Air, Water, Structural
Performance Test Report

Rendered To:
FreMarq Innovations, Inc.

Report No.:
QCT19-5237.01

Product/Series:
Zero-Sightline Vent Mockup

Test Date(s):
January 29, 2019 through January 30, 2019

Report Date:
February 12, 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

Quast Consulting & Testing INC.

Report Date: 02/12/2019
Test Date: 01/29/2019
Through: 01/30/2019

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

SERIES/MODEL: Zero-Sightline Vent Mockup
PRODUCT TYPE: Awning Window

Summary of Results	
Test Procedure/Standard	**Details**
Operating Force (ASTM E2068-00)*	See Results, PASS
Air Infiltration Resistance (ASTM E283-04)*	0.03 L/s/m² (0.006 cfm/ft²) @ 300 Pa (6.27 psf), PASS
Air Exfiltration Resistance (ASTM E283-04)*	0.03 L/s/m² (0.006 cfm/ft²) @ 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

*Specimen was not deconstructed in order to confirm sustantial compliance with as-built drawings

Reference must be made to Report No. QCT19-5237.01, dated 02/12/2019 for complete specimen description and data.

Project Summary:

Quast Consulting and Testing, Inc. was contracted by FreMarq Innovations, Inc. to perform testing on a Zero-Sightline Vent Mockup. The specimen was supplied by FreMarq Innovations, Inc. and 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. Test specimen description and results are reported herein.

Test Procedure:

Testing was conducted in accordance with:

ASTM E283-04 (2012)*	*Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*
ASTM E330M-14*	*Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*
ASTM E331-00 (2009)*	*Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*
ASTM E547-00 (2009)*	*Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference*
ASTM E2068-00 (2008)*	*Test Method for Determination of Operating Force of Sliding Windows and Doors*

*Specimen was not deconstructed in order to confirm sustantial compliance with as-built drawings

Test Specimen Description:

Series/Model:	Zero-Sightline Vent Mockup
Product Type:	Awning Window
Overall Size:	1661 mm (65.38 in) wide x 1051 mm (41.38 in) high
Overall Area:	1.74 m² (18.78 ft²)
Curtainwall Frame:	1661 mm (65.38 in) wide x 1051 mm (41.38 in) high
Awning Frame:	1524 mm (60.00 in) wide x 914 mm (36.00 in) high
Awning Sash:	1499 mm (59.00 in) wide x 889 mm (35.00 in) high

Curtainwall Frame Construction:

The curtainwall frame members were composed of extruded aluminum and fiberglass attached using #14 x 3/4" HWH SMS spaced 16" on center. The fastener heads were sealed with silicone. The aluminum was attached using square cut corner joinery and #14 x 2" HWH TEX framing fasteners. A PVC caulk backer was snapped on at the outside perimeter.

Awning Frame Construction:

The awning frame members were composed of extruded aluminum and fiberglass snap-fit together. The aluminum was attached using mitered corner joinery and aluminum corner keys. The fiberglass was attached using square-cut corner joinery and one #8 x 1-1/2" PH PAN HD SMS per corner. The fasteners and inside corners were sealed with silicone. An aluminum cap was snapped on at the exterior of the frame. The awning frame was set into the curtainwall frame from the exterior against 60 Durometer EPDM gasket and secured using a pressure plate with 60 Durometer EPDM gasket and #14 x 1" HWH SMS Type A fasteners spaced 9" on center. The interior of the jambs were attached to the curtainwall using #10 x 1-3/4" PH PAN HD SMS spaced 18" on center.

Awning Sash Construction:

The awning frame was composed of extruded aluminum and fiberglass snap-fit together. The aluminum and fiberglass were attached using mitered corner joinery and aluminum corner keys. An aluminum weatherstrip receiver was snapped on at the exterior of the frame.

Glazing:

The specimen was glazed with a 1-1/8" insulated glass unit comprising 1/4" clear tempered, 5/8" aluminum spacer, 1/4" clear tempered. The glass was structurally glazed with a continuous Dow 983 silicone joint. The glass was set on 5/16" x 1-1/8" x 4" 85-durometer silicone setting blocks with a 7/8" glass bite.

Reinforcement: None

Weatherstripping:

Type	Quantity	Location
70-Durometer EPDM Bulb Gasket	Perim	Interior sash perimeter
70-Durometer EPDM Bulb Gasket	Perim	Mid-depth frame perimeter
70-Durometer EPDM Sweep Gasket	Perim	Exterior sash perimeter

Hardware:

Type	Quantity	Location
Gea Handle	1	Sash, center of bottom rail
Melron Locking Lug	6	Sash bottom rail, 16" from jambs. Sash stiles, 6-1/2" and 19" from sill
Melron Anti-Therft Keeper	2	Sill, 16" from jambs
Melron Keeper	4	Sash stiles, 6-1/2" and 19" from sill
Melron Corner Drive	2	Bottom sash corner
24" 4-Bar Hinge	2	Top of sash stiles
Snubbers	2	Top rail/frame head, 19" from jambs

Drainage: None

Installation:

The specimen was installed into a 2" x 8" x 1/4" HSS with a 7/8" perimeter joint. The specimen was anchored using 5" wide 6063 T6 aluminum installation anchors captured by the frame and attached to the buck using 1/4-20 self drilling hex head screws. The anchors were located at head and sill, 5" from curtainwall frame ends.

Test Results:

NAFS §	Title of Test	Results	Allowed
9.3.1	**Operational Force Test Per ASTM E2068-00 (2008)**		
	Awning	**PASS**	
	Breakaway Force	81 N (18.2 lbf)	Reported
	Open Operating Force	46 N (10.3 lbf)	Reported
	Closing Operating Force	61 N (13.7 lbf)	Reported
	Handle	**PASS**	
	Open Operating Force	37 N (8.3 lbf)	Reported
	Closing Operating Force	72 N (16.1 lbf)	Reported
9.3.2.1	**Air Infiltration/Exfiltration per ASTM E283-04 (2012)**		
	Infiltration	**PASS**	
	300 Pa	0.03 $L/s/m^2$	0.51 $L/s/m^2$
	(6.27 psf)	0.006 cfm/ft^2	0.100 cfm/ft^2
	Exfiltration	**PASS**	
	75 Pa	0.03 $L/s/m^2$	0.51 $L/s/m^2$
	(1.57 psf)	0.006 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 Temperature: 58.1 °F (14.5 °C)		
	Specimen #1	**PASS**	
	720 Pa (15.03 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

9.3.4.2 Uniform Load Deflection per ASTM E330M-14

Temperature: 58 °F (14.4 °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)	
Sash Rail, Between Locks	**PASS**	
Span (L):	711 mm (28 in)	L/175
Positive Deflection:	1.0 mm (0.04 in)	4.1 mm (0.16 in)
Negative Deflection:	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. for general compliance with the test specimen reported herein.

List of Official Observers:

Name:	Company:
Brian Sasman	Quast Consulting and Testing, Inc.
Kelly Marlow	Quast Consulting and Testing, Inc.
Jeff Beyer	FreMarq Innovations, Inc.
Ben Knospe	FreMarq Innovations, Inc.

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.

Arlen Fisher
Project Manager

QUAST CONSULTING & TESTING, INC.

Brian M. Sasman, PE
Reviewer

Attachments: This report is complete only when all attachments listed are included.
Appendix A: As-Built Drawings (4 Pages)

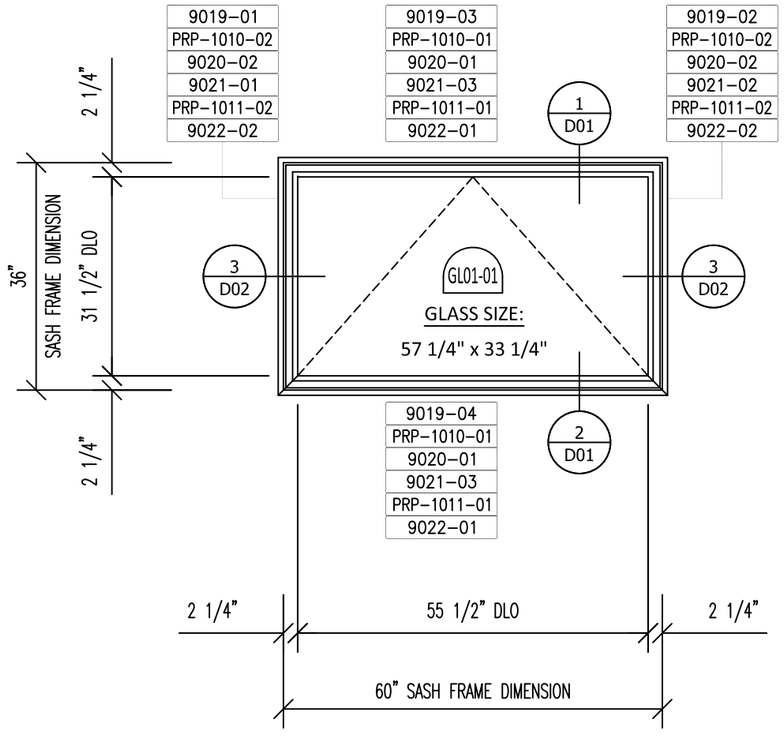
PERFORMANCE REQUIREMENT

WATER: 15#
AIR: 6.24
STRUCTURAL: 50 PSF

VT-1 — 1 REQUIRED

PERFORMANCE MOCK-UP

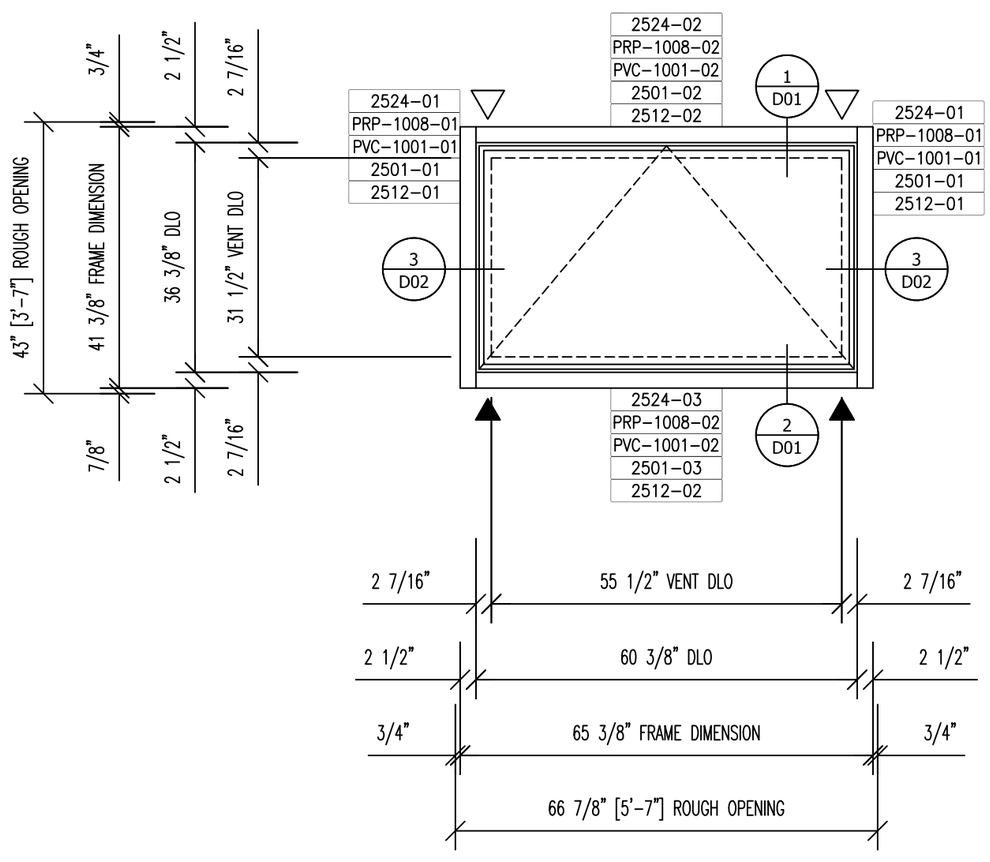
FINISH: ANY FINISH



1 — 1 REQUIRED

PERFORMANCE MOCK-UP

FINISH: ANY FINISH



GLASS DESCRIPTION	
MARK	DESCRIPTION
GL01-01	1 1/8" OA IG UNIT 1/4" CLEAR TEMPERED GLASS 5/8" ALUMINUM AIR SPACER 1/4" CLEAR TEMPERED GLASS GLASS AND GLAZING SUPPLIED BY FERMARQ INNOVATIONS, INC.

Quast Consulting & Testing INC.

Drawings reviewed for general compliance with tested specimen

Project #: QCT19-5237
Date: 02/12/2019
Reviewer: Arlen Fisher

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.

REV. NO.	DATE	DRAWN	SUBMITTAL/REVISION DESCRIPTIONS

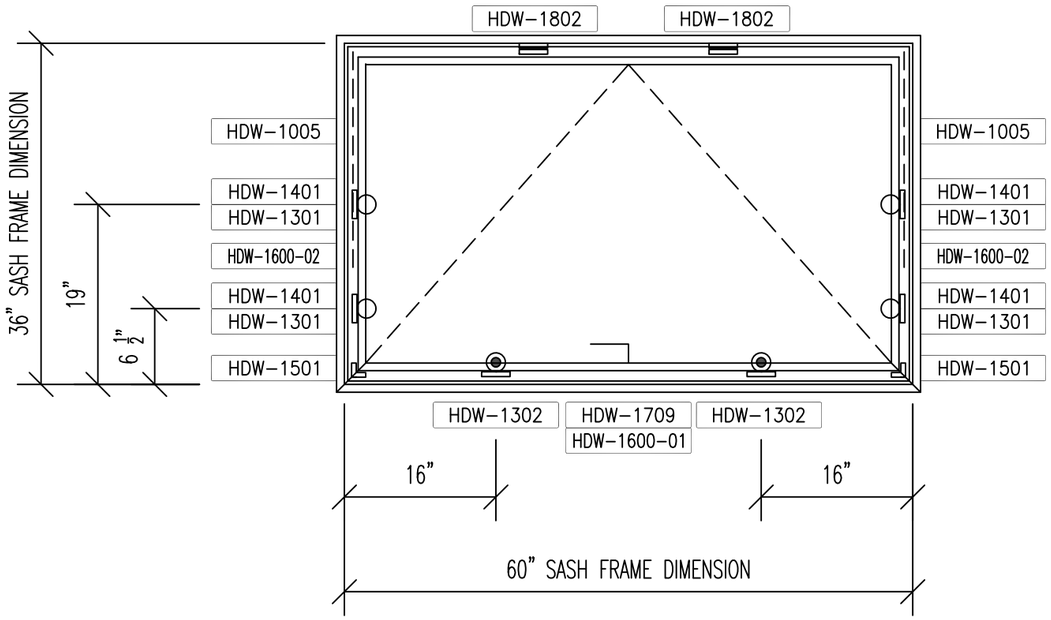
PROJECT NAME:
LOCATION:
ARCHITECT:
CUSTOMER:
REPRESENTATIVE:

FerMarq Innovations, Inc
3500 Highland Drive
Muskegon, MI 49441
PHONE (716) 649-4949

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 noted "approved as noted" or "approved as noted" shall be interpreted as an accurate condition of job requirements and such approval shall advise these to fabrication.
4. FrameQ shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.

JOB VENT MOCK-UP
CUST. ORDER NO.
SHEET NAME
SHOP ELEVATION
PERFORMANCE MOCK-UP
SCALE 1/2" = 1'-0"
DATE 12/13/18
DRAWN BY Ed Gerl
SHEET NO. SE01

VT-1 1 REQUIRED



HARDWARE LEGEND	
	DESCRIPTION
	HDW–1709: RH– GEA HANDLE – 0570–58
	HDW–1802: SNUBBER SET – 1622
	HDW–1401: MELRON LOCKING POINTS – 1585
	HDW–1301: MELRON KEEPERS – 1597i
	HDW–1302: MELRON ANTI–THEFT KEEPER – 1636
	HDW–1005: 24" 4–BARS HINGES
	HDW–1501: MELRON CORNER TRANSMISSION DRIVE

Quast Consulting & Testing INC.

Drawings reviewed for general compliance with tested specimen

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REV. NO.	DATE	DRAWN	SUBMITTAL/REVISION DESCRIPTIONS

PROJECT NAME:
LOCATION:
ARCHITECT:
CUSTOMER:
REPRESENTATIVE:

FreMarq Innovations, Inc
2900 Highland Drive
Wausau, WI 54401
PHONE (715) 842-8942

General Notes:
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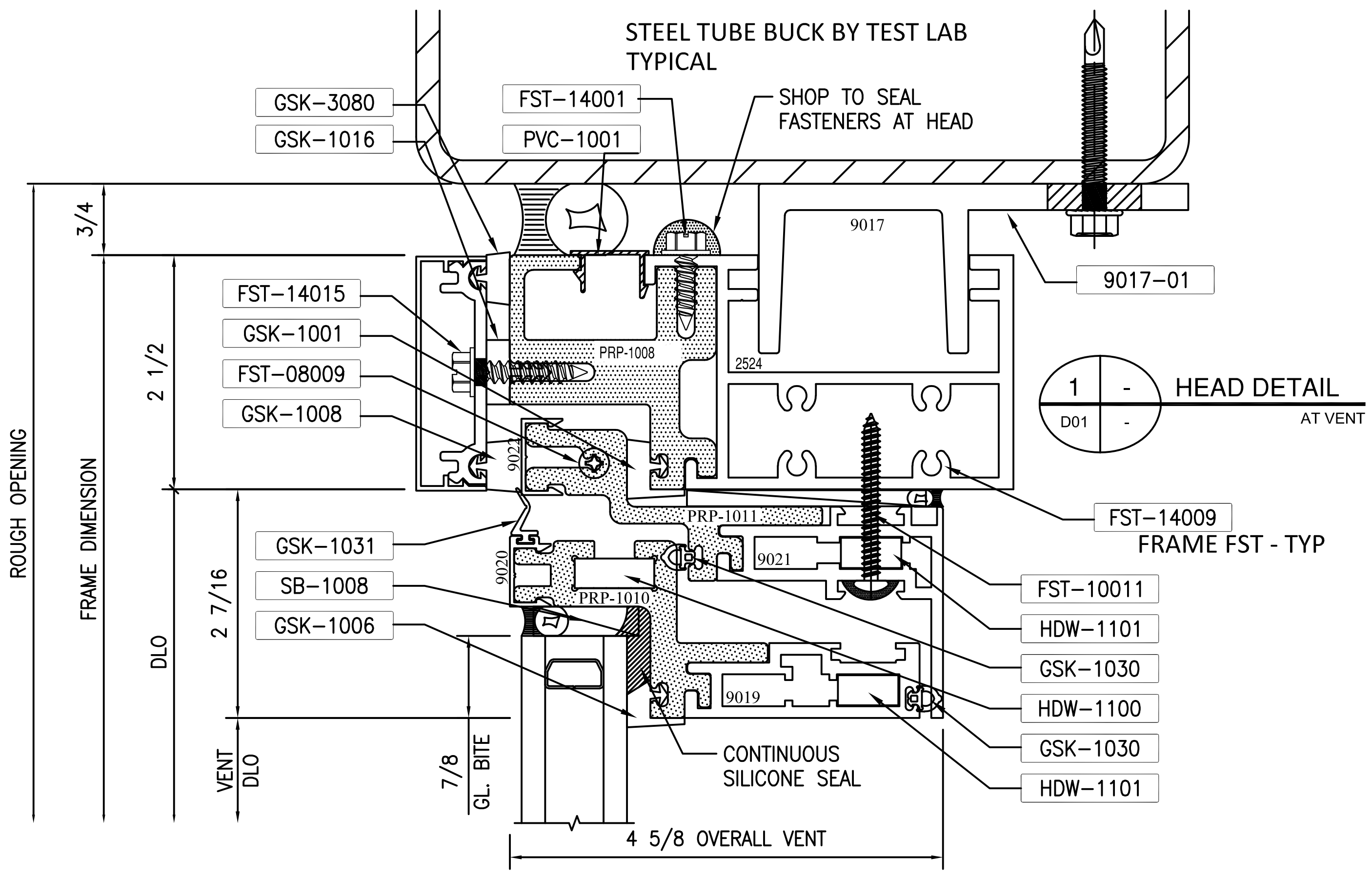
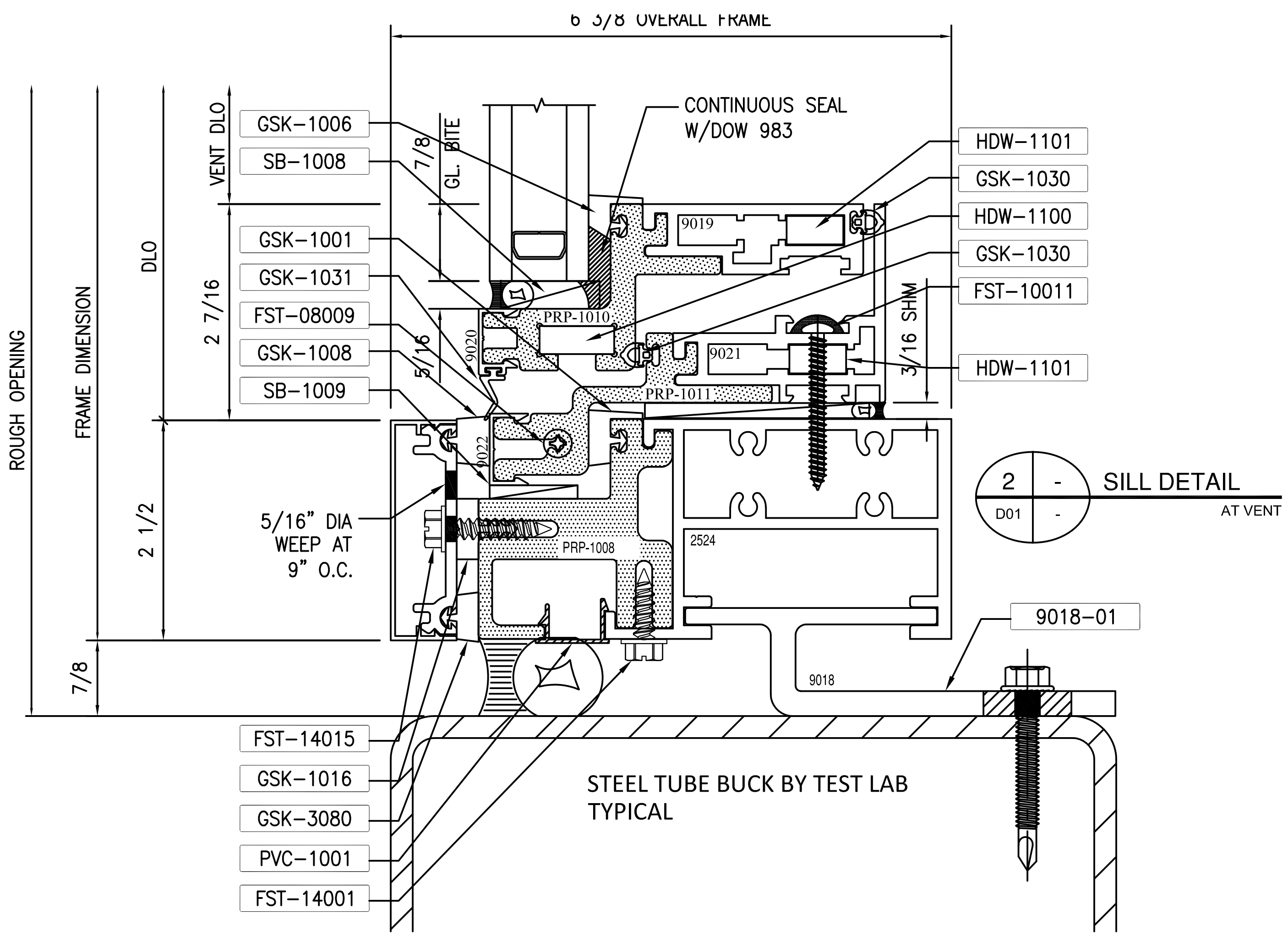
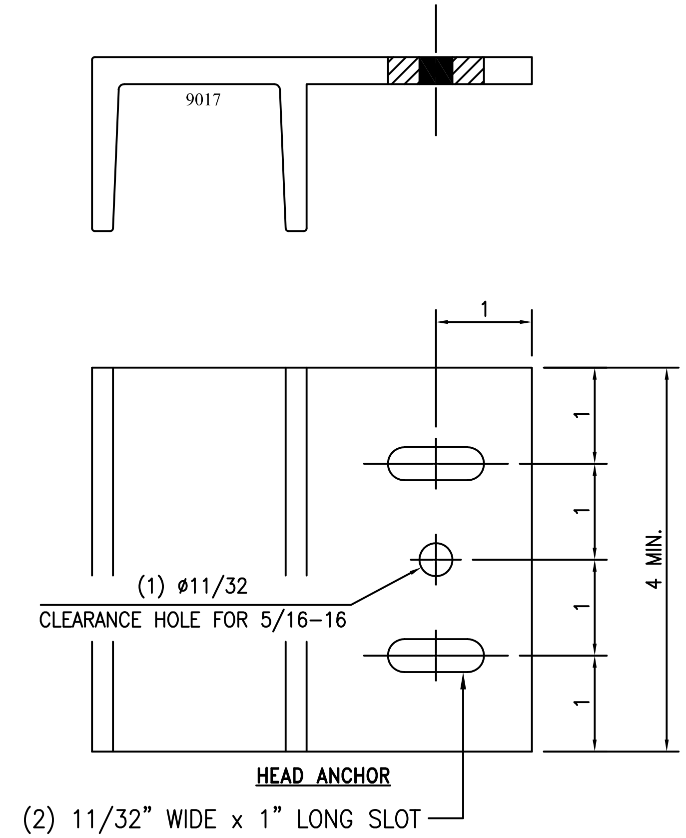
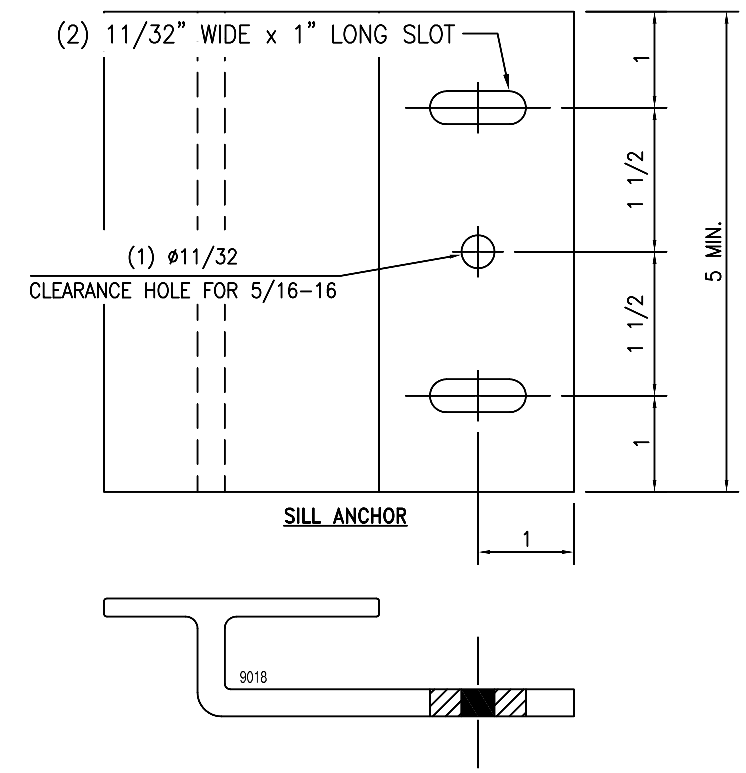
3. Drawings marked "reviewed for general compliance" shall be interpreted as an accurate condition of job requirements and such approval shall either release to fabrication.
4. FreMarq shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.

JOB VENT MOCK–UP
CUST. ORDER NO.
SHEET NAME
HARDWARE ELEVATION
PERFORMANCE MOCK–UP
SCALE 1/2" = 1'–0"
DATE 01/08/19
DRAWN BY Ed Gerl
SHEET NO. HDW–01









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TRIM TAGS KEY

9017-01	HEAD ANCHOR 6063-T6 4" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	
9018-01	SILL ANCHOR 6063-T6 5" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS	
UIF FST-08009	#8 x 1 1/2" PH PAN HD SMS 4 PER VENT (1 AT EACH CORNER)	
UIF FST-10011	#10 x 1 3/4" PH PAN HD SMS AT JAMBS ONLY @ 18" O.C. MAX	
UIF FST-14001	#14 x 3/4" HWH SMS AT 16" O.C. MAX	
UIF FST-14009	#14 x 2" HWH TEX FRAMING FASTENER	
UIF FST-14015	#14 x 1" HWH SMS TYPE A AT 9" O.C. PRESSURE PLATE	
UIF GSK-1001	INTERIOR GLAZING SPACER 60 DUROMETER EPDM [LN. FT.]	
UIF GSK-1006	70 DUROMETER SILICONE GASKET [LN. FT.]	
UIF GSK-1008	EXTERIOR GLAZING GASKET 60 DUROMETER EPDM GASKET	
UIF GSK-1016	STEM ISOLATOR 70 DUROMETER EPDM GASKET	
UIF GSK-1030	WEATHER STRIP 70 DUROMETER EPDM	
UIF GSK-1031	PERIMETER SWEEP GASKET 70 DUROMETER EPDM	
UIF GSK-3080	EXTERIOR GLAZING SPACER 60 DUROMETER EPDM GASKET	
UIF SB-1008	5/16" x 1 1/8" x 4" 85 DUROMETER BLACK SILICONE SETTING BLOCK (2) PER LITE	
UIF SB-1009	1/8" x 1" x 4" BLACK SILICONE SETTING BLOCK (2) PER LITE	
UIF PVC-1001	CAULK BACKER	
UIF HDW-1101	FRAME CORNER KEY AND SASH CORNER KEY 1	
UIF HDW-1100	SASH CORNER KEY 2	

REV. NO.	DATE	DRAWN	SUBMITTAL/REVISION DESCRIPTIONS

PROJECT NAME: LOCATION:
ARCHITECT:
CUSTOMER:
REPRESENTATIVE:

FreMarq Innovations, Inc
8300 Highland Drive
WAUSAU, WI 54401
PHONE (715) 842-6842

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JOB
CUST. ORDER NO.
SHEET NAME
PERFORMANCE MOCK-UP DETAILS
SCALE HALF
DATE 12/13/18
DRAWN BY Ed Gerl
SHEET NO. D01

1/11/2019 12:06:48 PM, EGerl

TRIM TAGS KEY

9017–01	HEAD ANCHOR 6063-T6 4" WIDE LOCATION: 1 CLIP PER VERTICAL 1 CLIP AT JAMBS
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UIF FST–14009	#14 x 2" HWH TEX FRAMING FASTENER
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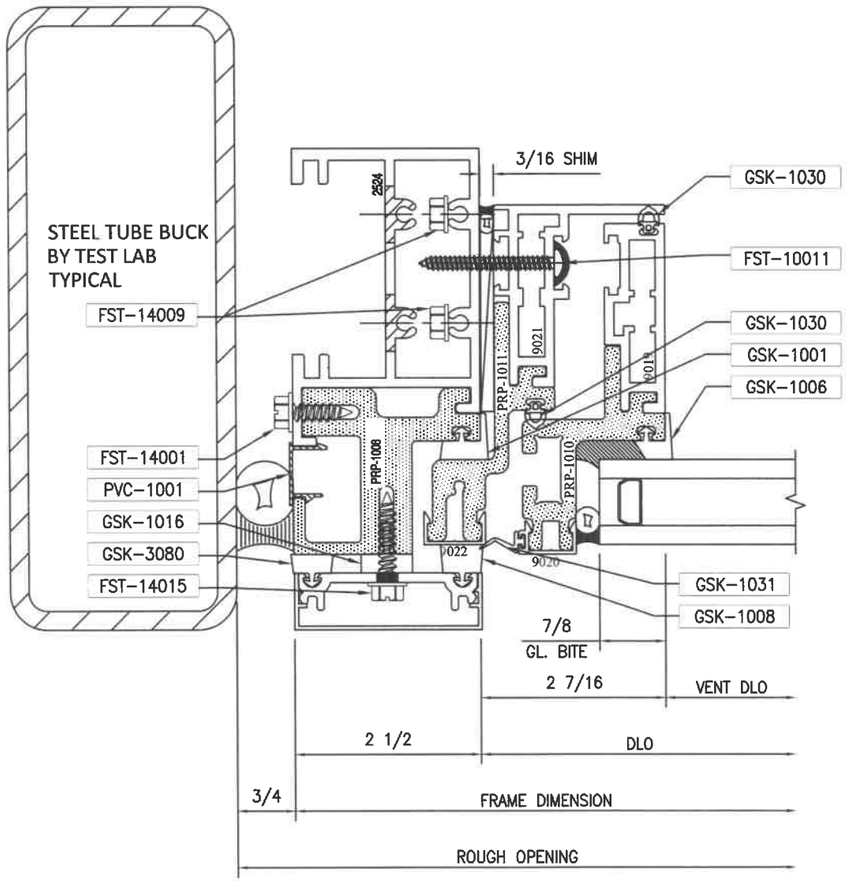
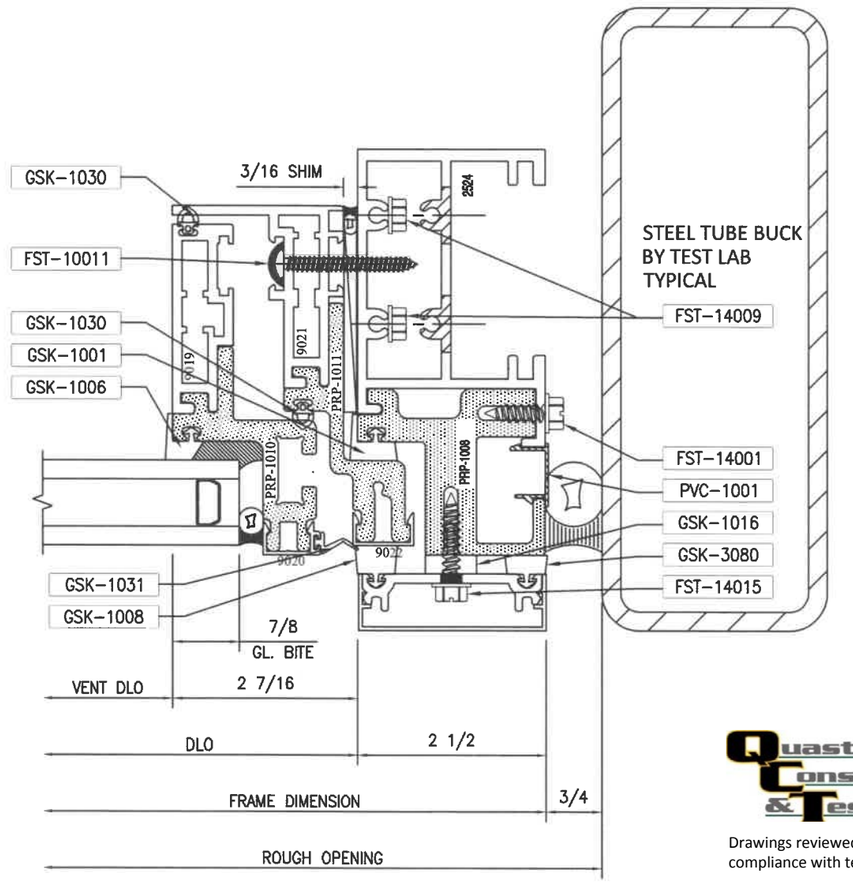
UIF GSK–1001	INTERIOR GLAZING SPACER 60 DUROMETER EPDM [LN. FT.]
UIF GSK–1006	70 DUROMETER SILICONE GASKET [LN. FT.]
UIF GSK–1008	EXTERIOR GLAZING GASKET 60 DUROMETER EPDM GASKET
UIF GSK–1016	STEM ISOLATOR 70 DUROMETER EPDM GASKET
UIF GSK–1030	WEATHER STRIP 70 DUROMETER EPDM
UIF GSK–1031	PERIMETER SWEEP GASKET 70 DUROMETER EPDM
UIF GSK–3080	EXTERIOR GLAZING SPACER 60 DUROMETER EPDM GASKET
UIF SB–1008	5/16" x 1 1/8" x 4" 85 DUROMETER BLACK SILICONE SETTING BLOCK (2) PER LITE
UIF SB–1009	1/8" x 1" x 4" BLACK SILICONE SETTING BLOCK (2) PER LITE
UIF PVC–1001	CAULK BACKER
UIF HDW–1101	FRAME CORNER KEY AND SASH CORNER KEY 1
UIF HDW–1100	SASH CORNER KEY 2



3 - D02 - LEFT JAMB DETAIL AT VENT



4 - D02 - RIGHT JAMB DETAIL AT VENT

Quast Consulting & Testing INC.

Drawings reviewed for general compliance with tested specimen

Project #: QCT19-5237
Date: 02/12/2019
Reviewer: Arlen Fisher

REV. NO.	DATE	DRAWN	SUBMITTAL/REVISION DESCRIPTIONS

PROJECT NAME:
LOCATION:
ARCHITECT:
CUSTOMER:
REPRESENTATIVE:

FreMarq Innovations, Inc
8500 Highland Drive
Wauseon, OH 43567
PHONE (419) 848-0848

General Notes:
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3. These shop drawings as approved by "Approved as noted" shall be interpreted as an accurate condition of job requirements and such approval shall authorize release to fabrication.
4. Fremarq shall not be responsible for any errors and/or work that occurs from the use of these drawings by other trades.

JOB: MOCK–UP
CUST. ORDER NO.
SHEET NAME: PERFORMANCE MOCK–UP DETAILS
SCALE: HALF
DATE: 12/19/18
DRAWN BY: Ed Gerl
SHEET NO.: D02