0.173	0.167
973	0.180	0.182	0.181
1108	0.200	0.199	0.200
1178	0.220	0.214	0.217
1235	0.240	0.228	0.234
1262	0.260	0.240	0.250

[1] *Load for one hanger*



4.7 Test Summary

Direct Vertical Load (Uplift)
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Test No.	Ultimate Load [2] (lb)	Variance From Average	Load @ 1/8 in Displacement [1, 2] (Joist to Headers) (lb)	Average Joist and Header Moisture Content (%)
1	1457	+7.1%	1037	18
2	1350	-0.8%	1054	19
3	1277	-6.2%	964	16
Average:	**1361**		1018	17.7
		Standard Deviation:	47.8	1.5
		Coefficient of Variation:	4.7%	9%

[1] *Determined by linear interpolation*

[2] *Load for one joist hanger*

5.0 Torsional Moment Capacity Testing – Joist Hanger

5.1 General

The purpose of this testing was to determine the torsional moment capacity of joist hanger specimens in accordance with ASTM D 1761, *Standard Test Methods for Mechanical Fasteners in Wood*, as modified by Section 3.4 of ICC-ES™ AC13.

5.2 Product Information

Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

5.3 Test Specimens

Three test specimens were constructed of a single joist, two joist hangers, and two headers. The joist was a pressure-treated 2x8 by 24 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The headers were pressure-treated 2x8 by 21 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP). The joist was located 12 in from the centerline of the rocker support. The joist was located between the two headers with a gap of 1/8 in at each joist end. The joist hanger was connected to the header with (4) #12-10 x 1-1/4" (0.134 in minor dia., 0.389 in head dia.) Phillips head screws. The joist hanger was connected to the joist with (5) #12-10 x 1-1/4 in (0.134 in minor dia., 0.389 in head dia.) Phillips head screws.. A threaded rod with end flanges (similar to a pipe clamp) was located under the joist and clamped the headers to maintain the 25-1/4 in spacing between headers. Refer to drawings in Appendix A and photographs in Appendix B.

5.4 Test Setup

The headers were supported during testing on two rocker supports 12.0 in from the joist centerline per Figure 8 of ASTM D 1761. A 2-1/2 in wide by 5-1/2 in long by 3/4 in thick steel bearing block was placed at joist midspan. Four dial indicators, accurate to 0.001 in, were attached horizontally by steel fixtures to each header with the dial indicator tips resting against the flat side of the joist. The dial indicator tips were located 3 in from each end of the joist and either 1/2 in above the bottom or below the top of the joist. Reference photographs in Appendix B for test setup.

5.5 Test Procedure

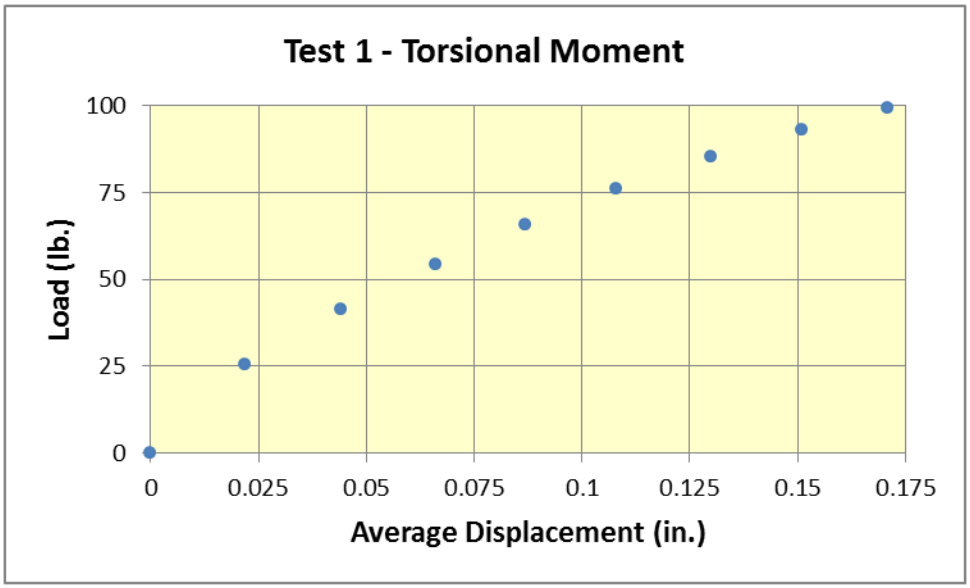
Testing was performed on 04/30/14, in a SATEC Unidrive, Model MII 50 UD Universal Testing Machine (ICN: Y002011). Test speed was 0.01 in/min. Vertical load was applied to the bearing block through a swivel joint, load cell and the testing machine crosshead. Load and deflection (dial indicator readings) were recorded manually. Maximum load was the arbitrary load at which the test was halted after the average of the deflections exceeded 1/8 in. It should not be construed as an ultimate load. The moisture content (MC) of each joist and header specimen was measured during testing with a hand-held Delmhorst Model BD-2100 moisture meter according to ASTM D 4444, *Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters*. Reference photographs in Appendix B for test setup.

5.6 Test Results

Test No. 1
Torsional Moment
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Horizontal Joist Displacement Relative to Headers (in)				
	A	B	C	D	Average
0	0.000	0.000	0.000	0.000	0.000
25	0.020	0.000	0.003	0.023	0.022
41	0.040	0.001	0.004	0.047	0.044
54	0.060	0.002	0.006	0.072	0.066
66	0.080	0.003	0.008	0.093	0.087
76	0.100	0.005	0.010	0.115	0.108
85	0.120	0.005	0.011	0.140	0.130
93	0.140	0.005	0.013	0.162	0.151
99	0.160	0.008	0.014	0.182	0.171

[1] *Load for one hanger*

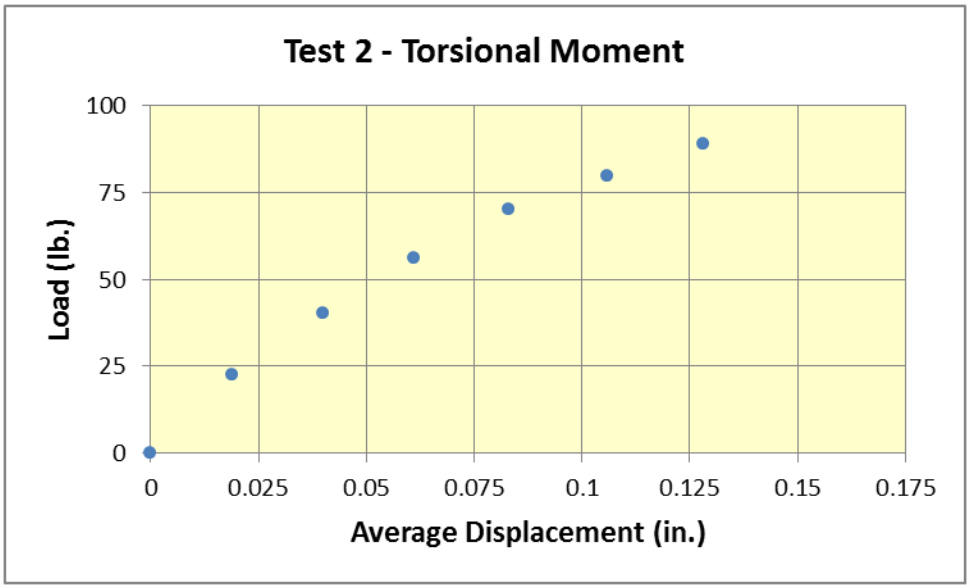


5.6 Test Results (Continued)

Test No. 2
Torsional Moment
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Horizontal Joist Displacement Relative to Headers (in)				
	A	B	C	D	Average
0	0.000	0.000	0.000	0.000	0.000
22	0.020	0.000	0.003	0.018	0.019
40	0.040	0.003	0.004	0.039	0.040
56	0.060	0.005	0.006	0.061	0.061
70	0.080	0.008	0.008	0.086	0.083
80	0.100	0.009	0.011	0.111	0.106
89	0.120	0.010	0.014	0.136	0.128

[1] *Load for one hanger*

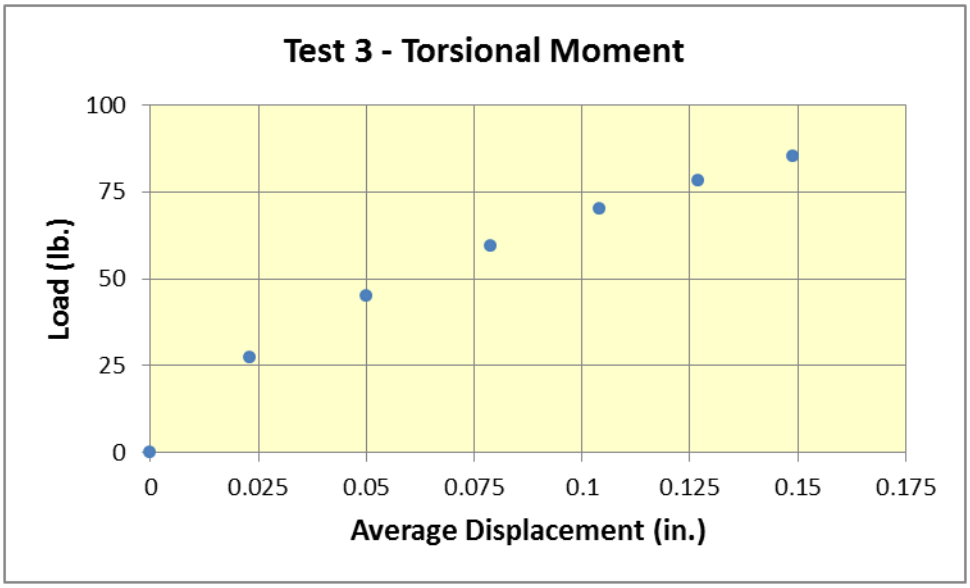


5.6 Test Results (Continued)

Test No. 3
Torsional Moment
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Load [1] (lb)	Horizontal Joist Displacement Relative to Headers (in)				
	A	B	C	D	Average
0	0.000	0.000	0.000	0.000	0.000
27	0.020	0.000	0.001	0.025	0.023
45	0.040	0.000	0.004	0.060	0.050
59	0.060	0.000	0.007	0.097	0.079
70	0.080	0.000	0.010	0.128	0.104
78	0.100	0.001	0.012	0.153	0.127
85	0.120	0.002	0.014	0.177	0.149

[1] *Load for one hanger*



5.7 Test Summary

Torsional Moment
Product: Joist Hanger 6-8" Flush; Item No. 56639 (JHF-68-LS)

Test No.	Maximum Load [2, 3] (lb)	Load @ 1/8 in Displacement [1, 2] (Joist to Headers) (lb)	Torsional Moment Capacity [2] (in-lbs)	Average Joist Moisture Content (%)
1	100	83	996	13
2	90	88	1056	14
3	88	77	924	14
Average:		83	992	14
Standard Deviation:		5.5	66	0.7
Coefficient Of Variation:		6.7	6.7%	5%

[1] *Determined by linear interpolation*

[2] *Load for one hanger*

[3] *Maximum load was the arbitrary load at which the test was halted after the average of the deflections exceeded 1/8 in. It should not be construed as an ultimate load.*

6.0 Uplift Load Testing - Post Base

6.1 General

The purpose of this testing was to determine the ultimate force required to cause failure of the post base connectors when subjected to uplift forces.

6.2 Product Information

4" x 4" Post Base; Item No. 56607 (4x4-PB-LS)
6" x 6" Post Base; Item No. 56608 (6x6-PB-LS)
8" x 8" Post Base; Item No. 56609 (8x6-PB-LS)

6.3 Test Specimens

Five specimens of each size were constructed. Short sections of 4x4, 6x6, or 8x8 No. 2 Grade, preservative treated Southern Yellow Pine (SYP) post were connected to the post base connectors which were attached to steel channels to simulate attachment to concrete. The post base connectors were attached to the steel channel with one 3/8 in dia. Grade 8 bolt with nut and washers for the 4 in by 4 in post base connector and one 5/8 in Grade 8 bolt with nut and washers for the 6 in by 6 in post base connector and the 8 in by 8 in post base connector. Each post base connector was connected to wood posts with the following eight lag bolts:

- 4x4 post base - 1/4"-7 x 1-3/4" (0.188 in minor dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug
- 6x6 post base - 1/4"-7 x 2-3/4" (0.188 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug
- 8x8 post base - 1/4"-7 x 3-3/4" (0.190 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug

The steel channel was securely attached to the base of the testing machine. A thru-hole was drilled into the wood posts for a rod to pass through, allowing connection to the crosshead of the test machine.

6.4 Test Procedure

Testing was performed using the methods described by ASTM D 1761. Testing was performed in a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD Universal Testing Machine. Specimens were securely attached to the base of the testing machine and the wood post section was attached to the crosshead of the testing machine. The specimen was loaded in tension until failure occurred. See photographs in Appendix A for test setup.

6.5 Test Results

4 in by 4 in Post Base; Item No. 56607 (4x4-PB-LS)
Test Date: 04/16/14
Crosshead Speed: 0.035 in/min

Specimen No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	5723	-3.6%	Sheared heads off screws
2	6253	+5.4%	
3	5535	-6.7%	
4	5771	-2.8%	Screws began pulling thru post (elongating holes)
5	6394	+7.7%	Sheared heads off screws
Average:	**5935**		
Allowable Capacity [1]:	1978		

[1] *Average ultimate load divided by a factor of safety of three (3.0).*

***Note**: Average moisture content of the lumber specimens used in testing was 18%.*

6.5 Test Results (Continued)

6 in by 6 in Post Base; Item No. 56608 (6x6-PB-LS)
Test Date: 04/16/14
Crosshead Speed: 0.035 in/min

Specimen No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	8389	+2.3%	Screws began pulling thru post (elongating holes)
2	7141	-12.9%	
3	8757	+6.8%	
4	9165	+11.8%	
5	7542	-8.0%	
Average:	**8199**		
Allowable Capacity [1]:	2733		

[1] *Average ultimate load divided by a factor of safety of three (3.0).*

***Note**: Average moisture content of the lumber specimens used in testing was 18%.*

8 in by 8 in Post Base; Item No. 56609 (8x6-PB-LS)
Test Date: 04/17/14
Crosshead Speed: 0.035 in/min

Specimen No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	9828	-12.9%	Screws began pulling thru post (elongating holes)
2	11557	+2.4%	
3	10994	-2.6%	
4	11445	+1.4%	
5	12615	+11.8%	
Average:	**11287**		
Allowable Capacity [1]:	3762		

[1] *Average ultimate load divided by a factor of safety of three (3.0).*

***Note**: Average moisture content of the lumber specimens used in testing was 17%.*

7.0 Uplift Load Testing - Post to Beam Connector

7.1 General

The purpose of this testing was to determine the ultimate force required to cause failure of the post to beam connectors when subjected to uplift forces.

7.2 Product Information

8" Post to Beam; Item No. 56610 (P2B- LS-2)
Post To Beam - Bolt Inline; Item No. 56637 (P2B-BO-LS)

7.3 Test Specimens

Three specimens of each size were constructed. Short sections of 6x6 No. 2 Grade, preservative treated Southern Yellow Pine (SYP) post were connected to two (one each side of post) short sections of pressure-treated 2x8 by 24 in long No. 2 Grade, preservative treated Southern Yellow Pine (SYP) headers. Each post-to-beam connection utilized a post to beam connector for each header for a total of two post-to-beam connectors per assembly. The upper portion of the post to beam connectors was attached to a header and post with two 1/4"-7 x 3-3/4" (0.190 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug. The upper portion of the post to beam - bolt in-line connector was attached to the header and post with two 11/16" diameter adjustable length rods with female threads on each end. A 3/8"-16 x 1" (0.327 in minor dia.) hex washer head bolt was attached to the adjustable length rod at each end and included a 1-1/2 in dia. hex washer cap plug. The lower portion of the post to beam connector was attached to the wood posts with two 1/4"-7 x 2-3/4" (0.188 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug. The lower portion of the post-to-beam - bolt in-line connector was attached to the wood posts with two 1/4"-7 x 2-3/4" (0.188 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug. The headers were securely attached to the base of the testing machine. A thru-hole was drilled into the wood posts for a rod to pass through, allowing connection to the crosshead of the test machine.

7.4 Test Procedure

Testing was performed using the methods described by ASTM D 1761. Testing was performed in a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD Universal Testing Machine. Specimens were securely attached to the base of the testing machine and the wood post section was attached to the crosshead of the testing machine. The specimen was loaded in tension until failure occurred. See photographs in Appendix A for test setup.

7.5 Test Results

8" Post to Beam; Item No. 56610 (P2B- LS-2)
Test Date: 04/24/14
Crosshead Speed: 0.05 in/min

Specimen No.	Ultimate Load [2] (lb)	Deviation From Average	Mode of Failure
1	7629	+6.3%	Screws began pulling thru post (elongating holes)
2	6686	-6.8%	
3	7216	+0.5%	
Average:	**7177**		
Allowable Capacity [1]:	2392		

[1] *Average ultimate load divided by a factor of safety of three (3.0)*

[2] *Ultimate load for a post to beam connector assembly with two post to beam connector plates (one post to beam connector plate on each side of post)*

Post to Beam - Bolt Inline; Item No. 56637 (P2B-BO-LS)
Test Date: 04/24/14
Crosshead Speed: 0.05 in/min

Specimen No.	Ultimate Load [2] (lb)	Deviation From Average	Mode of Failure
1	10148	+4.5%	Screws began pulling thru post (elongating holes)
2	10200	+5.0%	
3	8788	-9.5%	
Average:	**9712**		
Allowable Capacity [1]:	3237		

[1] *Average ultimate load divided by a factor of safety of three (3.0)*

[2] *Ultimate load for a post to beam connector assembly with two post to beam connector plates (one post to beam connector plate on each side of post)*

8.0 Lateral Load Testing - Post Base

8.1 General

The purpose of this testing was to determine the ultimate force required to cause failure of the post base connectors when subjected to lateral forces.

8.2 Product Information

4" x 4" Post Base; Item No. 56607 (4x4-PB-LS)
6" x 6" Post Base; Item No. 56608 (6x6-PB-LS)
8" x 8" Post Base; Item No. 56609 (8x6-PB-LS)

8.3 Test Specimens

Three specimens of each size were constructed. Short sections of 4x4, 6x6, or 8x8 No. 2 Grade, preservative treated Southern Yellow Pine (SYP) post were connected to the post base connectors which were attached to steel channels to simulate attachment to concrete. The post base connectors were attached to the steel channel with one 3/8 in dia. Grade 8 bolt with nut and washers for the 4 in by 4 in post base connector and one 5/8 in Grade 8 bolt with nut and washers for the 6 in by 6 in post base connector and the 8 in by 8 in post base connector. Each post base connector was connected to wood posts with the following eight lag bolts:

- 4x4 post base - 1/4"-7 x 1-3/4" (0.188 in minor dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug
- 6x6 post base - 1/4"-7 x 2-3/4" (0.188 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug
- 8x8 post base - 1/4"-7 x 3-3/4" (0.190 in minor dia.; 0.205 in shank dia.) hex washer head lag bolts with 1-1/2 in dia. hex washer cap plug

8.4 Test Procedure

Testing was performed using the methods described by ASTM D 1761. Testing was performed in a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD Universal Testing Machine. Specimens rested on the base of the testing machine. A 2 in wide by 1 in thick steel plate was placed at each end of the wood post, with a 1/4 in gap between the post base and the steel plate. 5/8 in radius steel loading noses attached to the crosshead of the testing machine applied load to the steel plates. The specimen was loaded in shear until failure occurred. The test speed was controlled by using a loading rate of 0.05 in/min. See photographs in Appendix A for test setup.

8.5 Test Results

4 in by 4 in Post Base; Item No. 56607 (4x4-PB-LS)
Test Date: 04/29/14

Specimen No.	Ultimate Load [2] (lb)	Deviation From Average	Mode of Failure
1	1539	-36.6%	Deformation of post base connector; Cracking of post; Withdrawal of lag bolts from post
2	3127	+28.8%	
3	2614	+7.7%	
Average:	**2427**		
Allowable Capacity [1]:	809		

[1] *Average ultimate load divided by a factor of safety of three (3.0)*

[2] *Load for one post base connector*

6 in by 6 in Post Base; Item No. 56608 (6x6-PB-LS)
Test Date: 04/29/14

Specimen No.	Ultimate Load [2] (lb)	Deviation From Average	Mode of Failure
1	5007	-1.1%	Deformation of post base connector; Cracking of post; Withdrawal of lag bolts from post
2	5040	-0.4%	
3	5135	+1.5%	
Average:	**5061**		
Allowable Capacity [1]:	1687		

[1] *Average ultimate load divided by a factor of safety of three (3.0)*

[2] *Load for one post base connector*

8 in by 8 in Post Base; Item No. 56609 (8x6-PB-LS)
Test Date: 04/25/14

Specimen No.	Ultimate Load [2] (lb)	Deviation From Average	Mode of Failure
1	9067	+10.4%	Deformation of post base connector; Cracking of post; Withdrawal of lag bolts from post
2	7377	-10.2%	
3	8199	-0.2%	
Average:	**8214**		
Allowable Capacity [1]:	2738		

[1] *Average ultimate load divided by a factor of safety of three (3.0)*

[2] *Load for one post base connector*

9.0 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 (35)
Appendix B - Photographs (7)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	06/13/14	N/A	Original report issue

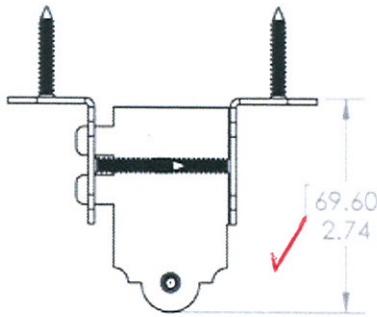
APPENDIX A

Drawings

Product & Packaging Specs

Joist Hanger - 6-8" Flush

Item #: 56639 (JHF-68-LS)



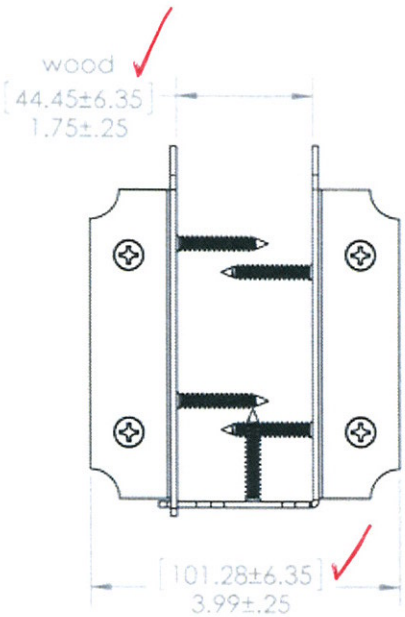
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	56639-11	56639 PART A
2	1	56639-12	56639 Part B
3	9	80010-01	SCREW, FHP #10 X 1.25", BLACK

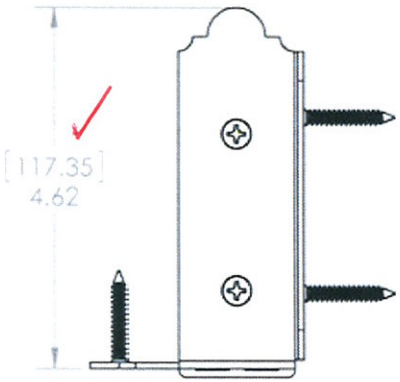
Architectural Testing

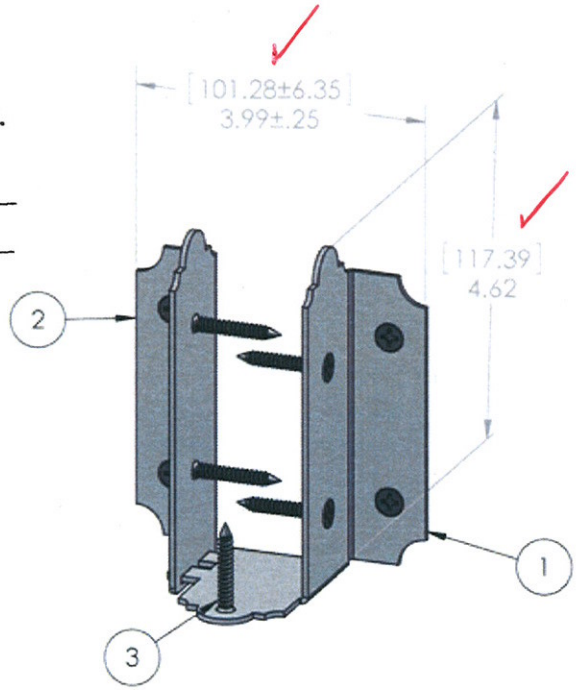
Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJs







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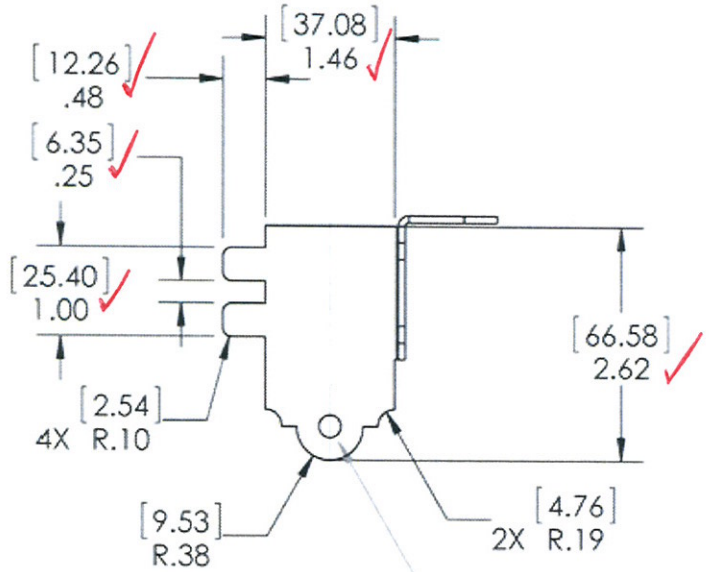
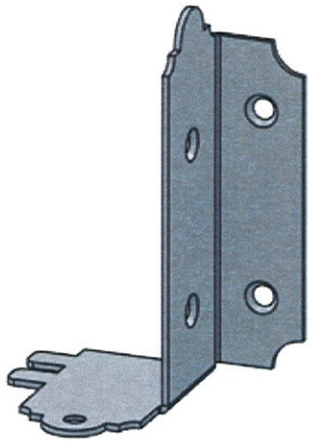


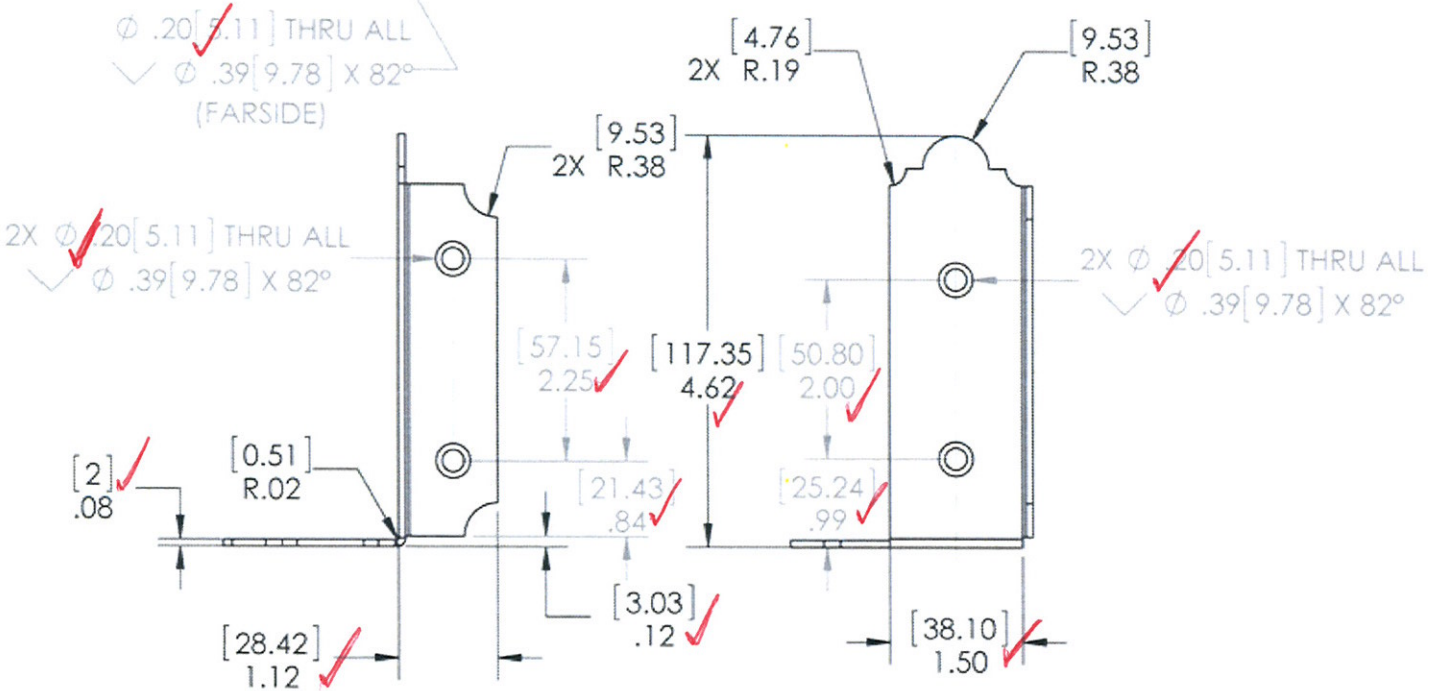
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS





Architectural Testing

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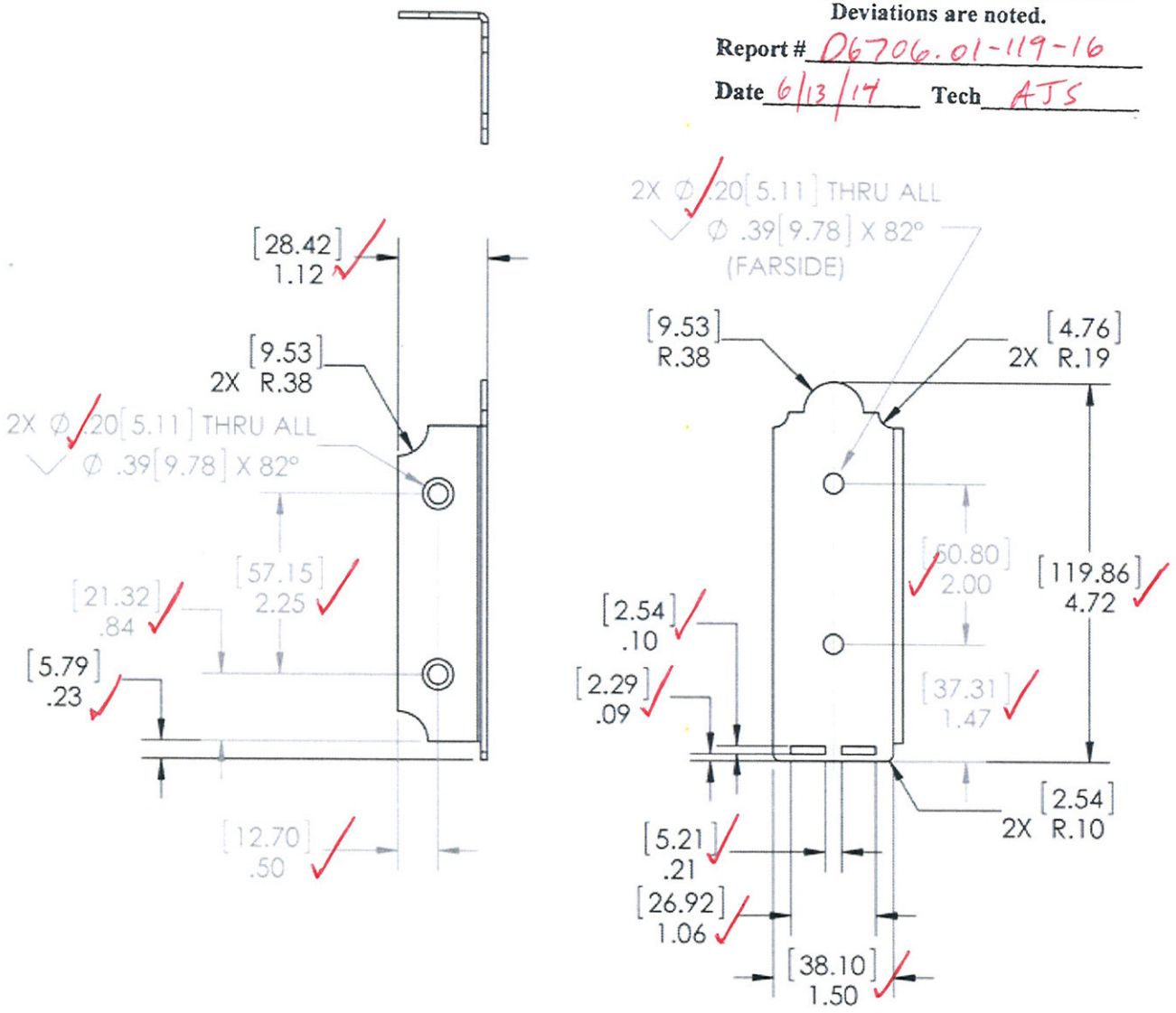
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS

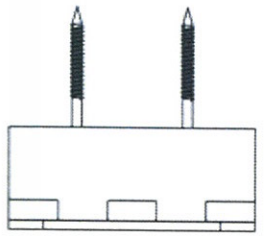


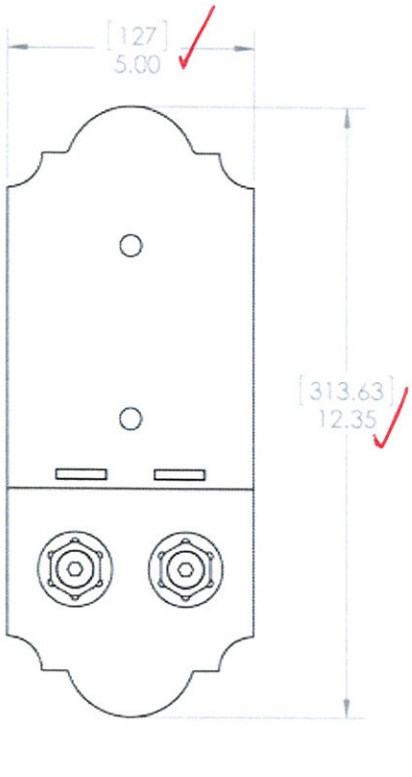
Product & Packaging Specs

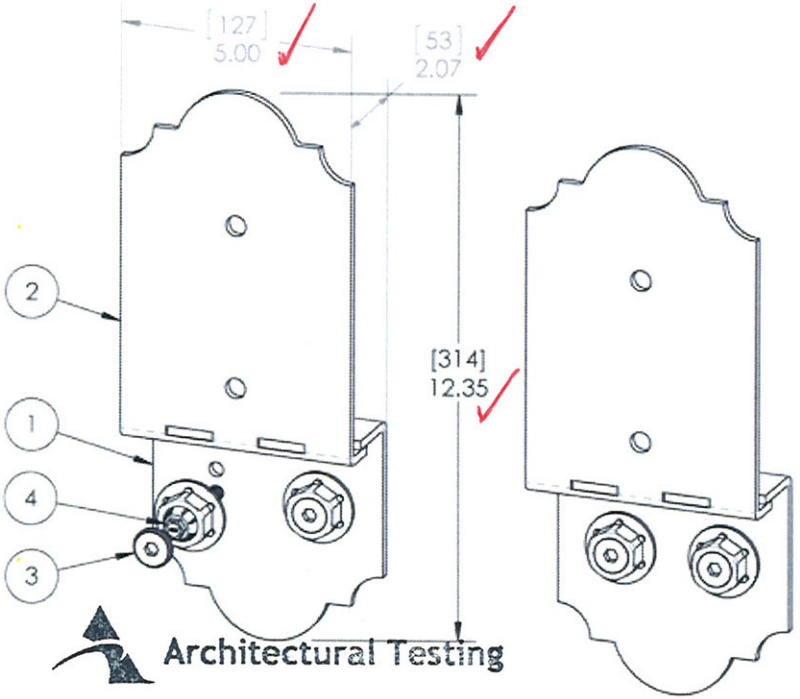
Bolt Inline Post To Beam

Item #: 56637 (P2B-BI-LS)

ITEM NO.	Public/QTY.	PART NUMBER	DESCRIPTION
1	2	56610-11	Post to Beam Ledge
2	2	56637-11	Plate, Top Bolt Inline
3	4	56621-10	1 1/2" Hex Cap Nut Assembly
4	4	56626-10	OWT Timber Screw 2-3/4"







Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS

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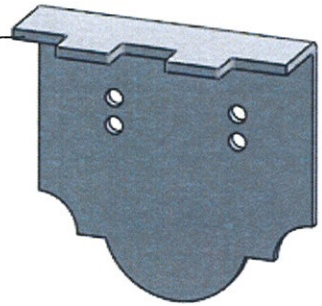
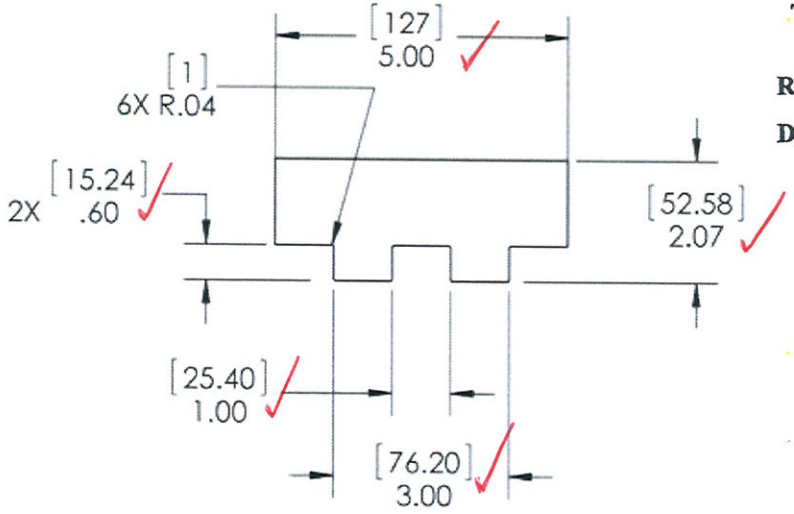
Architectural Testing

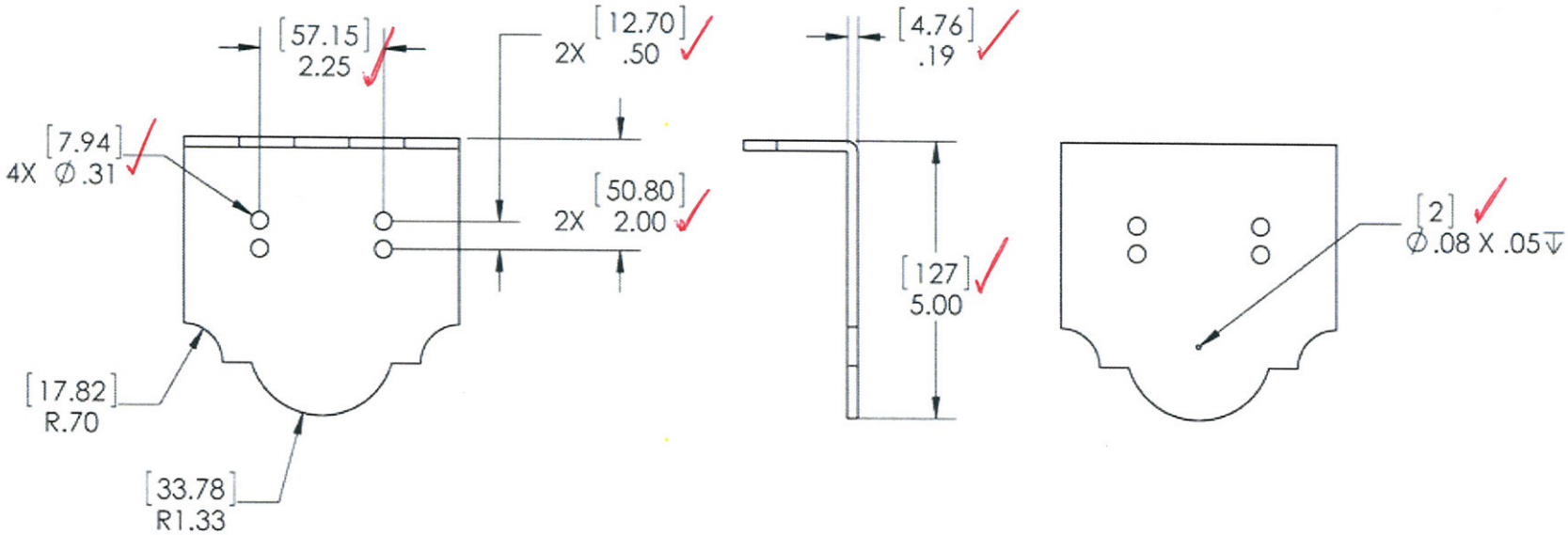
Test sample complies with these details.
Deviations are noted.

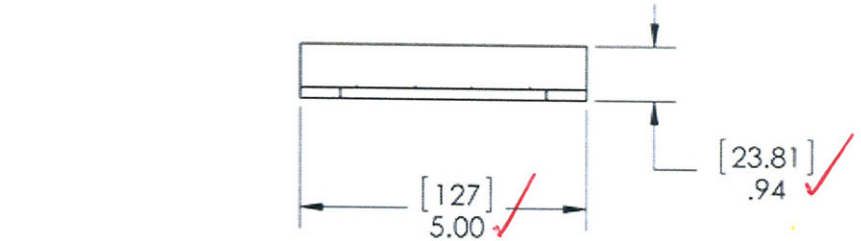
Report # 06706-01-119-16

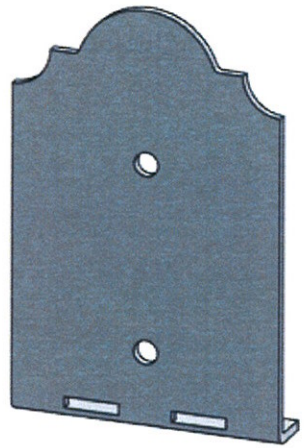
Date 6/13/14 **Tech** AJS

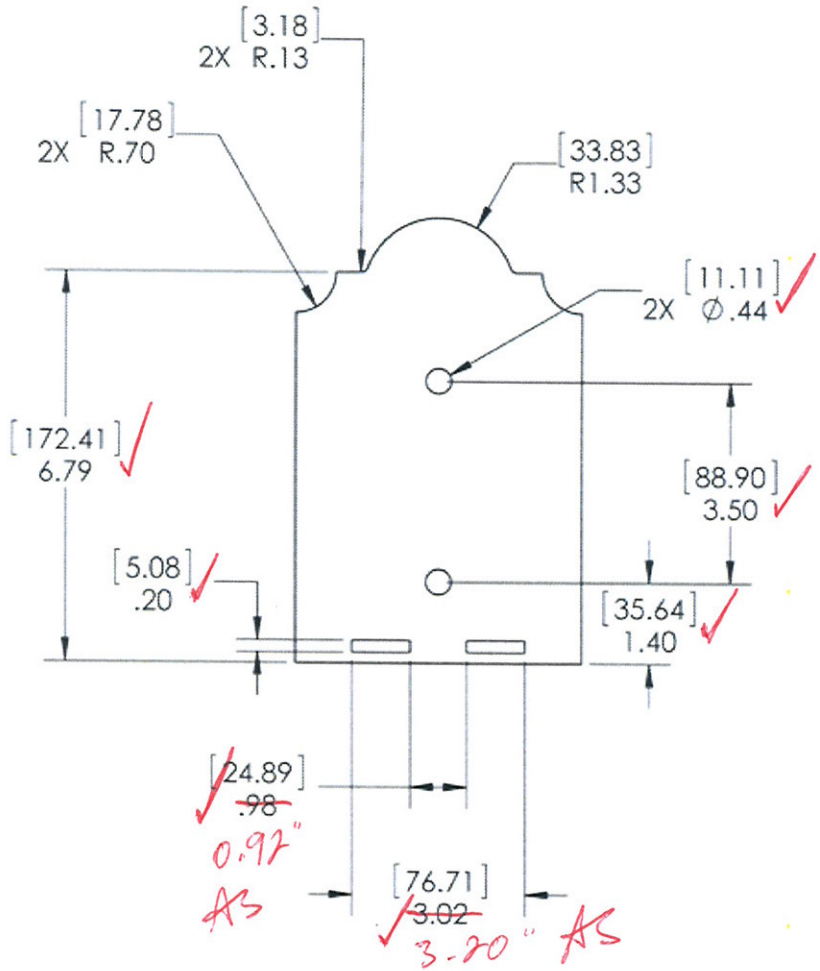


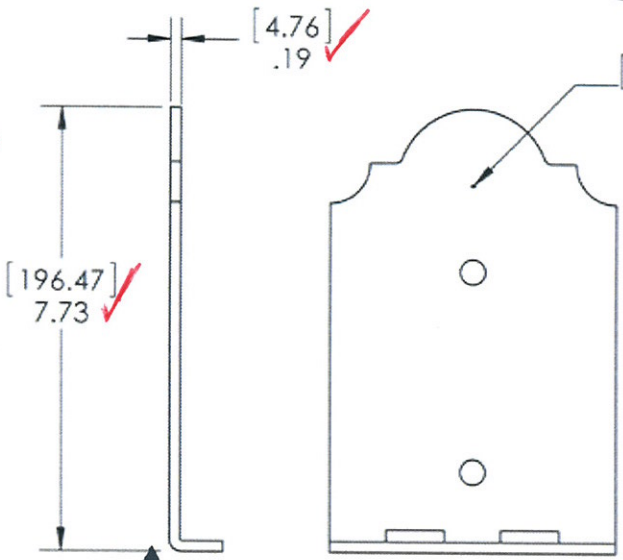












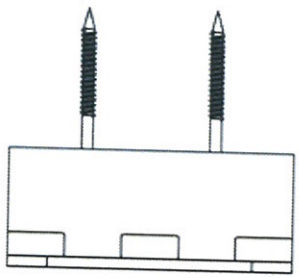
Architectural Testing

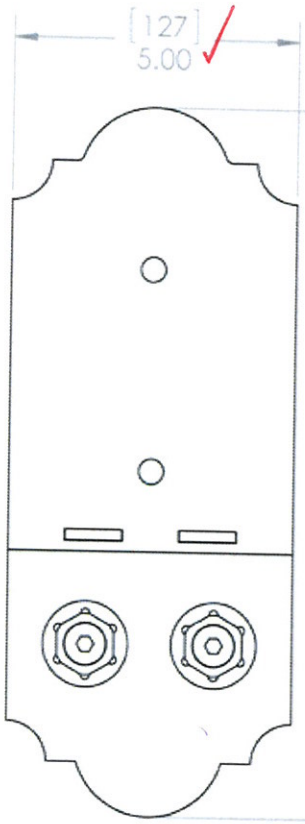
Test sample complies with these details.
Deviations are noted.

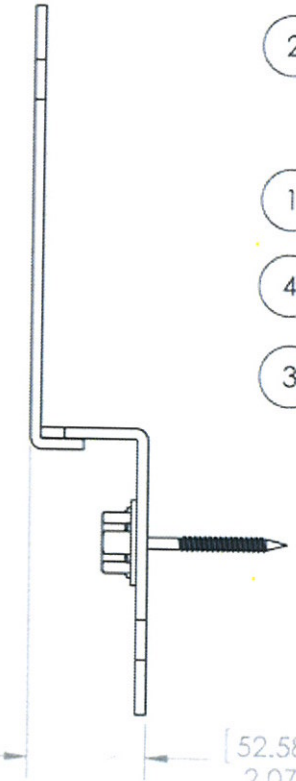
Report # 06706.01-119-16

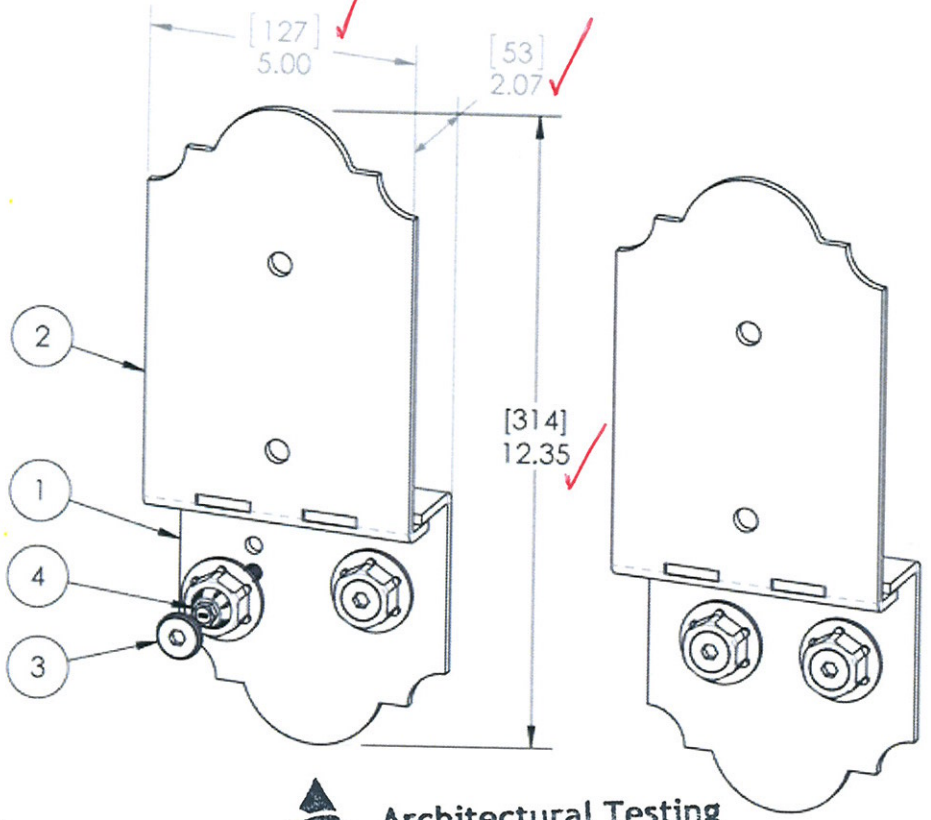
Date 6/13/14 **Tech** AJS

ITEM NO.	Public/QTY.	PART NUMBER	DESCRIPTION
1	2	56610-11	Post to Beam Ledge
2	2	56637-11	Plate, Top Bolt Inline
3	4	56621-10	1 1/2" Hex Cap Nut Assembly
4	4	56626-10	OWT Timber Screw 2-3/4"









Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

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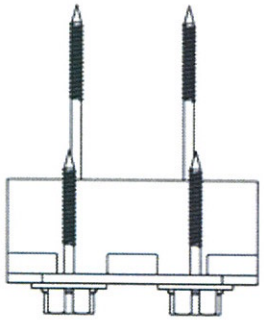
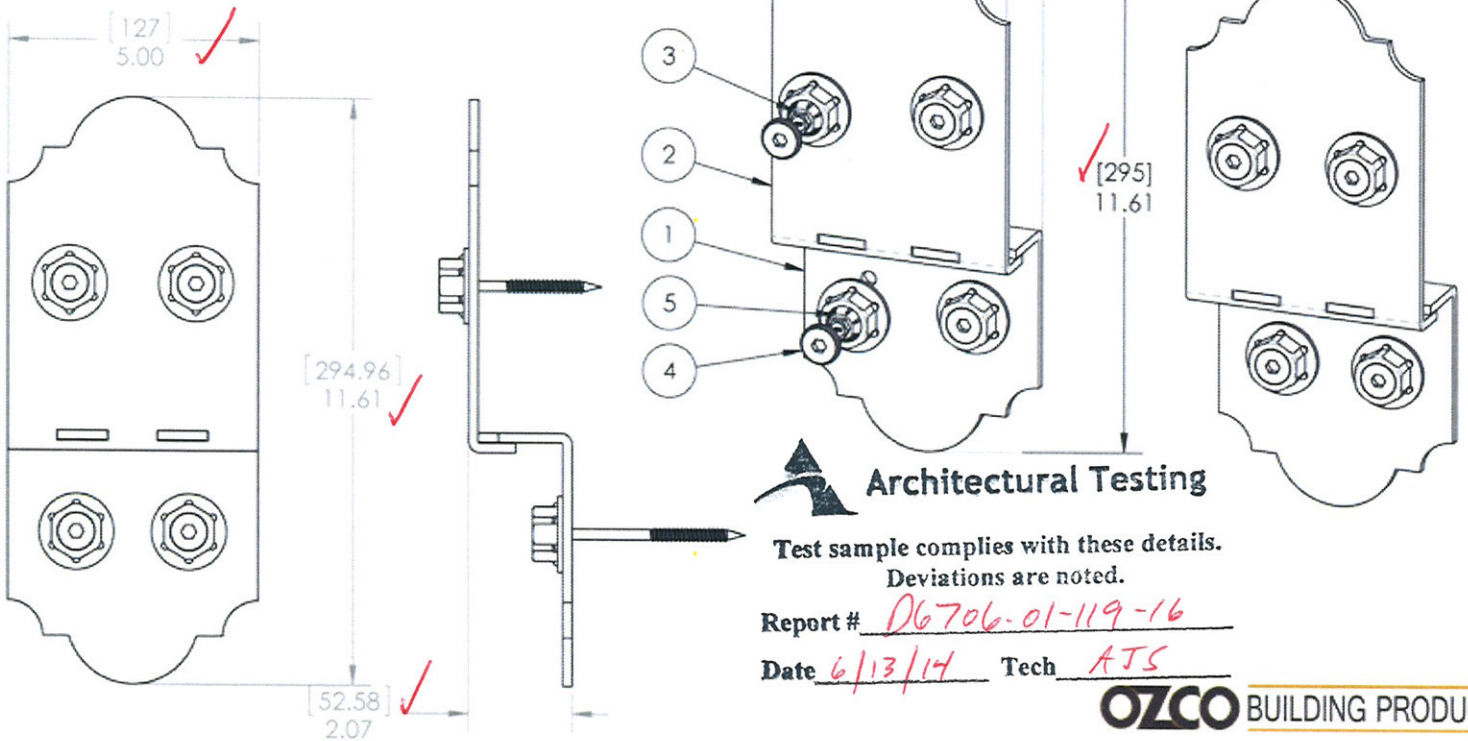
Product & Packaging Specs

8" Post To Beam

Item #: 56610 (P2B-LS-8)



ITEM NO.	Public/QTY.	PART NUMBER	DESCRIPTION
1	2	56610-11	Post to Beam Ledge
2	2	56610-12	Plate, Top 8" Post to Beam
3	4	56626-10	OWT Timber Screw 2-3/4 (70mm)
4	8	56621-10	1 1/2" Hex Cap Nut Assembly
5	4	56627-10	OWT Timber Screw 3-3/4 (95mm)



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS

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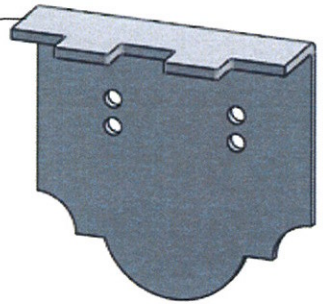
V1.00 – Installation Instructions effective until May 1, 2015 and reflects information that available as of April 10,2014. This information is updated periodically and should not be relied upon after May, 1, 2015. Please visit www.OZCOBP.com to get current information.

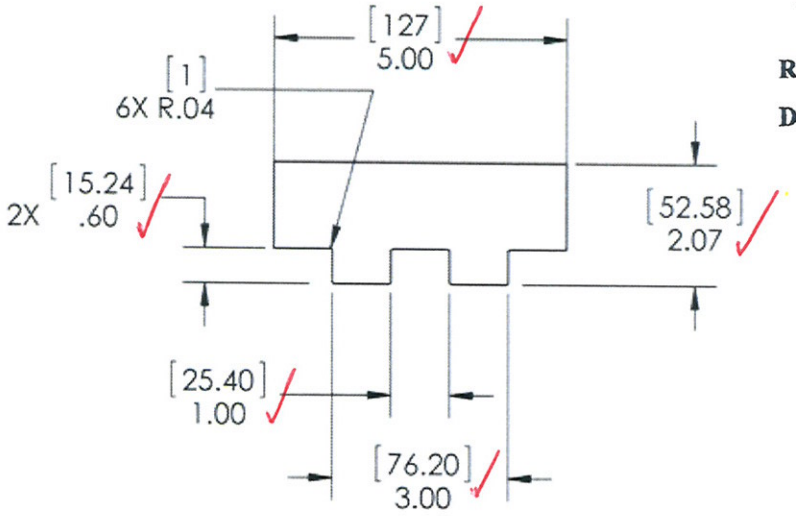
Architectural Testing

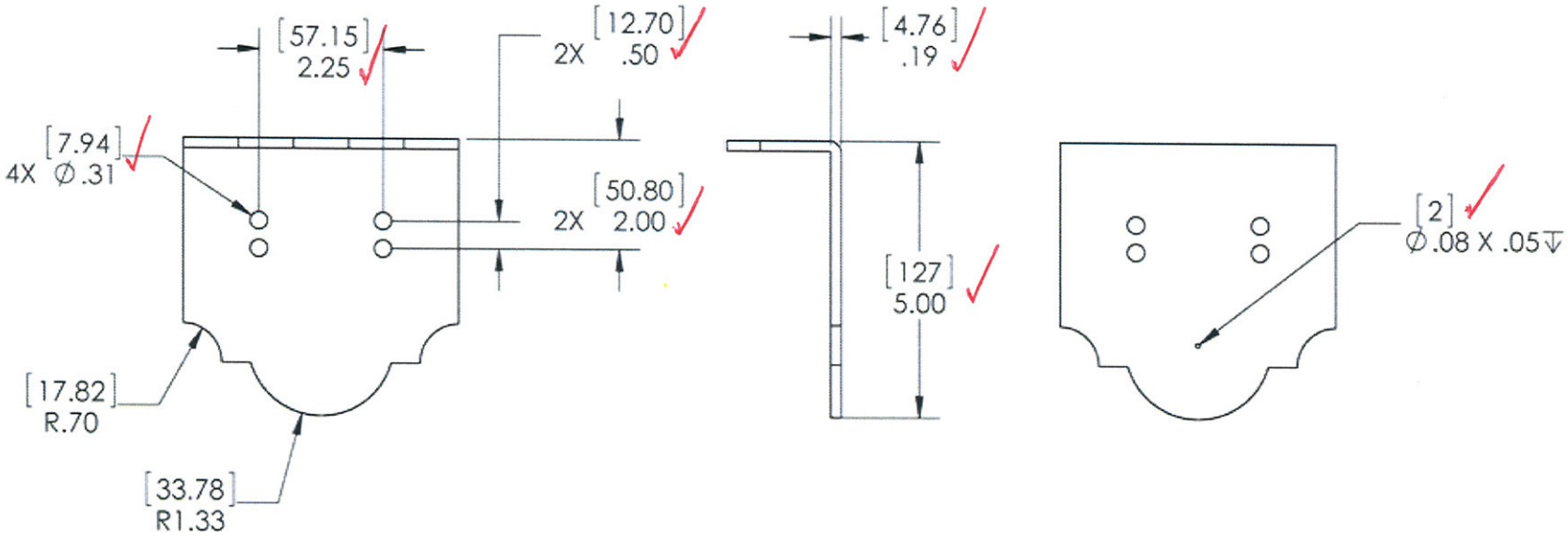
Test sample complies with these details.
Deviations are noted.

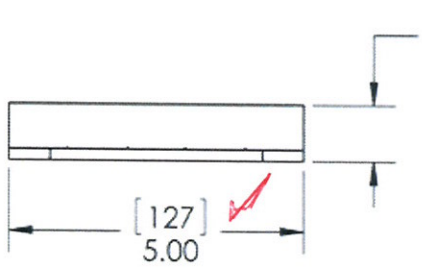
Report # 06706-01-119-16

Date 6/13/14 **Tech** AJS







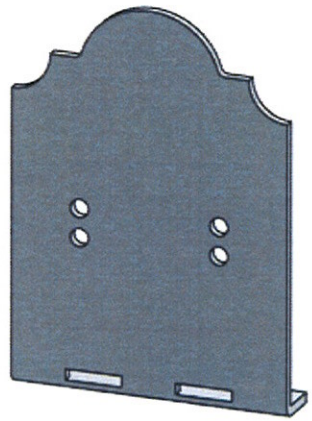


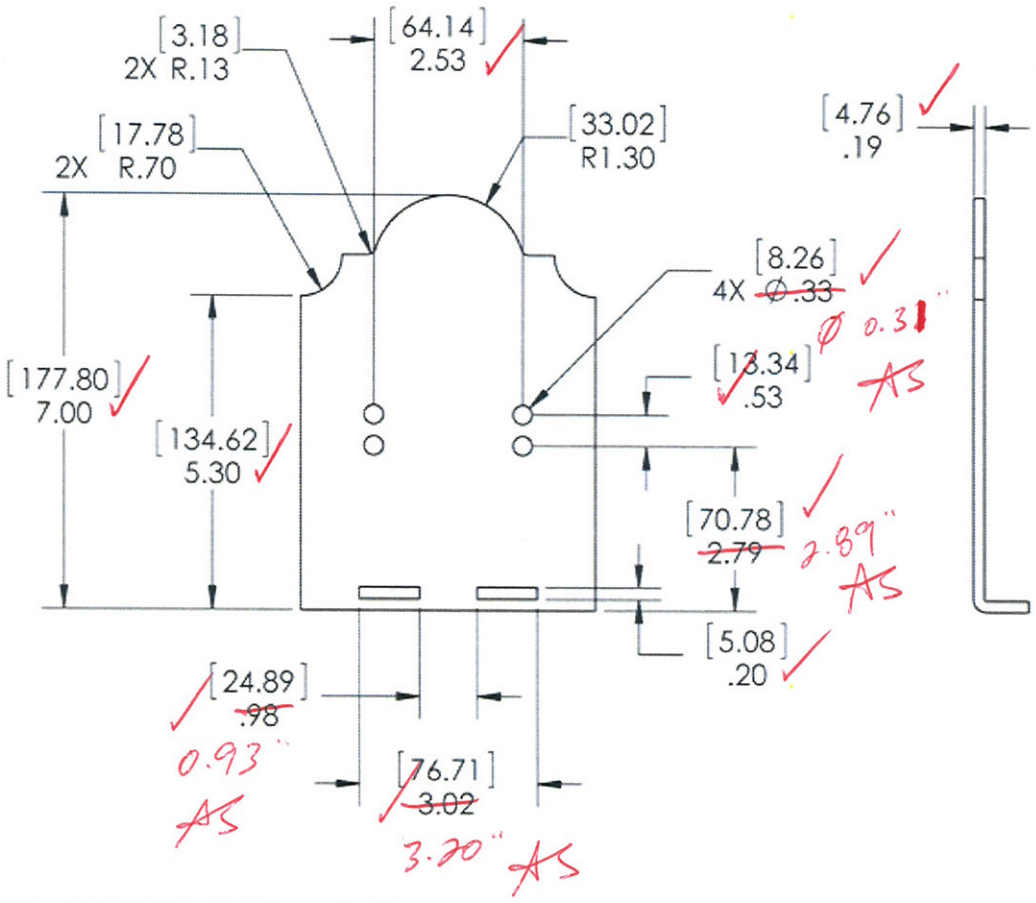
Architectural Testing

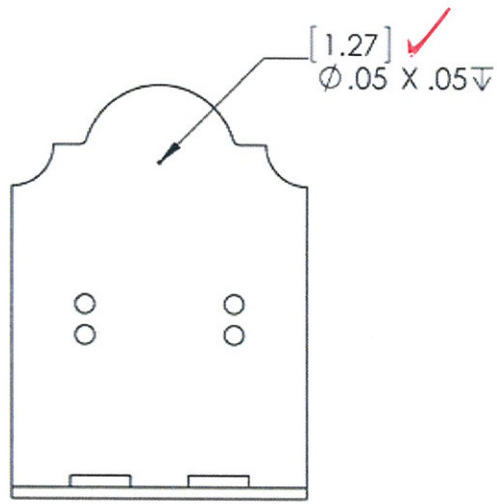
Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS





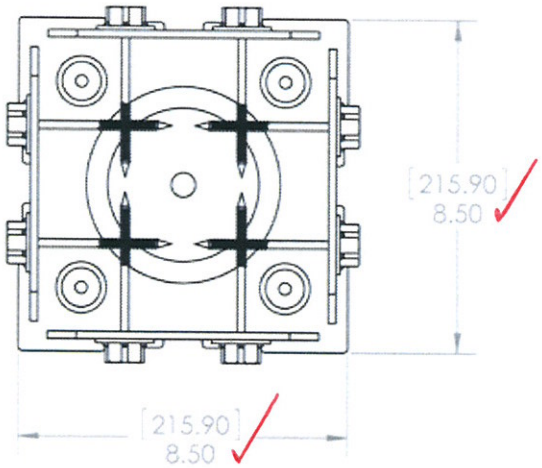


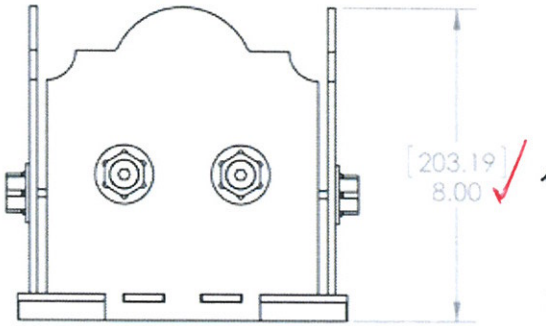
Product & Packaging Specs

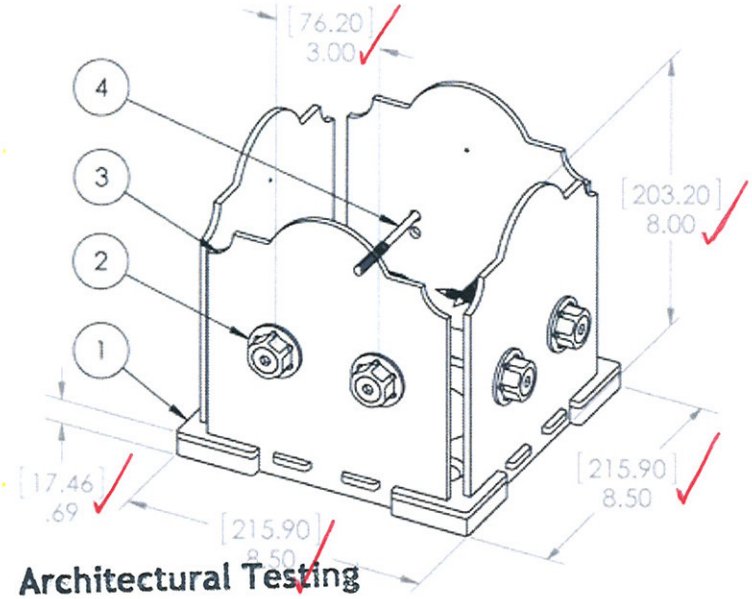
8"x 8" Post Base Kit

Item #: 56609 (8X8-PB-LS)

ITEM NO.	Default/ QTY.	PART NUMBER	DESCRIPTION
1	1	56609-11	Assembly, 8x8 Stand Off
2	8	56621-10	1 1/2" Hex Cap Nut Assembly
3	4	56609-15	Plate, 8x8 Side Compression
4	8	56627-10	OWT Timber Screw 3-3/4"







Architectural Testing

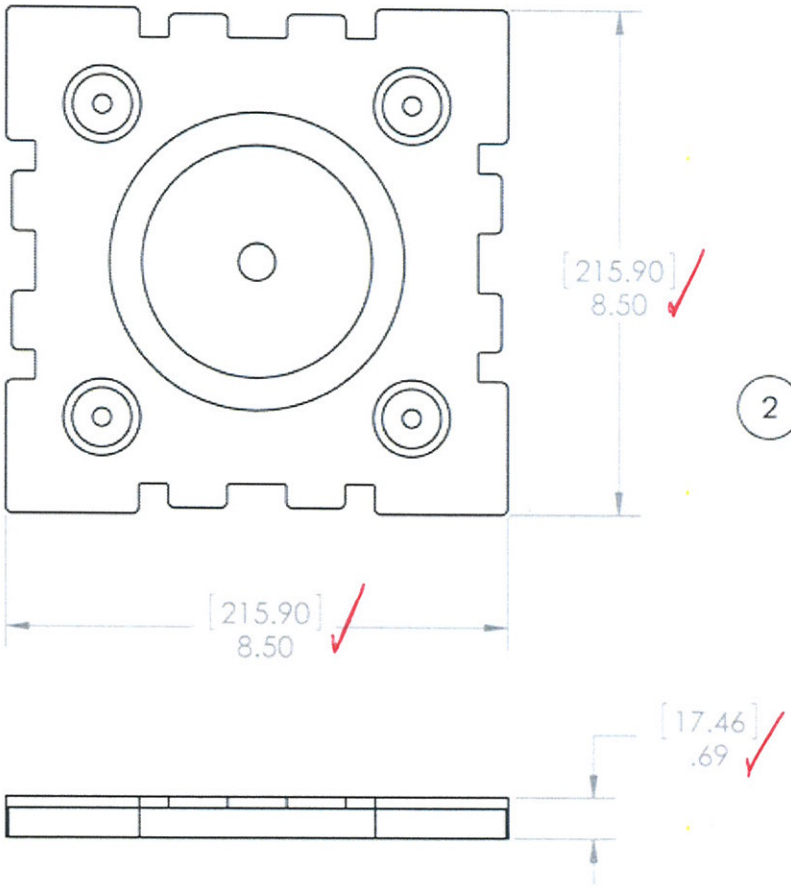
Test sample complies with these details.
Deviations are noted.

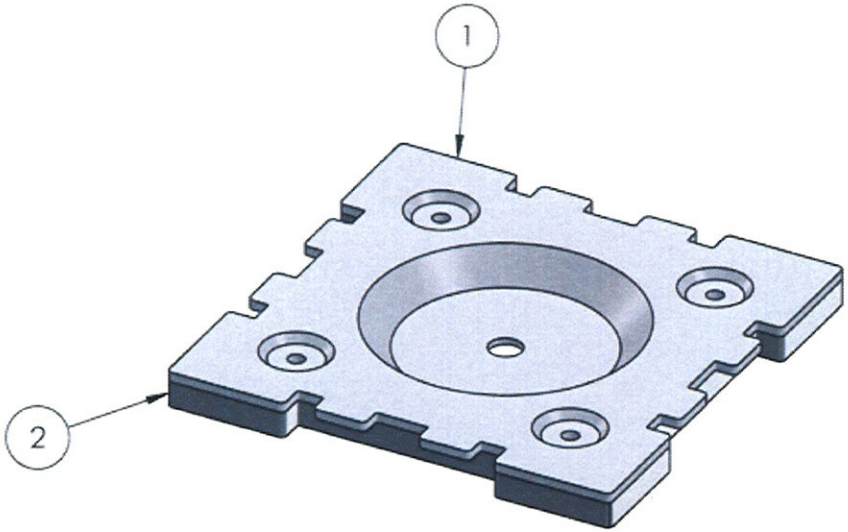
Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS

OZCO BUILDING PRODUCTS

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	56609-12	Adj Post Base Plate Sidewall
2	1	56609-13	Adj Base Side Stamping Assy



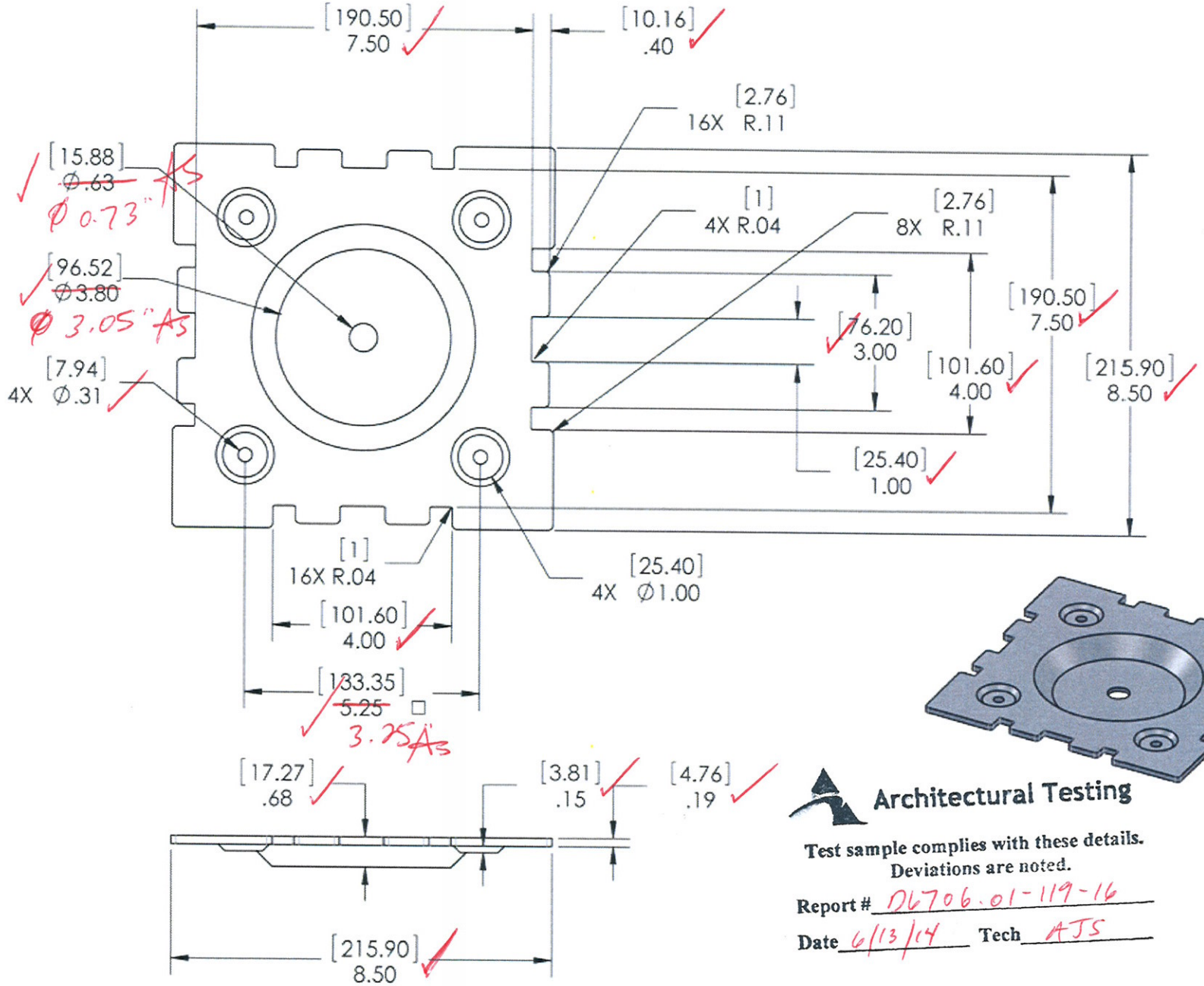


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706-01-119-16

Date 6/13/14 **Tech** AJS



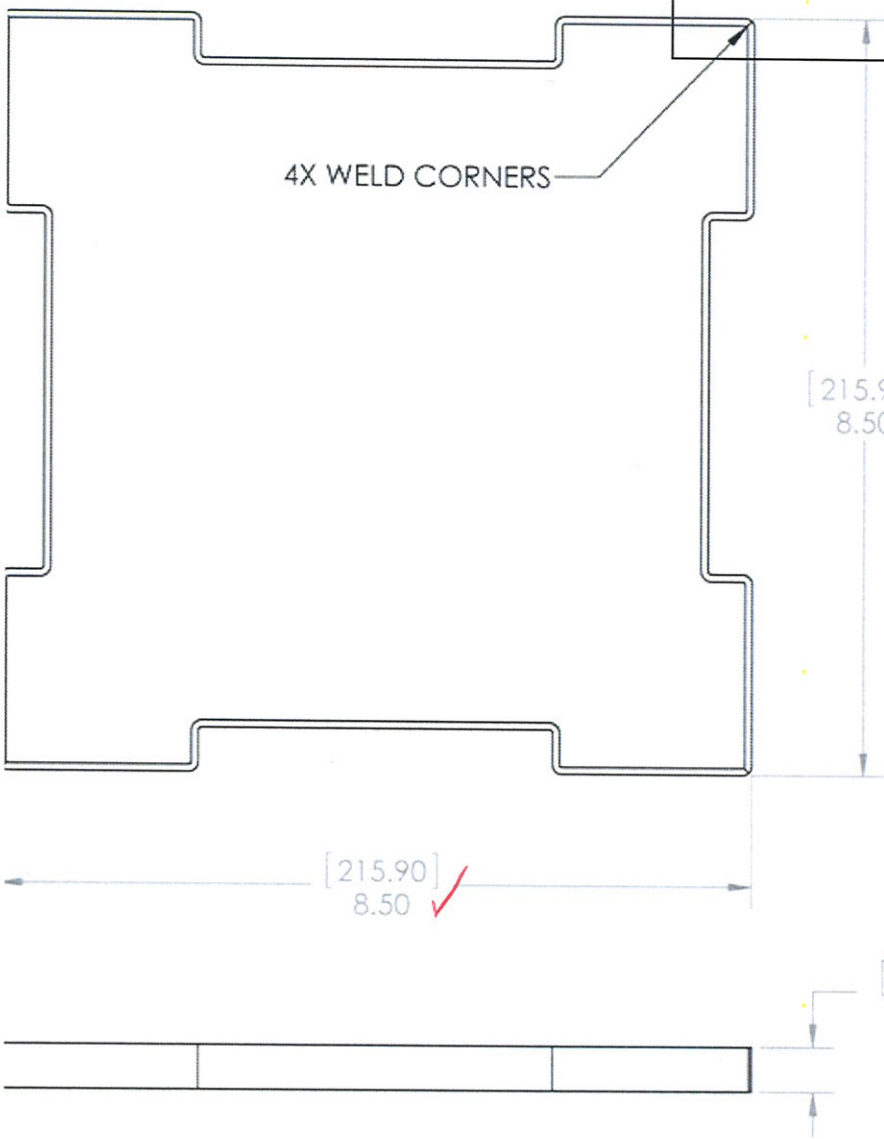
Architectural Testing

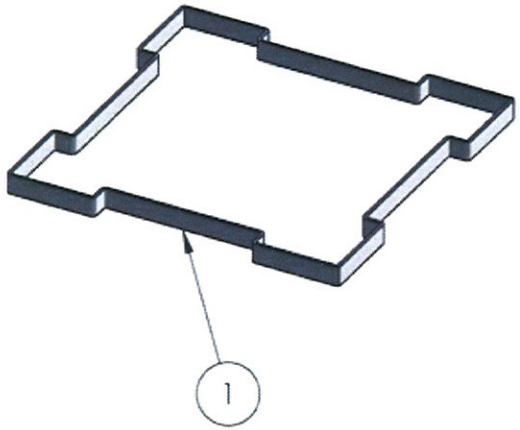
Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	4	56609-14	Adj Base Plate Stamping



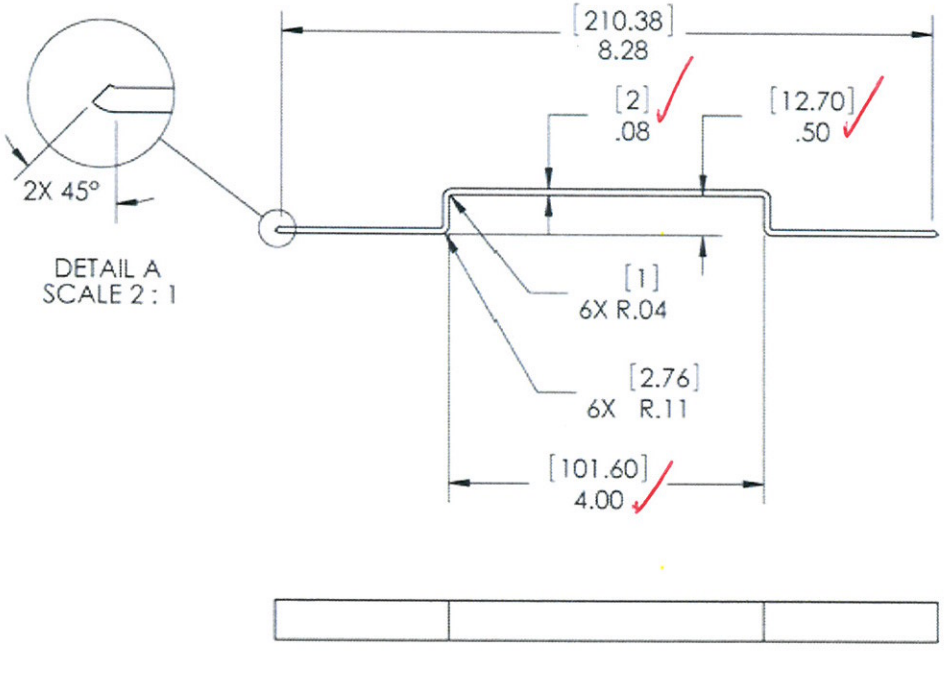


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706-01-119-16

Date 6/13/14 **Tech** AJS

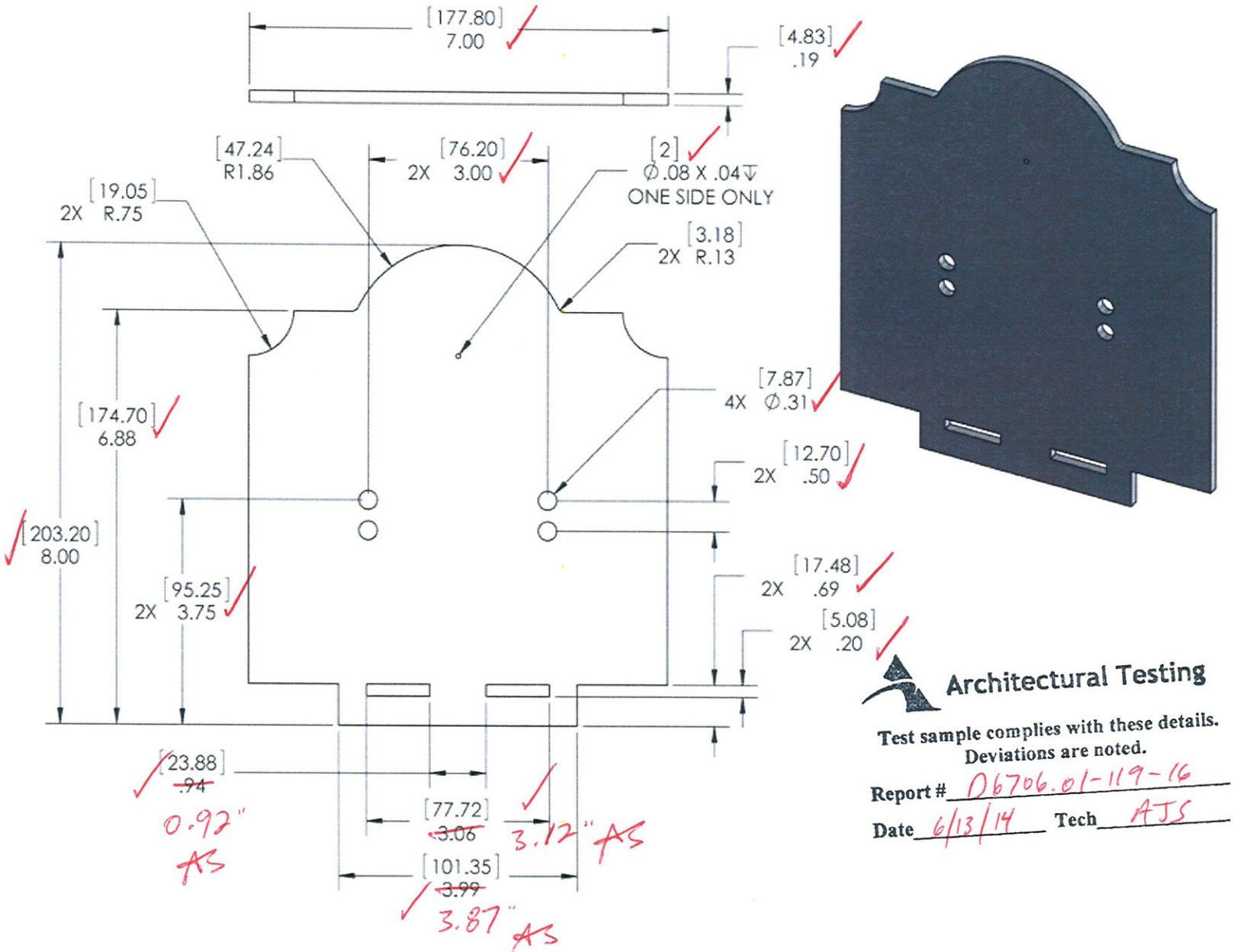


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 Tech AJS



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

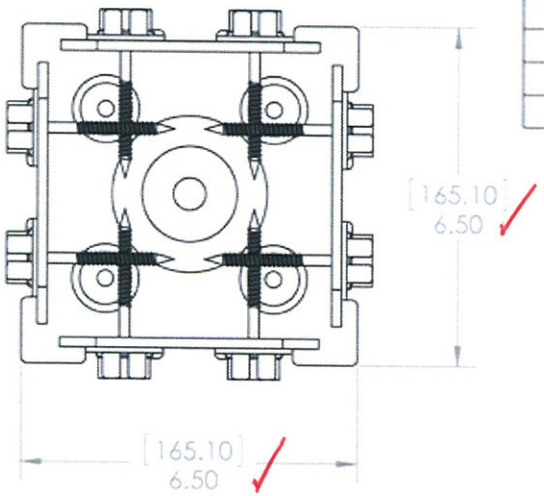
Date 6/13/14 **Tech** AJS

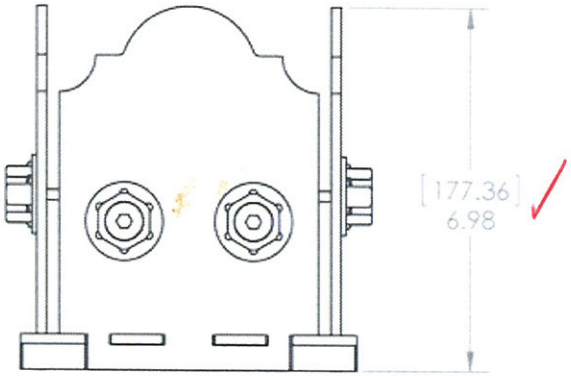
Product & Packaging Specs

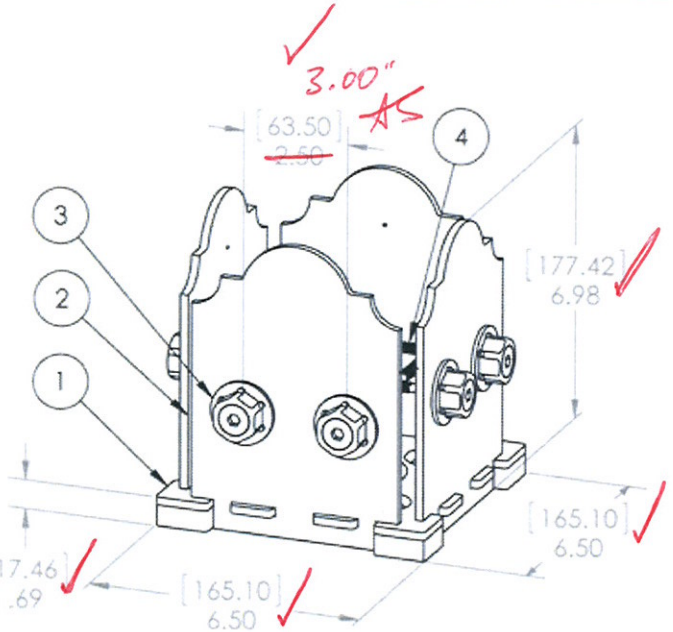
6"x 6" Post Base Kit

Item #: 56608 (6X6-PB-LS)

ITEM NO.	default/QTY.	PART NUMBER	DESCRIPTION
1	1	56608-11	Assembly, 6x6 Stand Off
2	4	56608-15	Plate, 6x6 Side Compression
3	8	56621-10	1 1/2" Hex Cap Nut Assembly
4	8	56626-10	OWT Timber Screw 2-3/4"







Architectural Testing

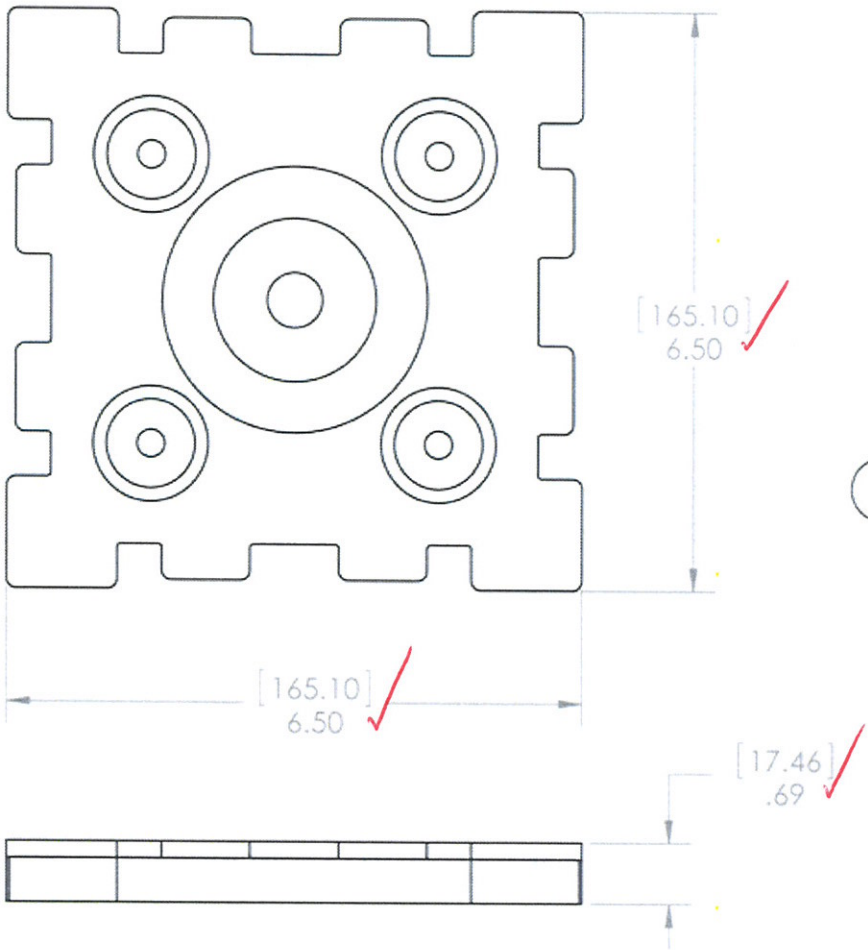
Test sample complies with these details.
Deviations are noted.

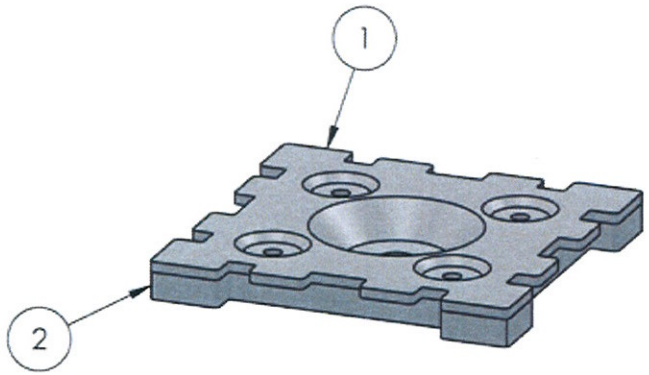
Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS

OZCO BUILDING PRODUCTS

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	56608-12	Adjustable Base Plate Sidewall
2	1	56608-13	Assembly, Adj Base Side Stamping



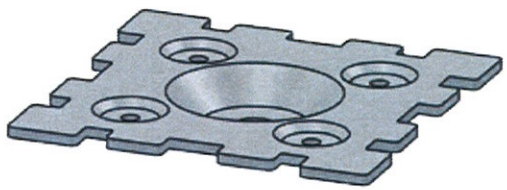


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS



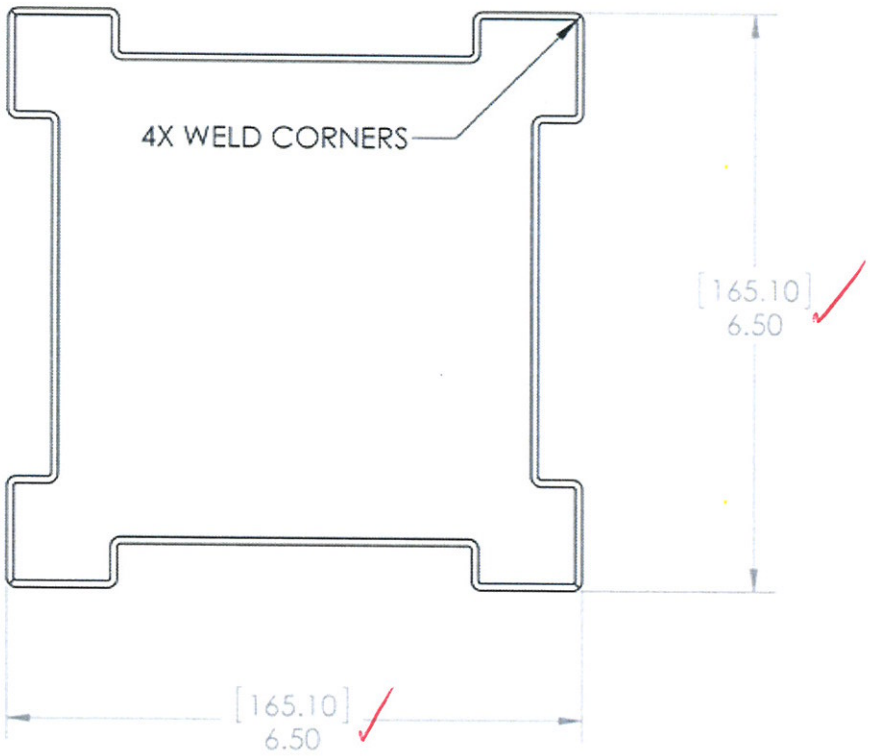
Architectural Testing

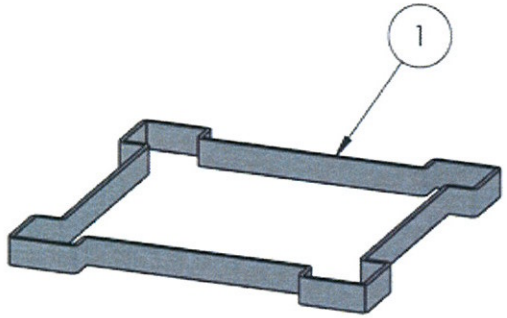
Test sample complies with these details.
Deviations are noted.

Report # 06706-01-119-16

Date 6/13/14 **Tech** AJS

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	4	56608-14	Adjustable Base Plate Stamping





Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

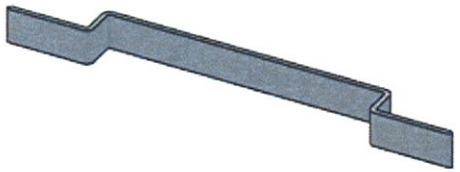
Date 6/13/14 **Tech** AJS

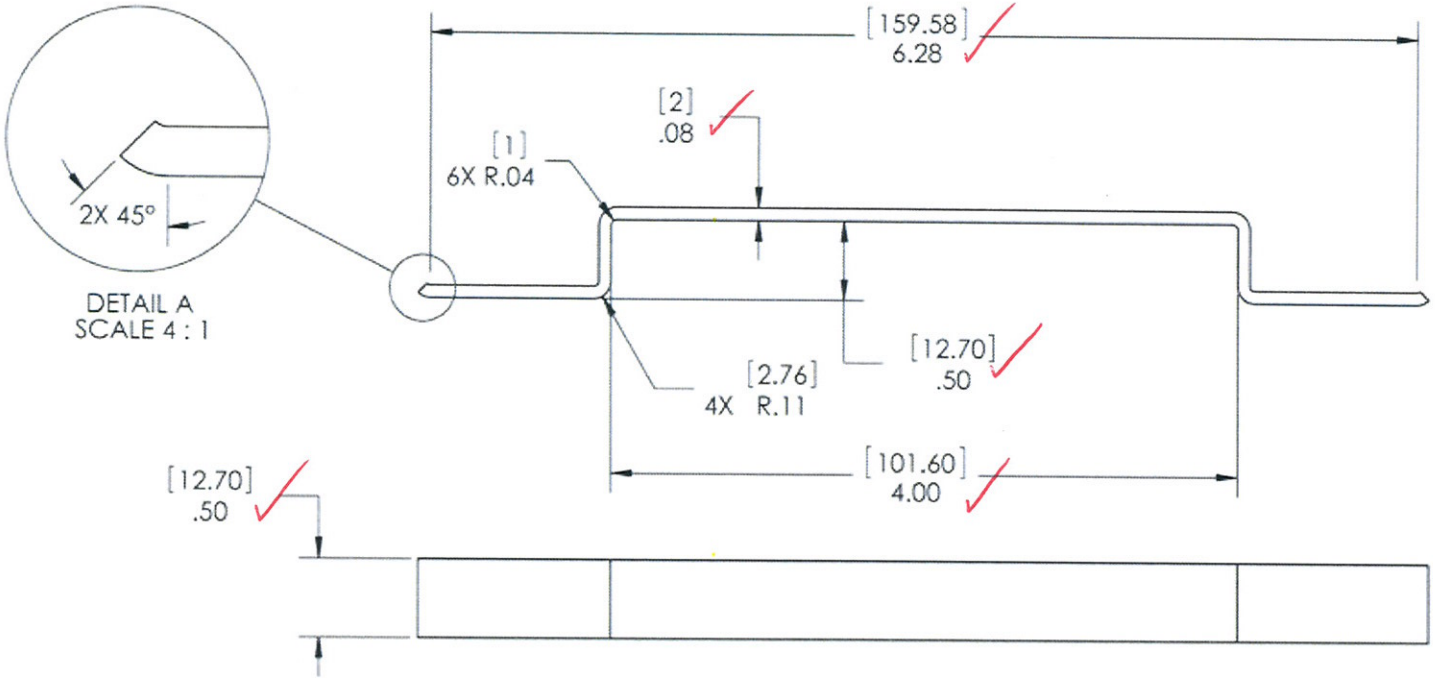
Architectural Testing

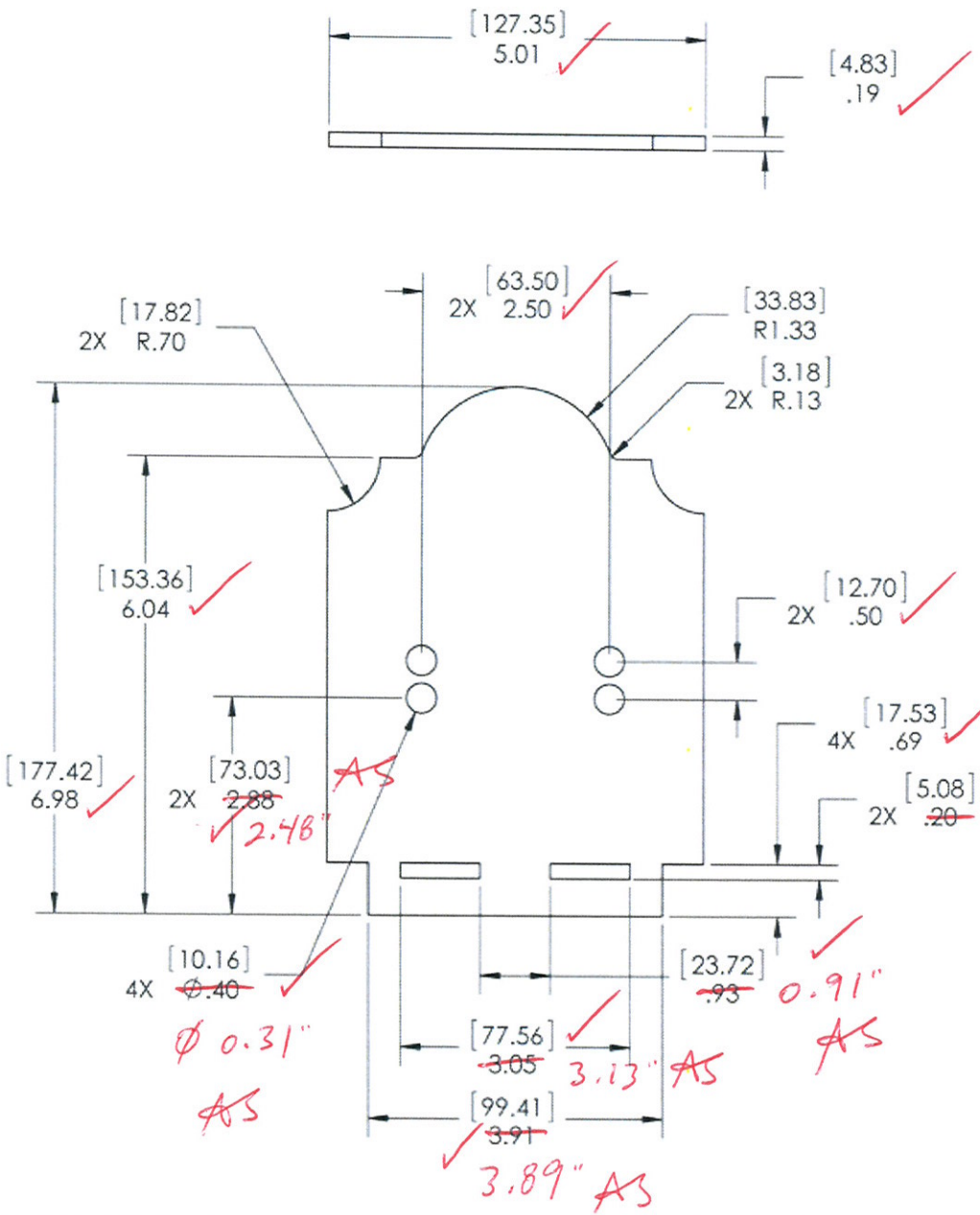
Test sample complies with these details.
Deviations are noted.

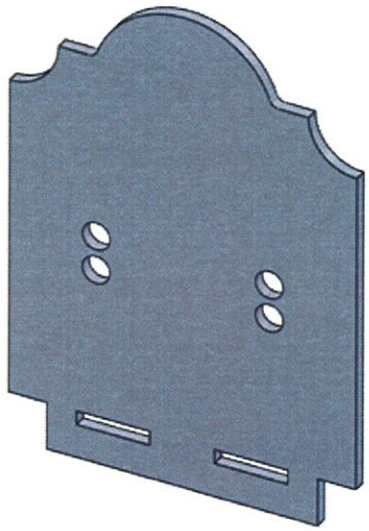
Report # 06706-01-119-16

Date 6/13/14 **Tech** AJS









Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

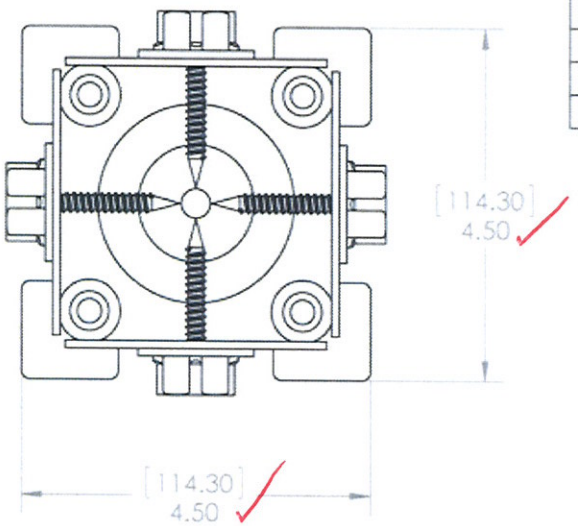
Date 6/13/14 Tech AJS

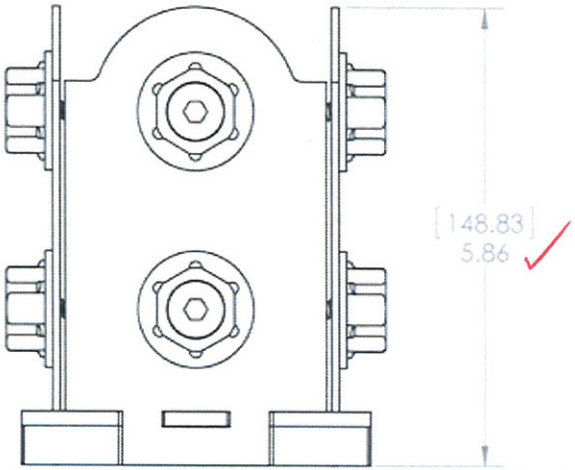
Product & Packaging Specs

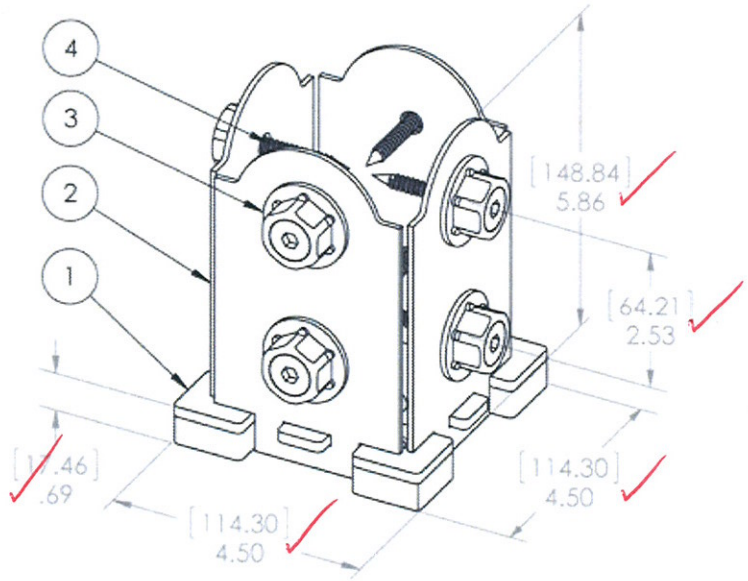
4"x 4" Post Base Kit

Item #: 56607 (4X4-PB-LS)

ITEM NO.	default/QTY.	PART NUMBER	DESCRIPTION
1	1	56607-11	Assembly, 4x4 Stand Off
2	4	56607-15	Plate, 4x4 Side Compression
3	8	56621-10	1 1/2" Hex Cap Nut Assembly
4	8	56625-10	1 3/4" OWT Timber Screws







Architectural Testing

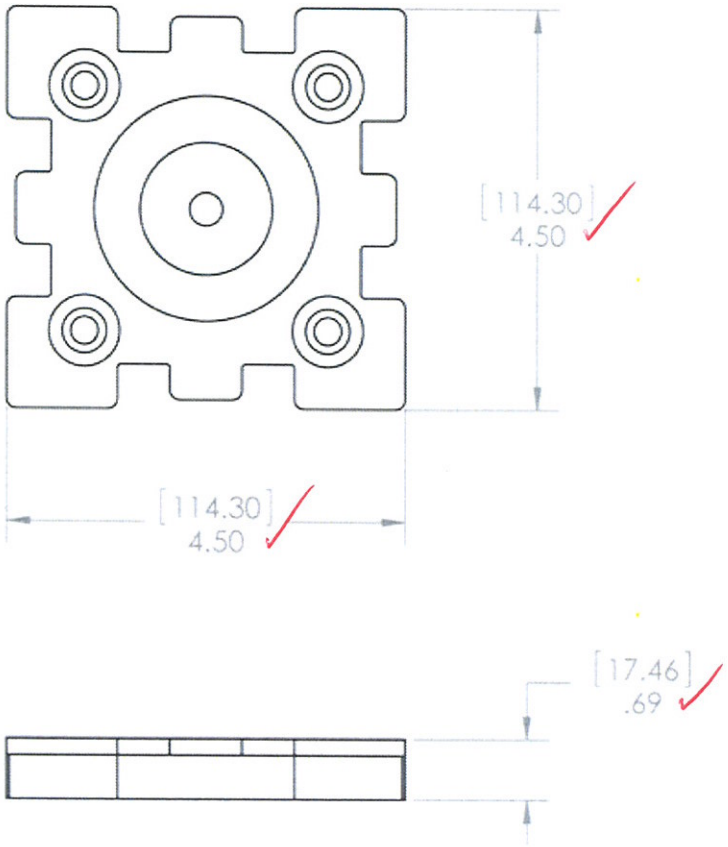
Test sample complies with these details.
Deviations are noted.

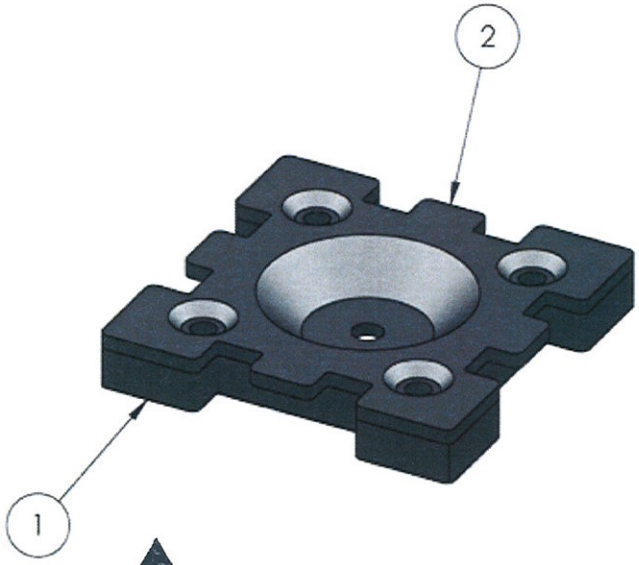
Report # 06706-01-119-16

Date 6/13/14 **Tech** ATS

OZCO BUILDING PRODUCTS

ITEM NO.	Default/ QTY.	PART NUMBER	DESCRIPTION
1	1	56607-13	Adj Base Side Stamping Assy
2	1	56607-12	Adj Post Base Plate Sidewall



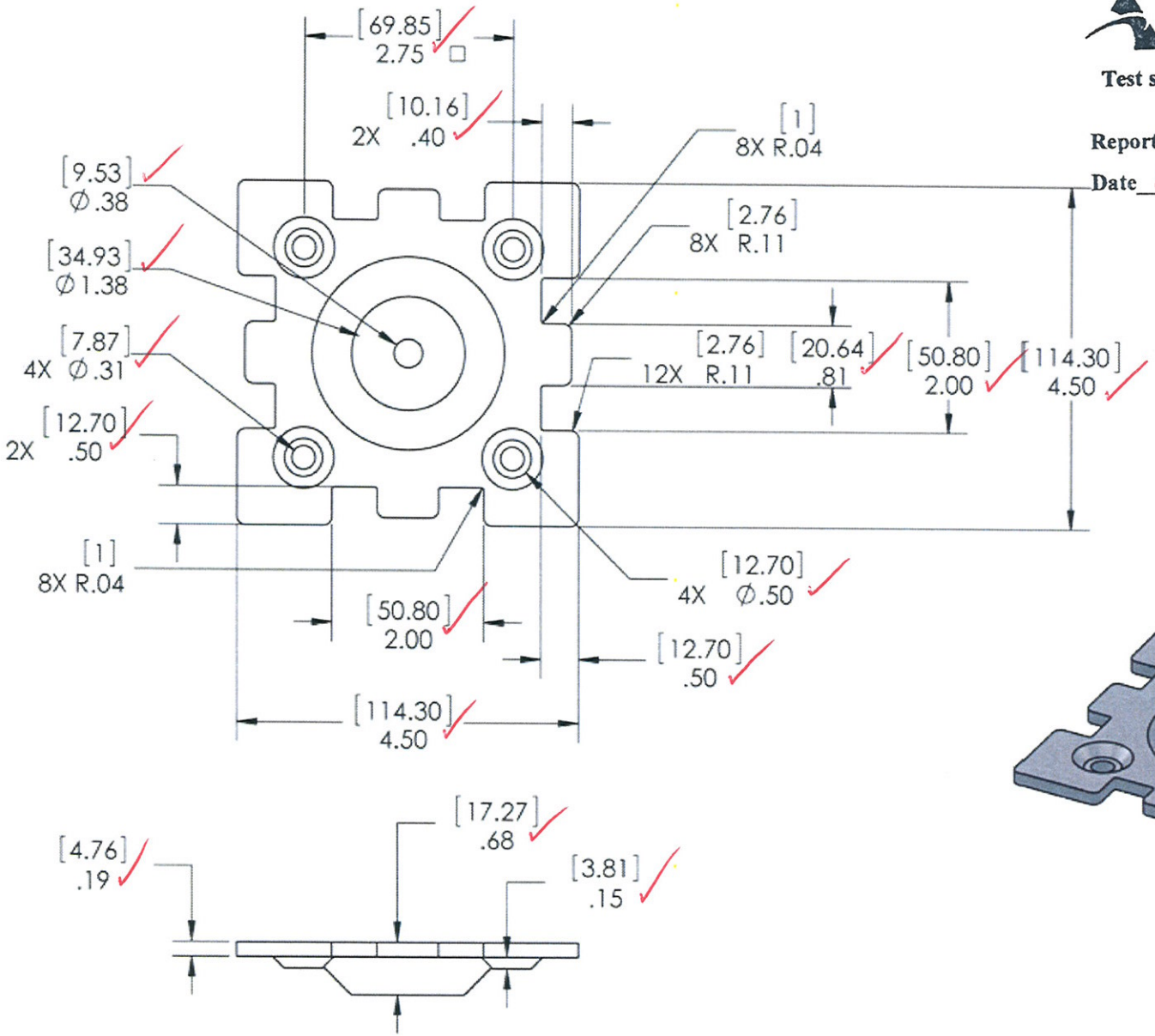


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS

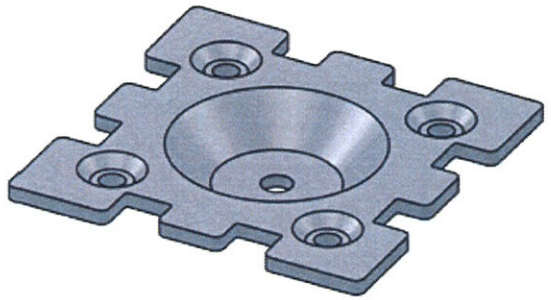


Architectural Testing

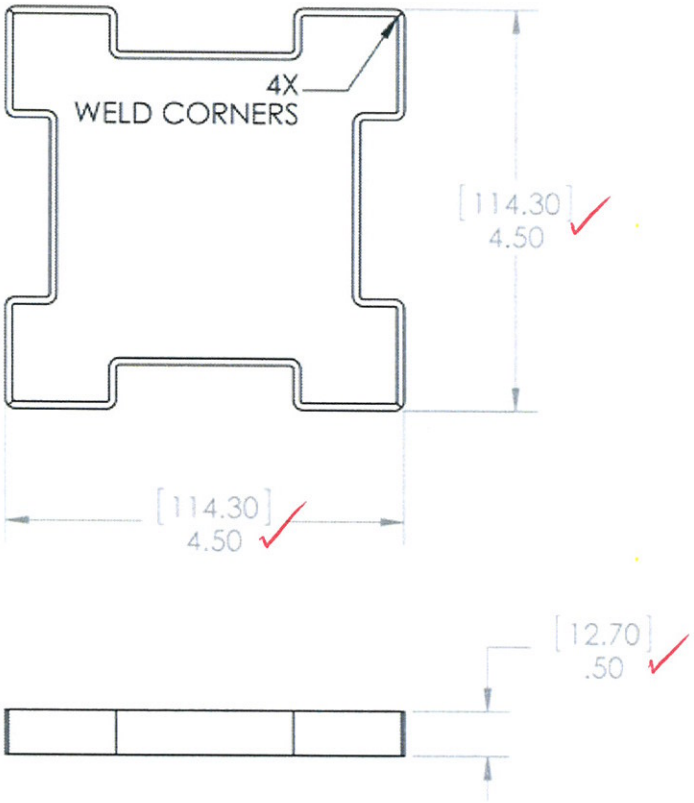
Test sample complies with these details.
Deviations are noted.

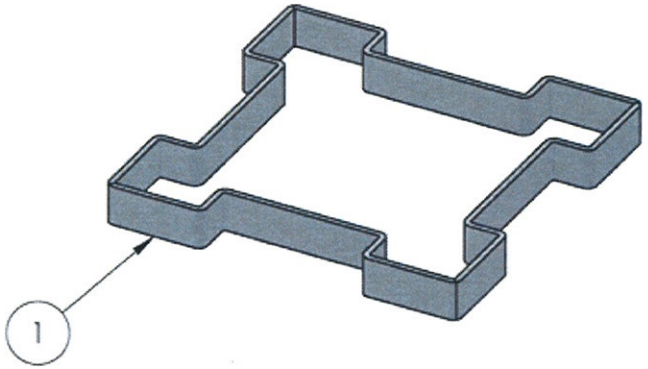
Report # D6706-01-119-16

Date 6/13/14 **Tech** AJS



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	4	56607-14	Adj Base Plate Stamping



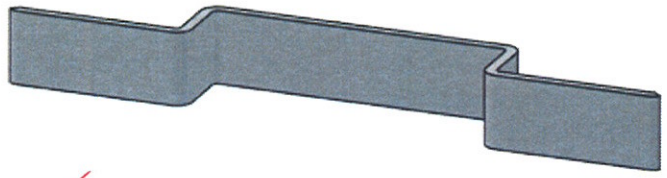


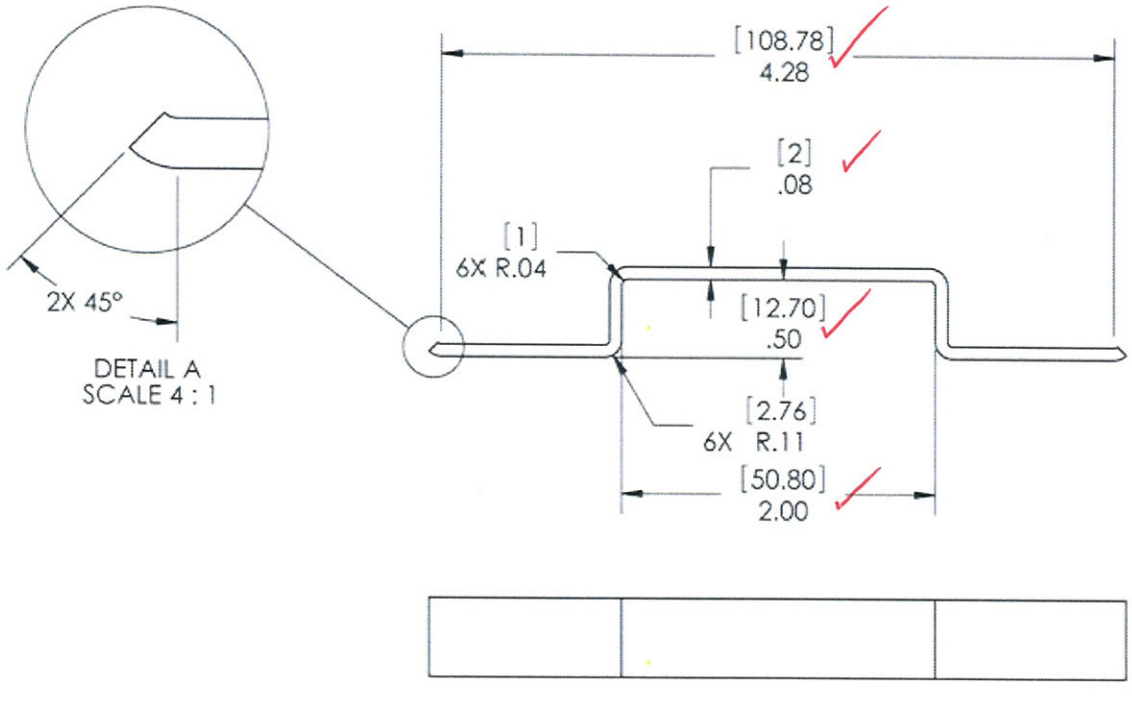
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS



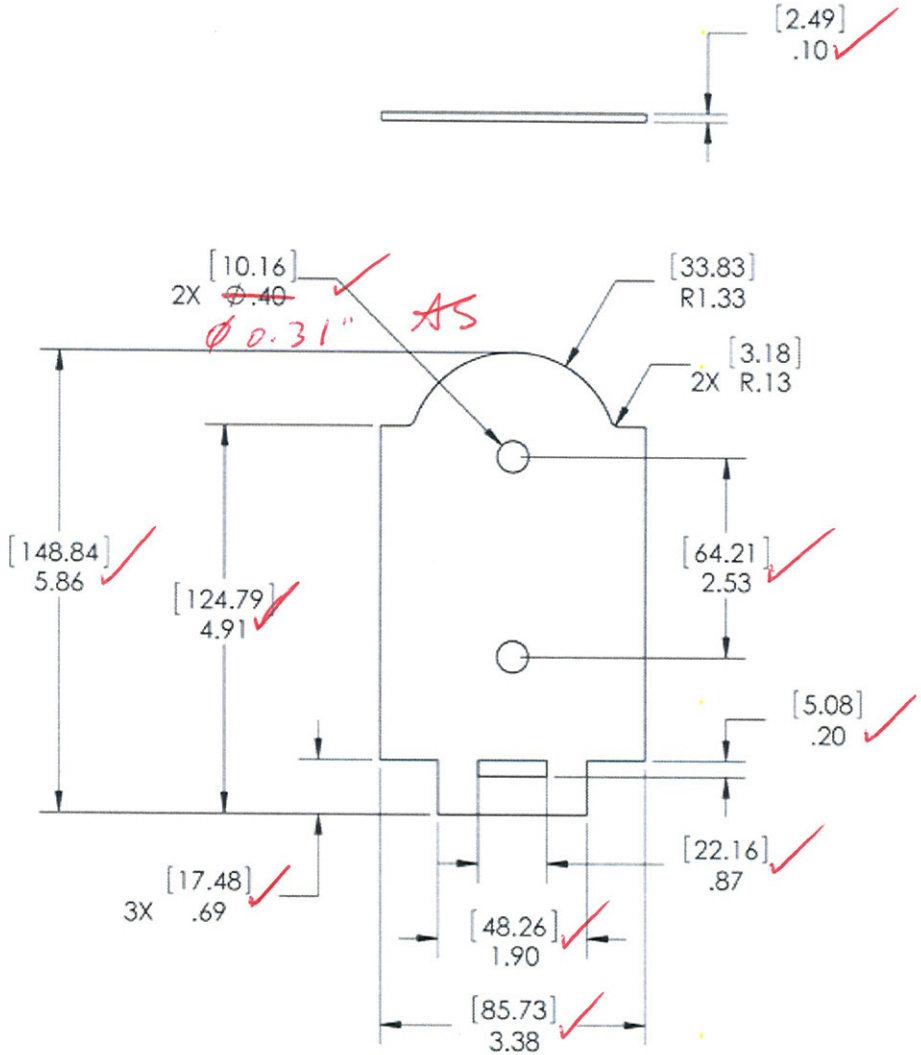


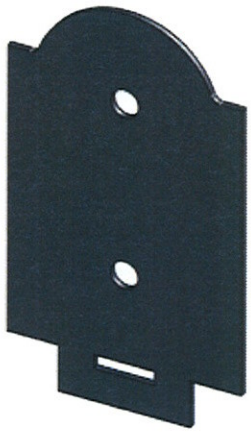
Architectural Testing

Test sample complies with these details. Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS





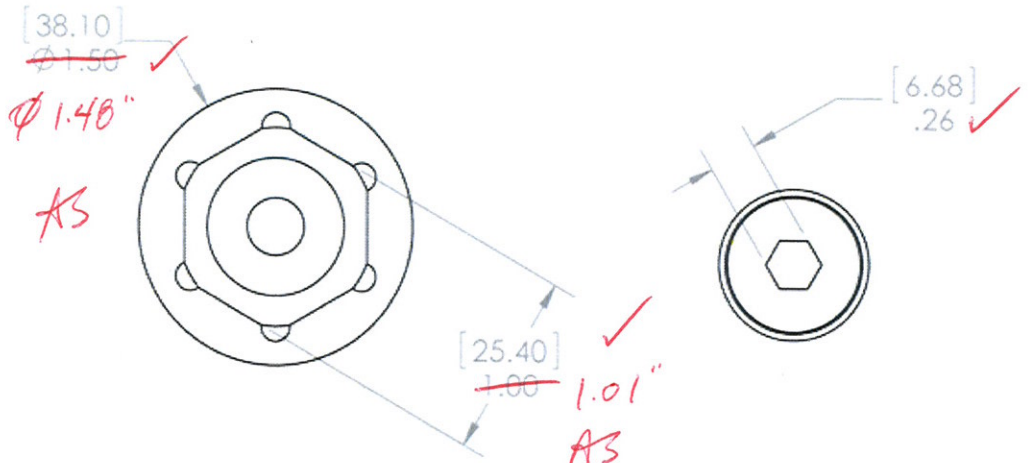
Architectural Testing

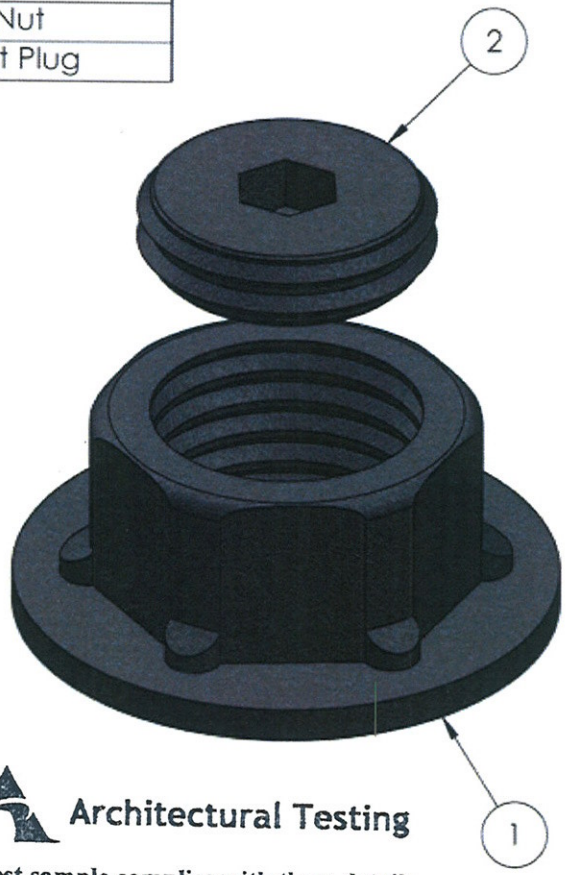
Test sample complies with these details.
Deviations are noted.

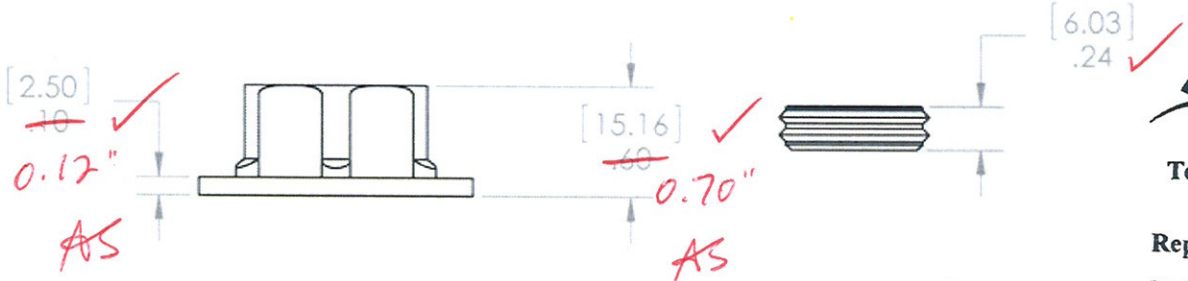
Report # D6706.01-119-16

Date 6/13/14 **Tech** ATS

ITEM NO.	Default/ QTY.	PART NUMBER	DESCRIPTION
1	1	56621-11	1 1/2" Hex Cap Nut
2	1	56621-12	1 1/2" Hex Cap Nut Plug





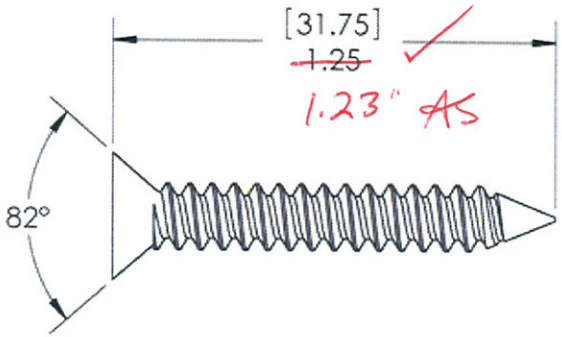


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS



Architectural Testing

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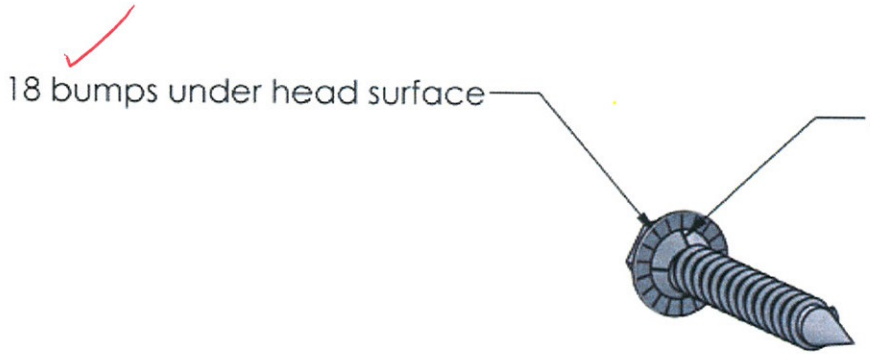
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS



Architectural Testing

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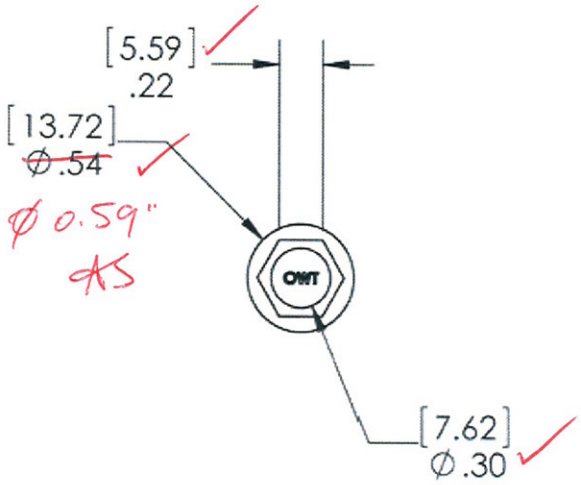
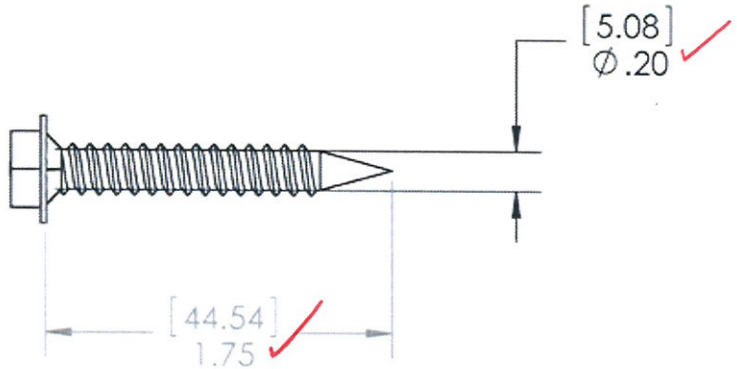
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS



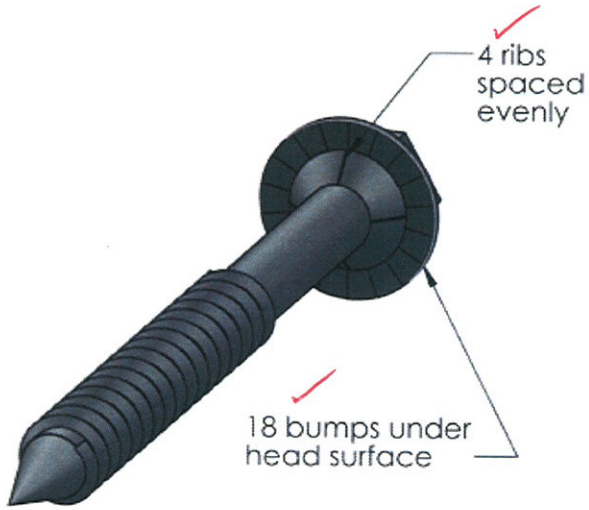


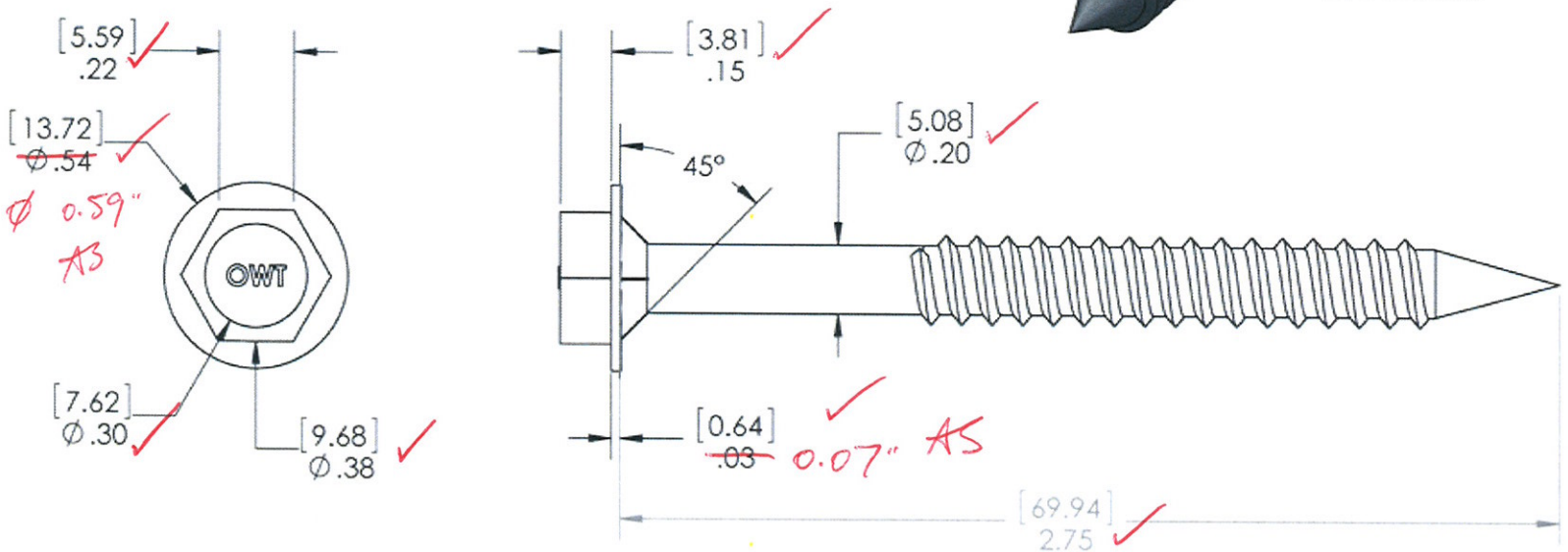
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 Tech AJS



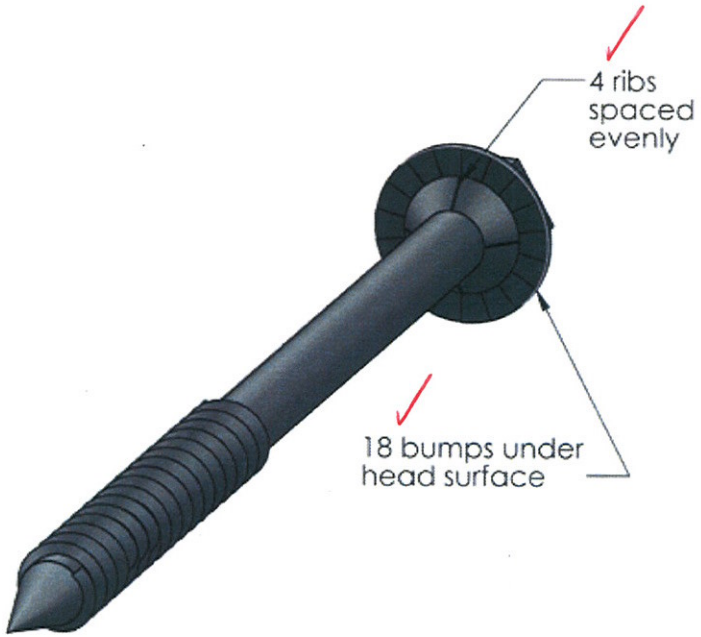


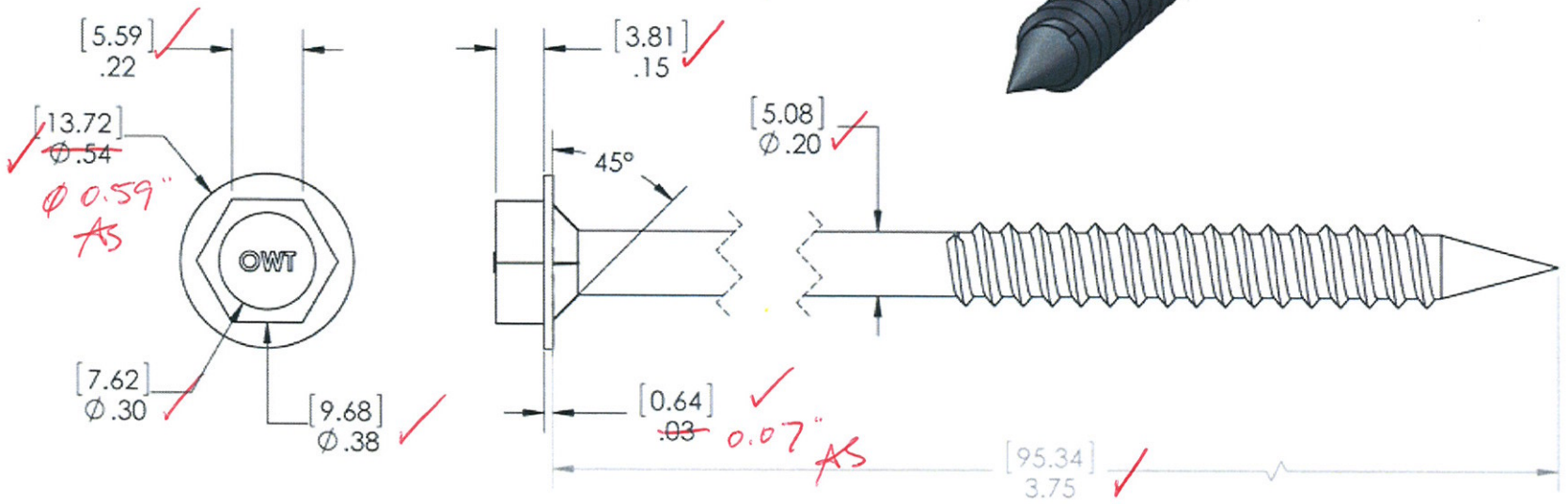
Architectural Testing

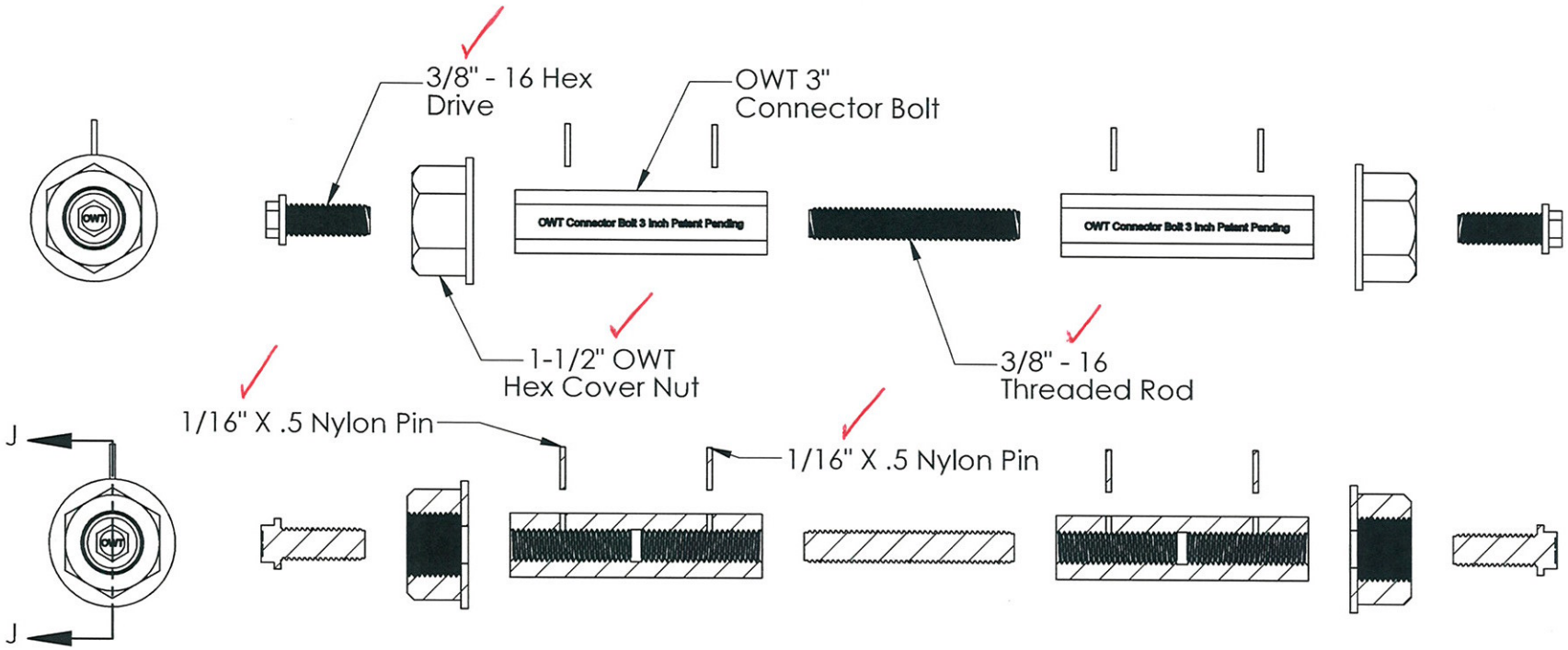
Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 Tech AJS







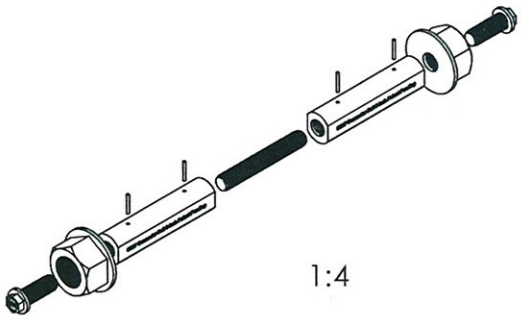
SECTION J-J
SCALE 1 : 2

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D6706.01-119-16

Date 6/13/14 **Tech** AJS



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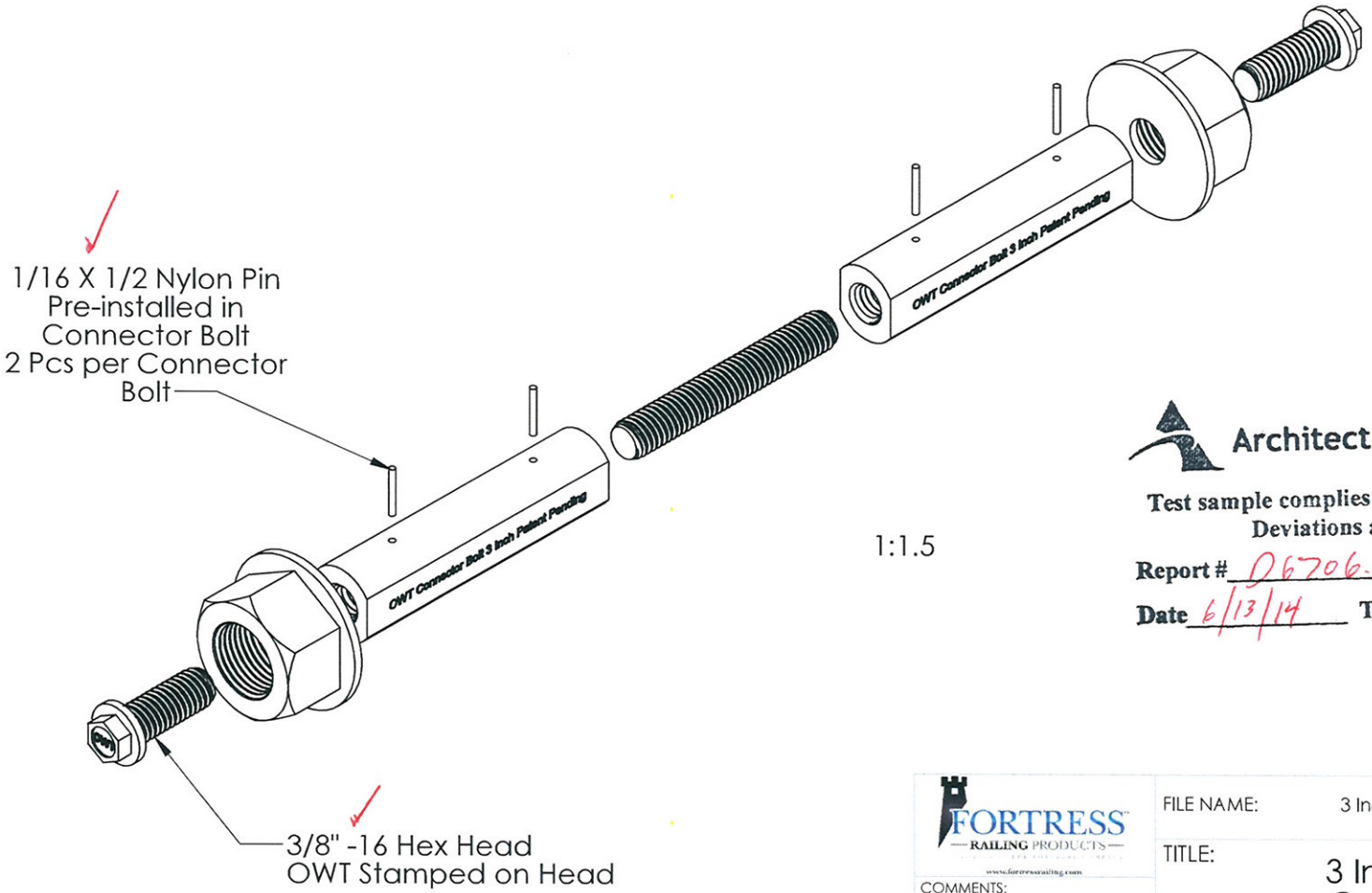
FORTRESS RAILING PRODUCTS
www.fortressrailing.com

COMMENTS:

FILE NAME:	3 Inch OWT Connector
TITLE:	3 Inch OWT Connector
DRAWN BY: KEVIN BURT	
SIZE A	DWG. NO. / REV
SCALE: NOTED	DATE: 11/08/12

5 4 3 2 1



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Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 06706.01-119-16

Date 6/13/14 **Tech** AJS

FORTRESS RAILING PRODUCTS

COMMENTS:

FILE NAME:	3 Inch OWT Connector
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APPENDIX B

Photographs

Photo No. 1
Direct Vertical Load on Joist Member with Joist Hangers on Each End

Photo No. 2
Direct Vertical Load - Typical Failure

Photo No. 3
Uplift Load Testing on Joist Member with Joist Hangers on Each End

Photo No. 4
Uplift Load Testing - Typical Failure

Photo No. 5
Torsional Test Setup

Photo No. 6
Post Base Uplift Load Test Setup

Photo No. 7
Post to Beam Uplift Load Test Setup

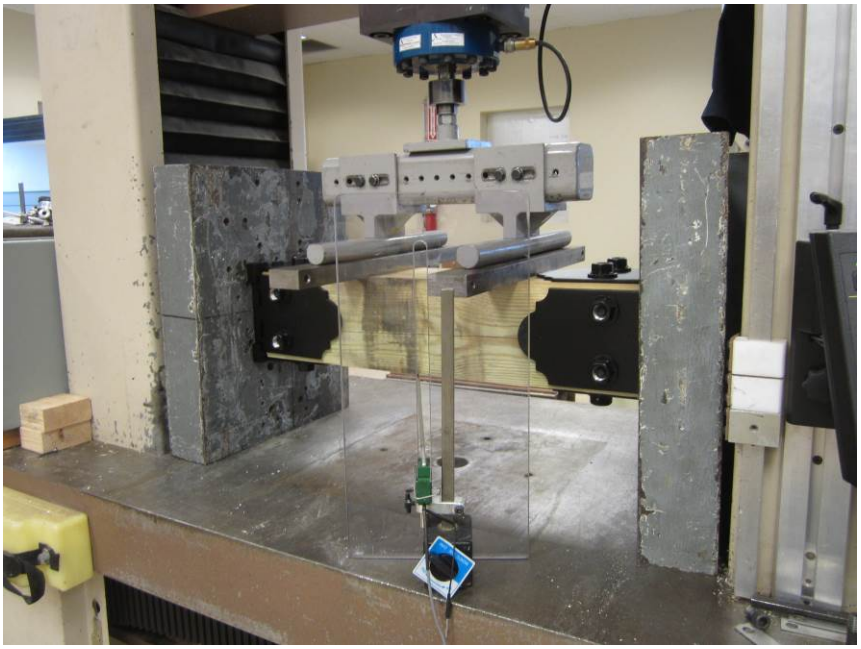

Photo No. 8
Lateral Load Test Setup

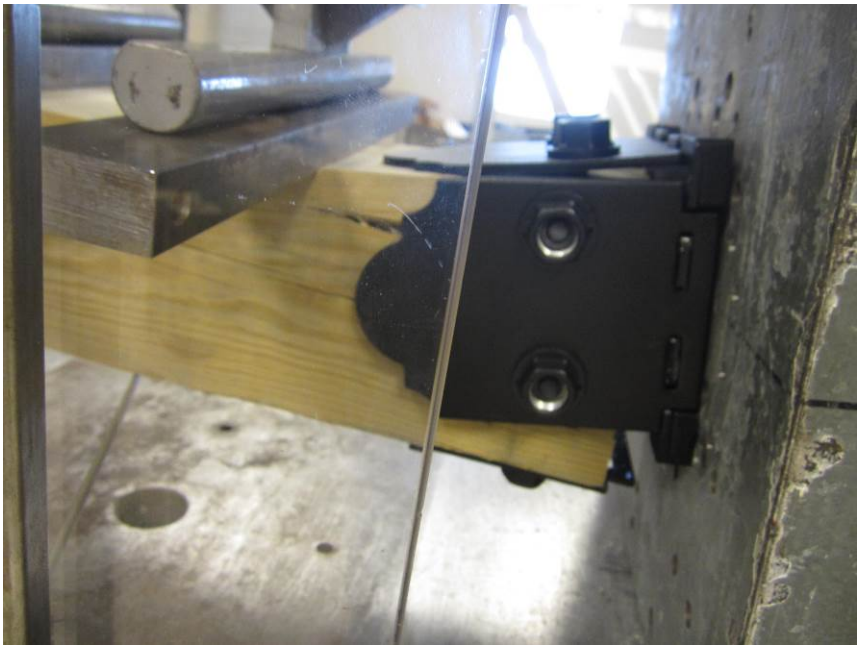

Photo No. 9
Lateral Load Test - Typical Failure

Photo No. 10
Typical Timber Post Lumber Stamping

Photo No. 11
Joist Hanger

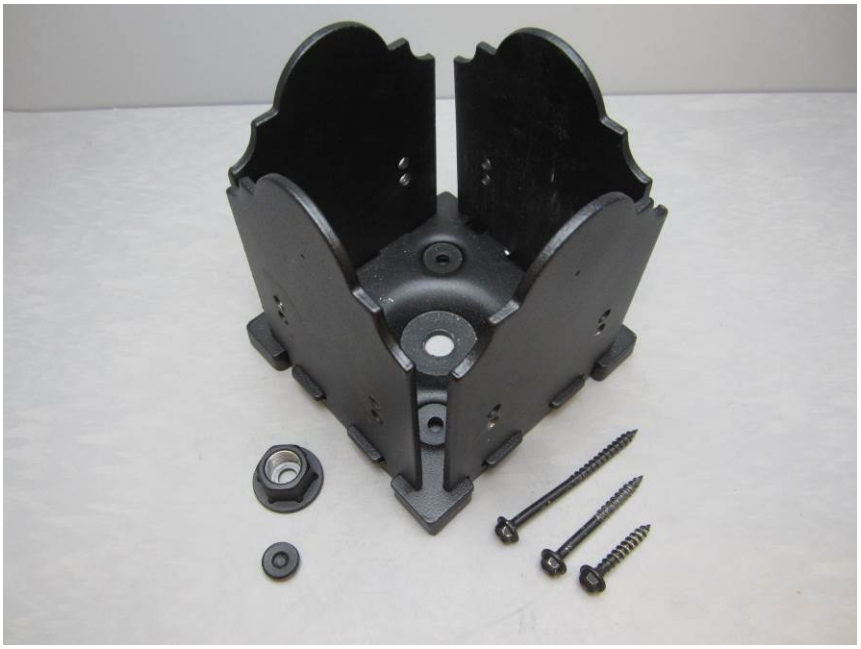

Photo No. 12
Post Base Connector

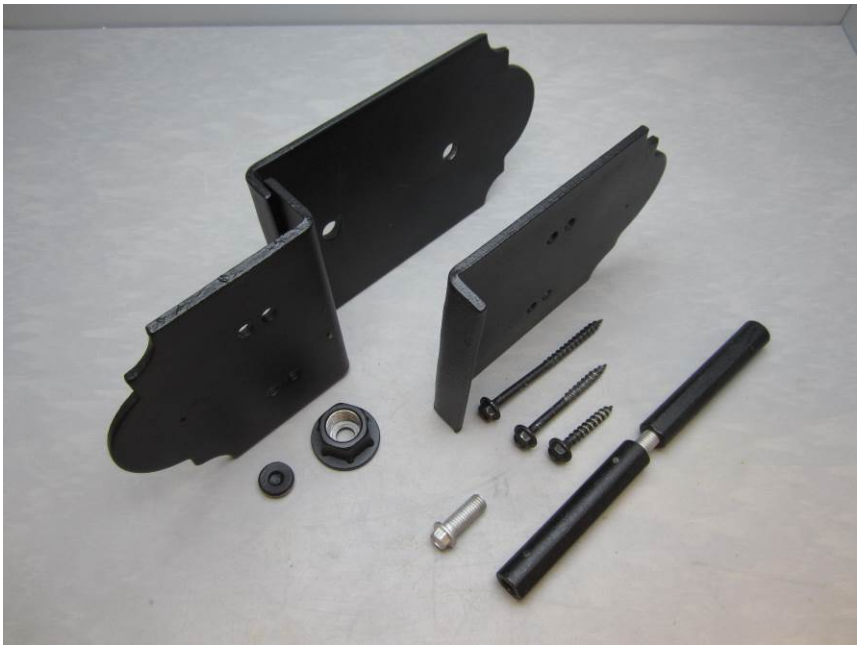

Photo No. 13
Post to Beam Connector