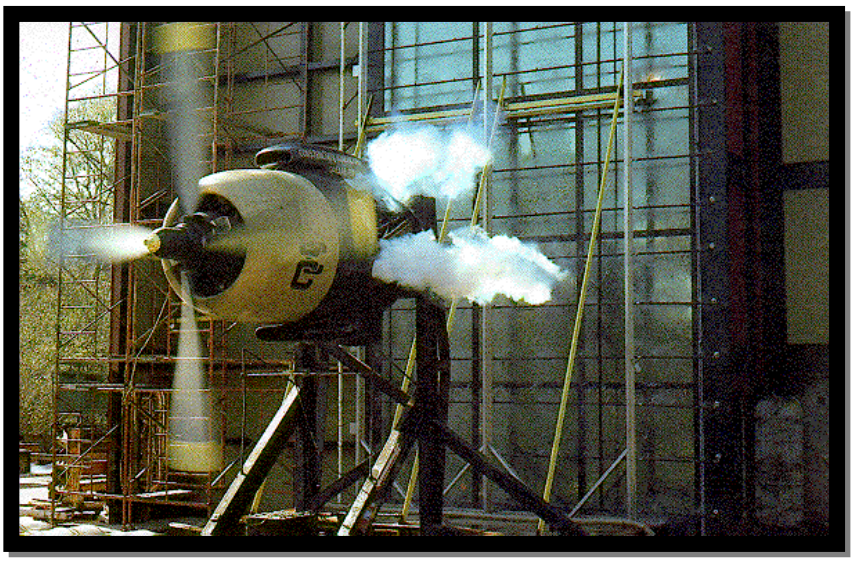
CONSTRUCTION CONSULTING LABORATORY



AAMA 501-15 and ASTM E 1996 Impact Resistance Performance Test Report

Product/Type: Hurricane Impact Resistant Aluminum Storefront
Series Model: Atlas Series HD500-T Thermal

Report: CCL 21-098R*
Revised November 11, 2021 (anchor bolt revision)

Test Completion: August 12, 2021

Prepared for

ATLAS ARCHITECTURAL METALS, INC.

Atlas Architectural Metals
11940 Brittmoore Park Drive
Houston, TX 77041
Phone: 713-869-9551

S- UNITED, INC.
A Quality Control Company

Atlas Glass and Metal Series HD500-T Storefront window system is a stick-built exterior glazed window wall system designed by Atlas Glass and Metal and installed by an Atlas Glass Sub-contractor at Construction Consulting Laboratory (CCL) in Carrollton, Texas. The mock-up was constructed with an overall width and height of 14'- 4" wide by 9'-11 ½" tall. The specimen was tested in accordance with the listed methods and achieved the results noted in the table below.

- AAMA 501-15 "Methods of Test for Exterior Walls"
- ASTM E 1996-17 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
- ASTM E 1886-19 "Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"

Atlas Series HD500-T Storefront			
Test	**Test Type**	**Pressure / Load / Dimension**	**Results**
1	ASTM E 330: Pre-load / Uniform Load	30 Psf 50% Pos / Neg Design	No Damage
2	ASTM E 283: Air Infiltration / Static Pressure	6.24 Psf – Pos	< 0.06Cfm / Ft²
3	ASTM E 283: Air Exfiltration / Static Pressure	6.24 Psf – Neg	< 0.06Cfm / Ft²
4	ASTM E 331: Static Water Resistance	12 Psf	No Leak Noted
5	AAMA 501.1: Dynamic Water Resistance	68Mph (equivalent to 12 Psf)	No Leak Noted
5	ASTM E 330: Uniform Load Deflection	Pos/Neg 60 Psf (30-Second Load)	No Damage
6	Repeat Air Infiltration Static Pressure	6.24 Psf – Pos	< 0.06Cfm / Ft²
7	Repeat Air Exfiltration Static Pressure	6.24 Psf – Neg	< 0.06Cfm / Ft²
8	Repeat Water Resistance / Static Pressure	12 Psf	No Leak Noted
9	Structural Uniform Proof Load	Pos/Neg 90 Psf (30-Second Load)	No Damage
10	ASTM E 1996 Missile Impact Testing	Type D Missile / seven (7) Impacts	No Penetration
11	ASTM E 1886 Uniform Load Cyclic Test	+/-60 Psf (+ 4500 / - 4500 Cycles) [1]	No Penetration
Note 1: ASTM E 1886 testing performed at a higher test load noted for the AAMA 501-15 testing.			
The test specimen passed all tests listed above with no glass breakage or permanent deformation to the vertical or horizontal framing members.			

TABLE OF CONTENTS

APPENDIXES

This report is not complete unless these drawings are stamped by **CCL** as illustrated below:

Sheet	Detail	Date	Stamped as Illustrated
1	Elevation / Plan / Section	Not Dated	Construction Consulting Laboratory1601 Luna Road Carrollton, Texas 75006 (972) 242-0556
2	Installation detail		
3	Parts List		
4	Frame Fabrication		
5-7	Glazing features		

1. PROJECT DATA

1.1. **REPORT ISSUED**

Atlas Architectural Metals	Houston, Texas	713-869-9551

1.2. **TEST LABORATORY and LOCATION**

Construction Consulting Laboratory (CCL)	Carrollton, Texas	972 242 0556

2. PROJECT SUMMARY

2.1. **Project:** AAMA 501-15 Performance Testing / ASTM E 1996-20 Impact Resistance testing / ASTM E 1886-18

2.2. **Product Type:** Aluminum Storefront

2.3. **Series/Model:** HD500-T (Non-Thermally Broken)

2.4. **Compliance Statement:** Results obtained are tested values and were secured by using the designated test methods. The mock-up was tested per AAMA 501-15 "Methods of Tests for Exterior Walls".

2.5. **Test Completion:** August 12, 2021

2.6. **Test Sample Source:** The test specimen was built and installed at **CCL** using lineal and parts provided by Atlas Architectural Metals. Reports, drawings, and project photographs will be retained by **CCL** for a minimum period of four (4) years from the test completion date.

2.7. **Drawing Reference:** The appended specimen drawings have been reviewed by **CCL** and are representative of the installation photographs and installation of the tested specimen.

2.8. **Observers:**

Witnessed By	Representative (All or Partial Viewing)		
Atlas Metals	Cesar Hernandez	Mark Camarena	
CCL	Edsson Alarcon	Dakota Poole	Wesley Wilson

3. TEST SPECIFICATIONS / METHODS

- **AAMA 501-15** "Methods of Tests for Exterior Walls and Project specifications"
  - **ASTM E 283-12 Air Infiltration** "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen".
  - **ASTM E 331-16 Static Water Penetration Resistance** "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference":
- **AAMA 501-.1-17** "Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors using Dynamic Pressure"
  - **ASTM E 330-14 Uniform Load Deflection and Proof Loading**: "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
  - **ASTM E1996-20:** "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
  - **ASTM E 1886-19 "**Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"

4. TEST EQUIPMENT

4.1. Test chamber consisted of steel reinforced wood walls, floor and roof and was accessible through a single bulkhead door.

4.2. Pressure differentials created with reversible pumps for positive/negative loading.

4.3. Chamber pressure differentials measured with manometers.

4.4. Air infiltration measured with a Meriam laminar flow element with inclined and digital manometers.

4.5. Water applied to the specimen from a spray rack equipped with swirl-type nozzles spaced two feet on center in vertical and horizontal directions, which under controlled pressure delivered a minimum of five gallons per square foot per hour on the specimen.

4.6. Dynamic winds generated by a Continental 150 Aircraft Engine with a two (2) blade 5'-0" diameter propeller, which generates typical and a-typical wind conditions.

4.7. Structural variations measured with Celesco String Potentiometers located throughout the test specimen.

4.8. A pneumatically charged cannon fitted with a ATS Impact cannon interface S/N CCL080818 to measure and record missile speed at the barrel exit. Missile selected for the testing is a Type D #2 Southern yellow pine missile weighing 4100g +/- 100g (9Lbs +/- 0.25 Lbs.), measuring2.4m +/-100m (8ft +/- 4in) propelled at a speed of 15.25m/s (f/s).

4.9. Cyclic pressure differentials created with PLC computer system operating pneumatically controlled valves and reversible pumps for positive/negative loading.

5. TEST PROCEDURES / TEST ALLOWABLE

5.1. **Uniform Load Pre-Load per ASTM E 330:** Per project specs, there shall be no system failure and deflection of aluminum members at 50% of the Positive design load.

Procedure: Preload the specimen 50% of the positive DP and maintain load for a minimum of 10 seconds[1].

Note 1: Manufacturer requested that all uniform loads be maintained for a period of 30 seconds

5.2. **Air Infiltration per ASTM E 283:** The total allowed infiltration shall not exceed .06 Cfm/ ft². Mock-up overall test size 14'-4" wide by 9'-11 ½" high = 142.73 Ft² x 0.06 CFM = 8.56 CFM – Allowed.

Infiltration Procedure: The specimen shall be covered with 4-mil plastic sheet material and sealed with spray adhesive and duct tape to the chamber perimeter, thus allowing no movement of air through the specimen. The specimen shall be subjected to a positive pressure differential of 6.24 Psf to obtain a leakage rate for the test chamber. The plastic bag shall be removed, and the chamber pressurized to a positive 6.24 Psf to measure total air infiltration. The chamber infiltration shall be subtracted from the total air infiltration resulting in the infiltration rate of the test specimen, **Photo 1.**

5.3. **Air Exfiltration per ASTM E 283:** The total amount of air exfiltration shall not exceed 0.06 Cfm/ ft². Mock-up overall test size 14'-4" wide by 9'-11 ½" high = 142.73 Ft² x 0.06 CFM = 8.56 CFM – Allowed.

Exfiltration Procedure: The chamber and PMU are pressurized to a negative differential pressure of 6.24 Psf to obtain a total exfiltration rate. The chamber infiltration tare is subtracted from the total exfiltration rate to obtain a calculated exfiltration rate for the PMU.

5.4. **Static Water Penetration per ASTM E 331:** Per project specifications, there shall be no water penetration during or at the conclusion of this test.

Procedure: Water shall be applied to the specimen at a minimum rate of 5 Gph/Ft², in such a way as to completely cover the exterior face of the specimen. Simultaneously, a specified positive static pressure shall be applied for a minimum period of fifteen (15) minutes, **Photo 2**.

5.5. **Dynamic Water Penetration per AAMA 501.1**: Per project specifications, there shall be no water penetration during or at the conclusion of this test at the wind speed of 68 Mph (equivalent to static pressure of 12 Psf.

Procedure: Water shall be applied to the specimen at a minimum rate of 5 Gph/Ft², in such a way as to completely cover the exterior face of the specimen. Simultaneously, a wind generated from a Continental 150 aircraft engine directed at the mock-up for a minimum period of fifteen (15) minutes, **Photo 3.**

5.6. **Design Load Deflections per ASTM E 330:** Per project specs, there shall be no system failure and deflection of aluminum members at 100% of design load and shall not exceed the following:

Procedure: Preload the specimen 50% of the positive or negative DP. Once set, the indicators shall be set to zero. Positive and or Negative loading, a pressure equal to 50% and then 100% of the DP shall be applied and maintained for 10 seconds per load. Between loads deflection shall be recorded.

TEST SPECIMEN DESIGN CRITERIA / Positive / Negative at Design Pressure	
Vertical mullion span (L/175): 120.0" /175:	Allowable = 0.686**"** (inches)
Horizontal span (L/175): 54.0" / 175:	Allowable = 0.308**"** (inches)

5.7. **Repeat Air Infiltration per ASTM E 283 at a Positive 6.24 Psf static test pressure**.

5.8. **Repeat Air Exfiltration per ASTM E 283 at a Negative 6.24 Psf static test pressure**.

5.9. **Repeat Static Water Penetration per ASTM E 331:** Per project specifications at the specified pressure for a minimum duration of 15 minutes.

5.10. **Proof Load Residual per ASTM E 330:** Per project specs, there shall be no permanent deformation of the aluminum members that exceed 0.02% of span at 150% of design load.

Procedure: The specimen shall be preloaded to 50% of the positive or negative DP. Once set, the indicators shall be set to zero. Positive and or negative loading, a pressure equal to 150% of the DP shall be applied and maintained for 10 seconds, pressure released, and permanent sets recorded.

TEST SPECIMEN PROOF LOAD / Positive / Negative Psf	
Mullion Span (L)/500: 120.0" / 500	Allowable = 0.240 (inches)
Horizontal Span (L)/500: 54.0" / 500	Allowable = 0.108 (inches)

5.11. **Large Missile Impact testing per ASTM E 1996-20:** The specimen shall be subjected to a missile impact in accordance with the methods noted in the procedure.

Procedure: Large Missile Impact locations on the mock-up were to the glazing, horizontal, and vertical mullions. The missile weight prior to testing was 9 Lbs. 0oz and missile length was 7ft 11 ½ inches. Nominal impact speed set at 15.25 m/s (50 feet per second-FPS), **Photo 4**. For impact locations and speeds, **See Large Missile Impact Location Diagrams, Appendix C.**

5.12. **Uniform Load Cyclic testing per ASTM E 1886-19:** The impacted specimen shall be subjected to a uniform load cyclic program in first the positive direction and then negative direction.

Procedure: Apply the required test pressure in accordance with the cyclic program listed below

Load Direction Positive	**Sequence**	**Range**	**Cycle Time**	**Cycles**
	Cycle 1	0.2 P to 0.5 P	< 3 seconds	3500
	Cycle 2	0 to 0.6 P	< 3 seconds	300
	Cycle 3	0.5 P to 0.8 P	< 3 seconds	600
	Cycle 4	0.3 P to 1.0 P	< 3 seconds	100
Load Direction Negative	**Sequence**	**Range**	**Cycle Time**	**Cycles**
	Cycle 1	0.3 P to 1.0 P	< 3 seconds	50
	Cycle 2	0.5 to 0.8 P	< 3 seconds	1050
	Cycle 3	0 to 0.6 P	< 3 seconds	50
	Cycle 4	0.2 P to 0.5 P	< 3 seconds	3350

6. MOCK-UP DESCRIPTION

Product Type:	Aluminum Storefront, **Product Drawings, Appendix A**		
Series Model:	Atlas HD500-T	**Design**: +/-60 Psf	**Square Feet**
Mock Up Size:	Overall Width: 14'-4" (172.0")	**Height:** 9'-11 ½" (120.0")	142.73 Ft²
Large Glass Size	Overall Width: 4'-6" (54.0")	**Height:** 6'-9 ¾" (81.750")	30.66 Ft²
Configuration:	3-bay wide / 2-lites per bay, Elevation, **Sheet 1, Appendix A**		

WEEP ARRANGEMENT: 5/16" weep holes spaced at ¼-points of glass DLO through sill exterior leg.

GLASS: Glass manufactured by Precision Glass is a laminated Sealed Insulating Glass constructed of one (1) piece ¼" clear heat strengthened (HS) outboard, 1/2" Super spacer with laminated inboard glass constructed from two (2) ¼" clear HS glass and 0.090" Kuraray SentryGlas Plus (SGP) interlayer.

GLASS GLAZING: Glass lites are exterior set and supported on 4" setting blocks (Part# 9809) at 1/4 points of glass DLO. EPDM interior preset backer gasket (Part# 9810) and Dow Corning Dowsil 995 structural silicone used full interior perimeter. Exterior aluminum snap-in glazing bead at base of glass, intermediate horizontal and sill, with flush glaze wedge gasket (Part# 9100) used at DLO full perimeter. Dow Corning DOWSIL 995 (DC-795) silicone applied a minimum of 2" in each direction at the corners and between ends of gaskets.

PERIMETER SEALANT: Frame perimeter sealed to chamber steel members with backer rod and Dow Corning DC-795 silicone full perimeter. Interior bead at sill not installed to view cavity during water testing.

INTERNAL SEALANT: Dow Corning Dowsil 795 silicone used at the following locations. Frame starter sill anchor bolts sealed below head and capped over head during starter installation. Sealant applied to each end of intermediate horizontal to vertical members, jambs, and intermediates during fabrication. Exterior face of shear blocks sealed prior to setting horizontal with squeeze out tooled to aluminum. Starter's aluminum end dams sealed to starter at interior and exterior side prior to setting member. Frame sill (Part# 8952) sealed to starter / flashing (Part# 8955) at the interior face full span and at the exterior shelf, full span and secured to starter with a group of four (4) #12 x ¾" pan head screws set on 6" centers at the midspan of glass DLO. All exposed fasteners are sealed with DC 795 silicone. Aluminum water diverter set in and sealed over with DC 795 at each end if starter. Snap in pocket filler (Part# 8949) sealed to heavy mullion at exterior snap full span and interior snap 6" from bottom.

REINFORCEMENT: None

ANCHORAGE: Frame head and sill members attach to chamber 3/8" thick tube steel with groups of three (3) 5/16 x 3" thread cutting countersunk fasteners set per jamb and each side of intermediate mullion spaced on 2" centers at the interior side of the thermal break.

OTHER FEATURES: Vertical members connect to horizontal screws splines with four (4) #14-1" hex head screws per connection.

DESCRIPTION DISCLAIMER: The written description is based on the appended drawings and install photographs taken during installation. Field assembly or installation deviations from that reported is the responsibility of the installer.

7. PERFORMANCE RESULTS

Method	Title of Test	Test Pressure	Measured	Allowed
ASTM E 330	Uniform Pre-Load	Positive 30 Psf	No damage	No Damage
ASTM E 283	Air Infiltration	Positive 6.24 Psf	0.02 Cfm/ft^2	0.06 Cfm/ft^2
ASTM E 283	Air Exfiltration	Negative 6.24 Psf	0.02 Cfm/ft^2	0.06 Cfm/ft^2
ASTM E 331	Water Resistance	Positive 12.0 Psf	No Leakage	No Leakage
ASTM E 330	Deflections @ Typical Vertical Mullion			
		Positive 60.0 Psf	0.610"	0.686"
		Negative 60.0 Psf	0.635"	0.686"
ASTM E 330	Deflections @ Intermediate Horizontal			
		Positive 60.0 Psf	0.02"	0.308"
		Negative 60.0 Psf	0.02"	0.308
ASTM E 283	Air Infiltration	Positive 6.24 Psf	0.03 Cfm/ft^2	0.06 Cfm/ft^2
ASTM E 283	Air Exfiltration	Negative 6.24 Psf	0.03 Cfm/ft^2	0.06 Cfm/ft^2
ASTM E 331	Water Resistance	Positive 12 Psf	No Leakage	No Leakage
ASTM E 330	Uniform Load [1] @ Typical Mullion			
	Permanent Set	Positive 90.0 Psf	0.07"	0.240"
	Permanent Set	Negative 90.0 Psf	0.08"	0.240"
ASTM E 1996	Large Missile Impact (seven-(7) locations)		No Penetration	No Penetration
ASTM E 1886	Uniform Load Cyclic 2			
	60.0Psf / 4500 Positive Cycles		No Penetration	No Penetration
	60.0Psf / 4500 Positive Cycles		No Penetration	No Penetration

Note 1: *Atlas requested uniform loads be maintained for 30 seconds. Plastic sheeting was not used to apply and maintain test loads*

Note 2: *Atlas requested uniform Cyclic load be performed at +/-60.0 Psf*

8. DISCLAIMER

The tested specimen performed within the specified criteria.

Respectfully submitted,

CONSTRUCTION CONSULTING LABORATORY

EDSSON ALARCON
TESTING MANAGER
Signed Electronically

WESLEY WILSON
LABORATORY MANAGER
Signed Electronically

APPENDIX A

Sheet	Detail	Date	Stamped as Illustrated
1	Elevation / Plan / Section	Not Dated	Construction Consulting Laboratory1601 Luna Road Carrollton, Texas 75006 (972) 242-0556
2	Installation detail	Not Dated	
3	Parts List	Not Dated	
4	Frame Fabrication	Not Dated	
5-7	Glazing features	Not Dated	

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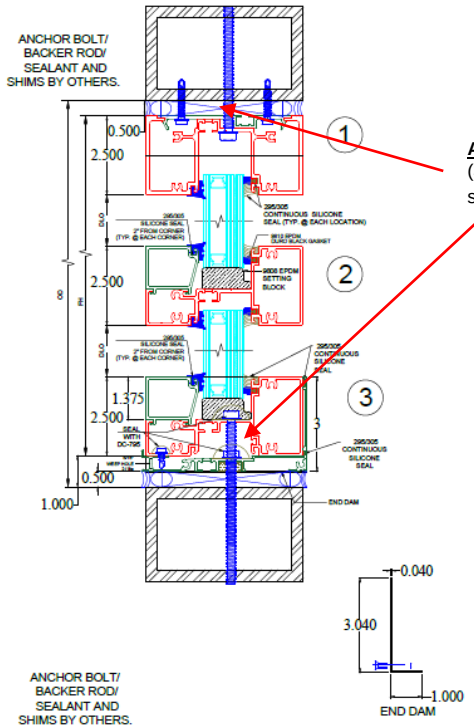
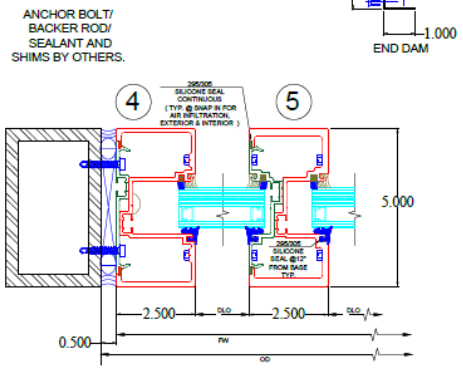
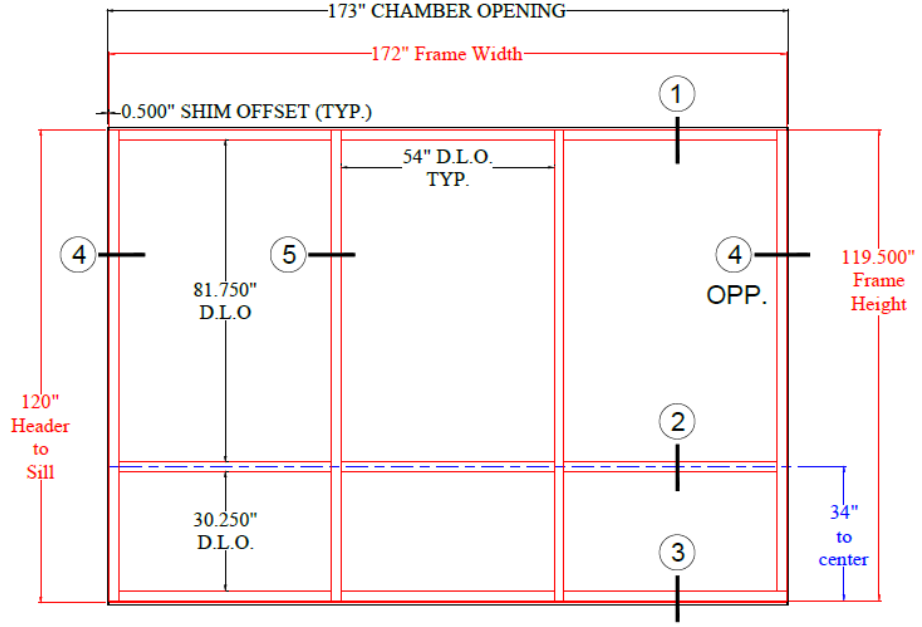




HD500-T HURRICANE IMPACT

(NON-THERMAL BREAK)

ANCHORAGE: Frame head and sill members attach to chamber 3/8" thick tube steel with groups of three (3) 5/16 x 3" thread cutting countersunk fasteners set per jamb and each side of intermediate mullion spaced on 2" centers at the interior side of the thermal break.



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HURRICANE IMPACT INSTALLATION MANUAL

FRAME FABRICATION

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Carrollton, Texas 75006
(972) 242-0556

1.1 Establish frame size & cut metal to length.

Measure width of rough opening.

A. Measure opening at bottom.

B. Measure opening at center.

C. Measure opening at top.

The frame width will be the smallest dimension less 1" allowing for a 1/2" caulk joint at each jamb.

Repeat process to determine frame height.

A. Beginning on left side of opening, measure dimension from top to bottom.

B. Repeat at center.

C. Repeat at right side of opening.

The frame height will be the smallest dimension minus 1-1/2" to allow for subsill and a 1/2" caulk joint at the head and sill.

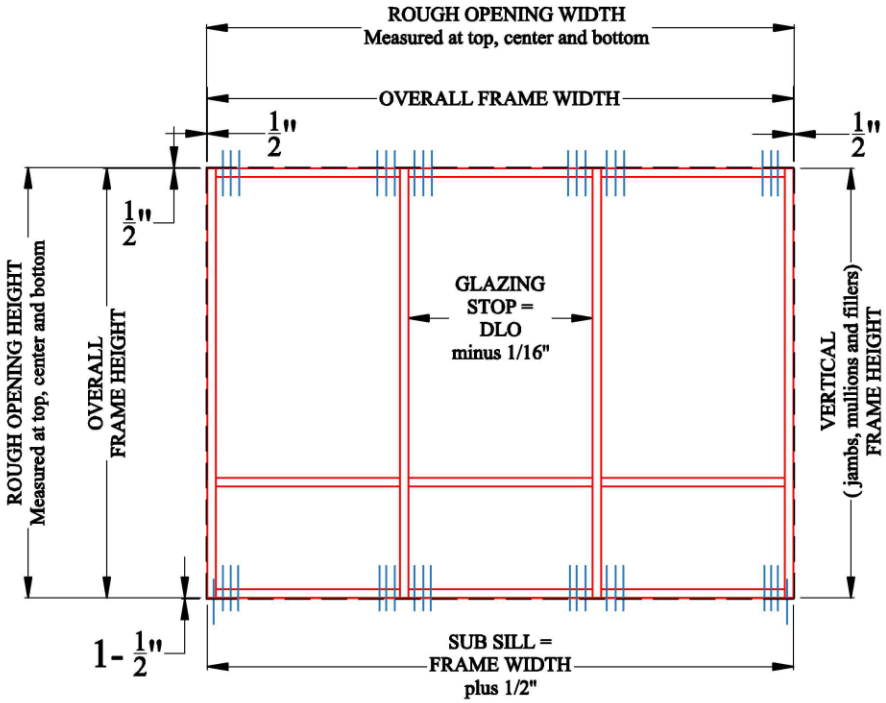

FIGURE 1.0
MOCK UP FOR
STEEL SUBSTRATE

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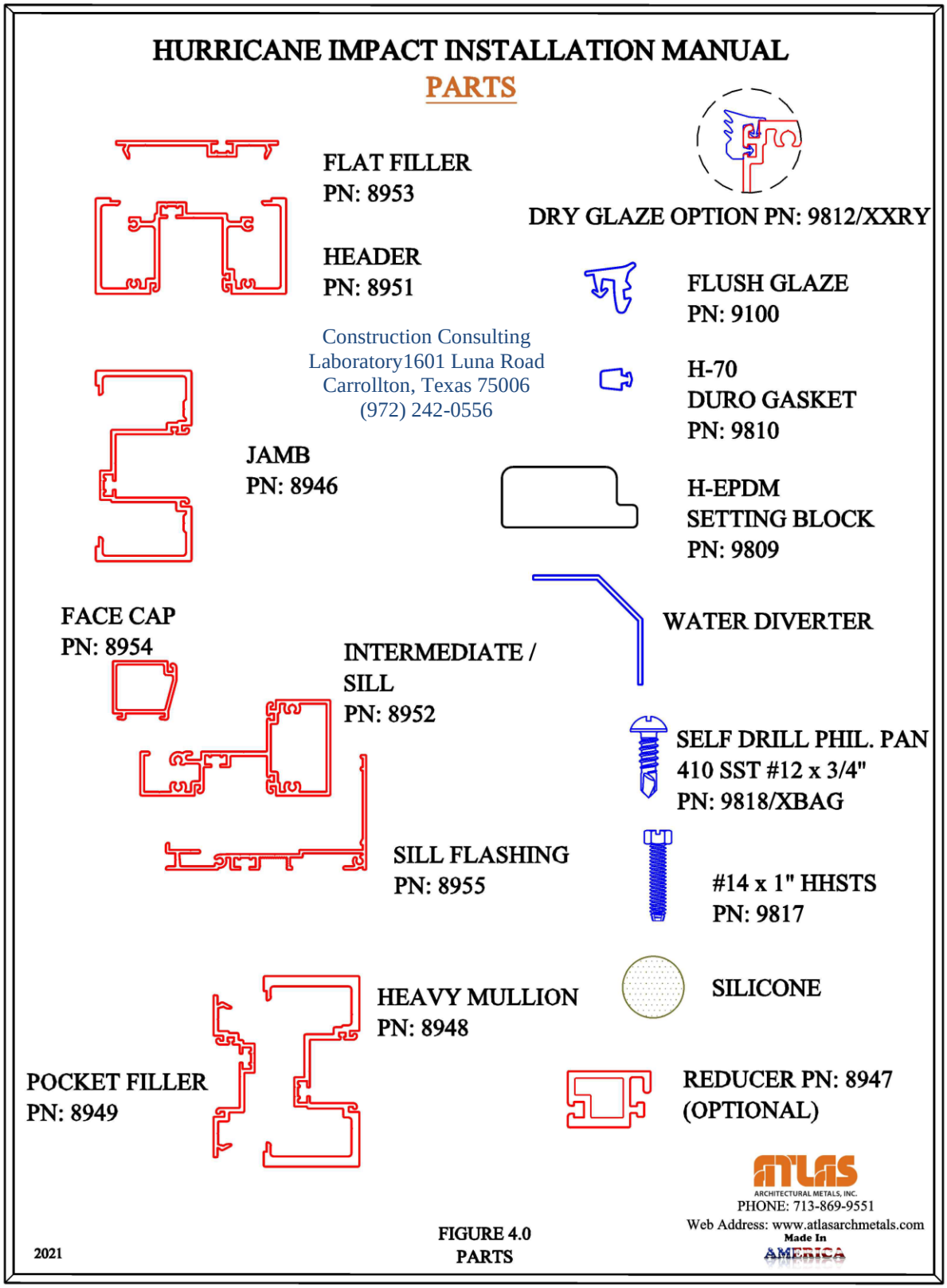
HURRICANE IMPACT INSTALLATION MANUAL
PARTS
FLAT FILLER
PN: 8953
HEADER
PN: 8951
DRY GLAZE OPTION PN: 9812/XXRY
FLUSH GLAZE
PN: 9100
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Laboratory1601 Luna Road
Carrollton, Texas 75006
(972) 242-0556
H-70
DURO GASKET
PN: 9810
JAMB
PN: 8946
H-EPDM
SETTING BLOCK
PN: 9809
WATER DIVERTER
FACE CAP
PN: 8954
INTERMEDIATE /
SILL
PN: 8952
SELF DRILL PHIL. PAN
410 SST #12 x 3/4"
PN: 9818/XBAG
SILL FLASHING
PN: 8955
#14 x 1" HHSTS
PN: 9817
SILICONE
HEAVY MULLION
PN: 8948
POCKET FILLER
PN: 8949
REDUCER PN: 8947
(OPTIONAL)
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FIGURE 4.0
PARTS

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FRAME FABRICATION

1.4 Offset 1st anchor holes @ 2" from Sill Flashing ends. SEE FIGURE 1.2

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FIGURE 1.2
SILL FLASHING FABRICATION

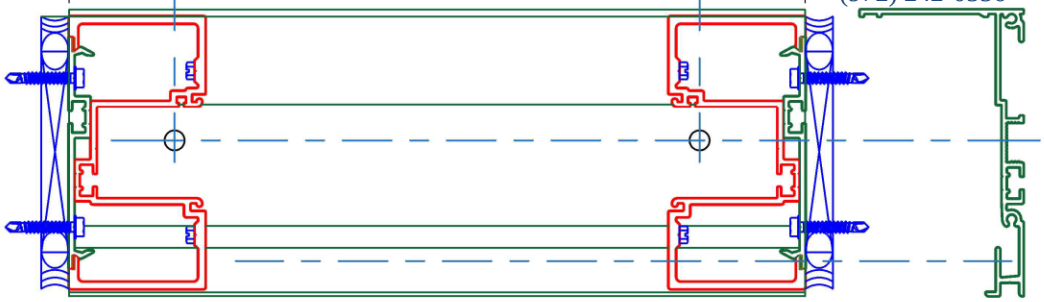
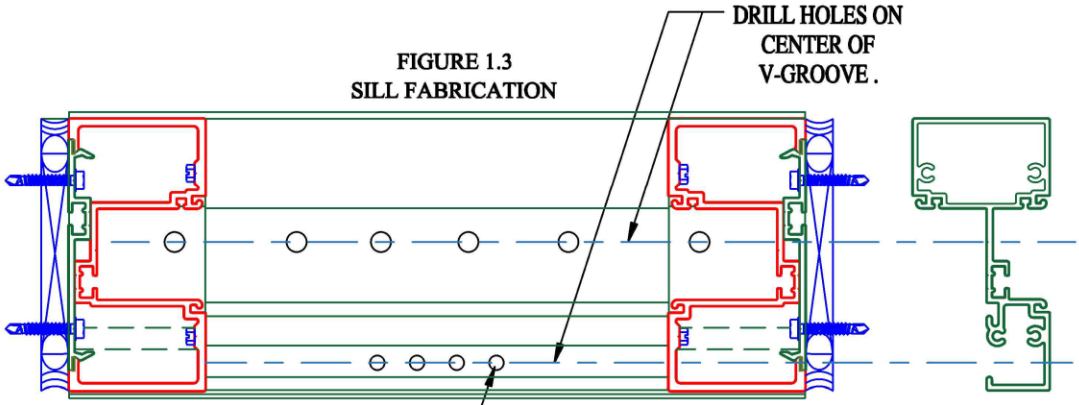


FIGURE 1.3
SILL FABRICATION



(4) #12 FASTENERS (300 SERIES SS)
@ MULLION LOCATIONS @ 6"O.C.
TYPICAL FOR BOTH SUBSTRATES.

1.5 Offset anchor holes according to SUBSTRATE .
SEE FIGURE 1.0 OR 1.1 for reference.

Anchor holes from both Sill Flashing and Sill should line up together.
SEE FIGURE 1.0 & 1.1 FOR ALIGNMENT
SEE FIGURE 1.4 for section detail.

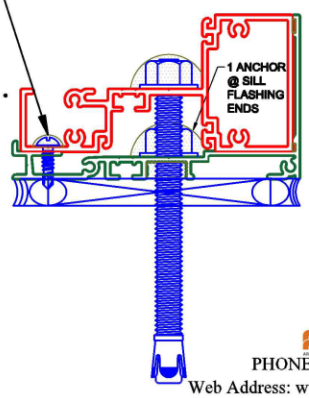


FIGURE 1.4
SILL DETAIL

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GLAZING GUIDELINES

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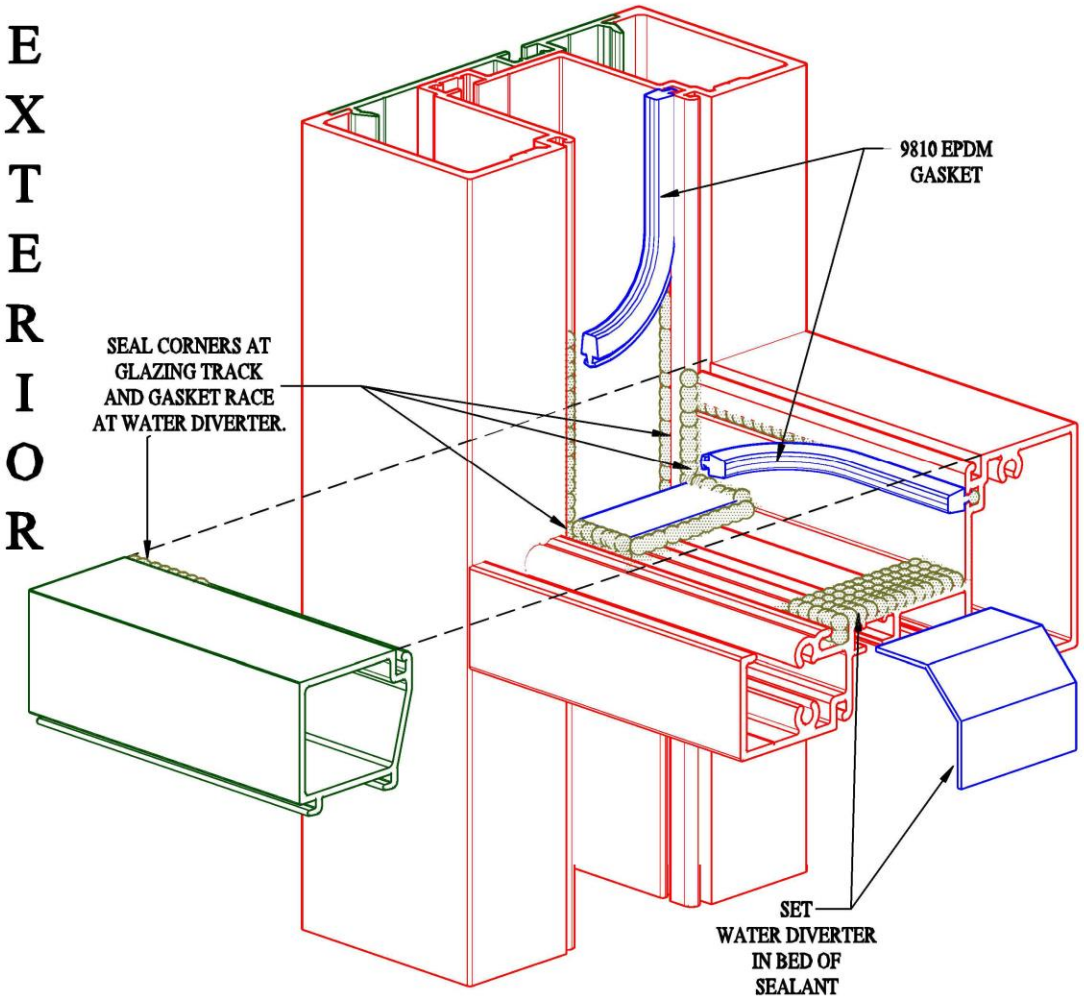

FIGURE 3.1
GLAZING

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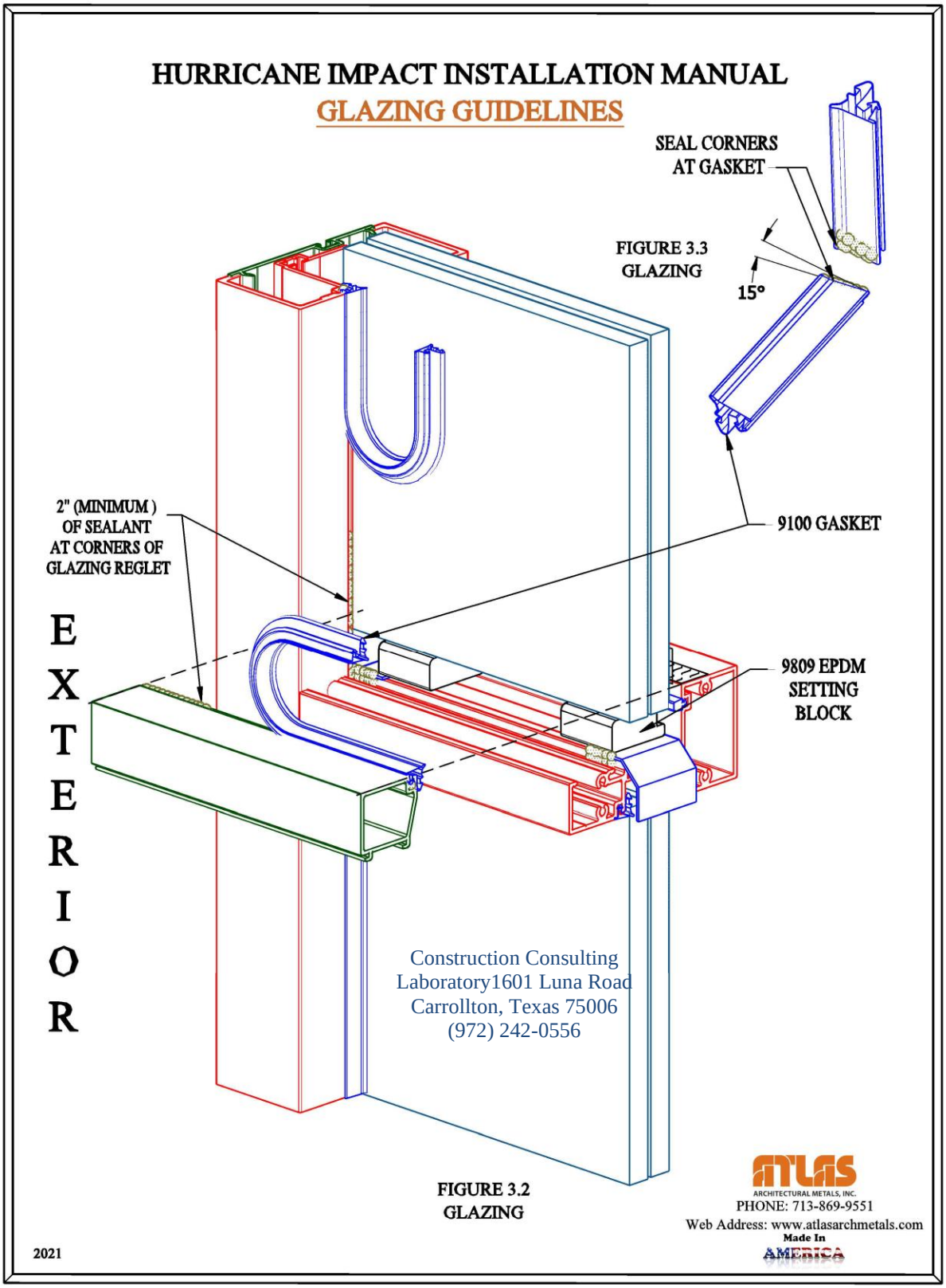
HURRICANE IMPACT INSTALLATION MANUAL
GLAZING GUIDELINES
SEAL CORNERS AT GASKET
FIGURE 3.3 GLAZING
15°
2" (MINIMUM) OF SEALANT AT CORNERS OF GLAZING REGLET
9100 GASKET
9809 EPDM SETTING BLOCK
EXTERIOR
Construction Consulting Laboratory1601 Luna Road Carrollton, Texas 75006 (972) 242-0556
FIGURE 3.2 GLAZING
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GLAZING GUIDELINES

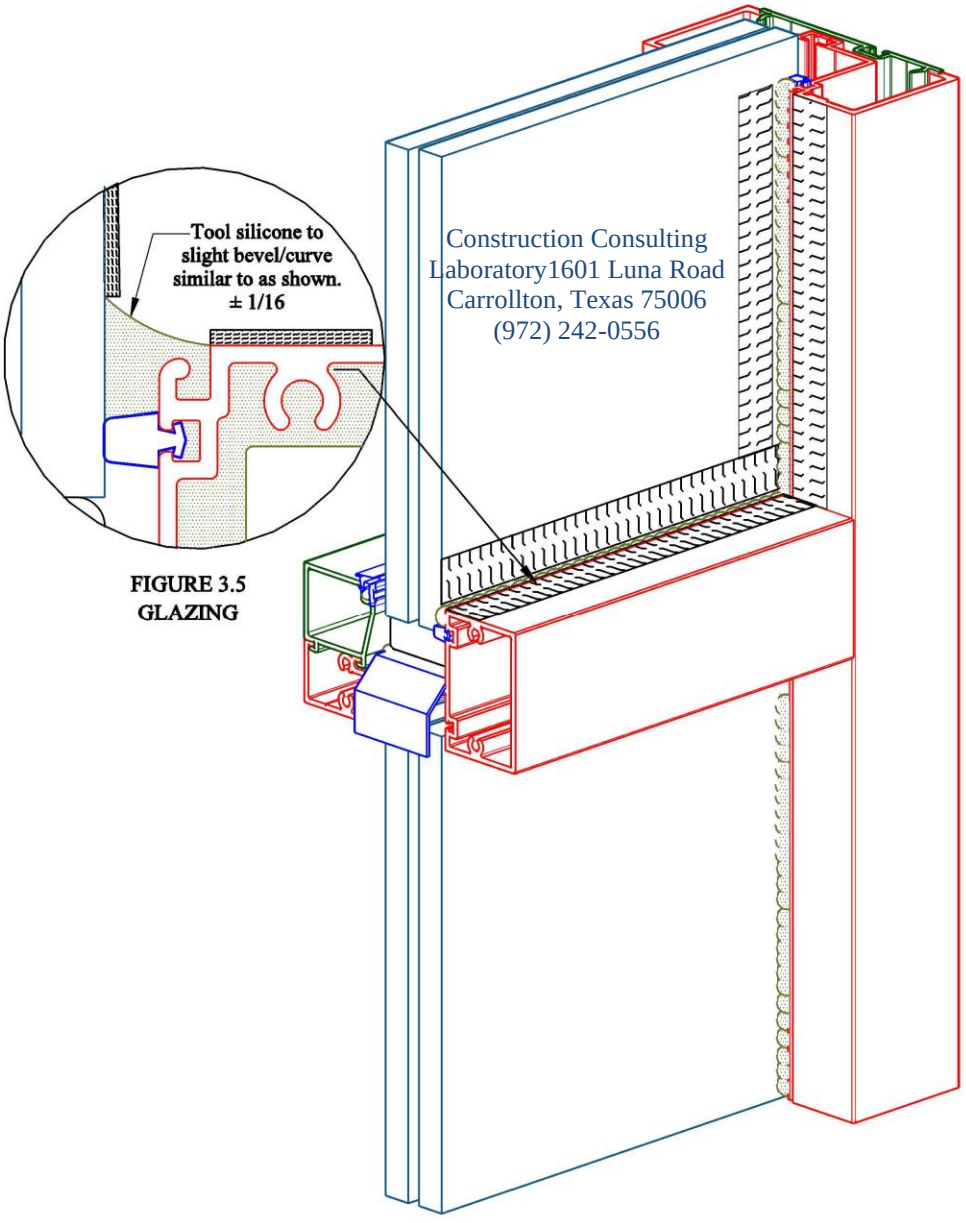

FIGURE 3.5
GLAZING

FIGURE 3.4
GLAZING

ATLAS ARCHITECTURAL METALS, INC.
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APPENDIX B

PHOTOGRAPHS

PHOTO 1

Air Infiltration per ASTM E 283: The total allowed infiltration shall not exceed .06 Cfm/ ft². Mock-up overall test size 14'-4" wide by 9'-11 ½" high = 142.73 Ft² x 0.06 CFM = 8.56 CFM – Allowed.

Infiltration Procedure: The specimen shall be covered with 4-mil plastic sheet material and sealed with spray adhesive and duct tape to the chamber perimeter, thus allowing no movement of air through the specimen. The specimen shall be subjected to a positive pressure differential of 6.24 Psf to obtain a leakage rate for the test chamber. The plastic bag shall be removed, and the chamber pressurized to a positive 6.24 Psf to measure total air infiltration. The chamber infiltration shall be subtracted from the total air infiltration resulting in the infiltration rate of the test specimen

PHOTO 2

Static Water Penetration per ASTM E 331: Per project specifications, there shall be no water penetration during or at the conclusion of this test.

Procedure: Water shall be applied to the specimen at a minimum rate of 5 Gph/Ft², in such a way as to completely cover the exterior face of the specimen. Simultaneously, a specified positive static pressure shall be applied for a minimum period of fifteen (15) minutes

PHOTO 3

Dynamic Water Penetration per AAMA 501.1: Per project specifications, there shall be no water penetration during or at the conclusion of this test at the wind speed of 68 Mph (equivalent to static pressure of 12 Psf.

Procedure: Water shall be applied to the specimen at a minimum rate of 5 Gph/Ft², in such a way as to completely cover the exterior face of the specimen. Simultaneously, a wind generated from a Continental 150 aircraft engine directed at the mock-up for a minimum period of fifteen (15) minutes.

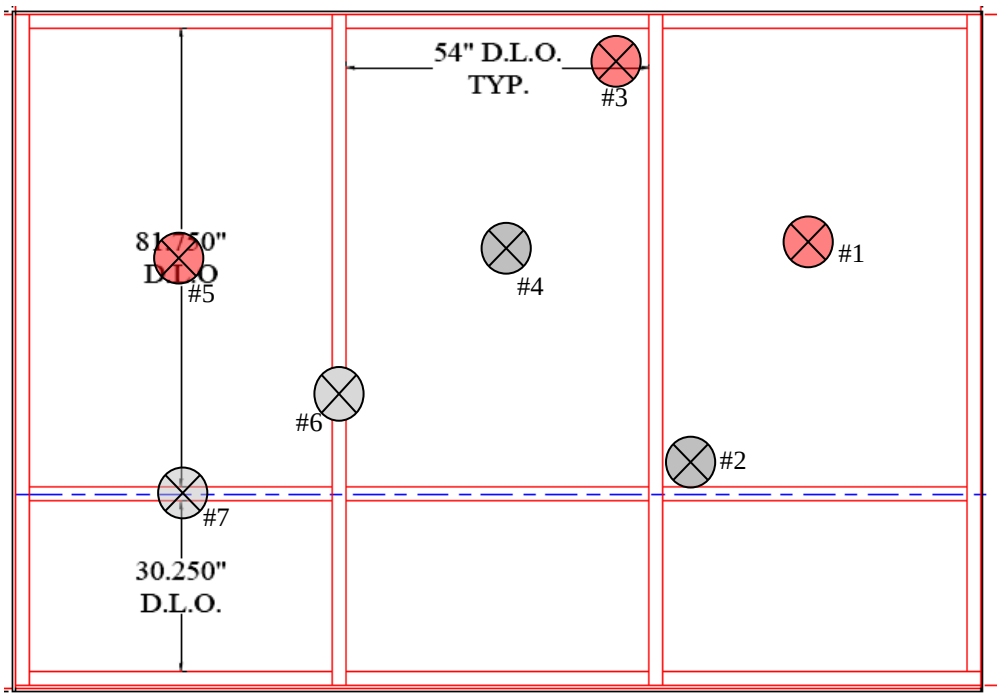
PHOTO 4

Large Missile Impact testing per ASTM E 1996-17: The specimen shall be subjected to a missile impact in accordance with the methods noted in the procedure.

Procedure: Large Missile Impact locations on the mock-up were to the glazing, horizontal, and vertical mullions. The missile weight prior to testing was 9 lbs. Nominal impact speed set at 15.25 m/s (50 feet per second-FPS), **Photo 4**. For impact locations and speeds, **See Large Missile Impact Location Diagrams, Appendix C.**

APPENDIX C

IMPACT LOCATION DIAGRAM



Missile Impact	Missile Speed	Result
1	50.0 fps	No Penetration
2	49.9 fps	No Penetration
3	51.1 fps	No Penetration
4	51.2 fps	No Penetration
5	50.9 fps	No Penetration
6	50.6 fps	No Penetration
7	51.2 fps	No Penetration
1st impact in a grouping		2nd impact in a grouping

-END OF REPORT-