Architectural Testing

ASTM E 330 and ASTM E 1886/1996
PERFORMANCE TEST REPORT

Rendered to:

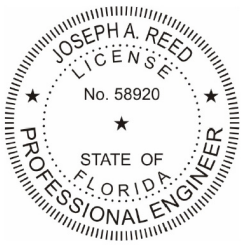
ORIOLUM CORPORATION

SERIES/MODEL: N/A
PRODUCT TYPE: Quick Shutter Clamping System

This report contains in its entirety:

Cover Page: 1 page
Report Body: 9 pages
Sketch: 1 page
Drawings: 8 pages
Photos: 2 pages

Secure Electronic Seal
for Electronic Submittal



Joseph A. Reed

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Date: 2008.02.15 13:56:22 -05'00'

Report No.: 78828.01-401-44
Test Dates: 12/27/07
Through: 02/15/08
Report Date: 02/15/08
Expiration Date: 02/15/12

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Architectural Testing

ASTM E 330 ASTM E 1886/1996 PERFORMANCE TEST REPORT

Rendered to:

ORIOLUM CORPORATION
15814 Scrimshaw Drive
Tampa, Florida 33624

Report No.:	78828.01-401-44
Test Dates:	12/27/07
Through:	02/15/08
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Project Summary: Architectural Testing, Inc. was contracted by Oriolum Corporation to perform testing on three specimens of their Quick Shutter clamping system. The samples tested met the performance requirements set forth in the referenced test procedures for a ±1440 Pa (±30.09 psf) Design Pressure with missile impacts corresponding to Missile Level D and Wind Zone 3. Test specimen description and results are reported herein. The samples were provided by the client.

Test Procedures: The test specimens were evaluated in accordance with the following:

ASTM E 1886-02, *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.*

ASTM E 1996-02, *Standard Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Wind Borne Debris in Hurricanes.*

ASTM E 330-02, *Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.*

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Test Specimen Description:

Product Type: Quick Shutter Clamping System

Overall Size: 1594 mm (62-3/4") wide by 1200 mm (47-1/4") high

Installation: Each specimen utilized four sets of the Quick Shutter Clamping System. Each set consisted of one clamp at the top of the specimen and one bumper at the bottom of the specimen. They were installed onto a 18.3 mm (3/4") thick by 1594 mm (62-3/4") wide by 1200 mm (47-1/4") high sheet of CDX plywood with #8 x 3/4" pan head screws. There were six screws in each clamp and three screws in each bumper. Clamps and bumpers were located 102 mm (4") from each end of the plywood and approximately 432 mm (17") on center from clamp to clamp and bumper to bumper. (See Architectural Testing Sketch #1)

The panel with the clamps was then placed into a test frame. The clamps were extended and locked with a cotter pin. The test frame was constructed of 2 x 12 Southern Yellow Pine frame with a 2 x 4 Southern Yellow Pine buck at the jambs and head and a precast concrete sill. The rough opening of the test frame was 1600 mm (63") wide by 1219 mm (48") high.

Test Results: The following results have been recorded:

ASTM E 1886, *Large Missile Impact*

Conditioning Temperature: 24.8°C (76.6°F)
Missile Weight: 4082 g (9.0 lbs)
Missile Length: 2.47 m (8' 1")
Muzzle Distance from Test Specimen: 5.18 m (17' 0")

Test Unit #1

Impact #1: Missile Velocity: 15.1 m/s (49.6 fps); orientation within ±5° of vertical

Impact Area: Center midspan
Observations: Missile hit impact area, left 1/8" depression in panel
Results: Pass

Maximum Dynamic Deflection: 33.3 mm (1.31")
Residual Deflection: 6.4 mm (0.25")

Test Unit #2

Impact #1: Missile Velocity: 15.4 m/s (50.4 fps); orientation within ±5° of vertical

Impact Area: Lower left corner
Observations: Missile hit impact area, left 3/8" depression in panel
Results: Pass

Maximum Dynamic Deflection: 21.1 mm (0.83")
Residual Deflection: 16.3 mm (0.64")

Test Unit #3

Impact #1: Missile Velocity: 15.2 m/s (49.9 fps); orientation within ±5° of vertical

Impact Area: Upper right corner
Observations: Missile hit impact area, left 1/2" depression in panel
Results: Pass

Maximum Dynamic Deflection: 24.6 mm (0.97")
Residual Deflection: 23.9 mm (0.94")

***Note**: See Architectural Testing Sketch #1 for impact locations.*

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #1

Design Pressure: ±1440 Pa (±30.09 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
288 to 720 (6.0 to 15.04)	3500	1.52	1.02 (0.04)	1.52 (0.06)	1.27 (0.05)
0 to 864 (0 to 18.05)	300	1.64	1.27 (0.05)	2.29 (0.09)	1.52 (0.06)
720 to 1152 (15.04 to 24.07)	600	1.53	2.03 (0.08)	3.56 (0.14)	2.29 (0.09)
432 to 1440 (9.03 to 30.09)	100	1.65	2.29 (0.09)	4.06 (0.16)	2.54 (0.10)
			Permanent Set		
			0.25 (0.01)	1.02 (0.04)	0.76 (0.03)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
432 to 1440 (9.03 to 30.09)	50	2.86	3.81 (0.15)	5.33 (0.21)	4.32 (0.17)
720 to 1152 (15.04 to 24.07)	1050	2.03	3.30 (0.13)	5.08 (0.20)	3.81 (0.15)
0 to 864 (0 to 18.05)	50	2.05	3.05 (0.12)	4.57 (0.18)	3.30 (0.13)
288 to 720 (6.0 to 15.04)	3350	1.90	2.54 (0.10)	4.06 (0.16)	2.79 (0.11)
			Permanent Set		
			2.03 (0.08)	2.29 (0.09)	2.03 (0.08)

Result: Pass

***Note**: See Architectural Testing Sketch #1 for indicator locations.*

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #2

Design Pressure: ±1440 Pa (±30.09 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
288 to 720 (6.0 to 15.04)	3500	1.51	1.78 (0.07)	1.78 (0.07)	1.52 (0.06)
0 to 864 (0 to 18.05)	300	1.52	1.78 (0.07)	2.29 (0.09)	1.78 (0.07)
720 to 1152 (15.04 to 24.07)	600	1.51	2.29 (0.09)	3.30 (0.13)	2.03 (0.08)
432 to 1440 (9.03 to 30.09)	100	1.51	3.05 (0.12)	4.06 (0.16)	2.54 (0.10)
			Permanent Set		
			0.76 (0.03)	1.02 (0.04)	0.51 (0.02)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
432 to 1440 (9.03 to 30.09)	50	2.02	3.30 (0.13)	4.32 (0.17)	3.05 (0.12)
720 to 1152 (15.04 to 24.07)	1050	1.65	3.05 (0.12)	4.06 (0.16)	2.54 (0.10)
0 to 864 (0 to 18.05)	50	1.78	2.79 (0.11)	3.30 (0.13)	2.29 (0.09)
288 to 720 (6.0 to 15.04)	3350	1.77	2.54 (0.10)	3.05 (0.12)	2.03 (0.08)
			Permanent Set		
			1.52 (0.06)	1.78 (0.07)	1.27 (0.05)

Result: Pass

***Note**: See Architectural Testing Sketch #1 for indicator locations.*

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #3

Design Pressure: ±1440 Pa (±30.09 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
288 to 720 (6.0 to 15.04)	3500	1.52	0.76 (0.03)	1.78 (0.07)	1.02 (0.04)
0 to 864 (0 to 18.05)	300	1.65	1.02 (0.04)	2.29 (0.09)	1.02 (0.04)
720 to 1152 (15.04 to 24.07)	600	1.55	1.27 (0.05)	2.79 (0.11)	1.52 (0.06)
432 to 1440 (9.03 to 30.09)	100	1.58	1.27 (0.05)	2.79 (0.11)	1.78 (0.07)
			Permanent Set		
			0.25 (0.01)	0.76 (0.03)	0.51 (0.02)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)		
			#1	#2	#3
432 to 1440 (9.03 to 30.09)	50	3.47	5.59 (0.22)	9.65 (0.38)	6.35 (0.25)
720 to 1152 (15.04 to 24.07)	1050	1.89	4.83 (0.19)	8.13 (0.32)	5.59 (0.22)
0 to 864 (0 to 18.05)	50	2.91	4.57 (0.18)	7.37 (0.29)	5.08 (0.20)
288 to 720 (6.0 to 15.04)	3350	1.93	4.06 (0.16)	6.60 (0.26)	4.57 (0.18)
			Permanent Set		
			2.03 (0.08)	2.79 (0.11)	2.54 (0.10)

Result: Pass

***Note**: See Architectural Testing Sketch #1 for indicator locations.*

***General Note**: Upon completion of testing, the specimens met the requirements of Section 7 of ASTM E 1996.*

Test Results: (Continued)

ASTM E330, *Uniform Static Air Pressure Test*

The temperature during testing was 23.1°C (73.6°F). The results are tabulated as follows:

Load (psf)	Duration (sec)	Deflection at Indicator (inch) 1	2	3	Permanent Set at Indicator (inch) 1	2	3
-30.09	52.0	0.85	0.81	0.82	0.10	0.07	0.03
+30.09	52.0	0.10	0.13	0.12	<0.01	<0.01	<0.01
-45.14	10.0	1.37	1.30	1.29	0.17	0.11	0.02
+45.14	10.0	0.13	0.16	0.14	0.01	0.01	0.01

See Architectural Testing Sketch #1 for indicator locations.

Test Equipment:

Cannon: Constructed from steel piping utilizing compressed air to propel the missile

Missile: 2x4 Southern Yellow Pine

Timing Device: Electronic Beam Type

Cycling Mechanism: Computer controlled centrifugal blower with electronic pressure measuring device

Deflection Measuring Device: Linear transducers, dial indicators, and 6" digital calipers

Tape and film were used to seal against air leakage during structural testing. In our opinion, the tape and film did not influence the results of the test.

Drawing Reference: The test specimen drawings have been reviewed by Architectural Testing and are representative of the test specimen reported herein.

List of Official Observers:

Name	Company
Paul Kelley	Oriolum Corporation
Shawn Kelley	Oriolum Corporation
Steve Cunningham	Oriolum Corporation
John Porteiro	Architectural Testing, Inc.
John McClane	Architectural Testing, Inc.
Jack Hook	Architectural Testing, Inc.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire.

Results obtained are tested values and were secured by 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: Jack R. Hook

Jack R. Hook
Technician

Digitally Signed by: Joseph A. Reed

Joseph A. Reed, P.E.
Director – Engineering and Product Testing

JRH:ck/cmd

Attachments (pages): This report is complete only when all attachments listed are included.
- Appendix-A: Sketch (1)
- Appendix-B: Drawings (8)
- Appendix-C: Photographs (2)

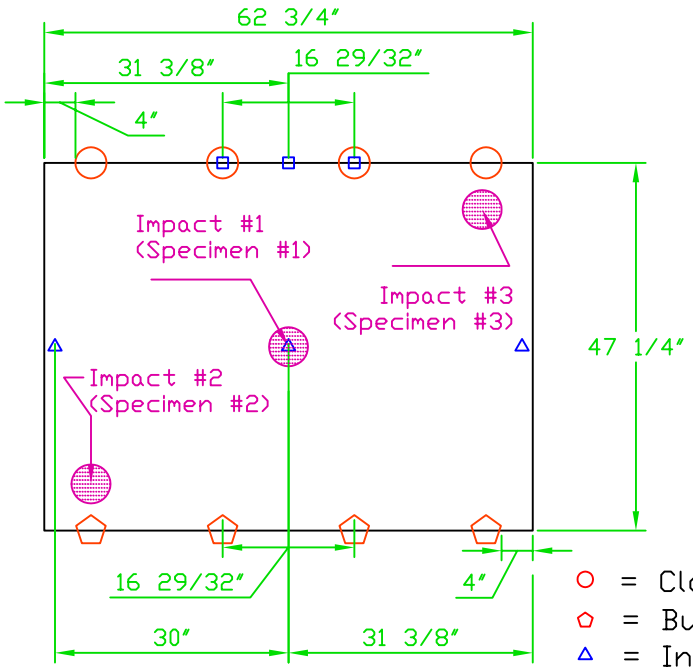
Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	02/15/08	N/A	Original report issue

Appendix A

Sketch

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



○ = Clamp
⬠ = Bumper
△ = Indicator (Structural and Cyclic)
□ = Indicator (Cyclic Only)

Architectural Testing

Test Details for QuickShutter Clamping System by Oriolum Corporation

SIZE	FSCM NO.	DWG NO.	REV
		001	0

SCALE		SHEET 1 of 1

Appendix B

Drawings

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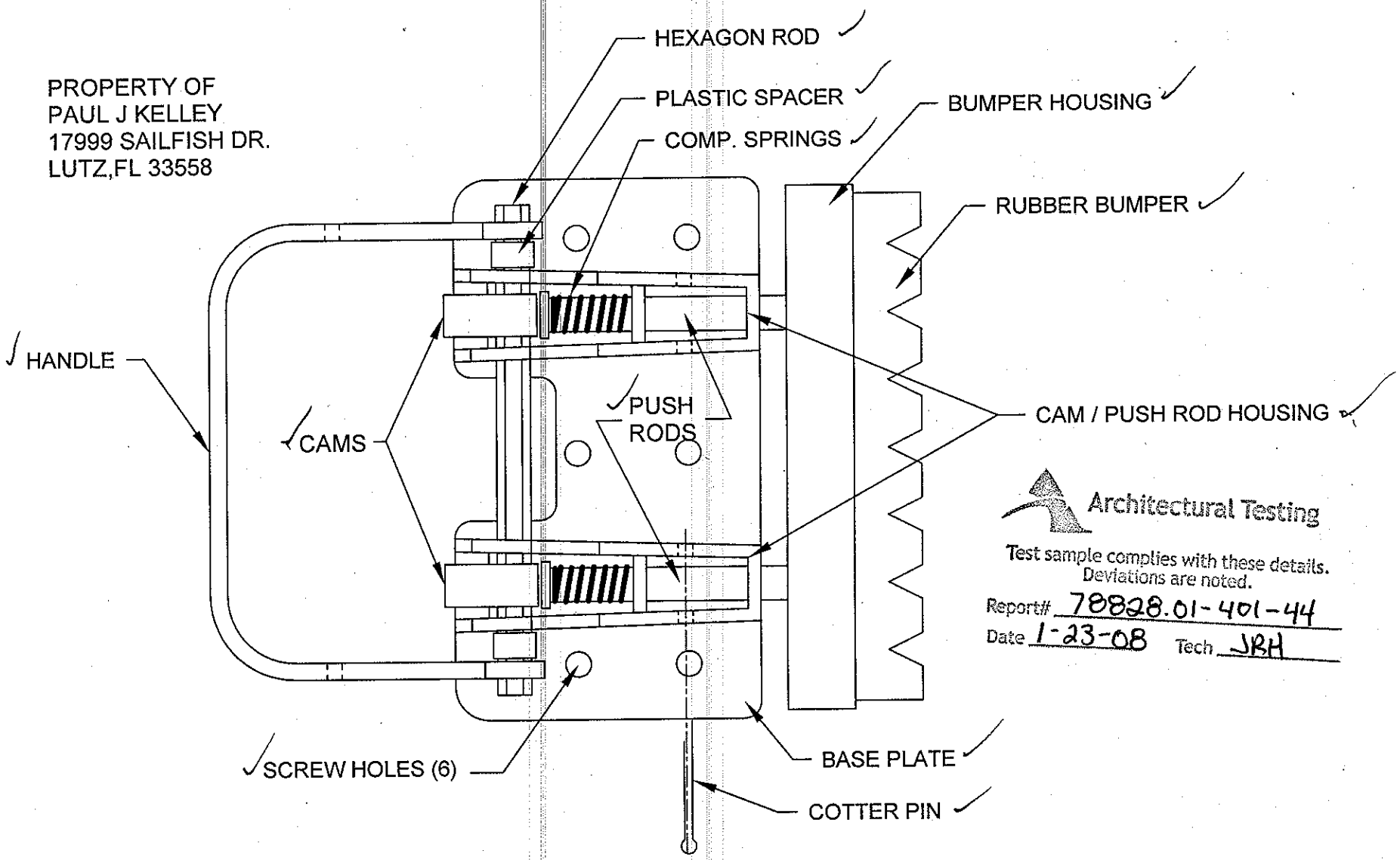

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 78828.01-401-44

Date 1-23-08 Tech JRH

PARTS IDENTIFICATION

NOTE: CLAMP AND BOTTOM BUMPER IS ATTACHED TO PLYWOOD WITH # 8 X 3/4" PAN - PHILLIPS

CLAMPS AND BOTTOM BUMPER IS MADE FROM 3/32" THICK STEEL

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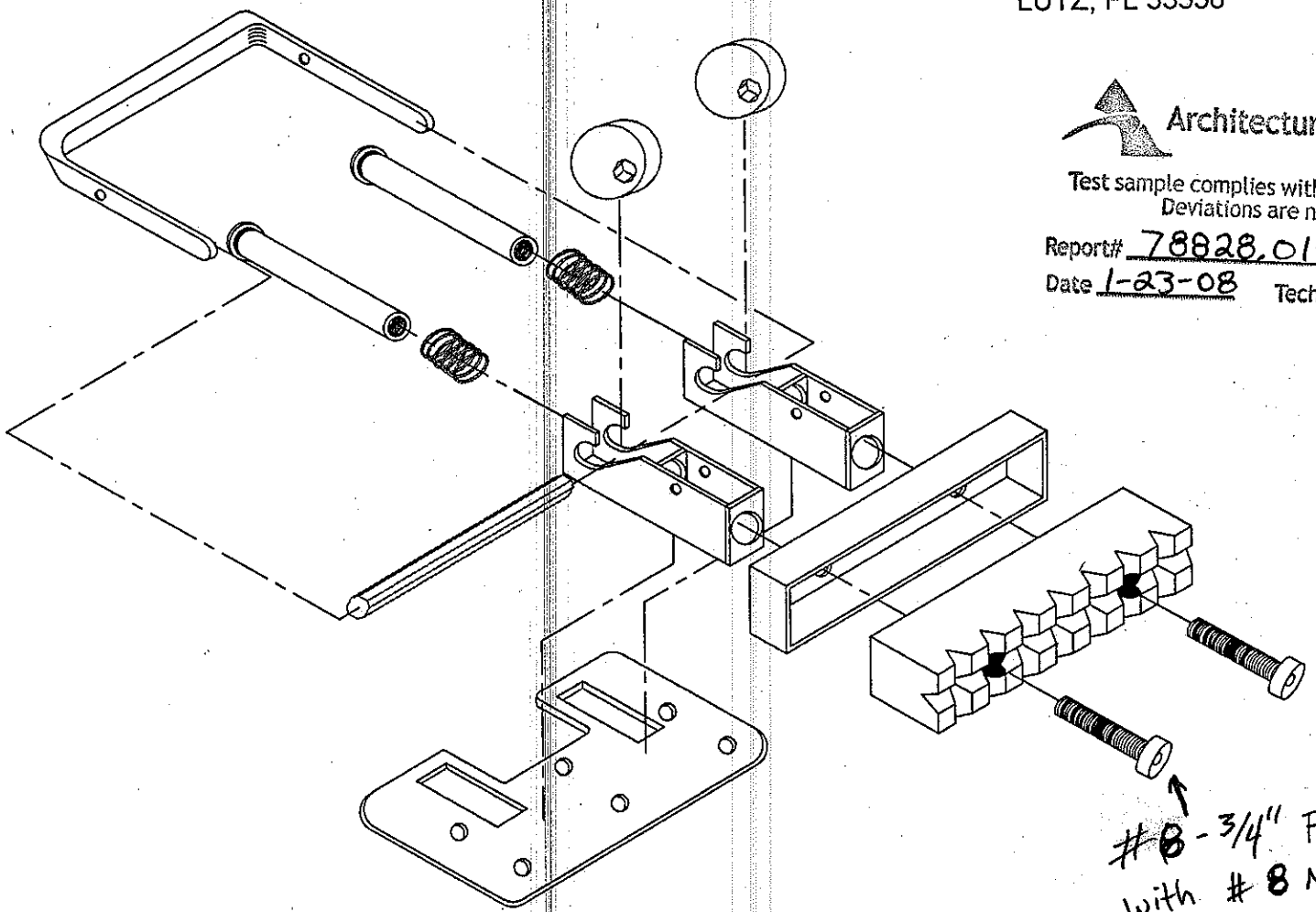
PAUL J KELLEY
17999 SAILFISH DR
LUTZ, FL 33558

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 78828.01-401-44

Date 1-23-08 Tech JKH



EXPLODED ISOMETRIC/ ASSEMBLY

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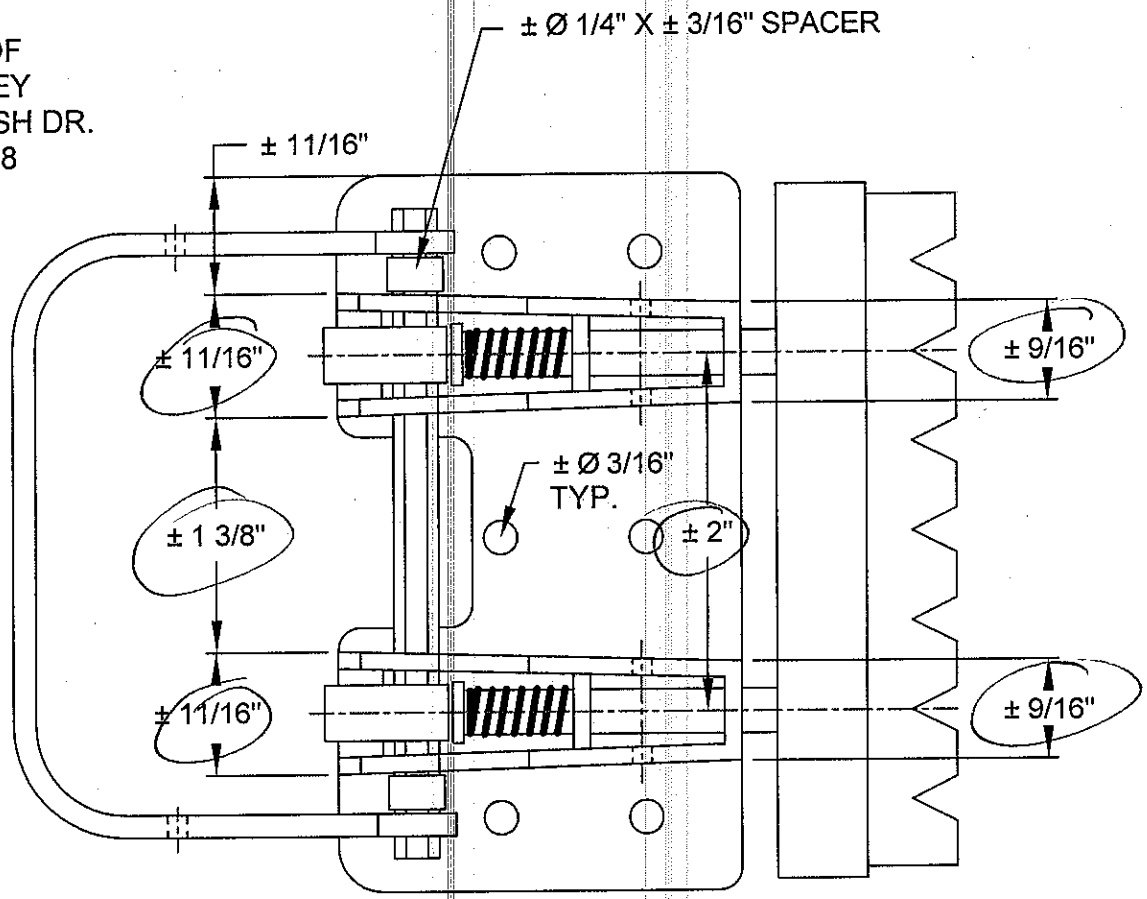

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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Date 1-23-08 Tech JRH

TOP VIEW

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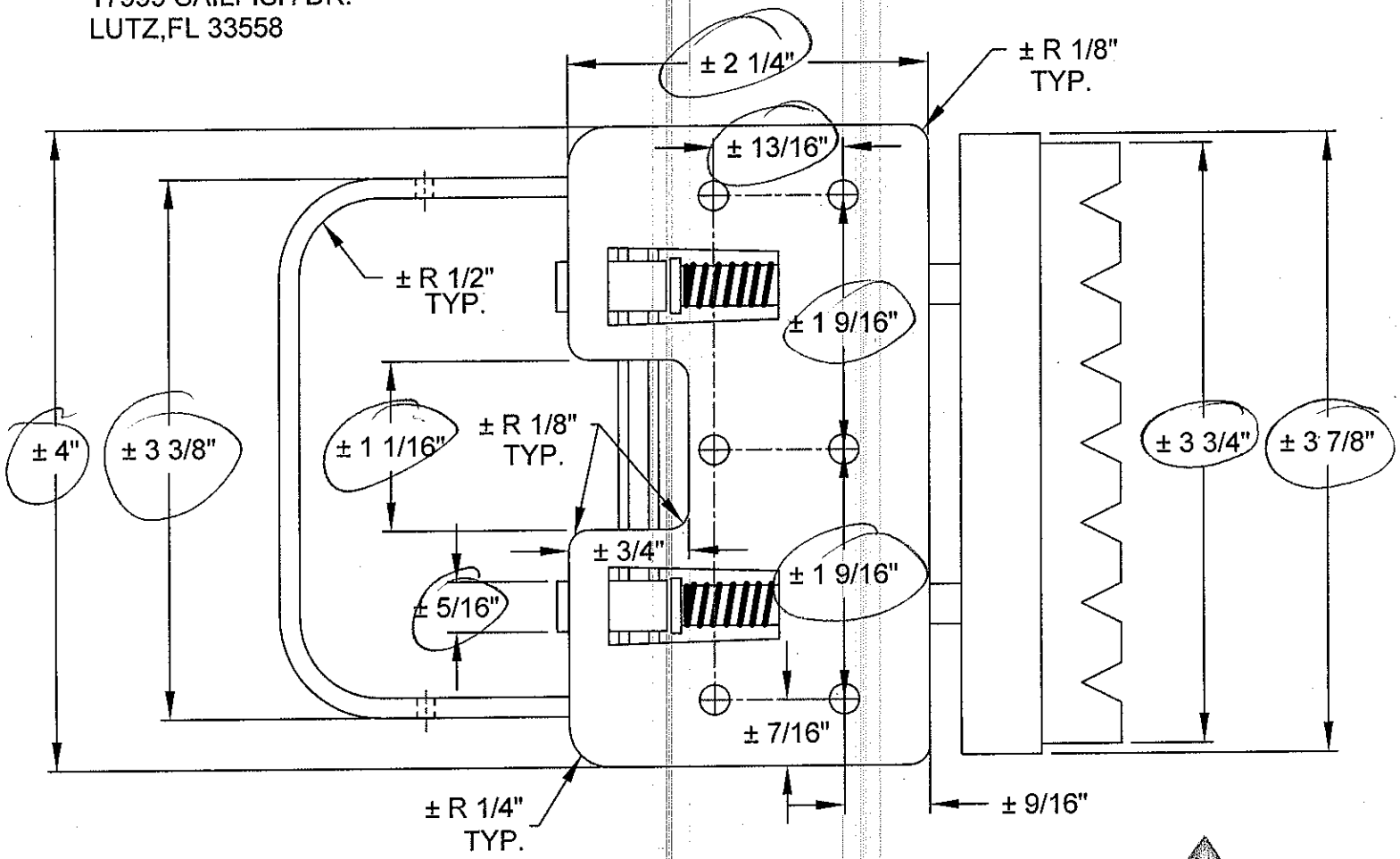

BOTTOM VIEW

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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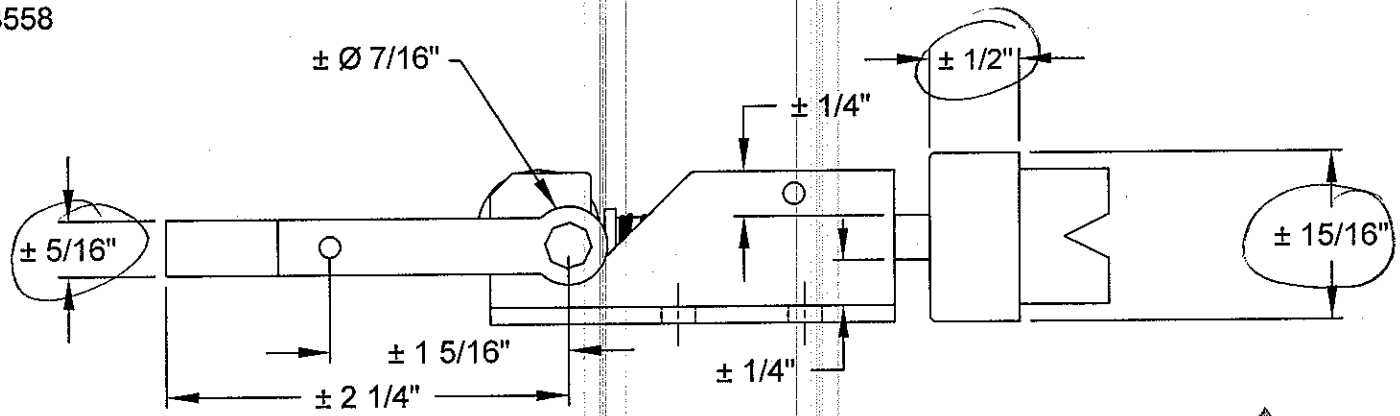

SIDE VIEW

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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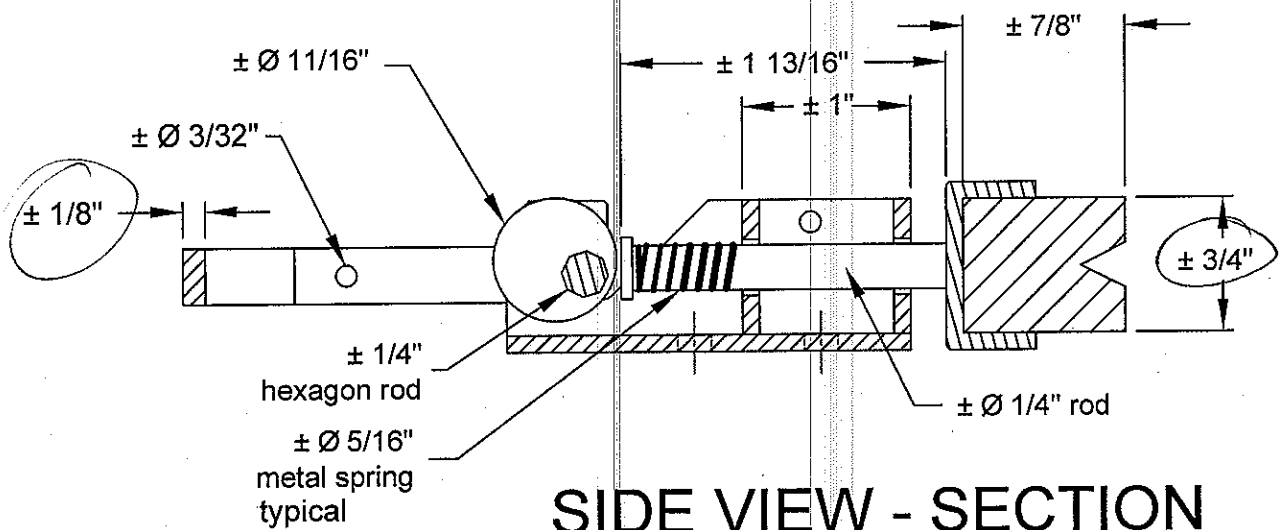
Date 1-23-08 Tech JRH



SIDE VIEW - SECTION

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Architectural Testing

Test sample complies with these details.
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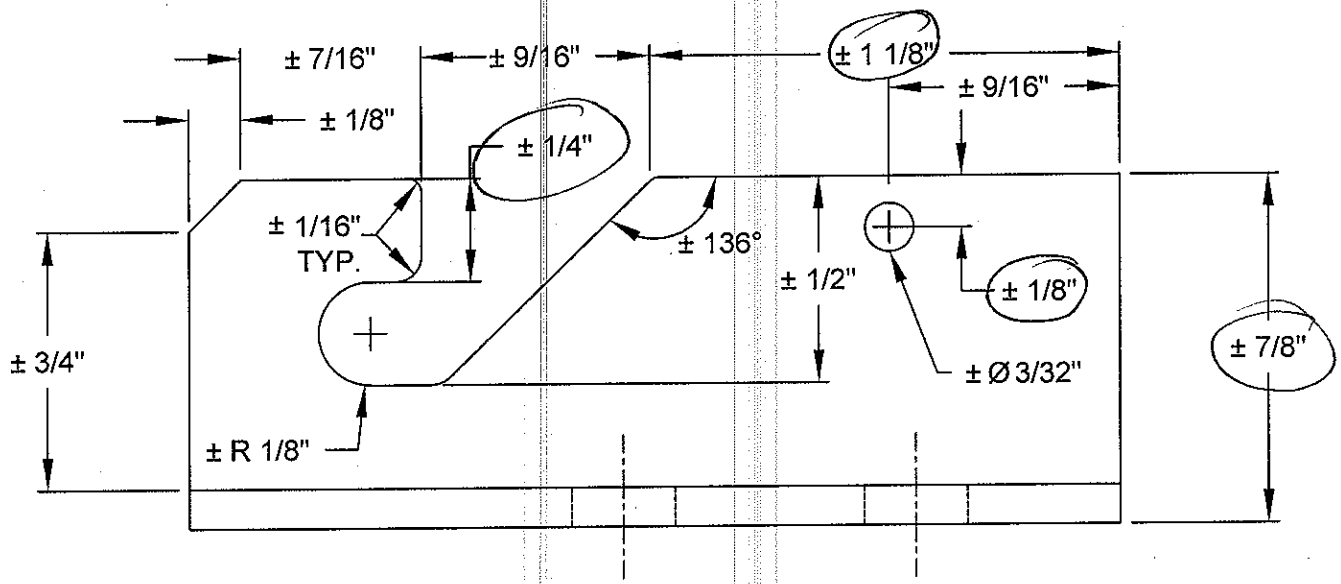
Date 1-23-08 Tech JKH



PUSH ROD / CAM HOUSING DETAIL

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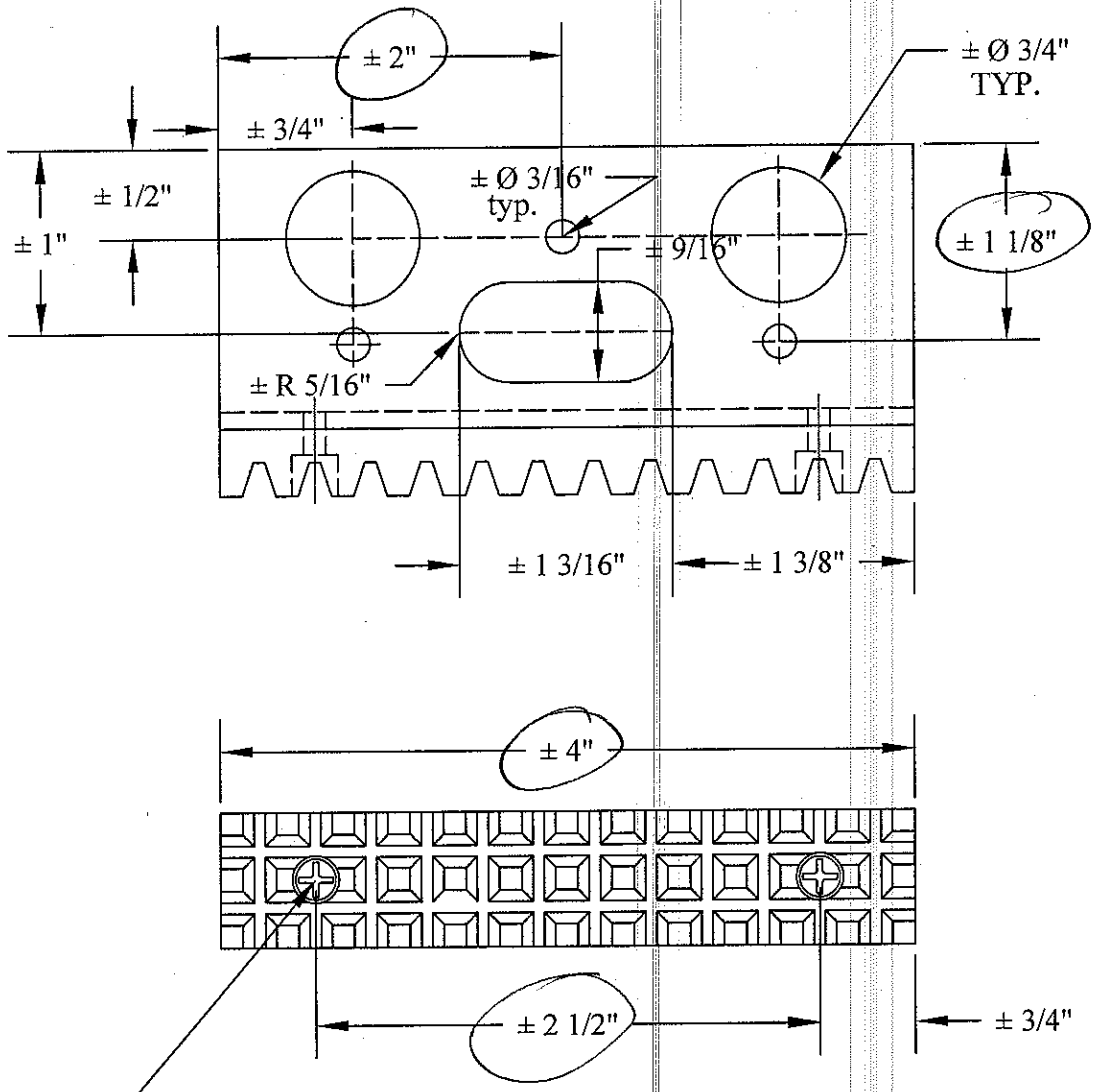

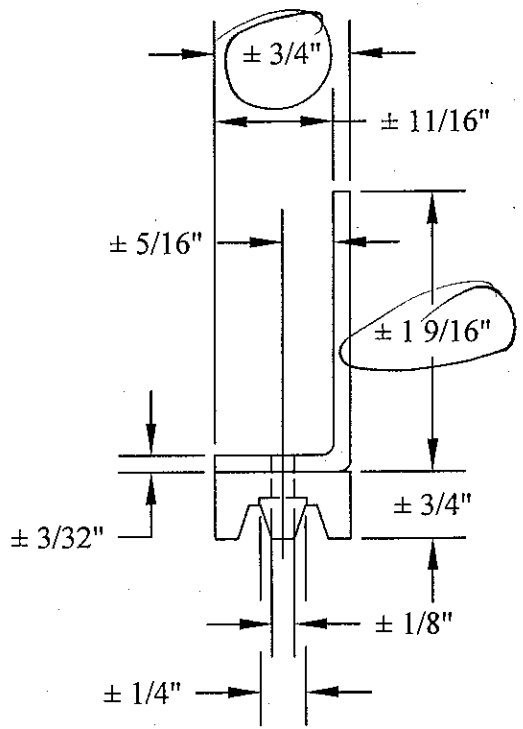

BOTTOM BUMPER

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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Deviations are noted.

Report# 78828.01-401-44

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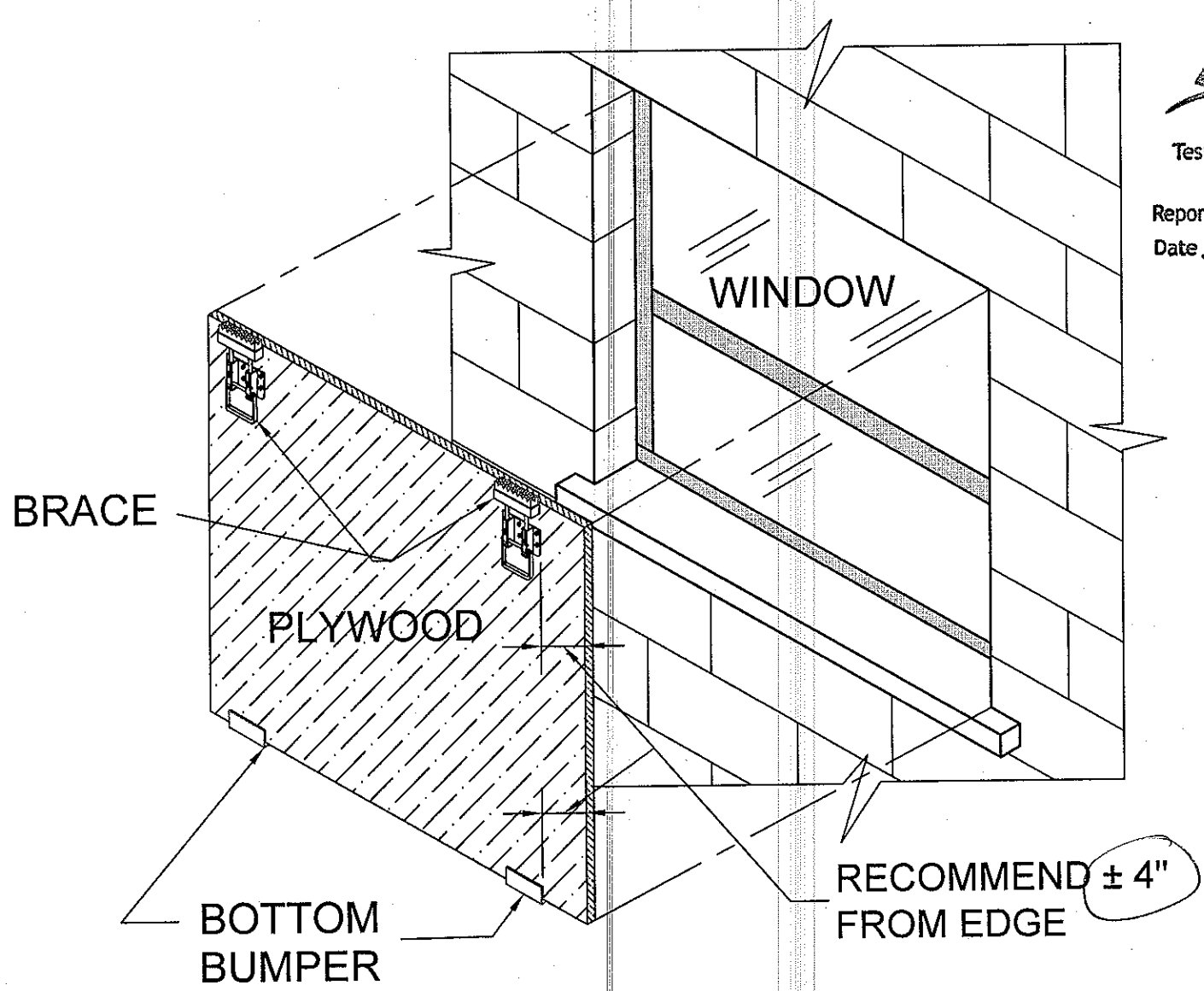

Appendix C

Photographs

Photo No. 1
Specimen # 3
Upper Right Corner Impact

Photo No. 2
Specimen # 3
Quick Shutter Clamp

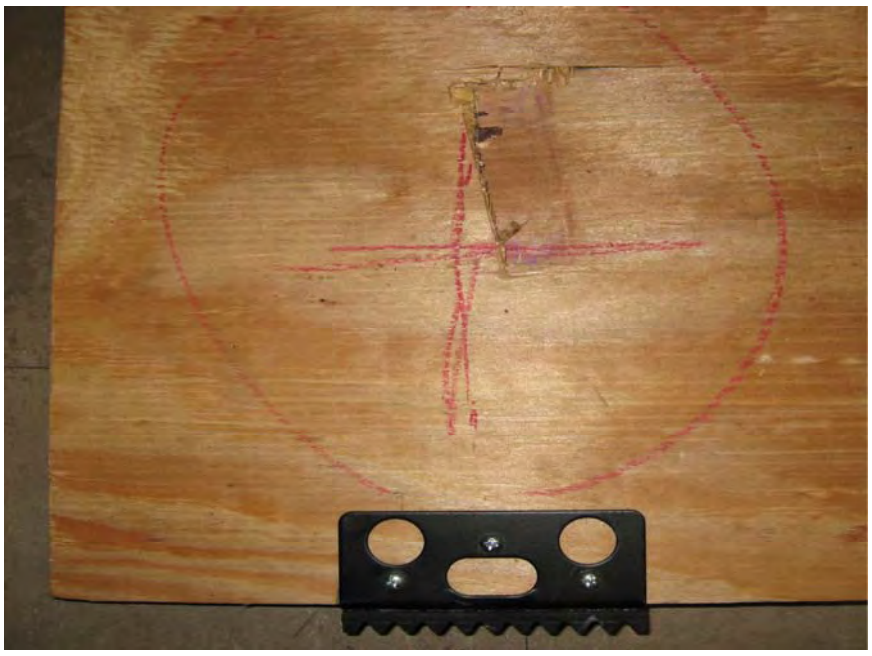

Photo No. 3
Specimen # 2
Lower Left Corner Impact

Photo No. 4
Specimen # 2
Quick Shutter Bumper