



Air, Water, Structural Performance Test Report

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

QUAST CONSULTING AND TESTING, INC.
Exterior Façade/Fenestration Consulting Testing
1055 Indianhead Drive • Mosinee, WI 54455-0241 • Phone: 715-693-TEST (8378) • Fax: 715-693-0689
www.qct-usa.com



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 ² (0.000 cfm/ft ²) @ 300 Pa (6.27 psf), PASS
Air Exfiltration Resistance (ASTM E283-04)	0.00 L/s/m ² (0.000 cfm/ft ²) @ 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:

ASTM E283-04 (2012)*	<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>
ASTM E330M-14*	<i>Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference</i>
ASTM E331-00 (2009)*	<i>Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference</i>
ASTM E547-00 (2009)*	<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:

Series/Model: FW2500 Cap
Product Type: Fixed Window Wall

Overall Size: 2007 mm (79.00 in) wide x 2007 mm (79.00 in) high
Overall Area: 4.03 m² (43.34 ft²)

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:

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



Test Results (Continued):

<u>NAFS §</u>	<u>Title of Test</u>	<u>Results</u>	<u>Allowed</u>
9.3.4.2	Uniform Load Deflection per ASTM E330M-14 Temperature: 60 °F (15.6 °C) Plastic film was not used to prevent air leakage		
	Specimen #1		
	Positive Load:	2400 Pa (50.1 psf)	
	Negative Load:	2400 Pa (50.1 psf)	
	Vertical Intermediate	PASS	
	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)
	Right Jamb	PASS	
	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)
9.3.4.3	Uniform Load Structural per ASTM E330M-14 Temperature: 58 °F (14.4 °C) Plastic film was not used to prevent air leakage		
	Specimen #1		
	Positive Load:	3600 Pa (75.2 psf)	
	Negative Load:	3600 Pa (75.2 psf)	
	Vertical Intermediate	PASS	
	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)
	Right Jamb	PASS	
	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:

<u>Name:</u>	<u>Company:</u>
Brian Sasman	Quast Consulting and Testing, Inc.
Arlen Fisher	Quast Consulting and Testing, Inc.
Gunner Quast	Quast Consulting and Testing, Inc.
Kelly Marlow	Quast Consulting and Testing, Inc.
Jeff Beyer	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.

QUAST CONSULTING & TESTING, INC.

Arlen Fisher
Project Manager

Brian M. Sasman, PE
Reviewer

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



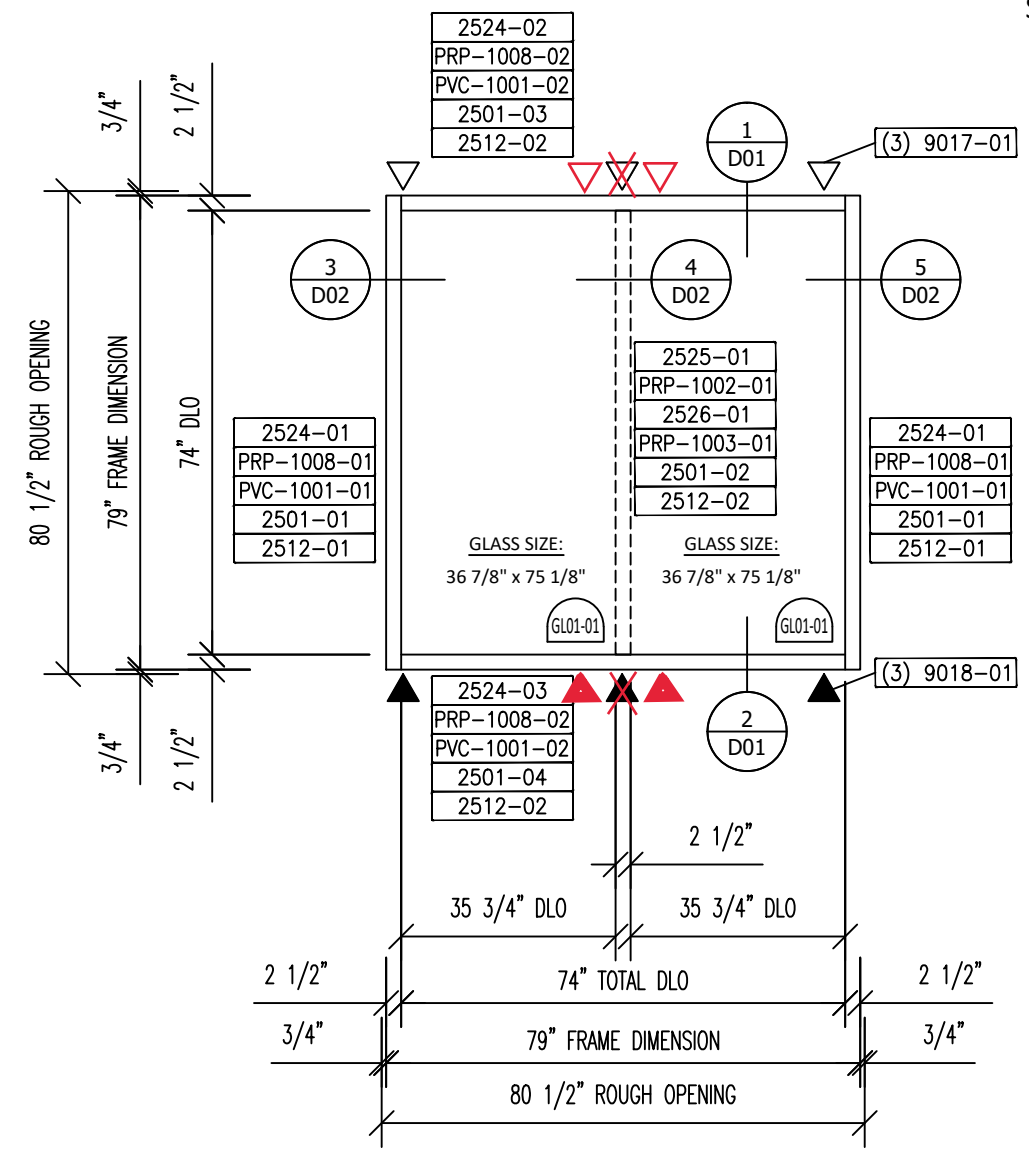
Drawings reviewed for general compliance with tested specimen

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

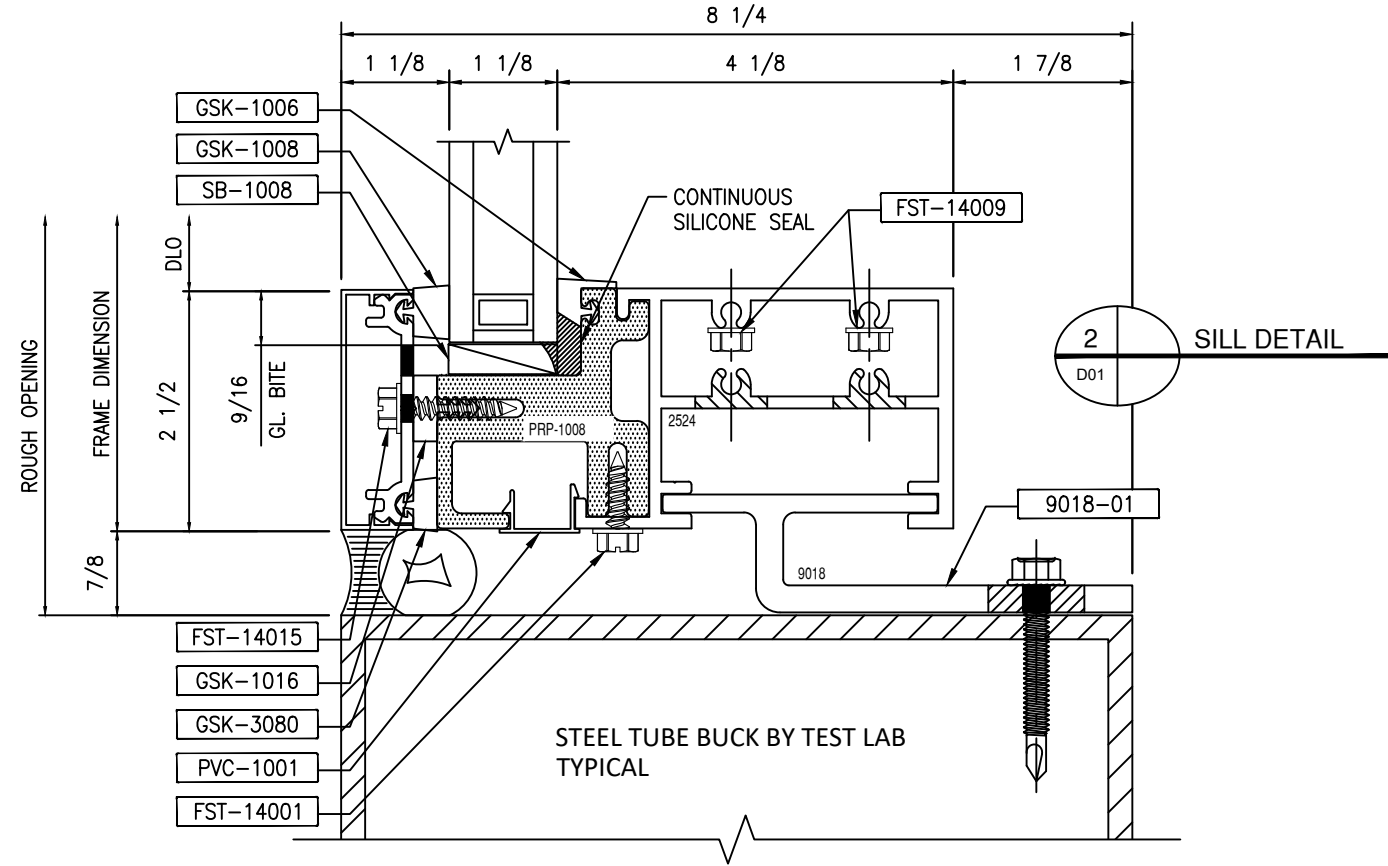
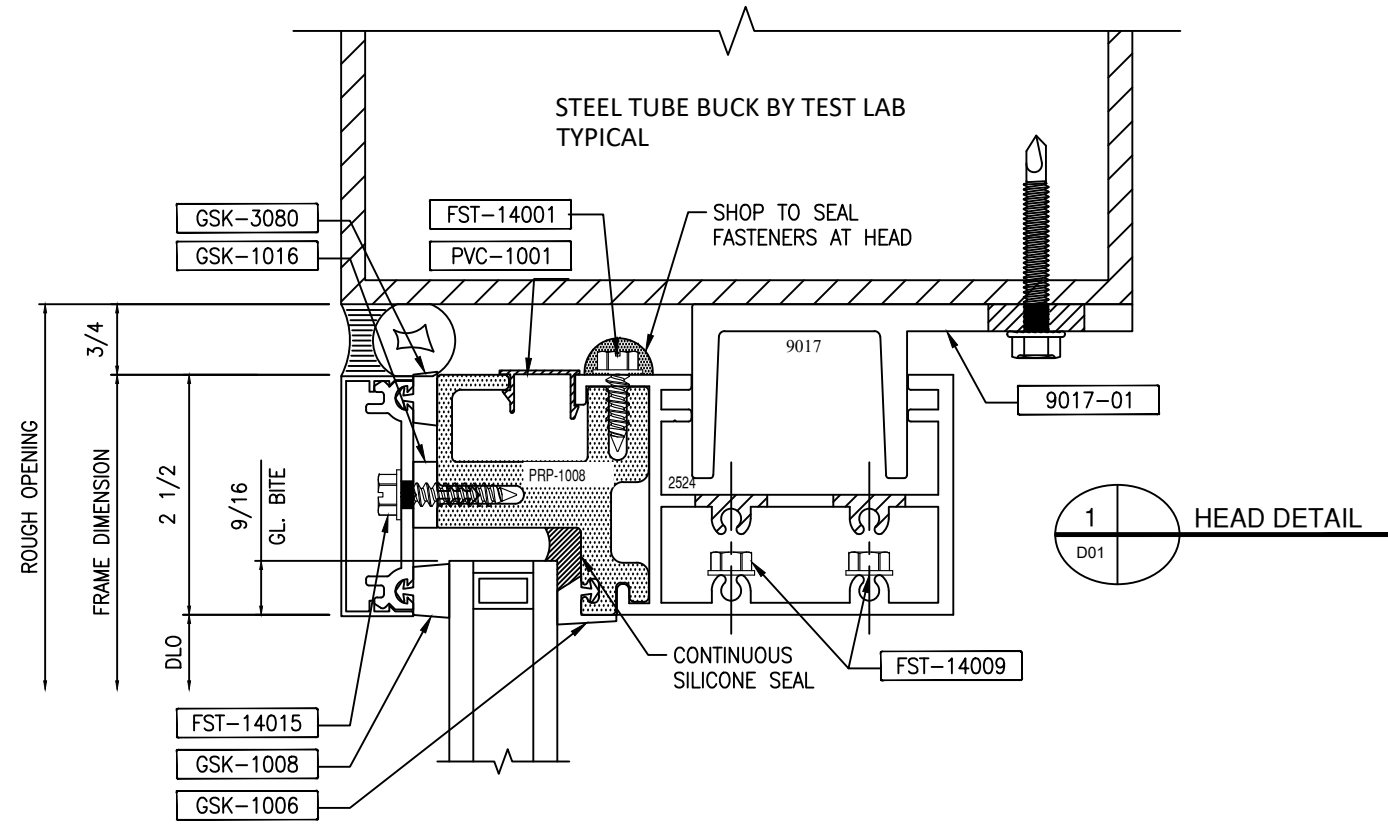


GLASS DESCRIPTION	
MARK	DESCRIPTION
GL-01	1 1/8" OA IG UNIT 1/4" CARDINAL 366 LOW-E CLEAR TEMPERED GLASS W/LOW-E ON #2 SURFACE 1/2" ALUMINUM AIR SPACER W/ARGON GAS 3/8" CLEAR TEMPERED GLASS SUPPLIED BY FERMARQ INNOVATIONS, INC. GLASS AND GLAZING

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:	
LOCATION:		CUSTOMER:	
REPRESENTATIVE:		DATE:	
PHONE: (716) 849-0842		DRAWN SUBMITAL/REVISION DESCRIPTIONS	
Fermarq Innovations, Inc. 8500 Highland Drive WAUSAU, WI 54981		DATE: 12/10/18	
JOB:		SHEET NO. SE01	
CUST. ORDER NO.:		DRAWN BY: Ed Gerl	
SHEET NAME: SHOP ELEVATION PERFORMANCE MOCK-UP		DATE: 12/10/18	
SCALE: 3/8" = 1'-0"		SHEET NO. SE01	

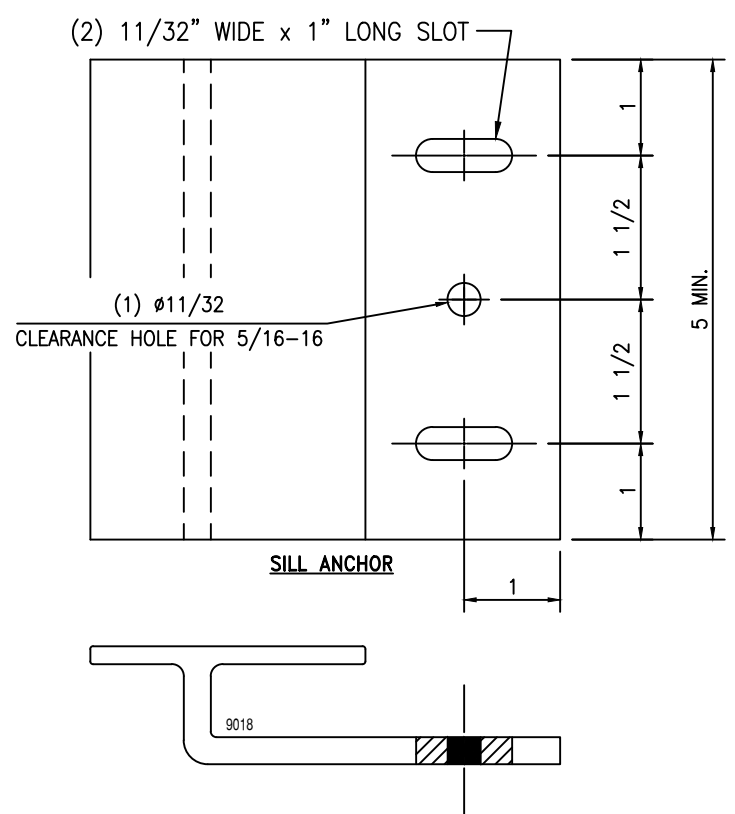
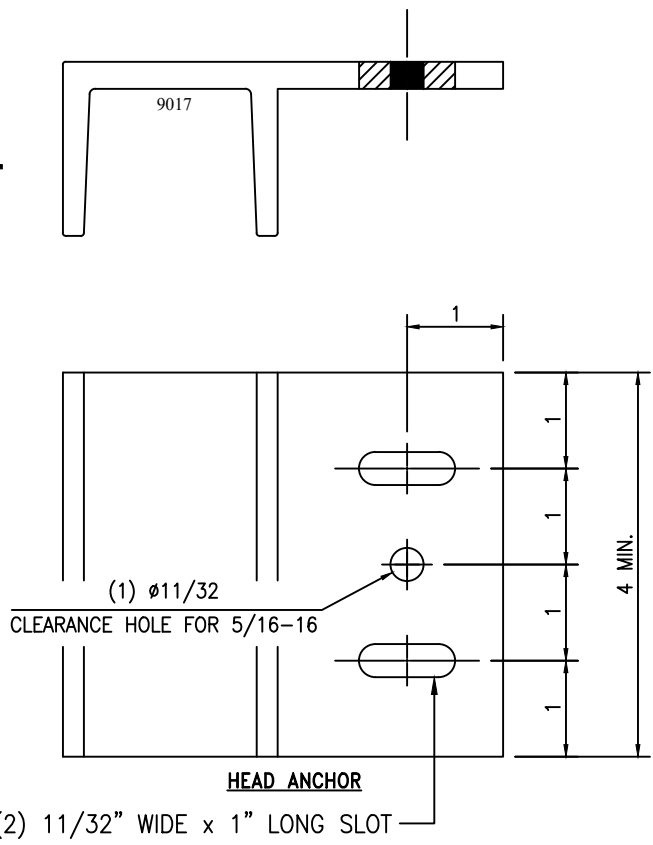


TRIM TAGS KEY

- | | | | | | |
|---------|--|--|----------|---|---|
| 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:	ARCHITECT:	DATE:	REV. NO.:	DRAWN:	SUBMITAL/REVISION:	DESCRIPTIONS:
LOCATION:	CUSTOMER:	REPRESENTATIVE:				
<p>General Notes: 1. Contractor to verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted. 2. Contractor to ensure proper coordination of all dimensions to ensure proper coordination. 3. Drawings marked "approved" or "approved as noted" shall be interpreted as an accurate condition of job requirements and such approval shall authorize release to fabrication. 4. Fielding shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.</p>						
<p>FreMiaq Innovations, Inc. 8500 Highland Drive WAUSAU, WI 54981 PHONE: (715) 849-0842</p>						
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			

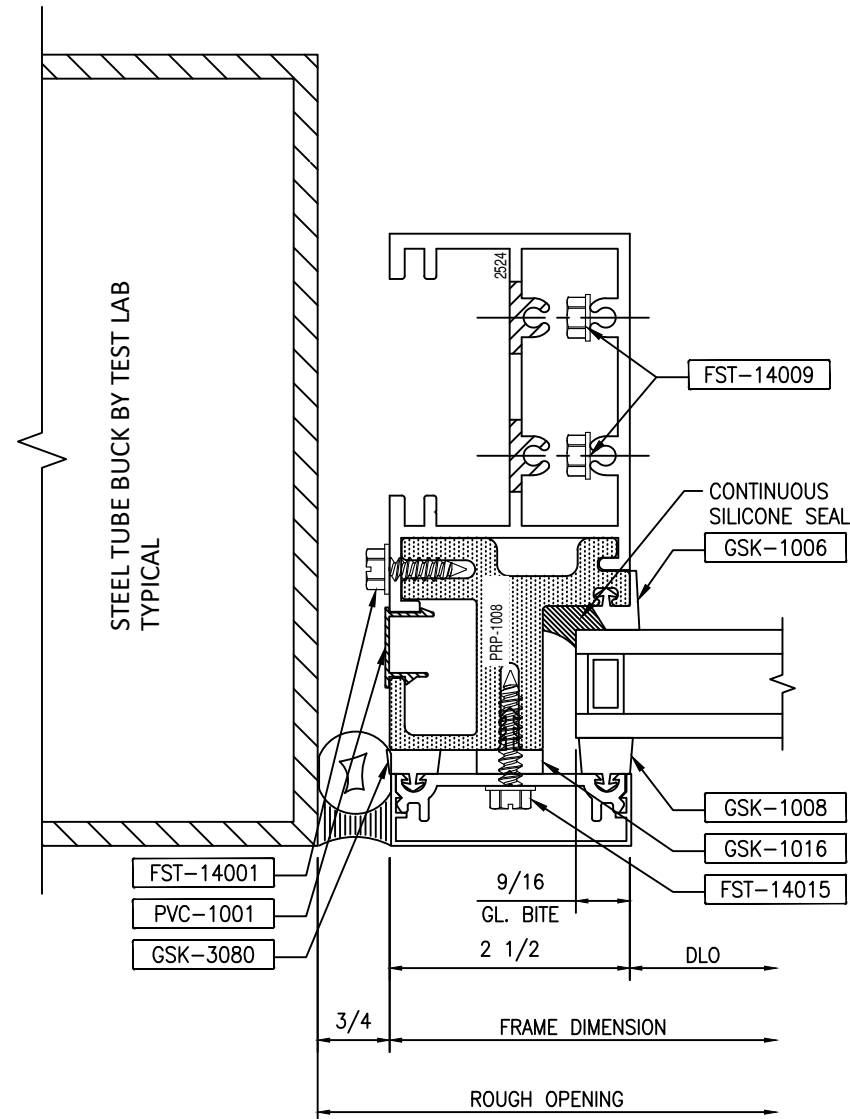


Drawings reviewed for general compliance with tested specimen

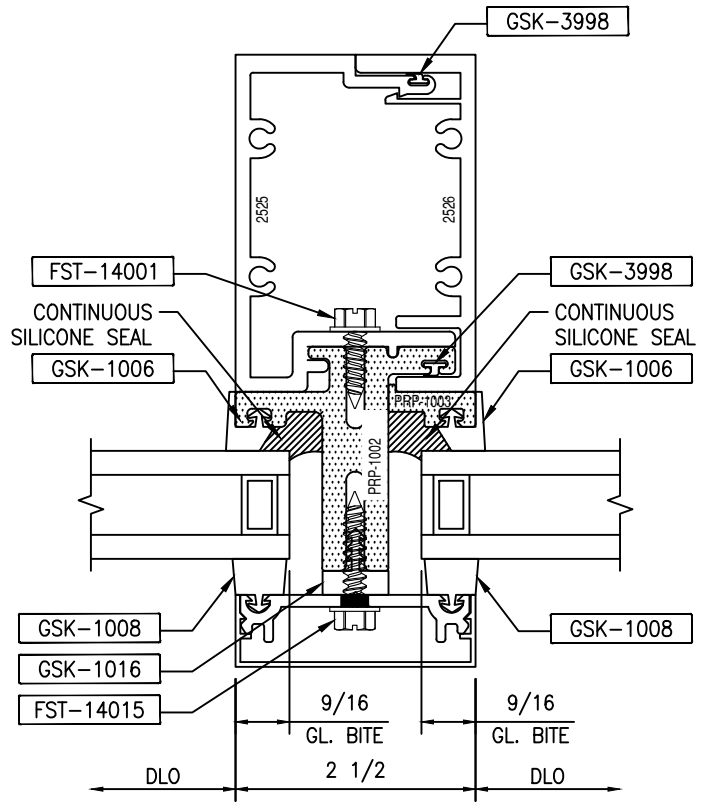
Project #: **QCT19-5236**
 Date: **01/14/2019**
 Reviewer: **Arlen Fisher**

TRIM TAGS KEY

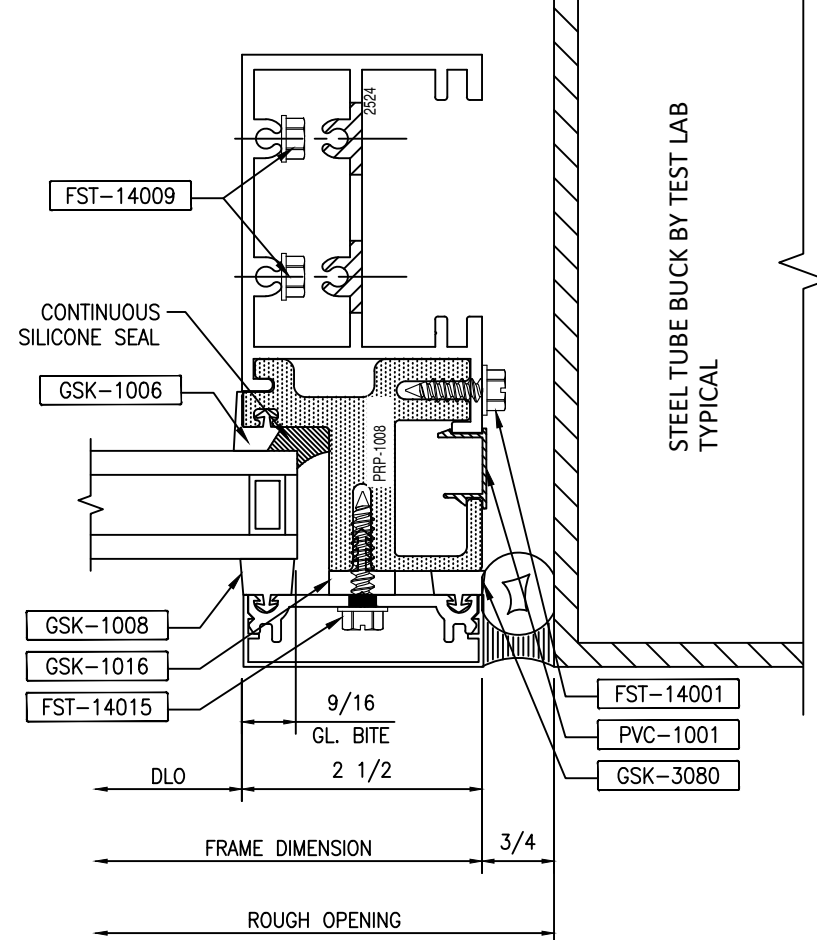
9017-01	HEAD ANCHOR 6063-T6 4" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	UIF	GSK-1006	70 DUROMETER SILICONE GASKET [LN. FT.]
9018-01	SILL ANCHOR 6063-T6 5" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	UIF	GSK-1008	EXTERIOR GLAZING GASKET 60 DUROMETER EPDM GASKET
UIF	PVC-1001	CAULK BACKER	UIF	GSK-3080
			UIF	GSK-1016
			UIF	GSK-3998
			UIF	SB-1008
UIF	FST-14001	#14 x 3/4" HWH SMS AT 16" O.C. MAX	UIF	GSK-1016
UIF	FST-14009	#14 x 2" HWH TEX FRAMING FASTENER	UIF	GSK-3998
UIF	FST-14015	#14 x 1" HWH SMS TYPE A AT 9" O.C. PRESSURE PLATE	UIF	SB-1008
			UIF	GSK-3080
			UIF	GSK-1016
			UIF	GSK-3998
			UIF	SB-1008



3 LEFT JAMB DETAIL
D02



4 VERTICAL MULLION DETAIL
D02



5 RIGHT JAMB DETAIL
D02

<p>PROJECT NAME: LOCATION: ARCHITECT: CUSTOMER: REPRESENTATIVE:</p>	<p>DATE REV. NO. DRAWN SUBMITAL/REVISION DESCRIPTIONS</p>
<p>FreMiaq Innovations, Inc 8300 Highland Drive WAUSAU, WI 54981</p> <p><small>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 ensure proper coordination and/or dimensions to ensure proper coordination. 3. Drawings marked "approved" or "approved as noted" shall be interpreted as an accurate condition of job requirements and such approval shall author release to fabrication. 4. Fielding shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.</small></p>	
<p>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</p>	



Drawings reviewed for general compliance with tested specimen

Project #: **QCT19-5236**

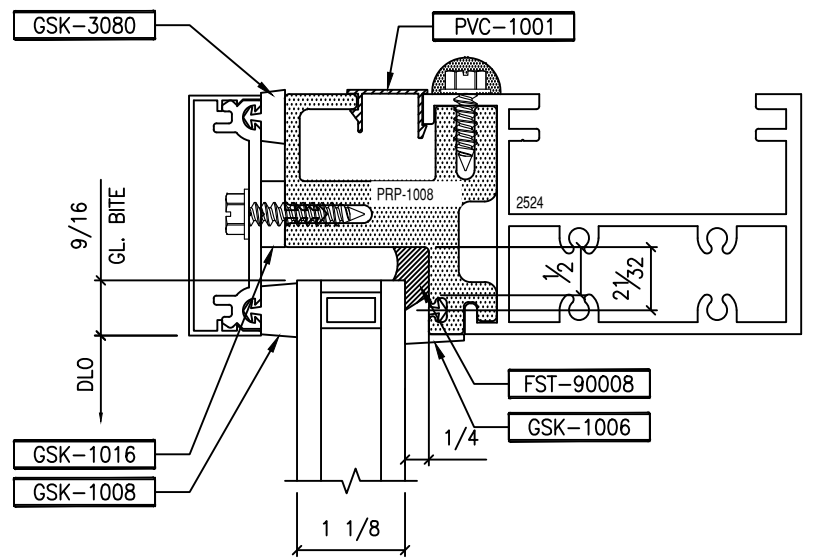
Date: **01/14/2019**

Reviewer: **Arlen Fisher**

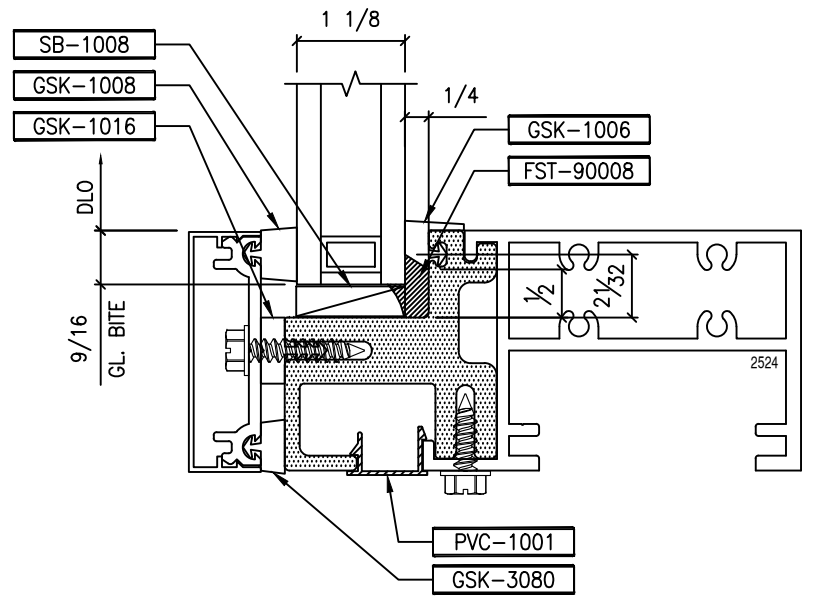
GLAZING TAGS KEY

UIF	SB-1008	5/16" x 1 1/8" x 4" 85 DUROMETER BLACK SILICONE SETTING BLOCK (2) PER LITE	UIF	GSK-1006	SILICONE GASKET (INTERIOR GLAZING) LN. FT. - 70 DUROMETER
UIF	PVC-1001	PVC CAULK BACKER SHOP APPLIED	UIF	GSK-1008	EPDM EXTERIOR GLAZING GASKET 60 DUROMETER
UIF	FST-90008	DOW 983 BLACK SILICONE STRUCTURAL GLAZING	UIF	GSK-1016	STEM ISOLATOR - 70 DUROMETER EPDM
UIF			UIF	GSK-3080	EXTERIOR PERIMETER GLAZING SPACER 60 DUROMETER EPDM

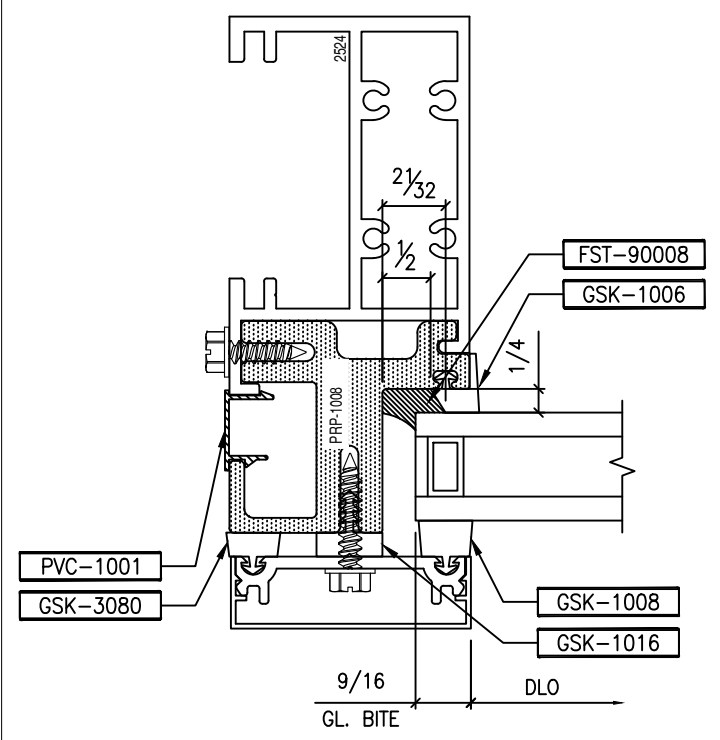
TYPICAL HEAD DETAIL



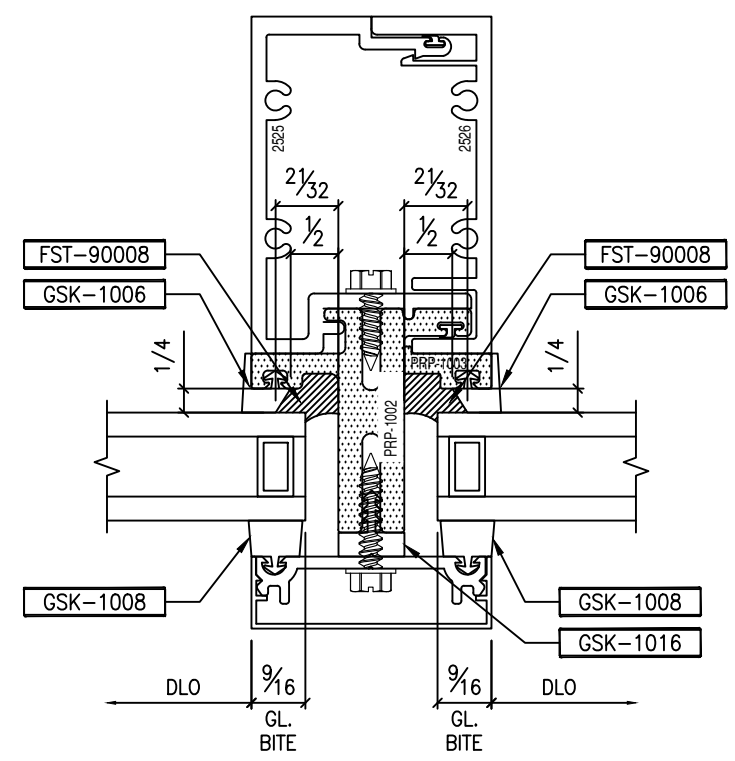
TYPICAL SILL DETAIL



TYPICAL JAMB DETAIL



TYPICAL VERTICAL MULL DETAIL



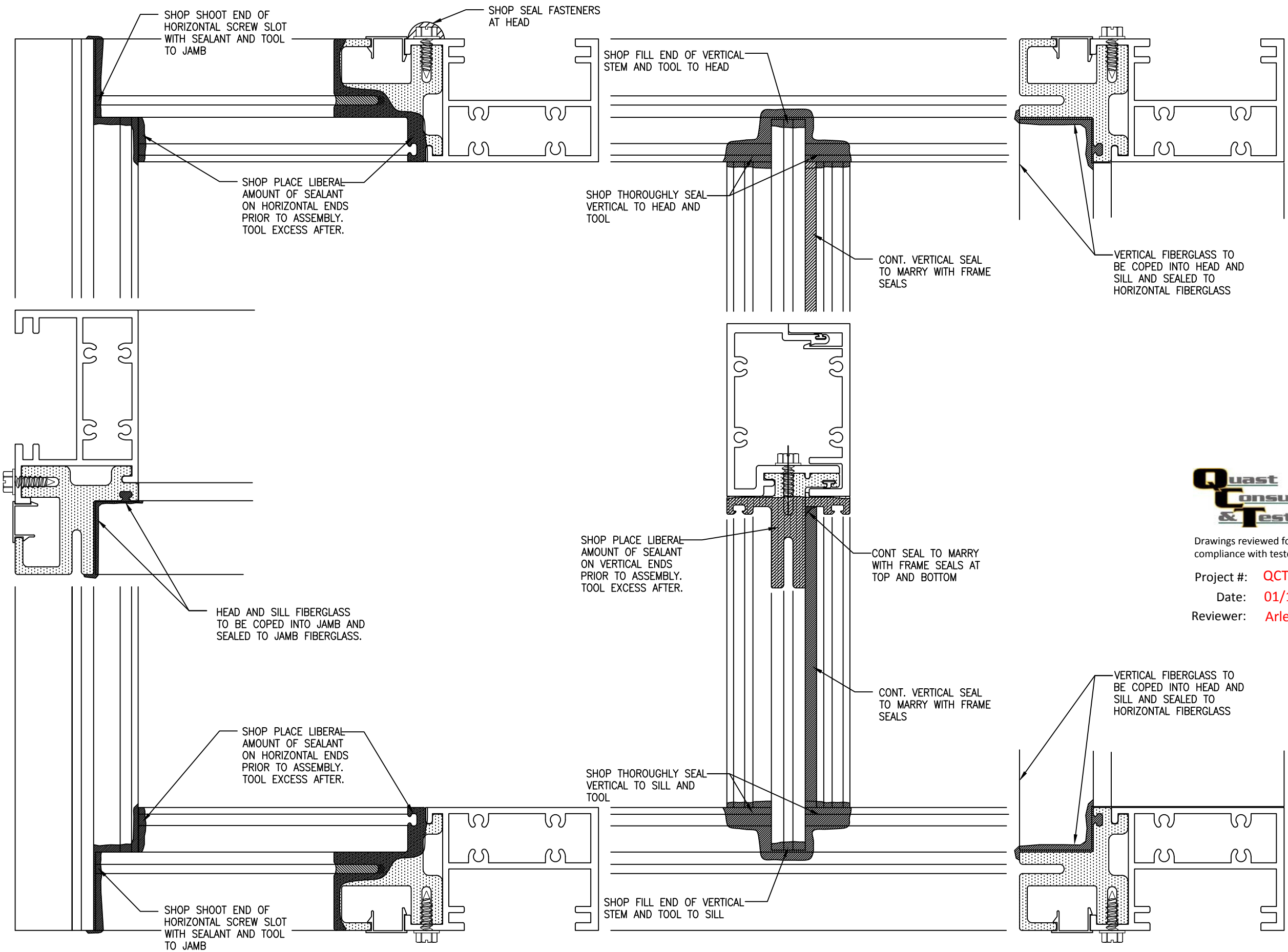
PROJECT NAME:
LOCATION:
ARCHITECT:
CUSTOMER:
REPRESENTATIVE:

FireMing Innovations, Inc
3300 Highland Drive
WAUSAU, WI 54981
PHONE (715) 842-0942

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 to contract documents and if required provide correct details and/or dimensions to ensure proper coordination.
3. Drawings prepared or approved or noted shall be interpreted as an accurate condition of job.
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
GLAZING DETAILS
PERFORMANCE - MOCK-UP
SCALE HALF DATE 1/12/18
DRAWN BY Ed Gerl SHEET NO. **GO1**

DATE
REV. NO.
DRAWN SUBMITTAL/REVISION DESCRIPTIONS



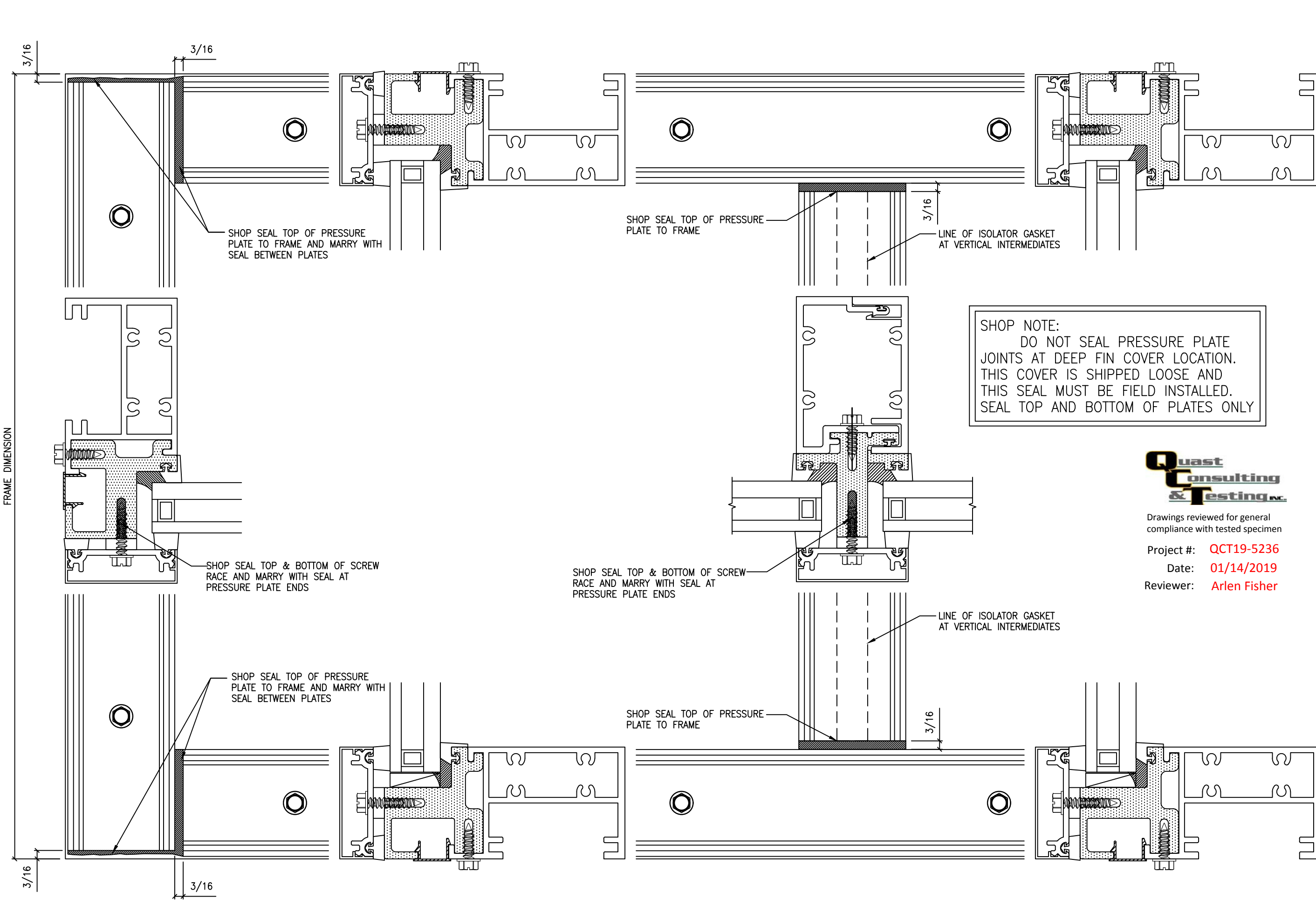
Drawings reviewed for general compliance with tested specimen

Project #: **QCT19-5236**

Date: **01/14/2019**

Reviewer: **Arlen Fisher**

PROJECT NAME:		DRAWN SUBMITAL/REVISION DESCRIPTIONS	
LOCATION:		DATE	
ARCHITECT:		REV. NO.	
CUSTOMER:		DATE	
REPRESENTATIVE:		DATE	
<p>PHONE (718) 842-0042</p> <p>Premier Innovations, Inc</p> <p>8300 Highland Drive</p> <p>WAUSAU, WI 54980</p>			
<p>General Notes: 1. Verify all dimensions in the field. All framing will be manufactured to the dimensions indicated unless otherwise noted.</p> <p>2. Architect to review all conditions for compliance to contract documents and if required provide correct details and/or dimensions to ensure proper coordination.</p> <p>3. All materials and workmanship shall be interpreted as an accurate condition of job requirements and such approved shall occur from the use of these drawings by other trades.</p> <p>4. Fixing shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.</p>			
JOB		CUST. ORDER NO.	
SHEET NAME		DATE	
SEALING DETAILS		12/12/18	
PERFORMANCE - MOCK-UP		SCALE	
SCALE HALF		DATE	
DRAWN BY		SHEET NO.	
Ed Gerl		GO2	



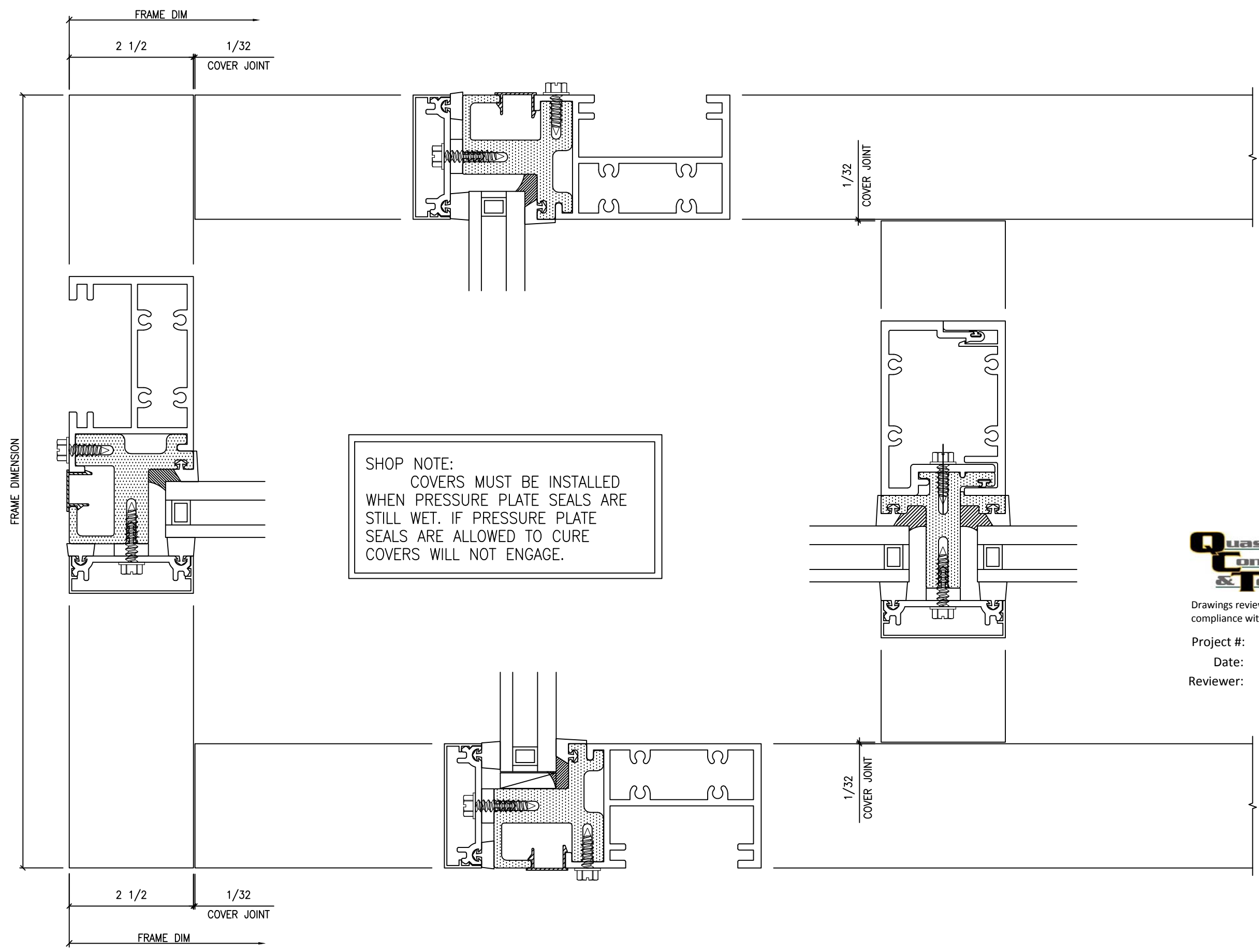
SHOP NOTE:
 DO NOT SEAL PRESSURE PLATE JOINTS AT DEEP FIN COVER LOCATION. THIS COVER IS SHIPPED LOOSE AND THIS SEAL MUST BE FIELD INSTALLED. SEAL TOP AND BOTTOM OF PLATES ONLY



Drawings reviewed for general compliance with tested specimen

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 Reviewer: **Arlen Fisher**

PROJECT NAME:		DRAWN SUBMITAL/REVISION DESCRIPTIONS	
LOCATION:		DATE	
ARCHITECT:		REV. NO.	
CUSTOMER:		DATE	
REPRESENTATIVE:		DATE	
<p>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. 3. Requirements and such approved shall occur from the use of these drawings by other trades. 4. Fixing shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.</p>			
<p>PREMIARY innovations, inc 8300 Highland Drive WAUSAU, WI 54983 PHONE (715) 842-0042</p>			
JOB			
CUST. ORDER NO.			
SHEET NAME			
SEALING DETAILS			
PERFORMANCE - MOCK-UP			
SCALE		DATE	
HALF		12/12/18	
DRAWN BY		SHEET NO.	
Ed Gerl		G03	



SHOP NOTE:
 COVERS MUST BE INSTALLED
 WHEN PRESSURE PLATE SEALS ARE
 STILL WET. IF PRESSURE PLATE
 SEALS ARE ALLOWED TO CURE
 COVERS WILL NOT ENGAGE.



Drawings reviewed for general compliance with tested specimen

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

PROJECT NAME:		DRAWN SUBMITAL/REVISION DESCRIPTIONS	
LOCATION:		DATE	
ARCHITECT:		REV. NO.	
CUSTOMER:		DATE	
REPRESENTATIVE:		REV. NO.	
<p>General Notes:</p> <ol style="list-style-type: none"> 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 to contract documents and if required provide correct details and/or dimensions to ensure proper coordination. 3. Requirements and such approved shall author issues to fabrication. 4. Fabricator shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades. 			
<p>PREMIERq Innovations, Inc 8300 Highland Drive WAUSAU, WI 54981 PHONE (715) 842-6942</p>			
JOB		CUST. ORDER NO.	
SHEET NAME			
SEALING DETAILS			
PERFORMANCE - MOCK-UP			
SCALE		DATE	
HALF		12/12/18	
DRAWN BY		SHEET NO.	
Ed Gerl		GO4	