



PERFORMANCE EVALUATION TEST REPORT

Rendered to:

ZILLA CORPORATION

**SERIES/MODELS: Zilla Zip Bolt, Double Stud Base Plate,
and Double Stud XL Base Plate**

PRODUCT: Flashing / Connector Products

Report No.: D6104.03-106-31

Report Date: 12/22/14

Test Record Retention Date: 12/06/18



PERFORMANCE EVALUATION TEST REPORT

Rendered to:

ZILLA CORPORATION
77 Waneka Parkway
Lafayette, Colorado 80026

Report No.: D6104.03-106-31
Test Start Date: 10/14/14
Test Completion Date: 12/06/14
Report Date: 12/22/14
Test Record Retention Date: 12/06/18

Series/Models: Zilla Zip Bolt, Double Stud Base Plate, and Double Stud XL Base Plate

Product: Flashing / Connector Products

Project Summary: Architectural Testing, Inc. was contracted by Zilla Corporation to perform uplift and shear load evaluations on fasteners used in conjunction with flashing and connector products for the installation of roof mounted photovoltaic systems. The following report details the procedure and results obtained during the test program. Average results of testing are contained in the following table:

Product Identification	Load Orientation		
	Vertical (lb _f)	Lateral Parallel to Beam (lb _f)	Lateral Perpendicular to Beam (lb _f)
Zilla Zip Bolt (Truss Attachment)	3,549	3,398	1,319
Double Stud Base Plate (Truss Attachment)	4,289	5,070	1,693
Double Stud XL Base Plate (Sheathing Attachment)	2,088	4,412	4,543

Test Method: The test specimens were evaluated in accordance with ICC-ES™ AC 13, Acceptance Criteria for Joist Hangers and Similar Devices (Approved 2010, Revised 2011) using the methodology of ASTM D 1761-12, *Standard Test Methods for Mechanical Fasteners in Wood*.

Test Specimen Description: Testing was performed in accordance with the loading methodology of ASTM D 1761 for shear or withdrawal (vertical) evaluation of all products. The Zilla Zip Bolts and Double Stud Base Plate products were installed on a 12" length of 2x4" southern yellow pine (SYP) to simulate a roof truss. Each roof truss was capped with a layer of 1/2" plywood and one layer of asphalt fiberglass shingle. Fasteners were installed into the southern yellow pine roof truss. Double Stud Base Plate fasteners were two (2), 5/16" x 3-1/2" lag screws.

The Double Stud XL Base Plate products were installed on a 24" by 24" area layer of 1/2" plywood and one layer of asphalt fiberglass shingle for the vertical load testing. The Double Stud XL Base Plate products were installed on a 12" by 12" area layer of 1/2" plywood and one layer of asphalt fiberglass shingle for the lateral load testing. Fasteners were installed into the 1/2" plywood using eight (8), 1/4" by 1-1/2" lag screws.

A total of three mockups for each test load orientation were assembled, with a separate wood mockup utilized for each test. Each fastener was installed with a typical screw gun and firmly tightened with a wrench. Test specimen with fasteners installed into the SYP were conditioned in an environmental chamber until the moisture content of the SYP reached 11% or greater as measured with a Delmhorst Moisture Meter (ATI ICN: 63154).

Test Procedures: Testing was performed on both a Satec and Instron Universal Testing Machine (ATI ICN's: Y002011 and 005740) with the loading crosshead motion set to a speed of 0.1 inch per minute. Each mockup section was secured on the base of the machine. Load was applied to the fastener or base plates until a load drop-off of at least 75% occurred. Continuous graphical recordings were made of each test and the peak loads were determined. Appendix A contains photographs of the test setups and typical failure modes.

Test Results: The individual results of testing are summarized in the following table. Detailed results, including load/deflection curves, for the individual specimens are provided in Appendix B.

Zilla Zip Bolt - Load Results

Orientation	Specimen No.	Result (lbf)	≤ 20% Allowable Variation	Moisture Content %
Vertical	1	3,692	Yes	10.5
	2	3,460		11.2
	3	3,495		10.8
Average		3,549		10.8
Lateral Parallel to Beam	1	3,814	Yes	11.7
	2	3,208		11.1
	3	3,173		11.5
Average		3,398		11.4
Lateral Perpendicular to Beam	1	1,410	Yes	11.7
	2	1,365		11.9
	3	1,182		11.1
Average		1,319		11.6

Test Results: (Continued)

Double Stud Base Plate - Load Results

Orientation	Specimen No.	Result (lb_f)	≤ 20% Allowable Variation	Moisture Content %
Vertical	1	4,455	Yes	11.0
	2	4,162		11.1
	3	4,250		10.9
Average		4,289		11.0
Lateral Parallel to Beam	1	5,088	Yes	11.3
	2	5,324		10.7
	3	4,800		10.6
Average		5,070		10.9
Lateral Perpendicular to Beam	1	2,024	No	11.3
	2	2,236		11.3
	3	1,167		12.2
	4	1,463		11.0
	5	1,560		11.1
	6	1,710		11.3
Average		1,693		11.4

Test Results: (Continued)

Double Stud XL Base Plate - Load Results

Orientation	Specimen No.	Result (lb_f)	≤ 20% Allowable Variation
Vertical	1	2,144	Yes
	2	1,842	
	3	2,277	
Average		2,088	
Lateral Parallel to Beam	1	4,588	Yes
	2	4,507	
	3	4,140	
Average		4,412	
Lateral Perpendicular to Beam	1	4,215	Yes
	2	4,867	
	3	4,547	
Average		4,543	



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 by using the designated tested 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 specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

Joseph M. Brickner
Laboratory Supervisor
Components / Materials Testing

Gary Hartman, P.E.
Director
Components / Materials Testing

JMB:jmb/kf

Attachments (pages) This report is complete only when all attachments listed are included.
Appendix A - Photographs (14)
Appendix B - Datasheets (9)
Appendix C - Drawings (1)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	12/22/14	N/A	Original report issue



D6104.03-106-31

APPENDIX A

Photographs



Photo No. 1
Zilla Zip Bolt - Setup for Vertical (Uplift) Loading

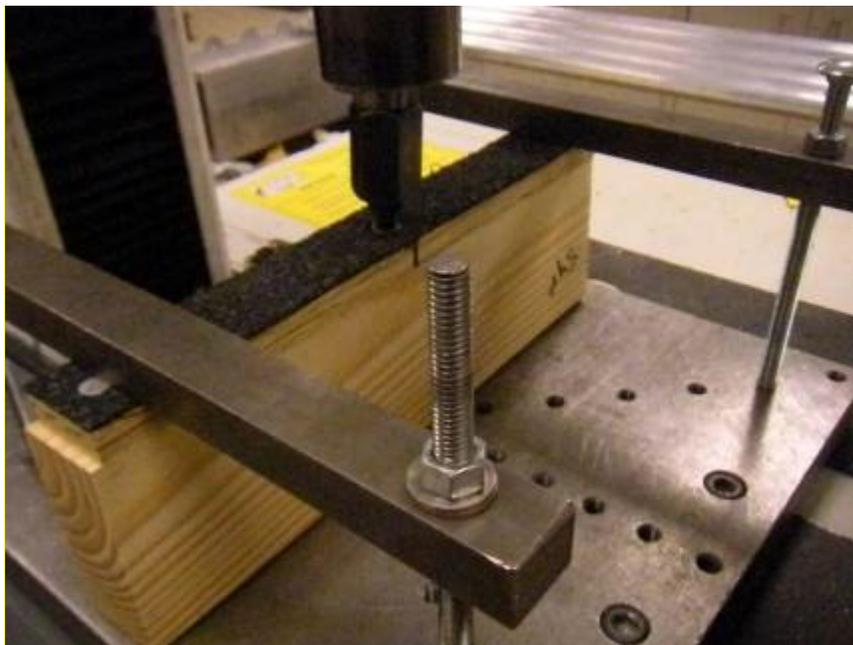


Photo No. 2
Zilla Zip Bolt - Setup for Vertical Loading



Photo No. 3
Zilla Zip Bolt - Setup for Vertical Loading

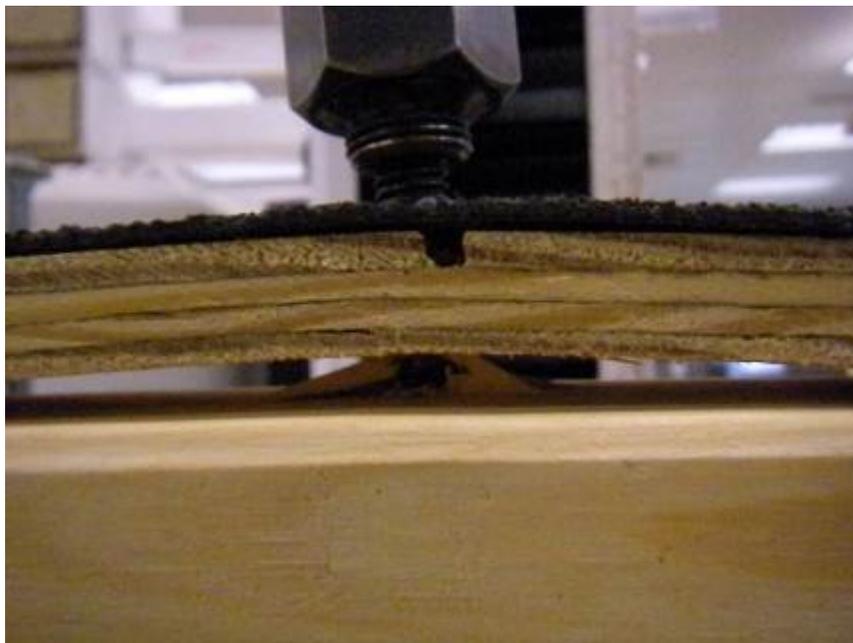


Photo No. 4
Zilla Zip Bolt - Failure Detail for Vertical Loading



Photo No. 5
Zilla Zip Bolt - Setup for Lateral Loading (Parallel)



Photo No. 6
Zilla Zip Bolt - Setup for Lateral Loading



Photo No. 7
Zilla Zip Bolt - Failure Detail for Lateral Loading



Photo No. 8
Zilla Zip Bolt - Setup for Lateral Loading (Perpendicular)



Photo No. 9
Zilla Zip Bolt - Setup for Lateral Loading



Photo No. 10
Zilla Zip Bolt - Failure Detail for Lateral Loading



Photo No. 11
Double Stud Base Plate - Setup for Vertical Loading



Photo No. 12
Double Stud Base Plate - Setup for Vertical Loading



Photo No. 13
Double Stud Base Plate - Failure Detail for Vertical Loading



Photo No. 14
Double Stud Base Plate - Setup for Lateral Loading (Parallel)



Photo No. 15
Double Stud Base Plate - Setup for Lateral Loading (Parallel)



Photo No. 16
Double Stud Base Plate - Failure Detail for Lateral Loading (Parallel)



Photo No. 17
Double Stud Base Plate - Setup for Lateral Loading (Perpendicular)



Photo No. 18
Double Stud Base Plate - Failure Detail for Lateral Loading (Perpendicular)



Photo No. 19
Double Stud XL Base Plate - Setup for Vertical Loading

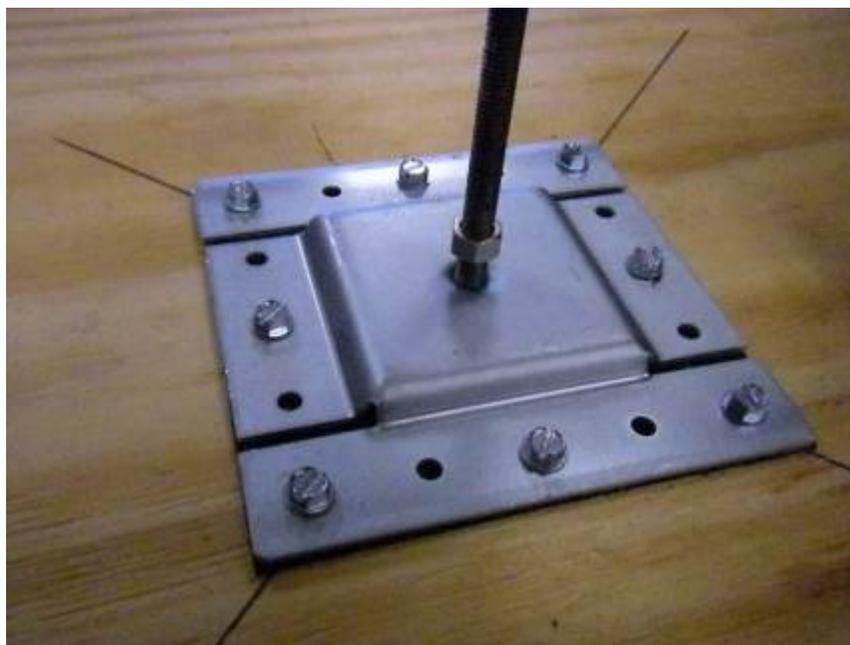


Photo No. 20
Double Stud XL Base Plate - Setup for Vertical Loading



Photo No. 21
Double Stud XL Base Plate - Setup for Vertical Loading

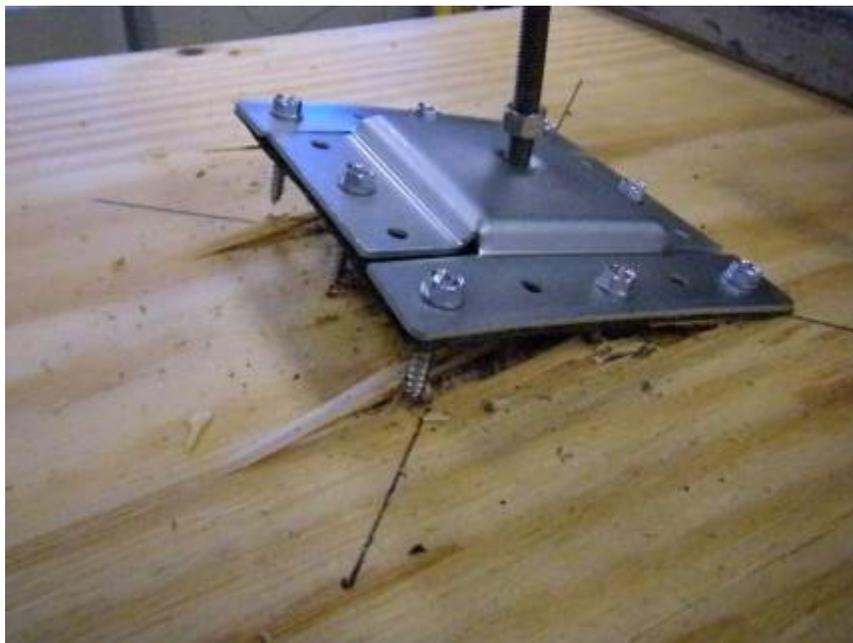


Photo No. 22
Double Stud XL Base Plate - Failure Detail for Vertical Loading



Photo No. 23
Double Stud XL Base Plate - Setup for Lateral Loading (Parallel)



Photo No. 24
Double Stud XL Base Plate - Setup for Lateral Loading (Parallel)



Photo No. 25
Double Stud XL Base Plate - Failure Detail for Lateral Loading (Parallel)

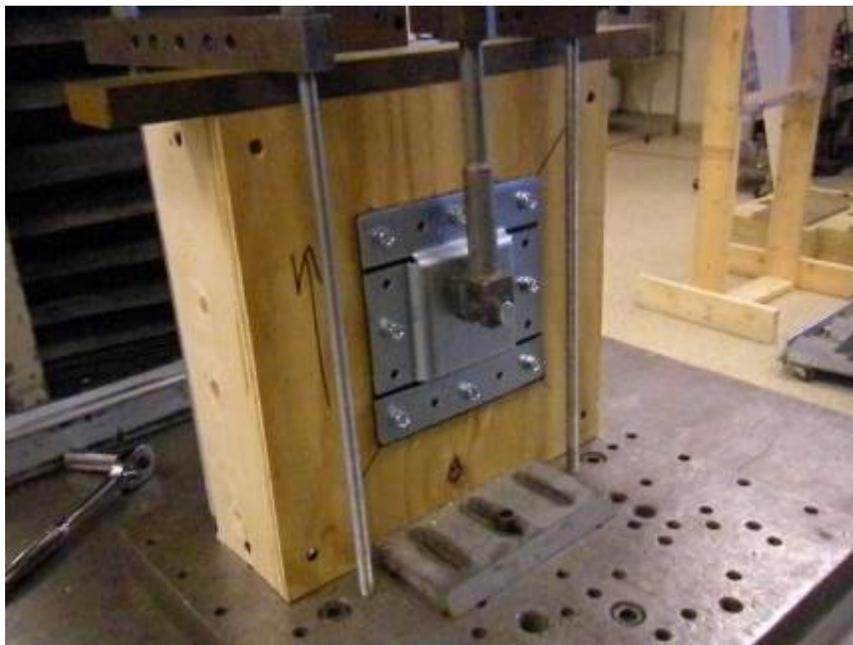


Photo No. 26
Double Stud XL Base Plate - Setup for Lateral Loading (Perpendicular)



Photo No. 27
Double Stud XL Base Plate - Failure Detail for Lateral Loading (Perpendicular)



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APPENDIX B

Datasheets



Architectural Testing

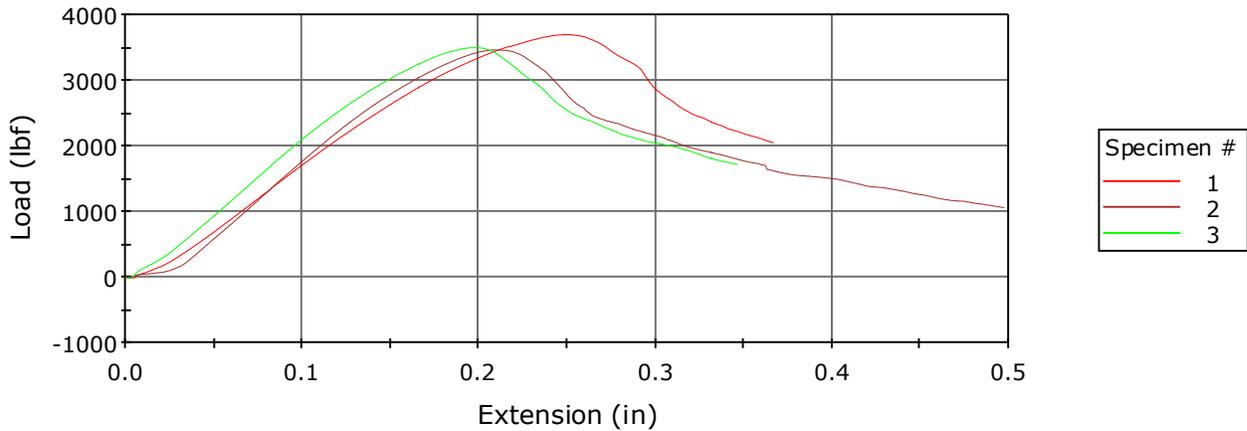
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Zilla Zip Bolt - Uplift Loading
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
1	#1	3691.8	0.24918	
2	#2	3460.2	0.21001	
3	#3	3495.1	0.19767	
Mean		3549.0	0.21895	
Standard Deviation		124.839	0.027	
Coefficient of Variation		3.51754	12.28179	



Architectural Testing

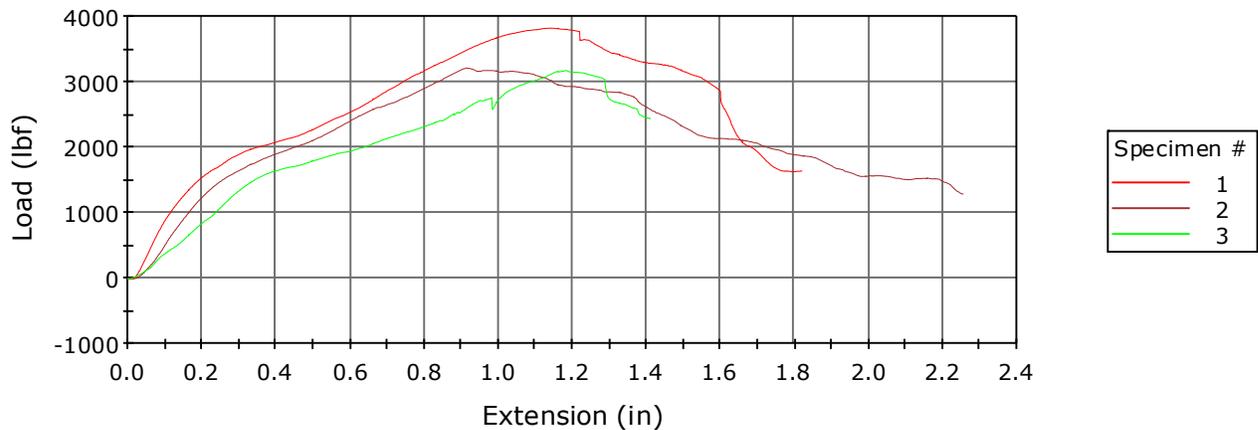
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Zilla Zip Bolt - Lateral Loading (parr. to truss beam)
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
	1 #1	3814.2	1.14134	
	2 #2	3207.9	0.91568	
	3 #3	3172.7	1.18335	
Mean		3398.3	1.08012	
Standard Deviation		360.660	0.144	
Coefficient of Variation		10.61307	13.32755	



Architectural Testing

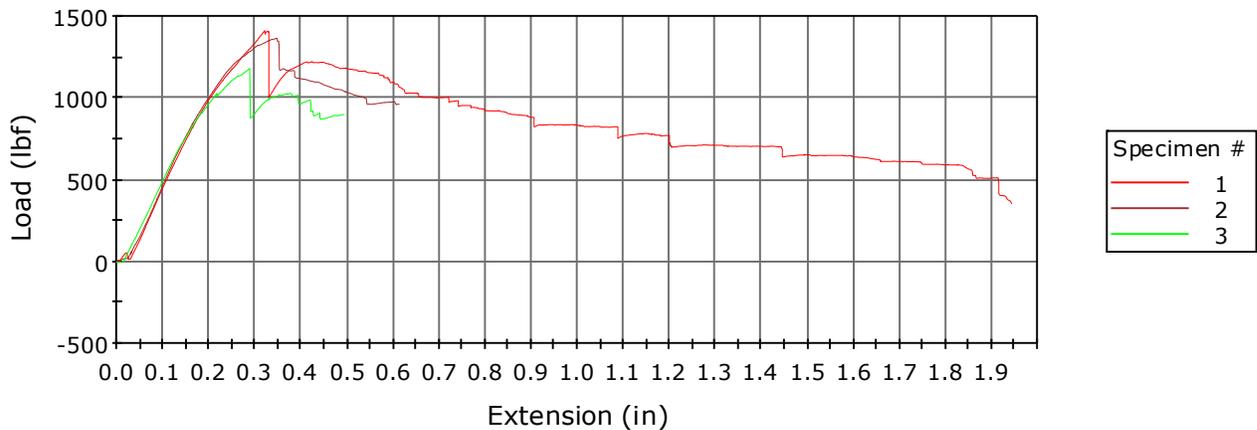
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Zilla Zip Bolt - Lateral Loading (perp to truss beam)
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
	1 #1	1410.4	0.32218	
	2 #2	1364.7	0.34835	
	3 #3	1181.6	0.29002	
Mean		1318.9	0.32018	
Standard Deviation		121.097	0.029	
Coefficient of Variation		9.18165	9.12550	



Architectural Testing

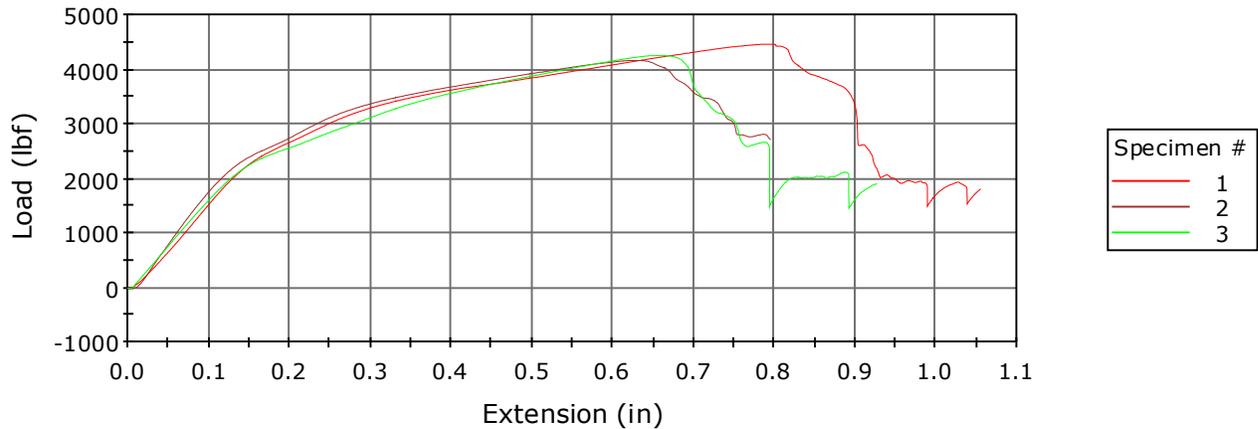
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud Base Plate - Uplift Loading
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
1	#1	4455.4	0.78950	
2	#2	4161.7	0.62434	
3	#3	4249.7	0.65350	
Mean		4288.9	0.68912	
Standard Deviation		150.770	0.088	
Coefficient of Variation		3.51534	12.79174	



Architectural Testing

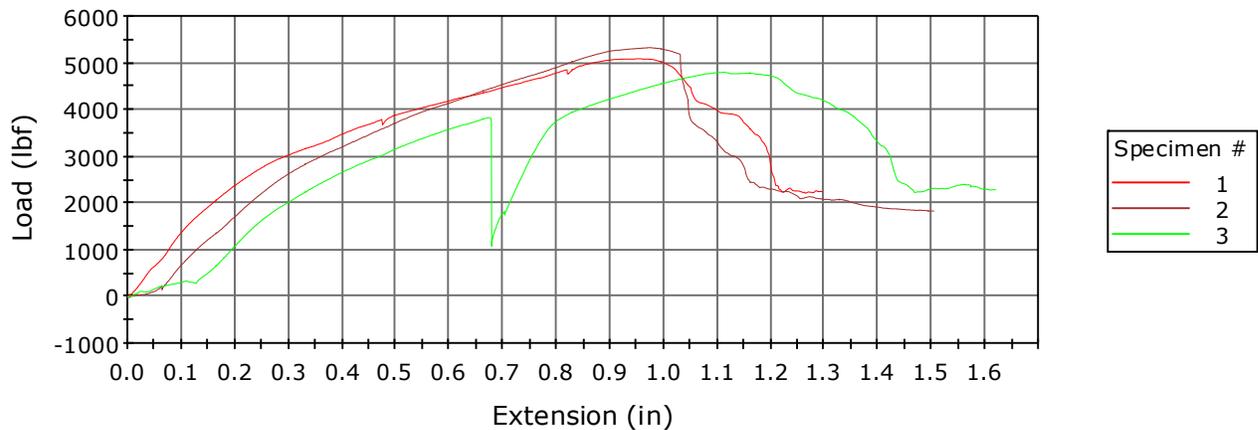
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud Base Plate - Lateral Loading (parr. to truss beam)
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
1	#1	5087.6	0.95650	
2	#2	5323.7	0.97235	
3	#3	4799.6	1.11234	
Mean		5070.3	1.01373	
Standard Deviation		262.447	0.086	
Coefficient of Variation		5.17616	8.46032	



Architectural Testing

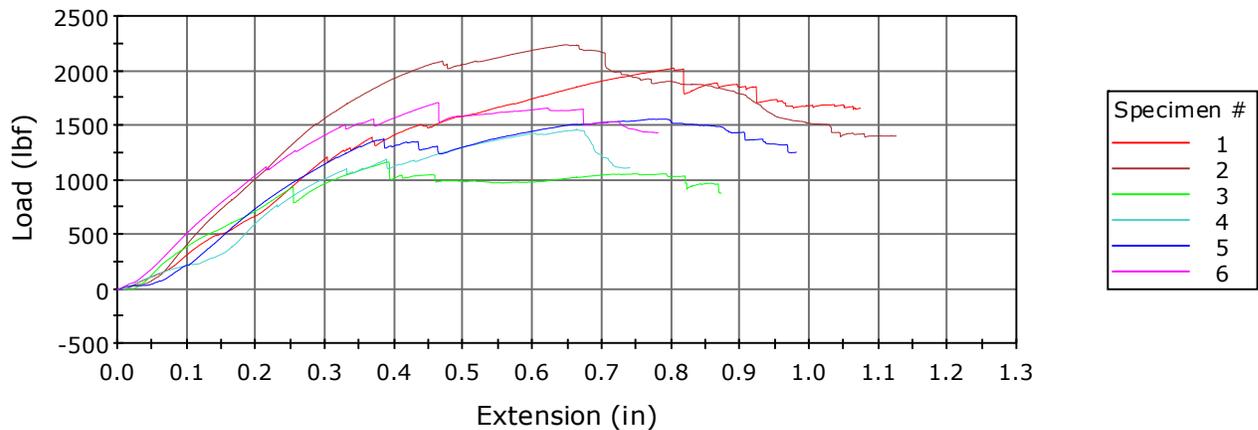
ASTM D 1761 - Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud Base Plate - Lateral Loading (perp to truss beam)
Test Speed	0.10000 in/min
Test Frame / ICN:	Instron 3369 / 005740
Load Cell Capacity / ICN:	50 KN (11,000 lbs) / 005741
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 6



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
1	#1	2024.0	0.80351	
2	#2	2236.4	0.64600	
3	#3	1166.9	0.39136	
4	#4	1462.5	0.66367	
5	#5	1559.6	0.76983	
6	#6	1709.8	0.46285	
Mean		1693.2	0.62287	
Standard Deviation		388.026	0.165	
Coefficient of Variation		22.91674	26.44242	



Architectural Testing

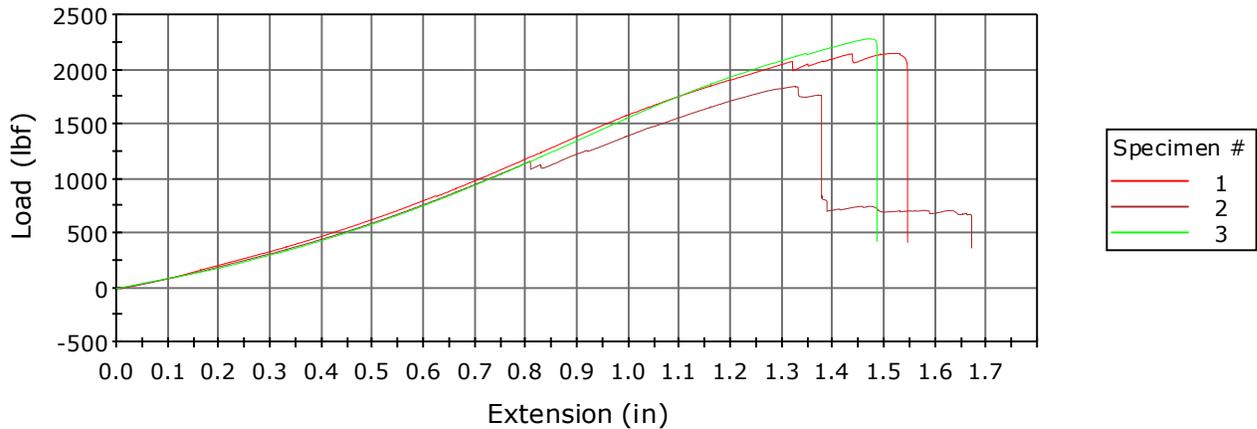
Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud II Base Plate - Withdrawal
Test Speed	0.10000 in/min
Test Frame / ICN:	Satec 50UD / Y002011
Load Cell Capacity / ICN:	50,000 lbs / 88507a
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
	1 #1 - Uplift	2144.4	1.51686	Fastener Withdrawal
	2 #2 - Uplift	1841.8	1.32198	
	3 #3 - Uplift	2276.6	1.46916	
Mean		2087.6	1.43600	
Standard Deviation		222.881	0.102	
Coefficient of Variation		10.67659	7.07422	



Architectural Testing

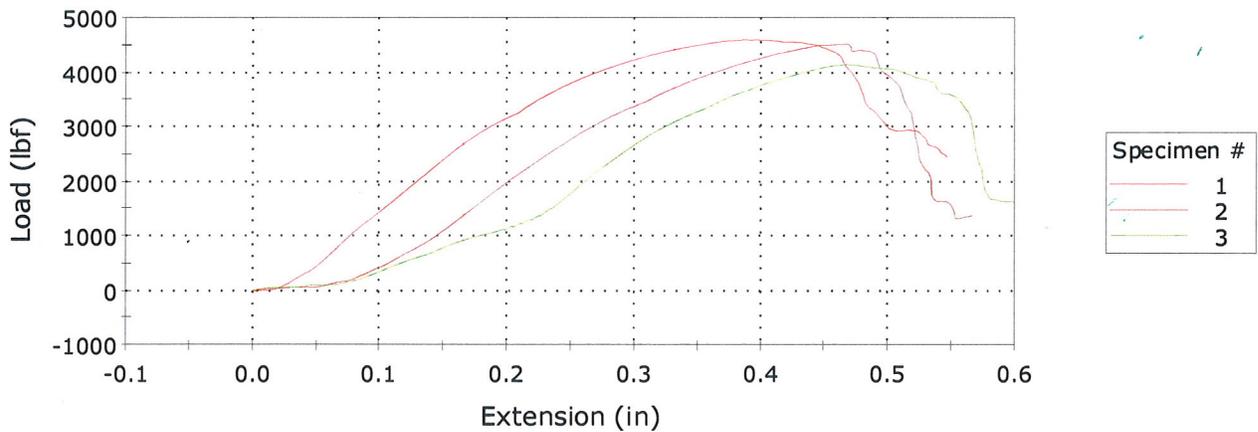
Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud II Base Plate - Lateral (Inline w/ Slots)
Test Speed	0.10000 in/min
Test Frame / ICN:	Satec 50UD / Y002011
Load Cell Capacity / ICN:	50,000 lbs / 88507a
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
	1 #1	4588.4	0.38767	
	2 #2	4507.1	0.46500	
	3 #3	4140.0	0.46719	
Mean		4411.9	0.43995	
Standard Deviation		238.886	0.045	
Coefficient of Variation		5.41463	10.29565	



Architectural Testing

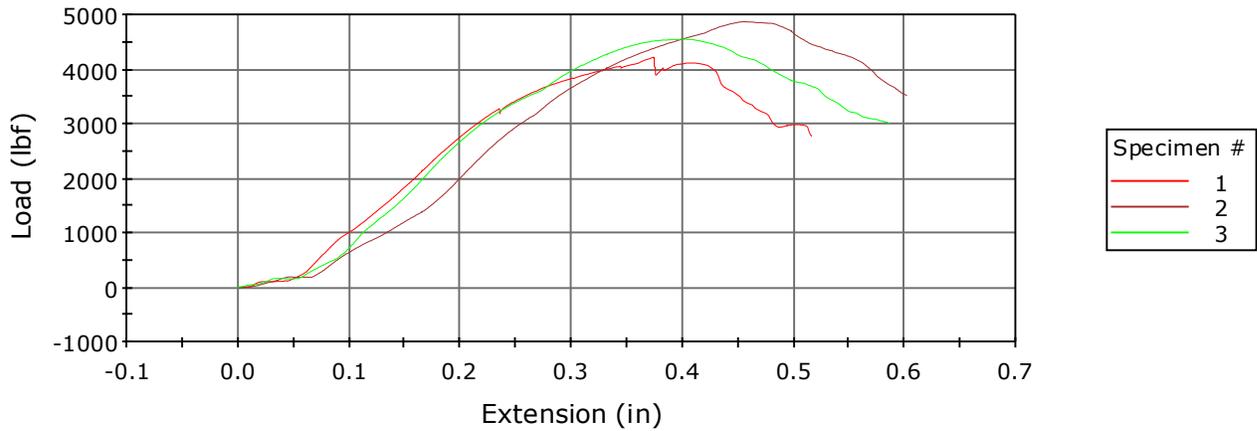
Withdrawal Test of Fasteners

Last Updated by: Todd Burroughs

Uses top Instron Wedge Grip with appropriate sample fixturing at base.

ATI Job #:	D6104.03-106-31
Client Name:	Zilla Corp.
User:	Joe B.
Specimen Description:	Double Stud II Base Plate - Lateral (against slots)
Test Speed	0.10000 in/min
Test Frame / ICN:	Satec 50UD / Y002011
Load Cell Capacity / ICN:	50,000 lbs / 88507a
Lab Conditions:	72°F / 50% R.H.

Specimen 1 to 3



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Mode of Failure
1	#1	4214.6	0.37321	
2	#2	4867.4	0.45667	
3	#3	4547.4	0.40116	
Mean		4543.1	0.41034	
Standard Deviation		326.384	0.042	
Coefficient of Variation		7.18410	10.35212	

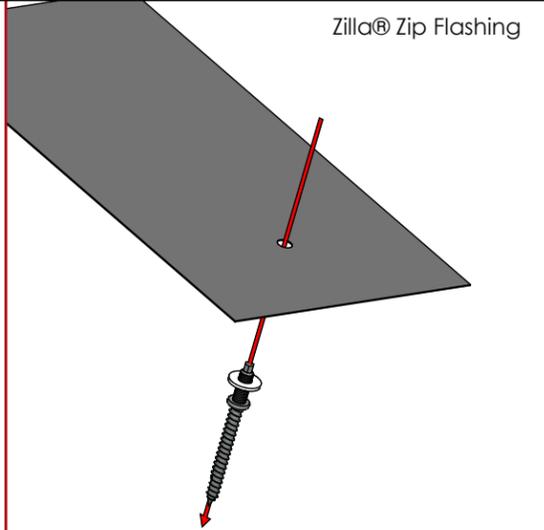
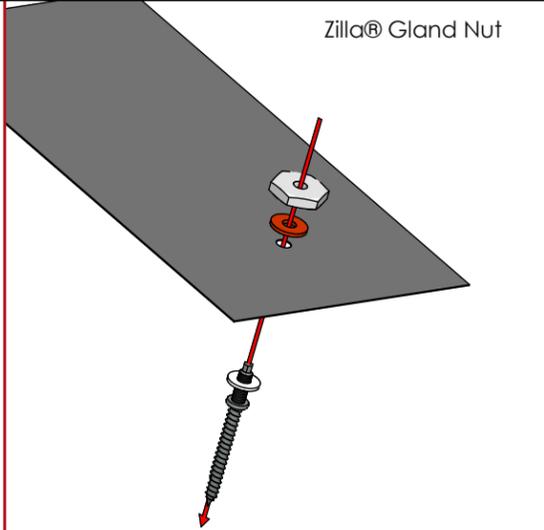
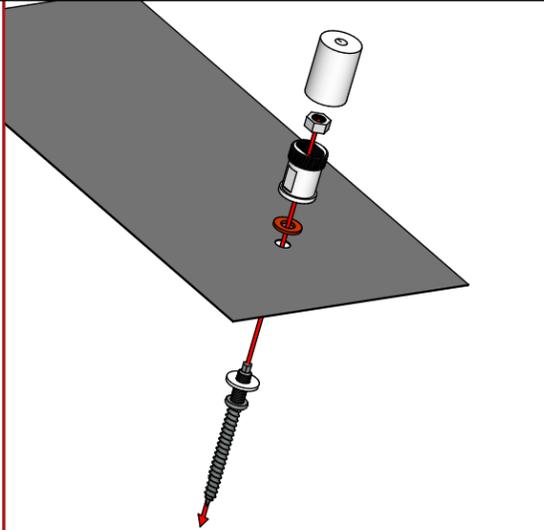
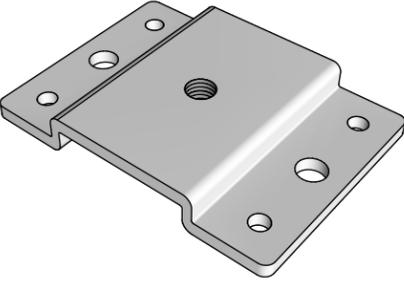
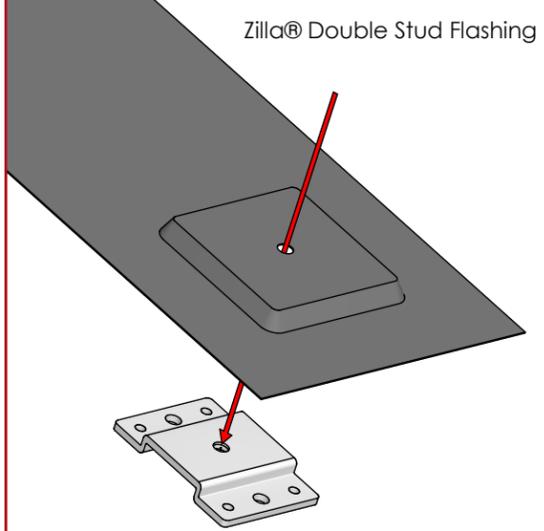
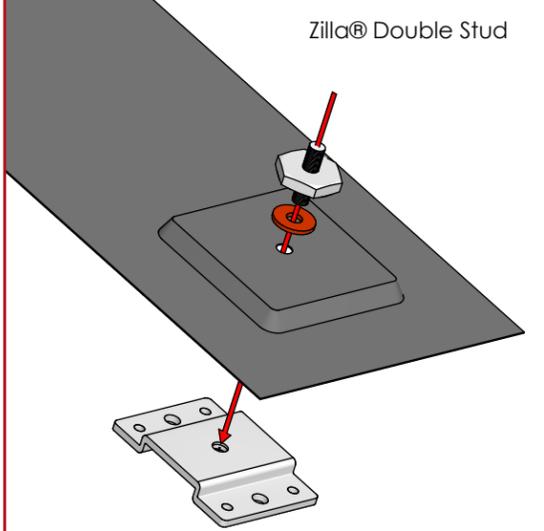
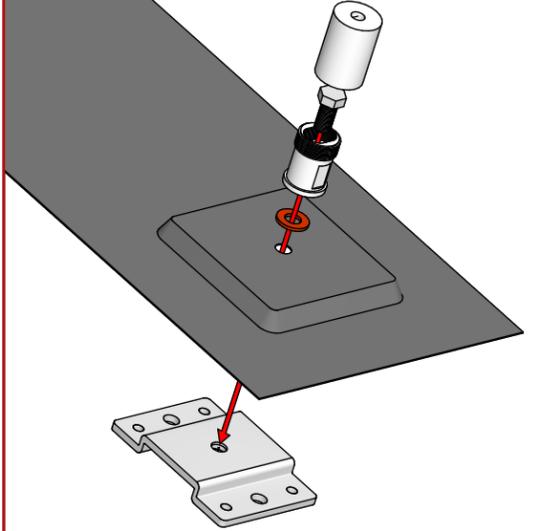
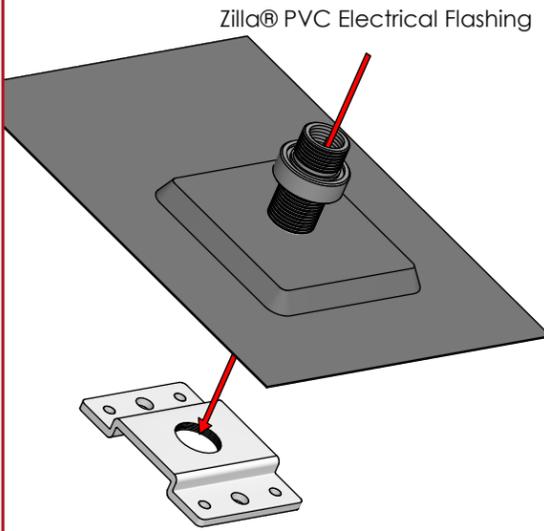
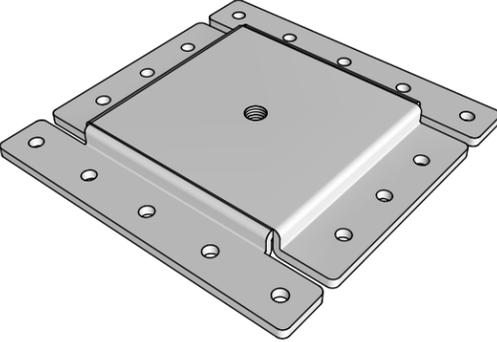
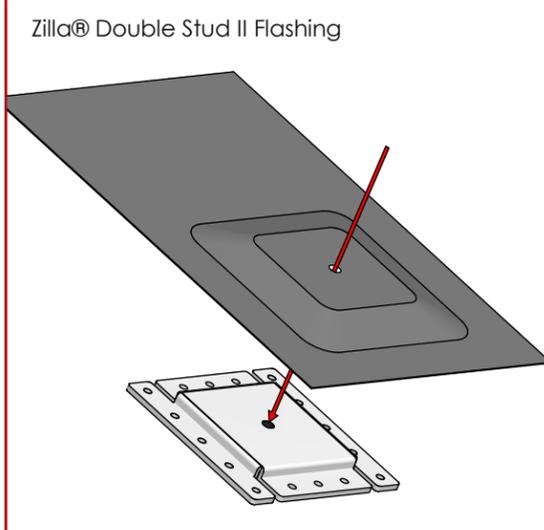
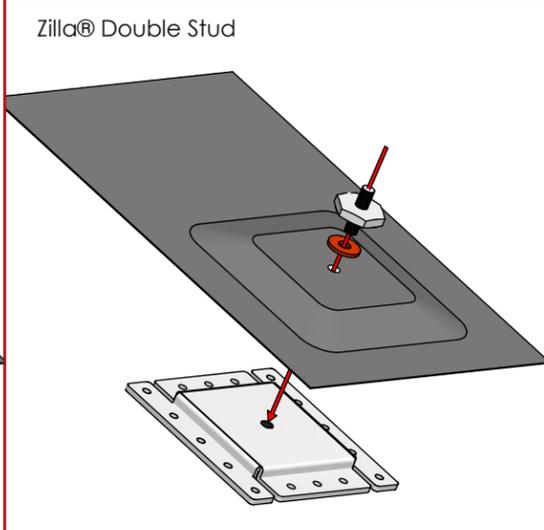
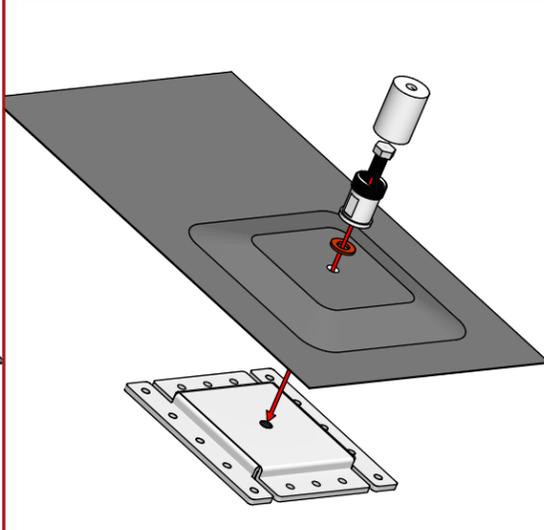
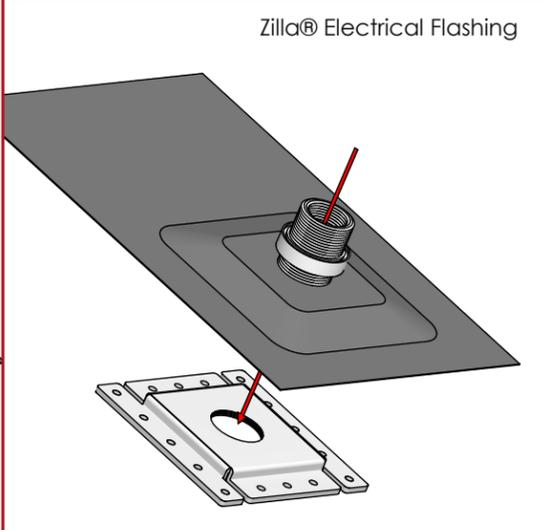


D6104.03-106-31

APPENDIX C

Drawings

Zilla® flashings ensure secure rooftop attachment, watertight protection and durable strength.

The Zilla® Zip Bolt	Zilla® Flashings	Zilla® Double Stud/ Gland Nut	Zilla® Mini Adjustable Standoff	Zilla® Electrical Flashing Options
				
				
				

77 Waneka Parkway · Lafayette, CO 80026
 720.880.6700 · fax 303.665.0379
 www.zillarc.com



Notes:

Project: N/A
 Description: Sample Flashings Variations
 Checked By: JL
 Drawn By: JB
 Date: April 30, 2014