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ETC Laboratories

AAMA/WDMA/CSA 101/I.S.2/A440-08
"NAFS - North American Fenestration Standard/Specification for Windows, Doors and Skylights."

Test Report
Rendered To

Croft, LLC
P.O. Box 826
McCombs, MS. 39649

Series / Model
Series 96 Single Hung

SPECIMEN 1 – (47 x 83) Equal lite

AAMA/WDMA/CSA 101/I.S.2/A440-08	
Title	**Summary of Results**
Product Designation	Class R – PG20 - 1194 x 2108 (47 x 83) - H
Overall Design Pressure	960 Pa (20.0 psf)
Air Leakage Rate	0.25 L/sec/m^2 (0.05 scfm/ft^2)
Maximum Water Pressure Achieved	220 Pa (4.50 psf)
Maximum Structural Pressure Achieved	1440 Pa (30.0 psf)
Forced Entry Resistance	Grade 10
Operating Force	142 N (32 lbf)

AAMA/WDMA 101/I.S.2/A440-05

Title	Summary of Results
Product Designation	H-R20 1194 x 2108 (47 x 83)

SPECIMEN 2 – (35 x 71) Equal lite

AAMA/WDMA/CSA 101/I.S.2/A440-08	
Title	**Summary of Results**
Product Designation	Class R – PG35 - 889 x 1803 (35 x 71) - H
Overall Design Pressure	1680 Pa (35.0 psf)
Air Leakage Rate	0.15 L/sec/m^2 (0.03 scfm/ft^2)
Maximum Water Pressure Achieved	260 Pa (5.25 psf)
Maximum Structural Pressure Achieved	2880 Pa (60.0 psf)
Forced Entry Resistance	Grade 10
Operating Force	98 N (22 lbf)

AAMA/WDMA 101/I.S.2/A440-05

Title	Summary of Results
Product Designation	H-R35 889 x 1803 (35 x 71)

AAMA/WDMA/CSA 101/I.S.2/A440-08
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Series / Model
Series 96 Single Hung

SPECIMEN 3 – (35 x 71) Oriel style

AAMA/WDMA/CSA 101/I.S.2/A440-08	
Title	**Summary of Results**
Product Designation	Class R – PG35 - 889 x 1803 (35 x 71) - H
Overall Design Pressure	1680 Pa (35.0 psf)
Air Leakage Rate	0.15 L/sec/m^2 (0.03 scfm/ft^2)
Maximum Water Pressure Achieved	260 Pa (5.25 psf)
Maximum Structural Pressure Achieved	2880 Pa (60.0 psf)
Forced Entry Resistance	Grade 10
Operating Force	76 N (17 lbf)

AAMA/WDMA 101/I.S.2/A440-05

Title	**Summary of Results**
Product Designation	H-R35 889 x 1803 (35 x 71))

Test Completion Date: 05/24/2010

Reference must be made to Report No. ETC-10-329-24078.0 dated 05/24/2010 for complete test specimen description and data.

Report Number: ETC-10-329-24078.0
Test Start Date: 05/20/2010
Test Finish Date: 05/24/2010
Report Date: 05/24/2010
Expiration Date: 05/24/2014

AAMA/WDMA/CSA 101/I.S.2/A440-08
"NAFS - North American Fenestration Standard/Specification for Windows, Doors and Skylights."

Test Report
Rendered To

Croft, LLC
P.O. Box 826
McCombs, MS. 39649

Series / Model
Series 96 Single Hung

Summary Description: The tested product was an aluminum single hung window. The test specimen was configured as a type A, (O/X). Specimen 1 was configured as an equal lite unit, measuring 47 inches wide by 83 inches high. Specimen 2 was an equal lite measuring 35 inches wide by 71 inches high. Specimen 3 was an oriel configuration measuring 35 inches wide by 71 inches high; all units were 1-3/4 inches deep and built with IG units that had a nominal thickness of a 1/2 inch with two lites of 3/32 inch annealed glass.

Specification: AAMA/WDMA/CSA 101/I.S.2/A440-08 "NAFS - North American Fenestration Standard/Specification for Windows, Doors and Skylights." The tested product also complies with the AAMA/WDMA/CSA 101/I.S.2/A440-05

Gateway Performance Test Results

Specimen 1 – (47 x 83) Equal lite

5.3.1	*Operating Force – E2068*		
	Force to initiate motion – Maximum	142 N (32 lbf)	Report Only
	Force to keep in motion - Maximum	133 N (30 lbf)	135 N (30 lbf)
5.3.1.1.3	Latching Devices - Maximum	13 N (3 lbf)	100 N (22.5 lbf)
5.3.2.1	*Air Leakage Resistance – ASTM E 283*		
	Test Pressure 75 Pa (1.60 psf)	0.25 L/sec/m^2 (0.05 scfm/ft^2)	1.5 L/sec/m^2 (0.30 scfm/ft^2)

The tested specimen meets (or exceeds) the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440 for air leakage resistance.

5.3.3.2 *Water Penetration Resistance – ASTM E 547*
204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.2 *Uniform Load Deflection - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.3 *Uniform Structural Load - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.5 *Forced Entry Resistance – ASTM F 588*
Grade: 10

Disassembly Test	Pass	No Entry
Tests A1 through A5 and A7	Pass	No Entry
Tool/Lock Manipulation Test	Pass	No Entry
Sash Manipulation Test	Pass	No Entry

Auxiliary (Durability) Test Results

Specimen 1 – (47 x 83) Equal lite

5.3.6.3	*Deglazing Test – ASTM E 987*		
	Top Rail 320 N (70 lbs)	4 %	< 90 %
	Bottom Rail 320 N (70 lbs)	5 %	< 90 %
	Left Stile 230 N (50 lbs)	2 %	< 90 %
	Right Stile 230 N (50 lbs)	2 %	< 90 %

Optional Performance Test Results

The product specified herein has successfully achieved all the required criteria in section 5 of the referenced specification for the Gateway size of the achieved Performance Rating and has been further successfully tested the product to higher performance levels as indicated below.

Specimen 1 – (47 x 83) Equal lite

4.3.2 *Water Resistance - ASTM E 547*

204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes
Design Pressure (DP) 1440 Pa (30.0 psf)

Test Pressure = 15% of DP		
Test Pressure = 220 Pa (4.50 psf)	Pass	No Leakage
Specimen was tested with and without screen		

Uniform Load Deflection - ASTM E 330	*Deflection at Load*	
Design Pressure (DP) 960 Pa (20.0 psf)		
Test Pressure = 100% of DP		
Positive Load = 960 Pa (20.0 psf)	15.39 mm (0.606 in.)	N/A
Negative Load = 960 Pa (20.0 psf)	14.05 mm (0.553 in.)	N/A
Note: Measurements taken from fixed rail		
Test Pressure = 100% of DP		
Positive Load = 960 Pa (20.0 psf)	16.94 mm (0.667 in.)	N/A
Negative Load = 960 Pa (20.0 psf)	2.13 mm (0.084 in.)	N/A
Note: Measurements taken from stile		
Test Pressure = 100% of DP		
Positive Load = 960 Pa (20.0 psf)	1.85 mm (0.073 in.)	N/A
Negative Load = 960 Pa (20.0 psf)	6.71 mm (0.264 in.)	N/A
Note: Measurements taken from lift rail		

Uniform Structural Load - ASTM E 330	*Permanent Set after Load*	
Design Pressure (DP) 960 Pa (20.0 psf)		
Test Pressure = 150% of DP		
Positive Load = 1440 Pa (30.0 psf)	0.25 mm (0.010 in.)	4.53 mm (0.178 in.)
Negative Load = 1440 Pa (30.0 psf)	0.38 mm (0.015 in.)	4.53 mm (0.178 in.)
Note: Measurements taken from fixed rail		
Test Pressure = 150% of DP		
Positive Load = 1440 Pa (30.0 psf)	0.56 mm (0.022 in.)	4.24 mm (0.167 in.)
Negative Load = 1440 Pa (30.0 psf)	0.15 mm (0.006 in.)	4.24 mm (0.167 in.)
Note: Measurements taken from stile		
Test Pressure = 150% of DP		
Positive Load = 1440 Pa (30.0 psf)	0.23 mm (0.001 in.)	4.61 mm (0.182 in.)
Negative Load = 1440 Pa (30.0 psf)	0.15 mm (0.009 in.)	4.61 mm (0.182 in.)
Note: Measurements taken from lift rail		

Gateway Performance Test Results

Specimen 2 – (35 x 71) Equal lite

5.3.1	*Operating Force – E2068*		
	Force to initiate motion – Maximum	89 N (20 lbf)	Report Only
	Force to keep in motion - Maximum	98 N (22 lbf)	135 N (30 lbf)
5.3.1.1.3	Latching Devices - Maximum	13.3 N (3 lbf)	100 N (22.5 lbf)
5.3.2.1	*Air Leakage Resistance – ASTM E 283*		
	Test Pressure 75 Pa (1.60 psf)	0.15 L/sec/m^2 (0.03 scfm/ft^2)	1.5 L/sec/m^2 (0.30 scfm/ft^2)

The tested specimen meets (or exceeds) the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440 for air leakage resistance.

5.3.3.2 *Water Penetration Resistance – ASTM E 547*
204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.2 *Uniform Load Deflection - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.3 *Uniform Structural Load - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.6 *Forced Entry Resistance – ASTM F 588*
Grade: 10
Reference Test Results from Specimen 1

Auxiliary (Durability) Test Results

Specimen 2 – (35 x 71) Equal lite

5.3.6.3 *Deglazing Test – ASTM E 987*
Reference Test Results from Specimen 1

Optional Performance Test Results

The product specified herein has successfully achieved all the required criteria in section 5 of the referenced specification for the Gateway size of the achieved Performance Rating and has been further successfully tested the product to higher performance levels as indicated below.

Specimen 2 – (35 x 71) Equal lite

4.3.2 *Water Resistance - ASTM E 547*

204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes
Design Pressure (DP) 1440 Pa (35.0 psf)

Test Pressure = 15% of DP		
Test Pressure = 260 Pa (5.25 psf)	Pass	No Leakage
Specimen was tested with and without screen		

Uniform Load Deflection - ASTM E 330	*Deflection at Load*	
Design Pressure (DP) 1920 Pa (40.0 psf)		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	9.09 mm (0.358 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	7.87 mm (0.310 in.)	N/A
Note: Measurements taken from fixed rail		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	16.71 mm (0.658 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	2.90 mm (0.114 in.)	N/A
Note: Measurements taken from stile		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	1.70 mm (0.067 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	4.78 mm (0.188 in.)	N/A
Note: Measurements taken from lift rail		

Uniform Structural Load - ASTM E 330	*Permanent Set after Load*	
Design Pressure (DP) 1920 Pa (40.0 psf)		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	0.43 mm (0.017 in.)	3.23 mm (0.127 in.)
Negative Load = 2880 Pa (60.0 psf)	0.58 mm (0.023 in.)	3.23 mm (0.127 in.)
Note: Measurements taken from fixed rail		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	1.47 mm (0.058 in.)	3.65 mm (0.144 in.)
Negative Load = 2880 Pa (60.0 psf)	0.51 mm (0.020 in.)	3.65 mm (0.144 in.)
Note: Measurements taken from stile		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	0.18 mm (0.007 in.)	3.40 mm (0.134 in.)
Negative Load = 2880 Pa (60.0 psf)	0.36 mm (0.014 in.)	3.40 mm (0.134 in.)
Note: Measurements taken from lift rail		

Gateway Performance Test Results

Specimen 3 – (35 x 71) Oriel style

5.3.1	*Operating Force – E2068*		
	Force to initiate motion – Maximum	76 N (17 lbf)	Report Only
	Force to keep in motion - Maximum	71 N (16 lbf)	135 N (30 lbf)
5.3.1.1.3	Latching Devices - Maximum	9 N (2 lbf)	100 N (22.5 lbf)

5.3.2.1 *Air Leakage Resistance – ASTM E 283*
Test Pressure 75 Pa (1.60 psf)
Reference Test Results from Specimen 2

5.3.3.2 *Water Penetration Resistance – ASTM E 547*
204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.2 *Uniform Load Deflection - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.4.3 *Uniform Structural Load - ASTM E 330*
Design Pressure = 720 Pa (15.0 psf)
Testing was started at pressures higher than gateway.

5.3.7 *Forced Entry Resistance – ASTM F 588*
Grade: 10
Reference Test Results from Specimen 1

Auxiliary (Durability) Test Results

Specimen 3 – (35 x 71) Oriel style

5.3.6.3 *Deglazing Test – ASTM E 987*
Reference Test Results from Specimen 1

Optional Performance Test Results

The product specified herein has successfully achieved all the required criteria in section 5 of the referenced specification for the Gateway size of the achieved Performance Rating and has been further successfully tested the product to higher performance levels as indicated below.

Specimen 3 – (35 x 71) Oriel style

4.3.2 *Water Resistance - ASTM E 547*

204 L/hr/m^2 (5 gal/hr-ft^2) - 4 Test cycles - 24 Minutes

Design Pressure (DP) 1680 Pa (35.0 psf)

Test Pressure = 15% of DP		
Test Pressure = 260 Pa (5.25 psf)	Pass	No Leakage
Specimen was tested with and without screen		

Uniform Load Deflection - ASTM E 330	*Deflection at Load*	
Design Pressure (DP) 1920 Pa (40.0 psf)		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	9.17 mm (0.361 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	7.62 mm (0.300 in.)	N/A
Note: Measurements taken from fixed rail		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	10.77 mm (0.424 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	2.87 mm (0.113 in.)	N/A
Note: Measurements taken from stile		
Test Pressure = 100% of DP		
Positive Load = 1920 Pa (40.0 psf)	1.12 mm (0.044 in.)	N/A
Negative Load = 1920 Pa (40.0 psf)	4.01 mm (0.158 in.)	N/A
Note: Measurements taken from lift rail		

Uniform Structural Load - ASTM E 330	*Permanent Set after Load*	
Design Pressure (DP) 1920 Pa (40.0 psf)		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	0.25 mm (0.010 in.)	3.23 mm (0.127 in.)
Negative Load = 2880 Pa (60.0 psf)	0.36 mm (0.014 in.)	3.23 mm (0.127 in.)
Note: Measurements taken from fixed rail		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	0.25 mm (0.010 in.)	3.32 mm (0.131 in.)
Negative Load = 2880 Pa (60.0 psf)	0.03 mm (0.001 in.)	3.32 mm (0.131 in.)
Note: Measurements taken from stile		
Test Pressure = 150% of DP		
Positive Load = 2880 Pa (60.0 psf)	0.13 mm (0.005 in.)	3.40 mm (0.134 in.)
Negative Load = 2880 Pa (60.0 psf)	0.33 mm (0.013 in.)	3.40 mm (0.134 in.)
Note: Measurements taken from lift rail		

Product Description of Test Specimen

Specimen Item	Laboratory Verification

Product description is inclusive of specimens 1 - 3 unless otherwise noted

Frame:

Series/Model Name	Series 96 Single Hung Window
Configuration	(O/X)
Size: **Specimen 1**	47 in. W. x 83 in. H. x 1-3/4 in. D.
Specimen 2	35 in. W. x 71 in. H. x 1-3/4 in. D.
Specimen 2	35 in. W. x 71 in. H. x 1-3/4 in. D.
DLO: **Specimen 1**	43-7/16 in. W. x 38-5/8 in. H.
Specimen 2	31-1/2 in. W. x 32-11/16 in. H.
Specimen 3	31-1/2 in. W. x 38-5/8 in. H.
Material	aluminum
Corner construction	cope and butt
Corner fastening	[2] #8 x 5/8 in. L. PHPS
Corner sealing	acrylic seam sealer
Fixed rail	aluminum, cope and butt end construction, secured to jambs with [1] #8 x 5/8 in. L. PHPS, no sealant

Vent:

Size	
Specimen 1	45-3/8 in. W. x 41-3/4 in. H. x 15/16 in. D.
Specimen 2	33-7/16 in. W. x 35-15/16 in. H. x 15/16 in. D.
Specimen 3	33-7/16 in. W. x 29-15/16 in. H. x 15/16 in. D.
Material	aluminum
Corner construction	cope and butt
Corner fastening	[1] #8 x 5/8 in. L. PHPS
Corner sealing	none

Weather-stripping:

Fixed rail	[1] row of center fin pile, T-slot backer, 0.187 in. W. x 0.250 in. H.
Stiles	[1] row of center fin pile, T-slot backer, 0.187 in. W. x 0.250 in. H. [1] row of center fin pile, T-slot backer, 0.187 in. W. x 0.180 in. H.
Pull rail	[1] row of hollow bulb seal, T-slot backer, 0.076 in. W. x 3/8 in. diameter. x 0.025 in. wall thickness

Glazing:

Overall IG thickness	1/2 in. (0.426 in. actual)
Thickness of glass	3/32 in. (0.085 in. actual)
Heat treatment	annealed

Product Description of Test Specimen

Specimen Item	Laboratory Verification
Glazing:	
Number of lights	2
Spacer ID	Intercept spacer (CU-D)
Method of glazing	interior laid-in
Sealing	wet glazed with silicone with PVC glazing beads
Bite depth	1/2 in.
Setting blocks	rigid vinyl, 1/8 in. thick, [3] on bottom rail and [2] on each stile of vent, [4] on bottom edge of direct set
Reinforcement:	none
Drainage:	
Frame	sloped sill
Vent	none
Hardware:	
Sweep lock	die cast zinc, surface mounted, centered 7-1/2 in. from each end, fastened with [2] #8 x 5/8 in. L. PHPS
Keeper	extruded pocket of fixed rail houses tongue of lock
Spiral balance	balance located 1 in. on center from exterior edge of head on equal size units and 13 in. from head on the oriel style, in the interior jamb pocket, fastened with [1] #10 x 5/8 in. L. PHPS
Tilt latch	plastic, spring loaded, surface mounted, fastened with [2] #6 x 3/4 in. L. PHPS
Pivot pins	sits in pocket profile of bottom edge of rail, fastened with [1] #6 x 3/8 in. L. PHPS
Screen:	
Overall size	
Specimen 1	44-3/16 in. W. x 41-1/2 in. H. x 5/16 in. D.
Specimen 2	32 in. W. x 35-7/16 in. H. x 5/16 in. D.
Specimen 3	32 in. W. x 29-1/2 in. H. x 5/16 in. D.
Material	aluminum frame, fiberglass cloth
Corner construction	cut square
Corner fastening	external plastic corner key
Method of retention	[4] plastic screen latches, 4 in. from ends
Other	[2] pan head steel screws are driven up from the bottom side of screen, 4 in. from either corner, raising screen 1/8 in. off sill

Product Description of Test Specimen

Specimen Item	Laboratory Verification
Test Buck:	
Mounting Gap	0 in. at sill, head and jambs
Shims	none
Stops	none
Sealant	silicone
Material	2 x 10 around 2 x 4, SYP, #2
Anchorage of Frame to Test Buck:	
Specimen 1	
Type	PHPS
Size	#8 x 1 in. L.
Quantity	[6] on head and sill, [9] on jambs, [30] total
Location	3/8 in. from corners on head and sill then 9-1/4 in. on center spacing 1-1/2 in. from corners on jambs then 10 in. on center spacing all screws through the nailing flange flange sealed with silicone to test buck
Specimen 2 & 3	
Type	PHPS
Size	#8 x 1 in. L.
Quantity	[5] on head and sill, [9] on jambs, [28] total
Location	2-1/2 in. from corners on head and sill then 7-1/2 in. on center spacing 2 in. from corners on jambs then 8-3/4 in. on center spacing all screws through the nailing flange flange sealed with silicone to test buck
Specimens 1-3	
Other	pine stops, 1-7/16 in. W. x 1-5/16 in. D. set over the nailing flange, full perimeter and secured with #8 x 1-3/4 in. L. screws, 3 in. from ends of stops with one additional screw added to the center of the vertical stops

Conditions, Terms, and General Notes Regarding These Tests

The product tested **Has Been** compared to the detailed drawings, bill of materials and fabrication information supplied by the client so named herein. Our analysis, which includes dimensional and component description comparisons, indicate the tested product and engineering information supplied by the client **"Are Equivalent"**.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by ETC Laboratories for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire.

These test results were obtained by employing all requirements of the designated test methods with no deviations. The test results and specimen supplied for testing are in compliance with the referenced specifications. The test results are specific to the product tested by this laboratory and of the sample supplied by the client named herein, and they relate to no other product either manufactured by the client, a fabricator of the client or of installed field performance. This report does not constitute a certified product.

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No conclusions of any kind regarding the adequacy of the glass in the test specimen may be drawn from the test. Procedure "A" in ASTM E330-02 was used for this test.

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For ETC Laboratories

Bradley Keirsbick, Test Technician

Mark Sennett, Product Description and Drawing Verifications

Eugene Baier, AWS Supervisor

Attachments: This report is complete only when all attachments listed are included.
Appendix A: Alteration Addendum (1)
Appendix B: Drawings (14)