



## **Air, Water, Structural Performance Test Report**

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Rendered To:  
FreMarq Innovations, Inc.

Report No.:  
QCT19-5236.01

Product/Series:  
FW2500 Cap

Test Date(s):  
January 7, 2019 through January 10, 2019

Report Date:  
January 14, 2019

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**MANUFACTURER: FreMarq Innovations, Inc.**  
**8300 Highland Drive**  
**Wausau, WI 54401**

**PRODUCT: FW2500 Cap**  
**PRODUCT TYPE: Fixed Window Wall**

Summary of Results	
Test Procedure/Standard	Details
Air Infiltration Resistance (ASTM E283-04)	0.00 L/s/m <sup>2</sup> (0.000 cfm/ft <sup>2</sup> ) @ 300 Pa (6.27 psf), PASS
Air Exfiltration Resistance (ASTM E283-04)	0.00 L/s/m <sup>2</sup> (0.000 cfm/ft <sup>2</sup> ) @ 75 Pa (1.57 psf), PASS
Water Penetration Resistance (ASTM E547-00)	No Penetration @ 720 Pa (15.03 psf), PASS
Water Penetration Resistance (ASTM E331-00)	No Penetration @ 720 Pa (15.03 psf), PASS
Uniform Load Deflection (ASTM E330M-14)	+2400 Pa (50.1 psf) / -2400 Pa (50.1 psf), PASS
Uniform Load Structural (ASTM E330M-14)	+3600 Pa (75.2 psf) / -3600 Pa (75.2 psf), PASS

Reference must be made to Report No. QCT19-5236.01, dated 01/14/2019 for complete specimen description and data.

### Project Summary:

Quast Consulting and Testing, Inc. was contracted by Fremarq Innovations to perform Air Infiltration, Water Penetration and Uniform Structural Load testing on an FW 2500 Cap Window Wall performance mockup. The sample supplied by Fremarq Innovations was tested at Quast Consulting and Testing laboratory located in Mosinee, WI. The specimen met the performance requirements set forth in the referenced test procedures. Specimen description and test results are reported herein.

### Test Procedure:

Testing was conducted in accordance with:

<b>ASTM E283-04 (2012)*</b>	<i>Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen</i>
<b>ASTM E330M-14*</b>	<i>Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference</i>
<b>ASTM E331-00 (2009)*</b>	<i>Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference</i>
<b>ASTM E547-00 (2009)*</b>	<i>Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference</i>

\*Specimen was not deconstructed in order to confirm substantial compliance with specimen description and attached drawings.

### Test Specimen Description:

<b>Series/Model:</b>	FW2500 Cap
<b>Product Type:</b>	Fixed Window Wall
<b>Overall Size:</b>	2007 mm (79.00 in) wide x 2007 mm (79.00 in) high
<b>Overall Area:</b>	4.03 m <sup>2</sup> (43.34 ft <sup>2</sup> )

### Specimen Construction:

The frame members were composed of extruded aluminum square cut and attached at corners and vertical mullion using four #14 x 2" HWH TEX fasteners per attachment. Fiberglass thermal breaks were attached to the aluminum frame members using #14 x 3/4" HWH SMS fasteners spaced 16" on center.

**Glazing:**

The specimen was glazed using a 1" Insulated Glass Unit comprising 1/4" Clear Tempered, 1/2" Argon Space with Technoform Warm Edge Back Air Spacer, 1/4" Clear Tempered. The glass was set against 70 Durometer Silicone Gasket and captured using an extruded aluminum pressure plate and 60 Durometer EPDM Gasket fastened with #14 x 2" HWH Tex Framing Fasteners. A continuous silicone heel bead was applied around the perimeter. The glass was set on 5/16" x 1-1/8" x 4" 85 Durometer Black Silicone setting blocks.

**Installation:**

The specimen was installed into an 8" x 8" x 1/4" thick HSS with a 3/4" perimeter gap. The specimen was anchored using 6" wide 6063-T6 aluminum anchors spaced at each end and 5" on center from center of vertical mullion at head and sill. The anchors were captured by the head and sill extrusions and attached to the steel buck using two 1/4-24 self tapping fasteners per anchor.

**Test Results:**

<b><u>NAFS §</u></b>	<b><u>Title of Test</u></b>	<b><u>Results</u></b>	<b><u>Allowed</u></b>
<b>9.3.2.1</b>	<b>Air Infiltration/Exfiltration per ASTM E283-04 (2012)</b>		
	<b>Infiltration</b>	<b>PASS</b>	
	300 Pa	0.00 L/s/m <sup>2</sup>	0.51 L/s/m <sup>2</sup>
	(6.27 psf)	0.000 cfm/ft <sup>2</sup>	0.100 cfm/ft <sup>2</sup>
	<b>Exfiltration</b>	<b>PASS</b>	
	75 Pa	0.00 L/s/m <sup>2</sup>	0.51 L/s/m <sup>2</sup>
	(1.57 psf)	0.000 cfm/ft <sup>2</sup>	0.100 cfm/ft <sup>2</sup>
<b>9.3.3</b>	<b>Water Penetration Resistance per ASTM E547-00 (2009)</b>		
	Water applied at a rate not less than 5 gallons per square foot per hour		
	<b>Specimen #1</b>	<b>PASS</b>	
	720 Pa (15.0 psf)	No Penetration	No Penetration
<b>9.3.3</b>	<b>Water Penetration Resistance per ASTM E331-00 (2009)</b>		
	<b>Specimen #1</b>	<b>PASS</b>	
	720 Pa (15.03 psf)	No Penetration	No Penetration

**Test Results (Continued):**

<b><u>NAFS §</u></b>	<b><u>Title of Test</u></b>	<b><u>Results</u></b>	<b><u>Allowed</u></b>
<b>9.3.4.2</b>	<b>Uniform Load Deflection per ASTM E330M-14</b> Temperature: 60 °F (15.6 °C) Plastic film was not used to prevent air leakage		
	<b>Specimen #1</b>		
	Positive Load:	2400 Pa (50.1 psf)	
	Negative Load:	2400 Pa (50.1 psf)	
	<b>Vertical Intermediate</b>	<b>PASS</b>	
	Span (L):	2007 mm (79 in)	L/175
	Positive Deflection:	1.8 mm (0.07 in)	11.4 mm (0.45 in)
	Negative Deflection:	1.8 mm (0.07 in)	11.4 mm (0.45 in)
	<b>Right Jamb</b>	<b>PASS</b>	
	Span (L):	2007 mm (79 in)	L/175
	Positive Deflection:	0.3 mm (0.01 in)	11.4 mm (0.45 in)
	Negative Deflection:	0.5 mm (0.02 in)	11.4 mm (0.45 in)
<b>9.3.4.3</b>	<b>Uniform Load Structural per ASTM E330M-14</b> Temperature: 58 °F (14.4 °C) Plastic film was not used to prevent air leakage		
	<b>Specimen #1</b>		
	Positive Load:	3600 Pa (75.2 psf)	
	Negative Load:	3600 Pa (75.2 psf)	
	<b>Vertical Intermediate</b>	<b>PASS</b>	
	Span (L):	2007 mm (79 in)	.2%*L
	Positive Permanent Set:	0.5 mm (0.02 in)	4.1 mm (0.16 in)
	Negative Permanent Set:	0.3 mm (0.01 in)	4.1 mm (0.16 in)
	<b>Right Jamb</b>	<b>PASS</b>	
	Span (L):	2007 mm (79 in)	.2%*L
	Positive Permanent Set:	0.3 mm (0.01 in)	4.1 mm (0.16 in)
	Negative Permanent Set:	0.5 mm (0.02 in)	4.1 mm (0.16 in)



**Drawing Reference:** The test specimen drawings have been reviewed by Quast Consulting and Testing, Inc. and are in general compliance with the specimen reported herein.

**List of Official Observers:**

Name:

Brian Sasman  
Arlen Fisher  
Gunner Quast  
Kelly Marlow  
Jeff Beyer

Company:

Quast Consulting and Testing, Inc.  
Quast Consulting and Testing, Inc.  
Quast Consulting and Testing, Inc.  
Quast Consulting and Testing, Inc.  
Fremarq Innovations

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Quast Consulting and Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such material 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. No conclusions of any kind regarding the adequacy or inadequacy of the glass in the test specimen can be made. 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 Quast Consulting and Testing, Inc.

QUAST CONSULTING & TESTING, INC.

A handwritten signature in cursive script, reading 'Arlen Fisher'.

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Arlen Fisher  
Project Manager

QUAST CONSULTING & TESTING, INC.

A handwritten signature in cursive script, reading 'Brian M. Sasman'.

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Brian M. Sasman, PE  
Reviewer

Attachments: This report is complete only when all attachments listed are included.  
Appendix A: As-Built Drawings (7 Pages)



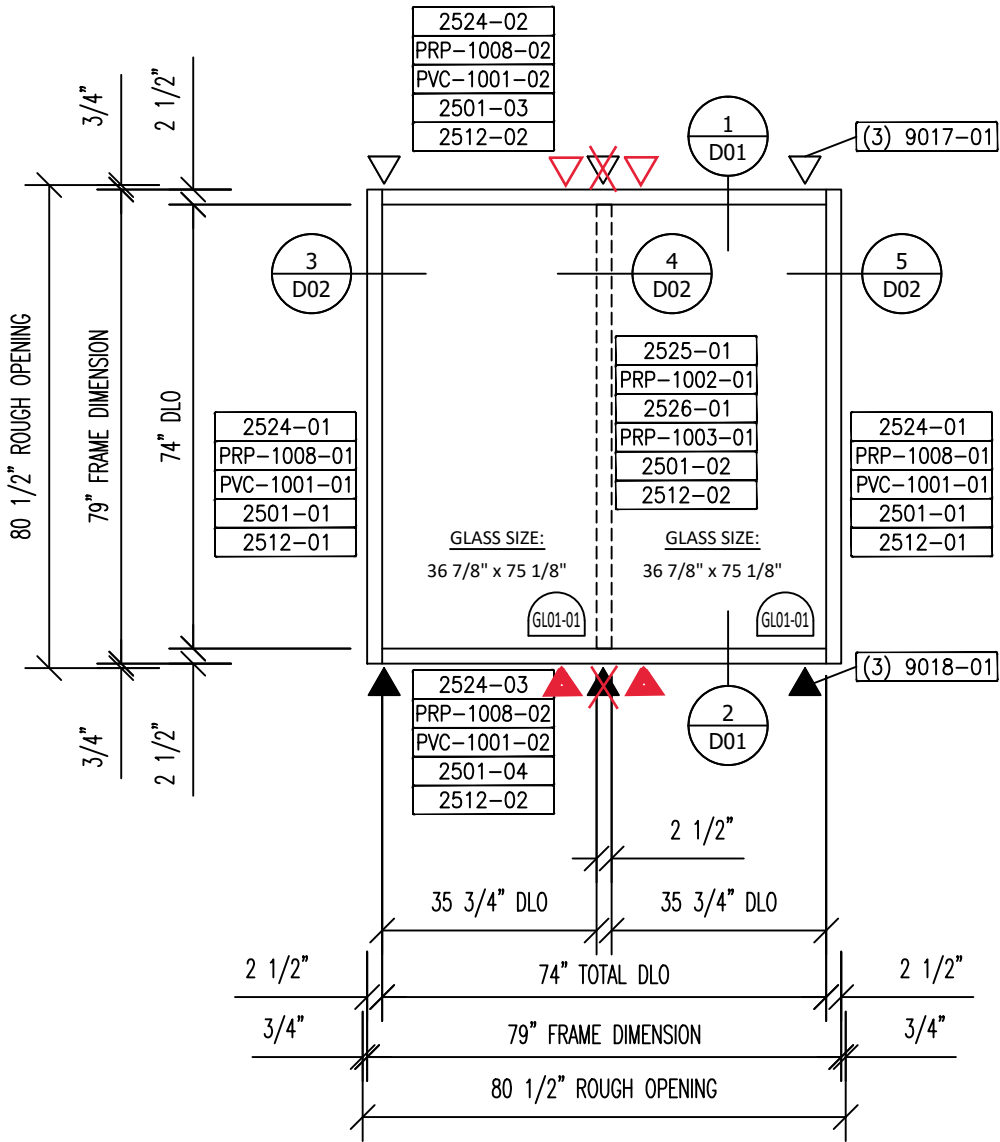
Drawings reviewed for general compliance with tested specimen

Project #: QCT19-5236  
Date: 01/14/2019  
Reviewer: Arlen Fisher

**1 REQUIRED**  
PERFORMANCE - MOCK-UP  
NO FINISH REQUIRED

PERFORMANCE REQUIREMENT

WATER: 15#  
AIR: 6.24  
STRUCTURAL: 50 PSF

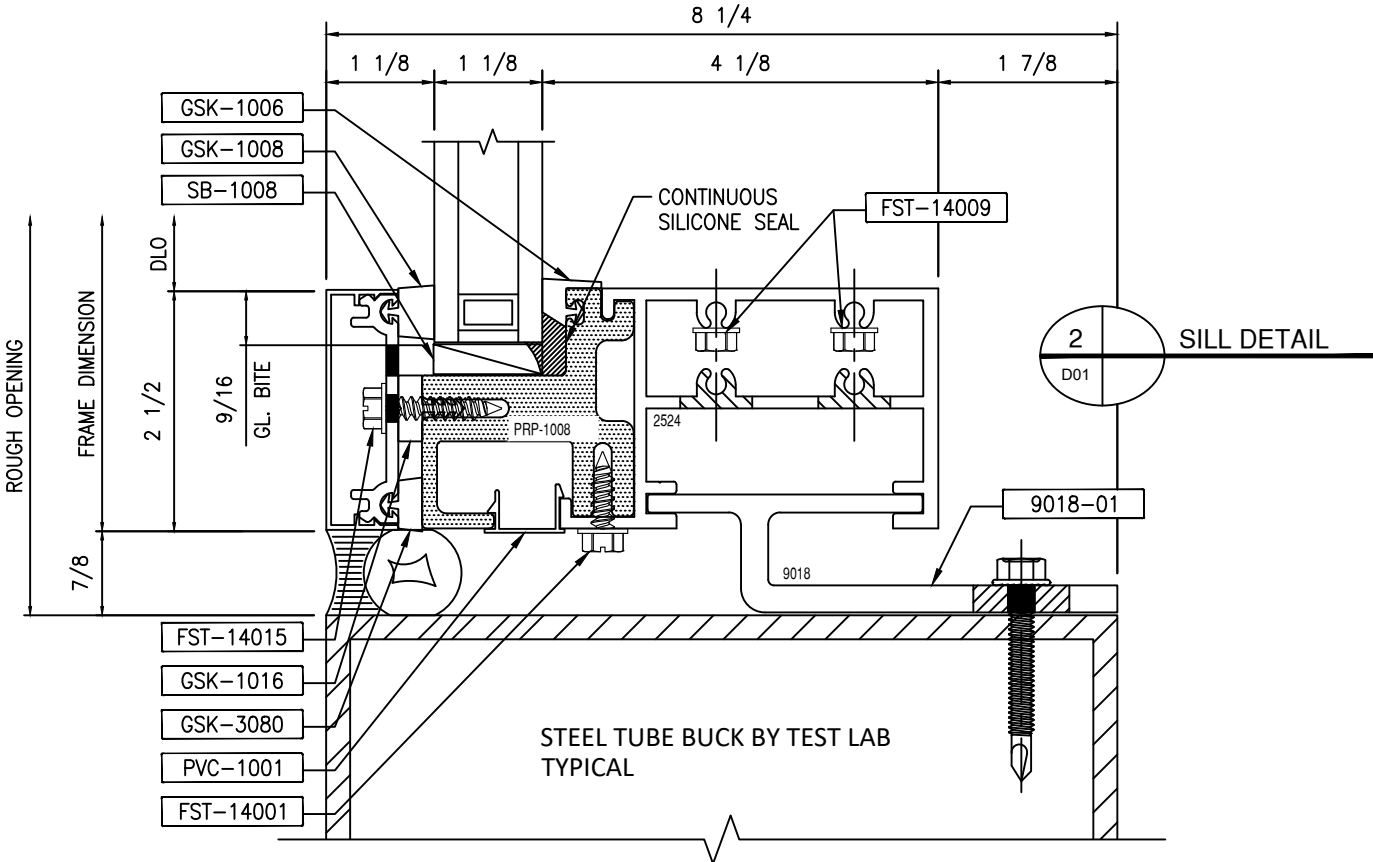
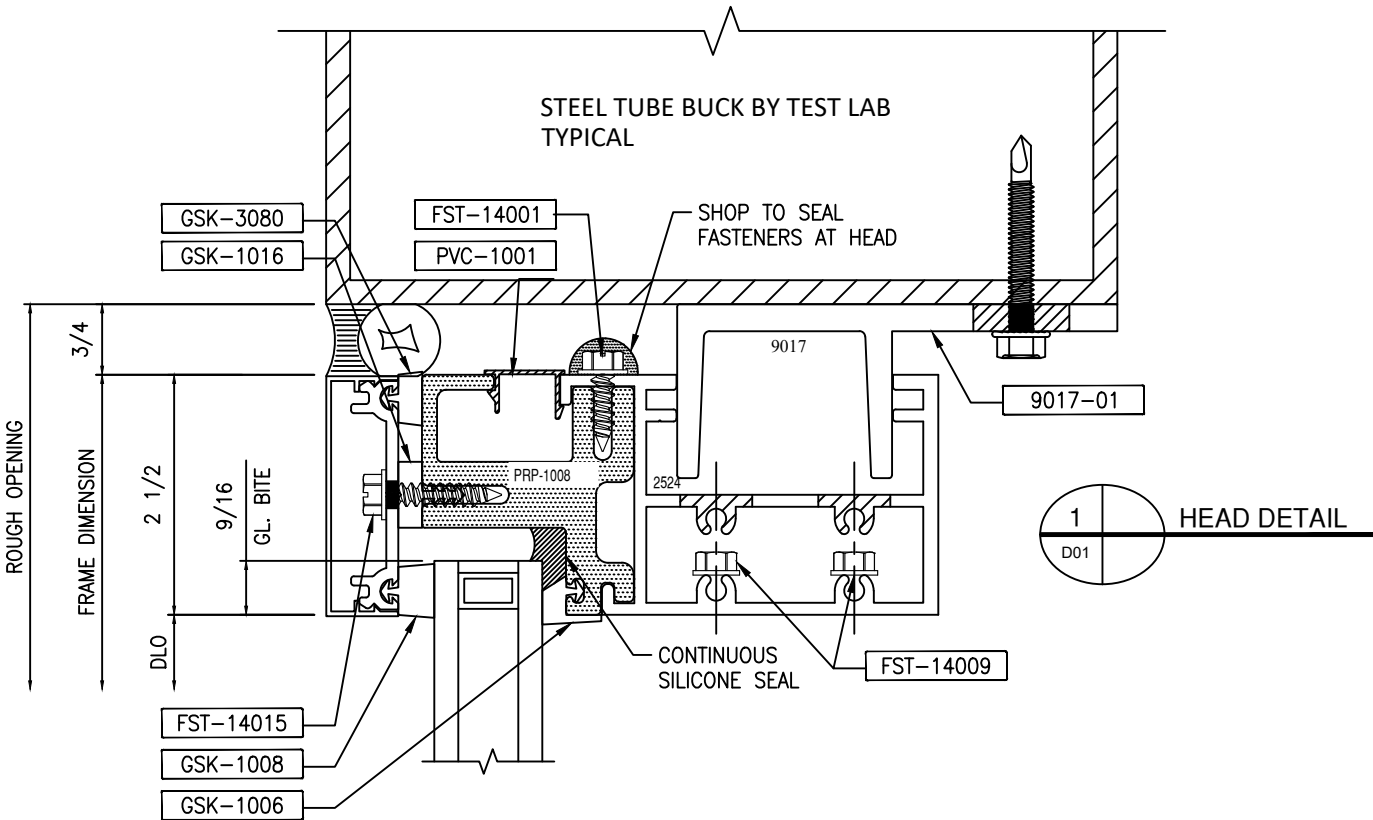


GLASS DESCRIPTION	
MARK	DESCRIPTION
GL-01	1 1/8" OA IG UNIT 1/4" CARDINAL 366 LOW-E CLEAR TEMPERED GLASS W/LOW-E ON #2 SURFACE 1/2" ALUMINUM AIR SPACER W/ARGON GAS 3/8" CLEAR TEMPERED GLASS  SUPPLIED BY FERMARQ INNOVATIONS, INC. GLASS AND GLAZING

SHOP NOTE:  
FRAMING TOLERANCES ARE AS FOLLOWS:  
- DLO's = +/- .030" (1/32")  
- FRAME SQUARE = +/- 1/16"  
  
ADJUST FRAME MEMBERS IF NEEDED TO BRING FRAMES WITHIN TOLERANCE. FRAME ARE NOT ALLOWED TO BE TRANSFERRED TO NEXT STAGE UNTIL ALL DIMENSIONS HAVE BEEN VERIFIED AND SIGNED OFF ON.

PROJECT NAME:		ARCHITECT:		CUSTOMER:		REPRESENTATIVE:	
LOCATION:		PHONE (718) 849-8842		JOB		CUST. ORDER NO.	
DATE		SHEET NAME		SHOP ELEVATION		PERFORMANCE MOCK-UP	
REV. NO.		SCALE 3/8" = 1'-0"		DATE 12/10/18		SHEET NO.	
DRAWN BY Ed Gerl		SE01		SUBMITAL/REVISION		DESCRIPTIONS	



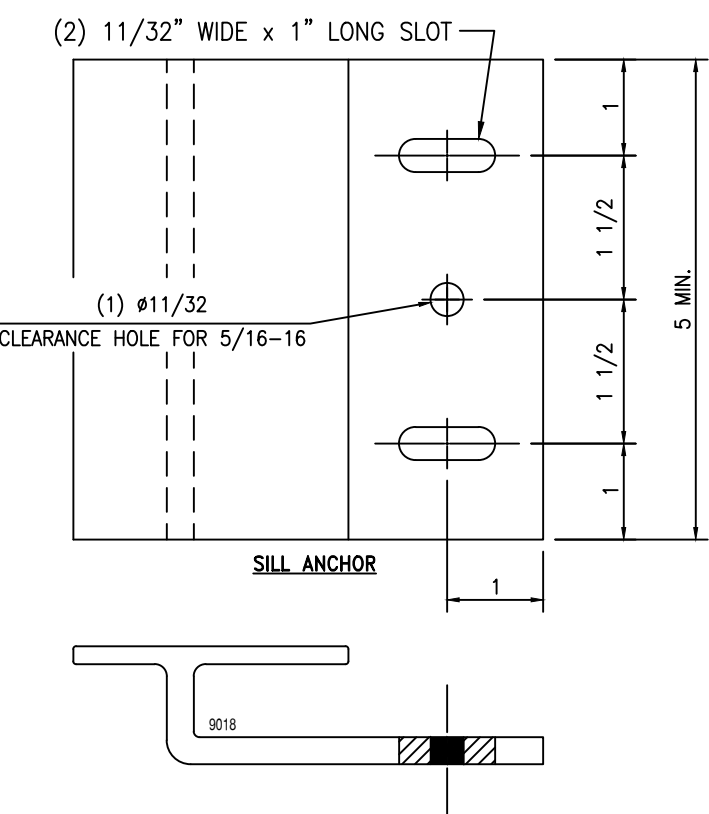
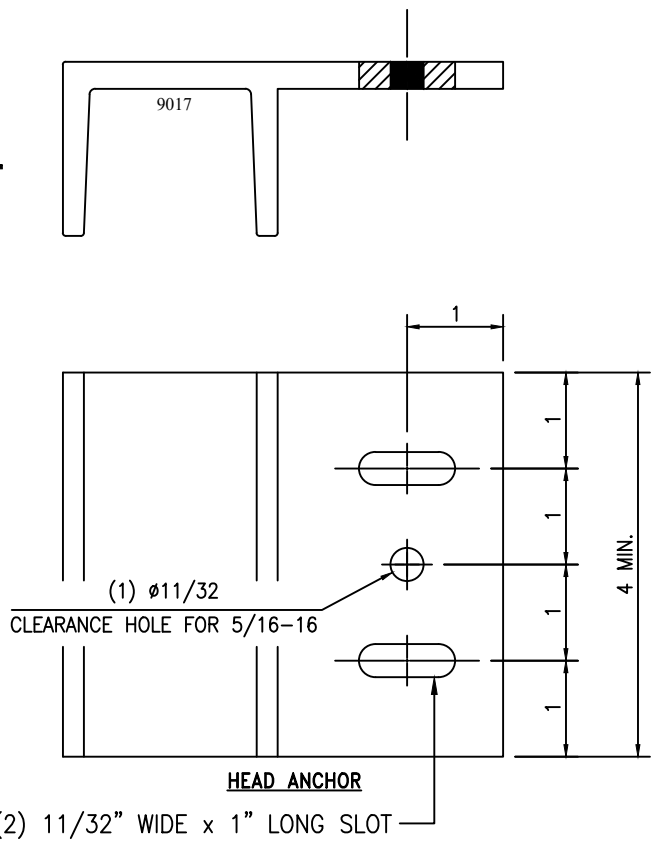


TRIM TAGS KEY			
9017-01	HEAD ANCHOR 6063-T6 4" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	UIF GSK-1006	70 DUROMETER SILICONE GASKET [LN. FT.]
9018-01	SILL ANCHOR 6063-T6 5" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	UIF GSK-1008	EXTERIOR GLAZING GASKET 60 DUROMETER EPDM GASKET
UIF PVC-1001	CAULK BACKER	UIF GSK-3080	EXTERIOR GLAZING SPACER 60 DUROMETER EPDM GASKET
UIF FST-14001	#14 x 3/4" HWH SMS AT 16" O.C. MAX	UIF GSK-1016	STEM ISOLATOR 70 DUROMETER EPDM GASKET
UIF FST-14009	#14 x 2" HWH TEX FRAMING FASTENER	UIF GSK-3998	SWEEP GASKET 73 DUROMETER SANTOPRENE/PP GASKET
UIF FST-14015	#14 x 1" HWH SMS TYPE A AT 9" O.C. PRESSURE PLATE	UIF SB-1008	5/16" x 1 1/8" x 4" 85 DUROMETER BLACK SILICONE SETTING BLOCK (2) PER LITE



Drawings reviewed for general compliance with tested specimen

Project #: QCT19-5236  
Date: 01/14/2019  
Reviewer: Arlen Fisher



PROJECT NAME:	LOCATION:	ARCHITECT:	CUSTOMER:	REPRESENTATIVE:
PHONE (718) 849-0842	WAUSAU, WI 54981	Freemary Innovations, Inc.		
JOB:	CUST. ORDER NO.:	SHEET NAME:	DETAILS	PERFORMANCE MOCK-UP
SCALE 6"=1'-0"	DATE 12/10/18	DRAWN BY Ed Gerl	SHEET NO. D01	

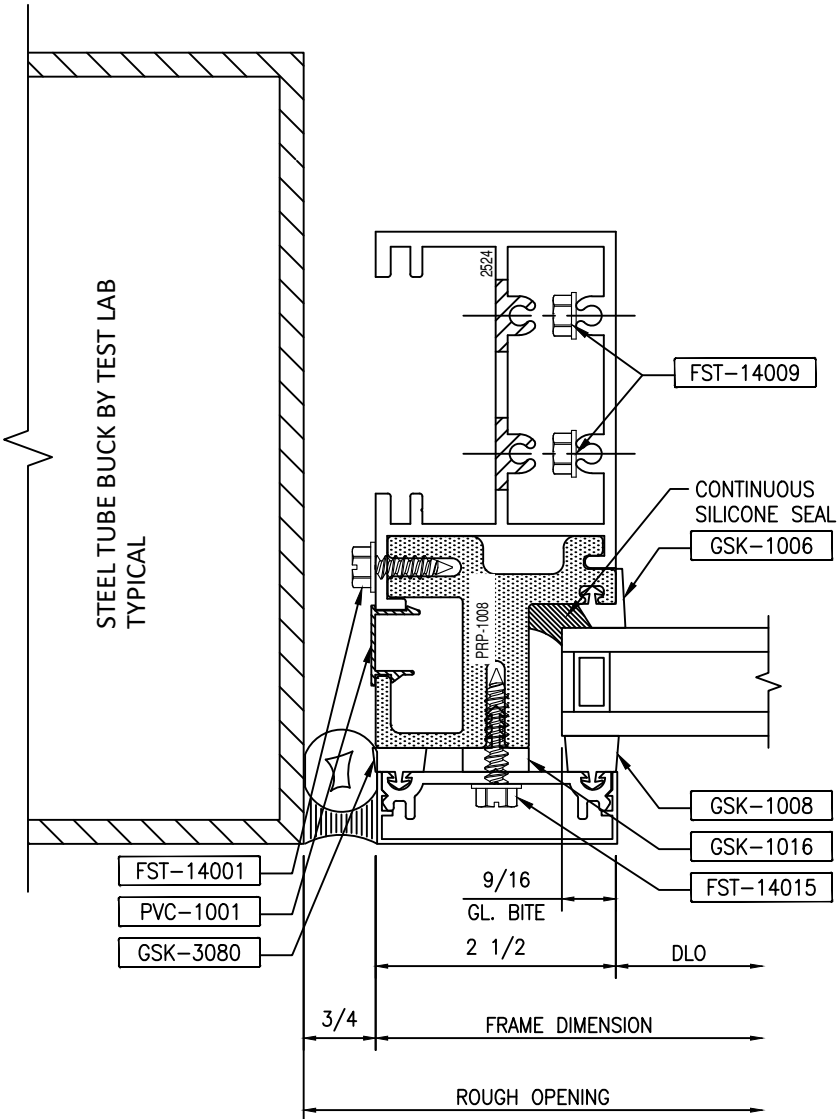


Drawings reviewed for general compliance with tested specimen

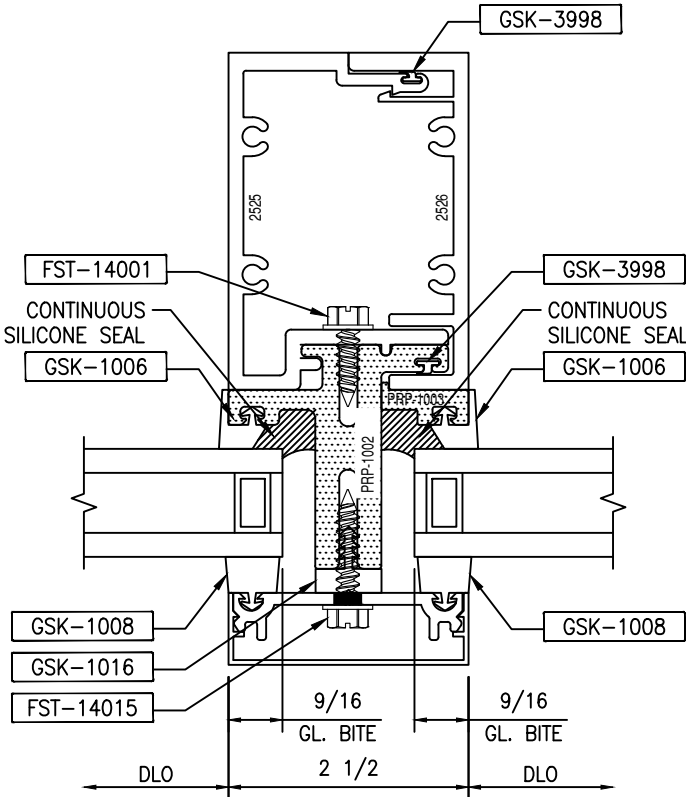
Project #: **QCT19-5236**  
Date: **01/14/2019**  
Reviewer: **Arlen Fisher**

TRIM TAGS KEY

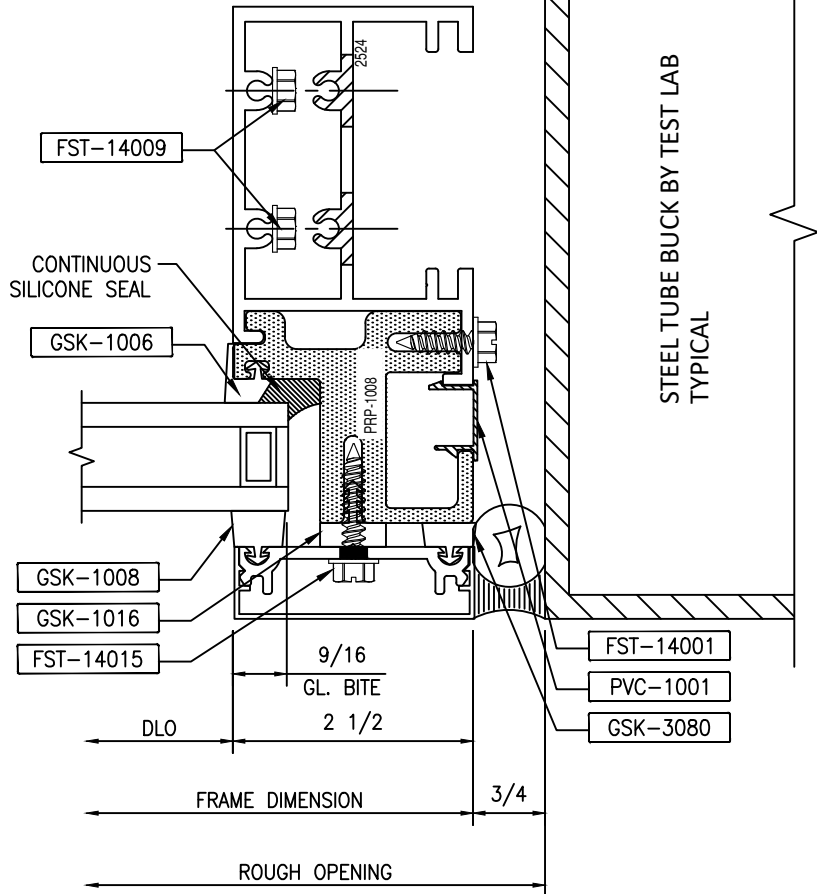
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3 LEFT JAMB DETAIL  
D02



4 VERTICAL MULLION DETAIL  
D02



5 RIGHT JAMB DETAIL  
D02

PROJECT NAME:  
LOCATION:  
ARCHITECT:  
CUSTOMER:  
REPRESENTATIVE:

PHONE (718) 849-0842  
3800 Highland Drive  
WALTON, NY 14140

General Notes:  
1. Contractor to verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted.  
2. All dimensions to outside face of member unless otherwise noted.  
3. Drawings marked "approved" or "approved as noted" shall be interpreted as an accurate condition of job requirements and such approval shall author release of fabrication.  
4. Fielding shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.

JOB  
CUST. ORDER NO.

SHEET NAME  
DETAILS  
PERFORMANCE MOCK-UP

SCALE 6"=1'-0" DATE 12/10/18  
DRAWN BY Ed Gerl SHEET NO. D02

REV. NO.  
DATE  
DRAWN  
SUBMITAL/REVISION DESCRIPTIONS



Drawings reviewed for general compliance with tested specimen

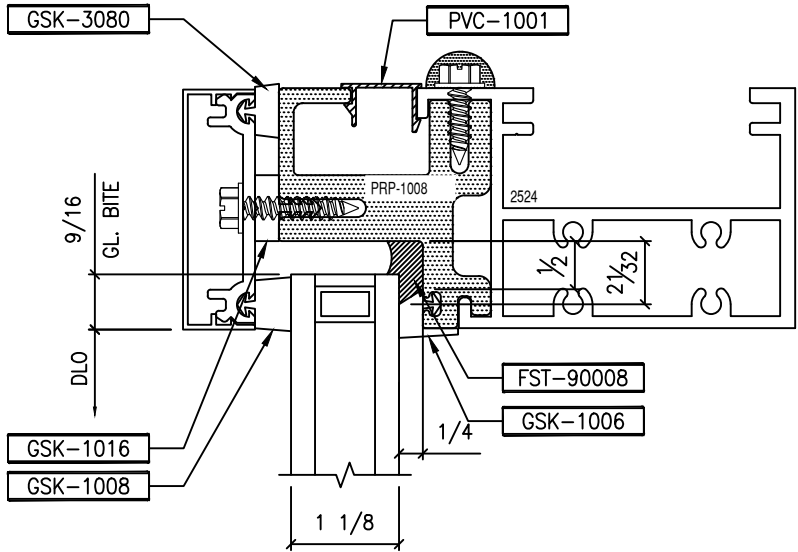
Project #: **QCT19-5236**  
Date: **01/14/2019**  
Reviewer: **Arlen Fisher**

GLAZING TAGS KEY

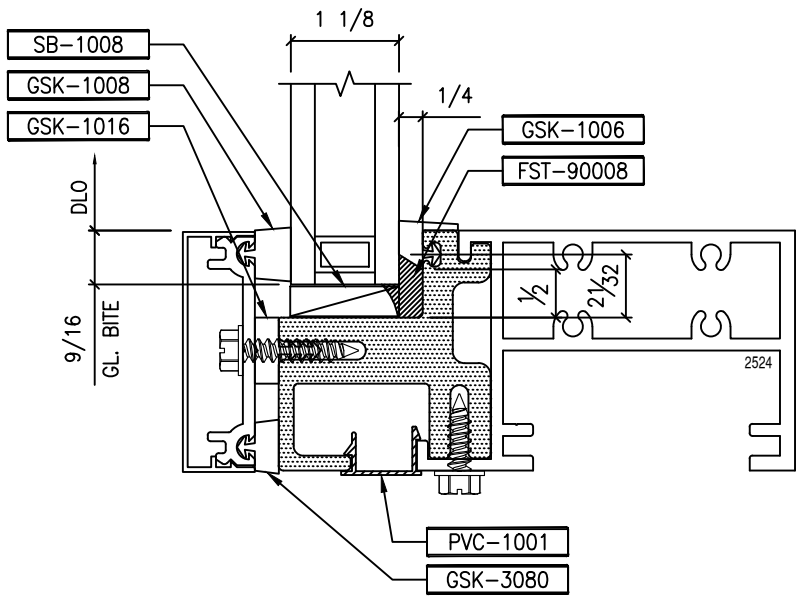
- UIF **SB-1008** 5/16" x 1 1/8" x 4" 85 DUROMETER BLACK SILICONE SETTING BLOCK (2) PER LITE
- UIF **PVC-1001** PVC CAULK BACKER SHOP APPLIED
- UIF **FST-90008** DOW 983 BLACK SILICONE STRUCTURAL GLAZING

- UIF **GSK-1006** SILICONE GASKET (INTERIOR GLAZING) LN. FT. - 70 DUROMETER
- UIF **GSK-1008** EPDM EXTERIOR GLAZING GASKET 60 DUROMETER
- UIF **GSK-1016** STEM ISOLATOR - 70 DUROMETER EPDM
- UIF **GSK-3080** EXTERIOR PERIMETER GLAZING SPACER 60 DUROMETER EPDM

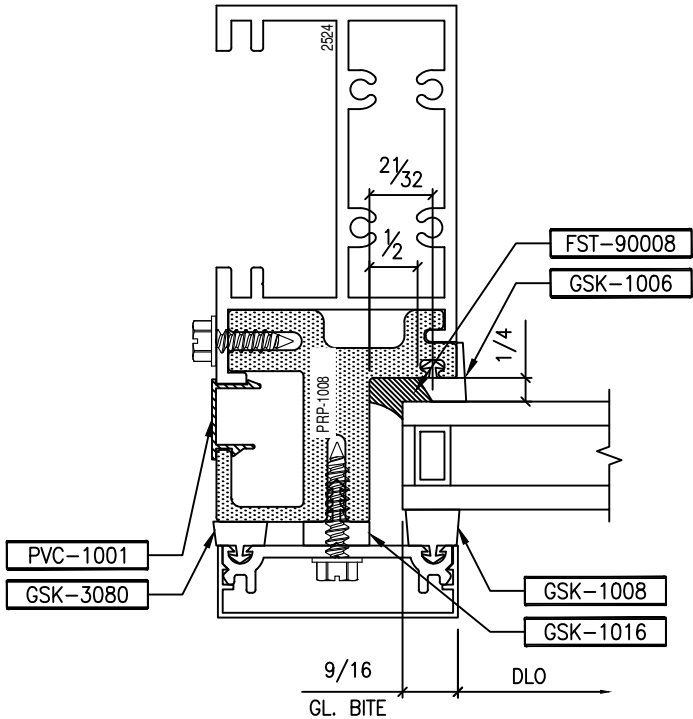
TYPICAL HEAD DETAIL



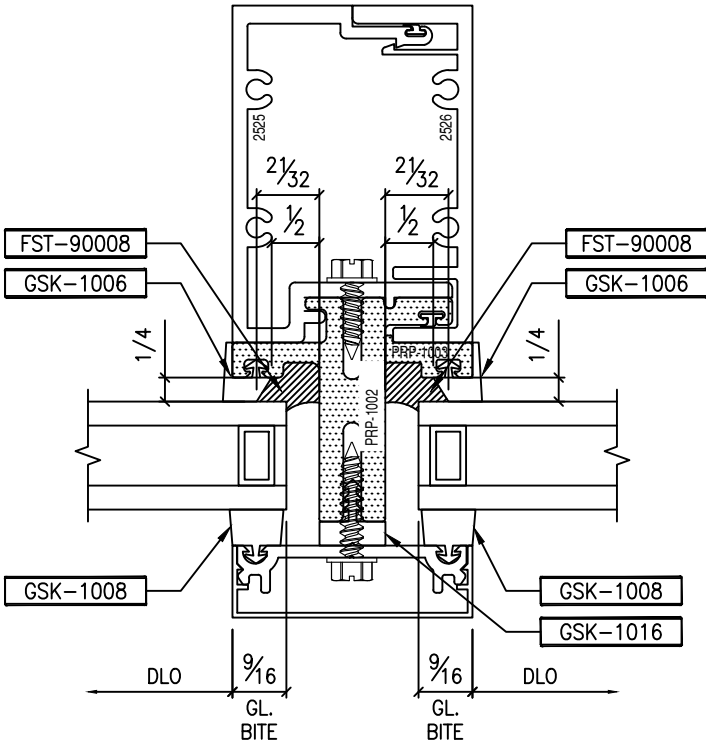
TYPICAL SILL DETAIL



TYPICAL JAMB DETAIL



TYPICAL VERTICAL MULL DETAIL

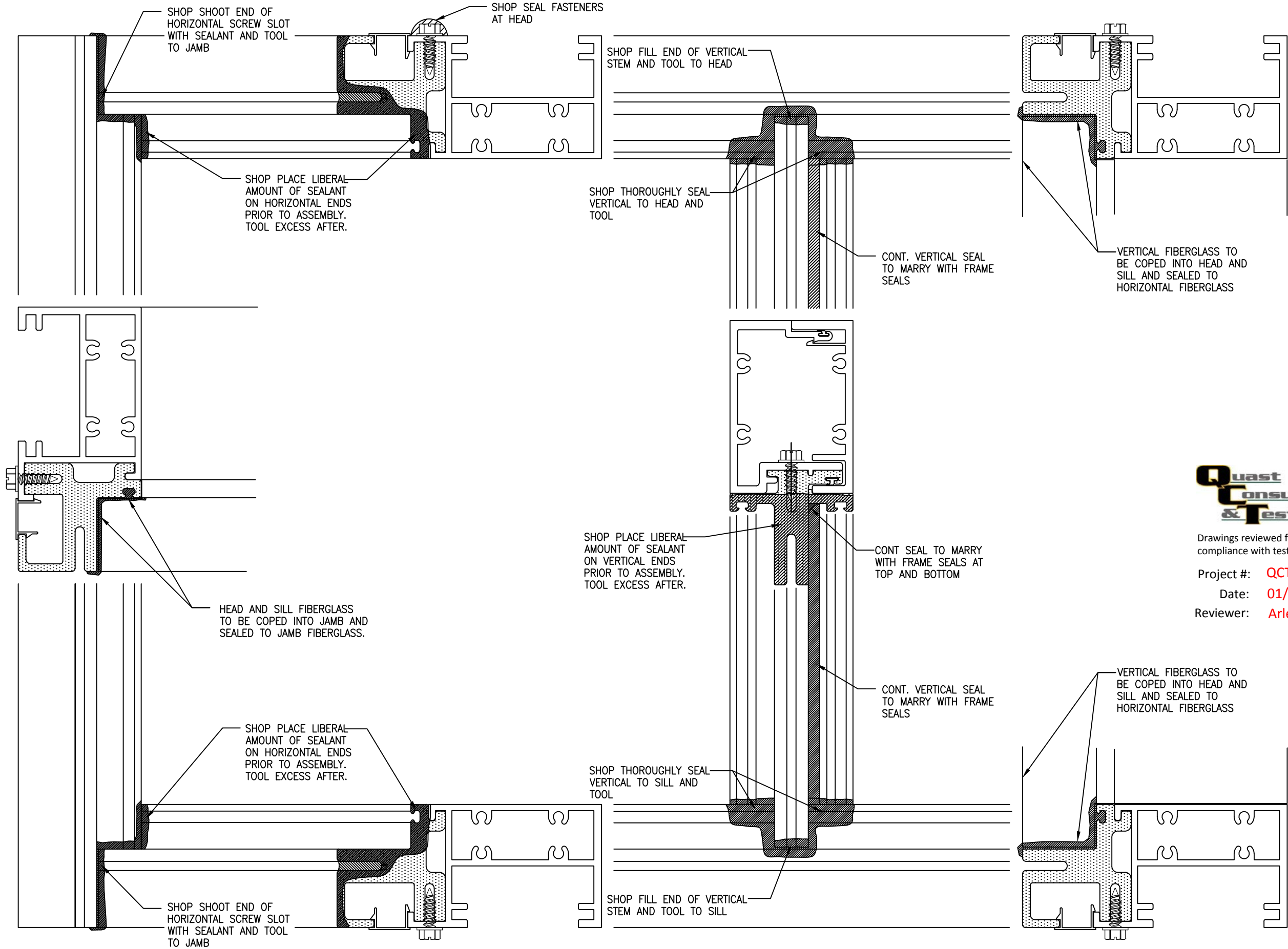


PROJECT NAME:  
LOCATION:  
ARCHITECT:  
CUSTOMER:  
REPRESENTATIVE:

FireMaing Innovations, Inc  
8300 Highland Drive  
WAUSAU, WI 54981  
PHONE (715) 842-6942

General Notes:  
1. Verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted.  
2. Architect to review all conditions for compliance and if required provide correct details and/or dimensions to ensure proper coordination.  
3. Drawings marked "approved" or "approved as noted" shall be interpreted as an accurate condition of job.  
4. FireMaing shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.

JOB  
CUST. ORDER NO.  
SHEET NAME  
GLAZING DETAILS  
PERFORMANCE - MOCK-UP  
SCALE HALF DATE 12/12/18  
DRAWN BY Ed Gerl SHEET NO. GO1

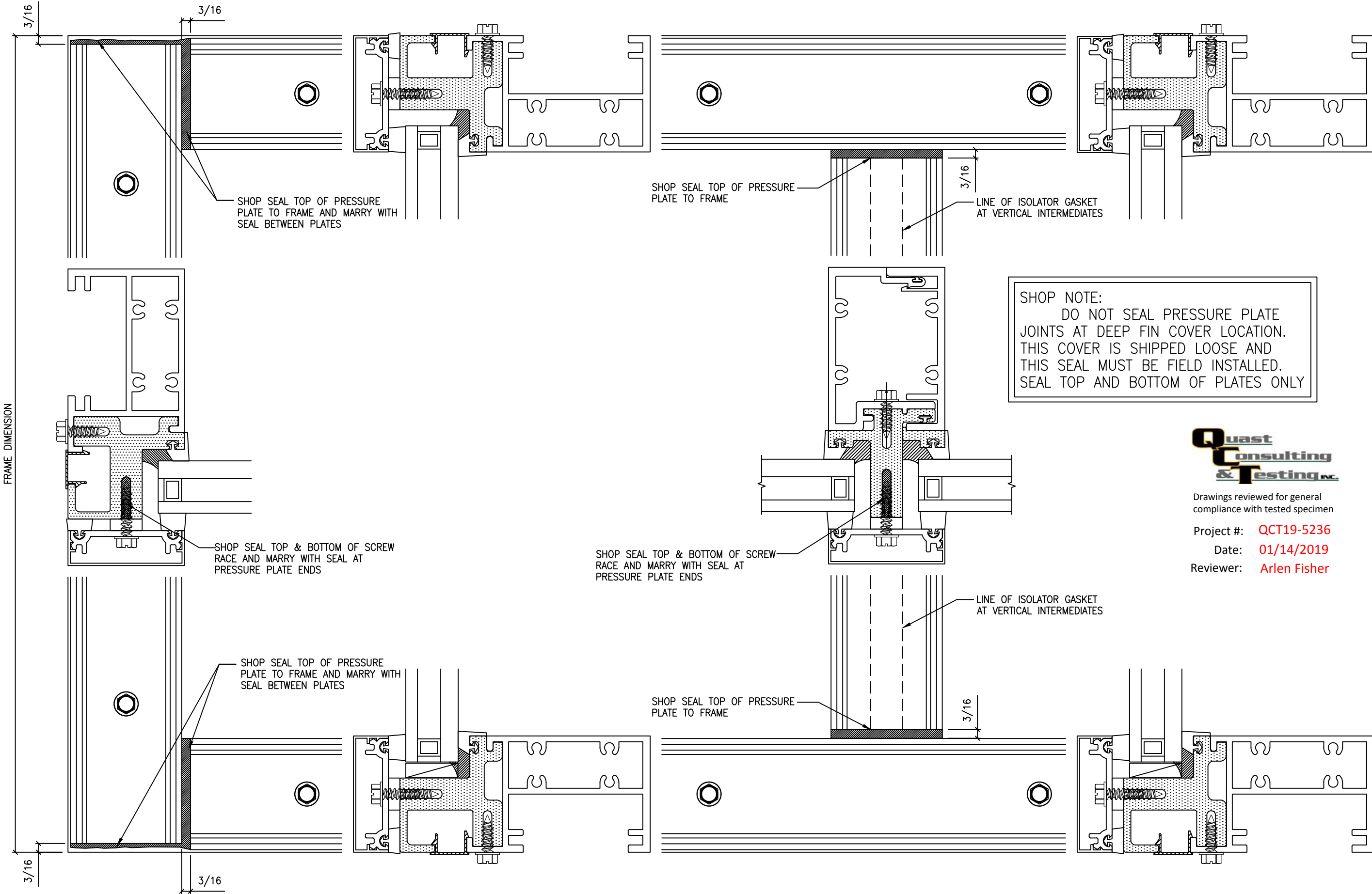


Drawings reviewed for general compliance with tested specimen

Project #: **QCT19-5236**  
Date: **01/14/2019**  
Reviewer: **Arlen Fisher**

PROJECT NAME:		ARCHITECT:		CUSTOMER:		REPRESENTATIVE:	
LOCATION:		DATE		DRAWN		SUBMITTAL/REVISION DESCRIPTIONS	
PHONE (715) 842-0942		REV. NO.					
Freemarq Innovations, Inc							
8300 Highland Drive							
WAUSAU, WI 54901							
General Notes:							
1. Contractor to verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted.							
2. Architect to review all conditions for compliance to contract documents and if required provide correct details and/or dimensions to ensure proper coordination.							
3. Drawings prepared, approved, or signed by Quast Consulting & Testing, Inc. shall be interpreted as an accurate condition of job and shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.							
4. Framing shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.							
JOB							
CUST. ORDER NO.							
SHEET NAME							
SEALING DETAILS							
PERFORMANCE - MOCK-UP							
SCALE		DATE					
HALF		12/12/18					
DRAWN BY		SHEET NO.					
Ed Gerl		G02					

FRAME DIMENSION



SHOP NOTE:  
DO NOT SEAL PRESSURE PLATE JOINTS AT DEEP FIN COVER LOCATION. THIS COVER IS SHIPPED LOOSE AND THIS SEAL MUST BE FIELD INSTALLED. SEAL TOP AND BOTTOM OF PLATES ONLY



Drawings reviewed for general compliance with tested specimen

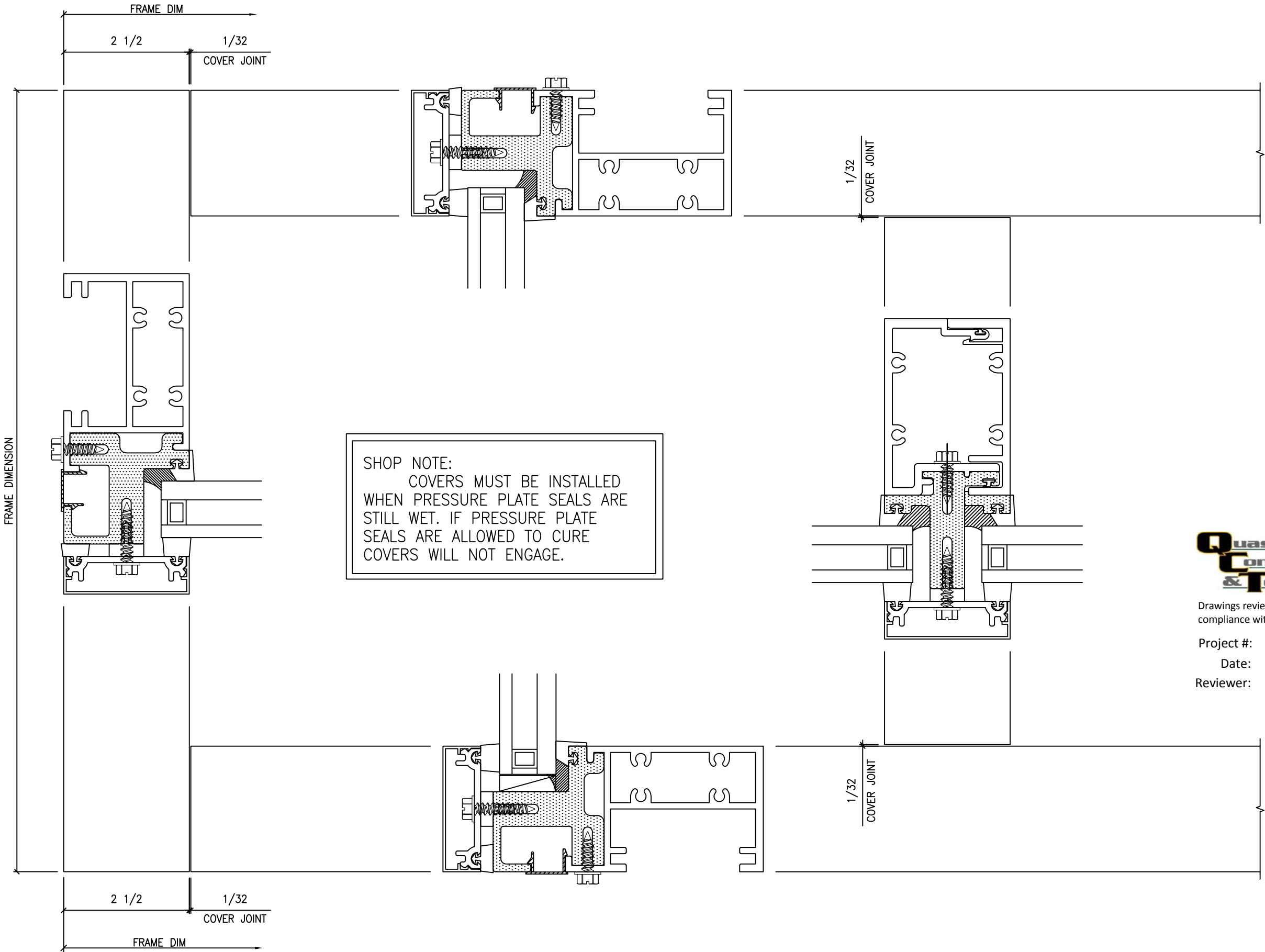
Project #: QCT19-5236  
Date: 01/14/2019  
Reviewer: Arlen Fisher

PROJECT NAME:		LOCATION:		ARCHITECT:		CUSTOMER:		REPRESENTATIVE:	
JOB		CUST. ORDER NO.		SHEET NAME		SCALE		DATE	
SEALING DETAILS		PERFORMANCE - MOCK-UP		DRAWN BY		SHEET NO.		DRAWN SUBMITAL/REVISION	
Ed Gerl		G03		DATE		REVISION		DESCRIPTIONS	

FireMareq Innovations, Inc.  
8300 Highland Drive  
WAUSAU, WI 54981  
PHONE (715) 842-0942

General Notes:  
1. To verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted.  
2. Architect to review all conditions for compliance to contract documents and if required provide correct details and/or dimensions to ensure proper coordination.  
3. Drawings prepared, approved, or approved for release shall be interpreted as an accurate condition of job.  
4. FireMareq shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.





Drawings reviewed for general compliance with tested specimen

Project #: QCT19-5236  
Date: 01/14/2019  
Reviewer: Arlen Fisher

PROJECT NAME:		LOCATION:		ARCHITECT:		CUSTOMER:		REPRESENTATIVE:	
JOB		CUST. ORDER NO.		SHEET NAME		SCALE		DATE	
GO4		GO4		SEALING DETAILS		PERFORMANCE - MOCK-UP		12/18	
DRAWN BY		Ed Gerl		SHEET NO.		DATE		DRAWN SUBMITTAL/REVISION DESCRIPTIONS	
Ed Gerl		GO4		12/18		12/18		12/18	