

Residential Windows 101

Criteria for selecting, specifying, and detailing residential windows

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MORRISON HERSHFIELD

Residential Windows 101

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Course Number 0901MH



Learning Objectives

- Window Selection
 - AAMA Labeling
 - Performance Criteria
 - Structural Criteria
 - Water Leakage
 - Air Leakage
 - Thermal / Energy
 - Other Considerations
 - Steps for Selecting a Window
 - Installation Detailing
 - Test Methods

AAMA Certification

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

PRIME & REPLACEMENT LABEL (AWS ONLY)



(PRINTED IN BLACK INK)

PRIME & REPLACEMENT LABEL (AWS & THERMAL)



(PRINTED IN BLACK INK)

KEY

- A** Manufacturer's Code Number. Code number is required, but manufacturer may also show company name.
- B** Air, Water, Structural Specification Identification
- C** Manufacturer's Series Number
- D** Product Type, Performance Class (design pressure), and Performance Grade
- E** Maximum Size Tested
- F** NFRC – assigned manufacturer's code and product line number
- G** Thermal Specification Identification

AAMA Product Type



AP	=	Awning, Hopper, Projected Window
BW	=	Basement Windows
C	=	Casement Windows
DA	=	Dual Action Windows
DA-HGD	=	Dual Action Hinged Glass Doors
F	=	Fixed Windows
GH	=	Greenhouse Windows
H	=	Hung Windows (Single, Double, Triple)
HE	=	Hinged Egress Windows
HGD	=	Hinged Glass Doors
HP	=	Horizontally Pivoted Windows
HS	=	Horizontal Sliding Windows
J	=	Jalousie Windows
JA	=	Jal-Awning Windows
SHW	=	Side Hinged Inswinging Windows
SGD	=	Sliding Glass Doors
TA	=	Tropical Awning Windows
TH	=	Top Hinged Windows
VP	=	Vertically Pivoted Windows
VS	=	Vertical Sliding Windows

AAMA Performance Grade Design Pressures



- Grade Designation – Gateway (Minimum) Performance:
 - R = Residential = 15 psf
 - LC = Light Commercial = 25 psf
 - C = Commercial = 30 psf
 - HC = Heavy Commercial = 40 psf
 - AW = Architectural Window = 40 psf
- Products may be tested at optional performance grade higher than minimum grade in increments of 5 psf

AAMA Performance Grade Design Pressures



- Design Pressure (DP) = Performance Grade
- Structural Test Pressure = 1.5 x DP
- Water Test Pressure*
 - R, LC, C & HC = 0.15 x DP (12 psf max)
 - AW = .20 x DP (12 psf max)
- Air Leakage**
 - R, LC, C & HC: 0.3 ft³/(min ft²) @ 1.57 psf
 - AW: 0.3 0.3 ft³/(min ft²) @ 6.24 psf

* AAMA allows further 1/3 reduction for field test pressure

** AAMA allows 50% increase in air leakage for field testing

AAMA Product Size Tested



- Minimum Size Tested
- Gateway (minimum) Sizes Vary by Performance Grade

AAMA Product Size Tested



- Size Limits / Recommended Class

- R15 – R20 40x63 43x74
- LC 25 44x75 55x90
- C30 – C35 56x91 59x98
- HC 40 60x99 Not Allowed
for Hung
Window

Minimum
Test Size
For Class

AAMA Summary

- Performance grade and design pressure specified
- Water leakage test pressure % of design pressure
- Field test pressure for water reduced to 2/3 of laboratory test pressure
- Air leakage criteria based on grade
- Field test air leakage increased by 50%

Performance Criteria Structural

- Determine Design Pressure
 - ASCE 7
 - Cladding and Component - psf
 - Worst case – Positive or Negative
 - Typically - Use same pressure for all units
 - Typically calculated by Structural Engineer
- Impact Resistance
 - Required in hurricane zones (per code)
 - TAS 201/203 (Miami-Dade / Broward)
 - AAMA 506

Performance Criteria

Water Leakage

- No building code requirements
- Per AAMA (field performance)
 - R, LC, C & HC = 10% of Positive Design Pressure
 - AW = 13% of Positive Design Pressure
- For low-rise buildings, minimum AAMA gateway results in very low field performance threshold

Example:

- R25 window: $25 \text{ psf} * 0.10 = 2.5 \text{ psf}$



Performance Criteria

Water Leakage

- MH Recommendations (field performance):
 - 20% of positive structural pressure (can reduce if sheltered by overhang or balcony)
 - < 25 psf structural: 4.5 psf for water
 - < 30 psf structural: 6.0 psf for water
 - < 40 psf structural: 8.0 psf for water
 - < 60 psf structural: 12.0 psf for water

Performance Criteria

Water Leakage

- For high wind loads
 - AAMA limits water test pressure to 12 psf (max)
 - Field performance = $12^{2/3} = 8$ psf.
 - Too low for suitable performance in high wind areas.
 - **When higher water leakage resistance is required, the water field test pressure must be specified explicitly**

Performance Criteria

Water Leakage

- Window Design
 - Review window shop drawings
 - Confirm glazing pocket is weeped
 - Confirm sill track is weeped
 - Gaskets, sealants, and weather stripping

Performance Criteria

Air Leakage

- AAMA gateway (minimum) performance
 - R, LC, C & HC: 0.3 cfm / ft² @ 1.57 psf
 - AW: 0.3 cfm/ ft² @ 6.24 psf
- MH Recommended performance
 - Fixed, Casement or Awning: 0.10 cfm / ft² @ 1.57 psf
 - Sliding window: 0.15 cfm / ft² @ 1.57 psf
 - Sliding glass doors: 0.30 cfm / ft² @ 1.57 psf

Performance Criteria

Thermal

- U-Value
 - Measure of heat transfer through window
 - Lower value = better thermal resistance
 - Requirements dependent on climate zone
 - PVC is an excellent insulator
 - Thermal breaks may be required for aluminum
- Solar Heat Gain Coefficient (SHGC)
 - Fraction of heat from the sun that enters through a window (from 0 to 1)
 - Requirements dependent on climate zone and shading
 - Important in cooling climates

Performance Criteria

Thermal

- Minimum values determined by Energy Code
- 2006 International Energy Conservation Code for most States (IECC 2006)
- Prescriptive or performance based compliance options usually allowed
- LEED buildings require improved performance. Minimum 14% better than ASHRAE 90.1
- Confirm required criteria with project Energy Consultant

Performance Criteria Thermal - Prescriptive

**TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

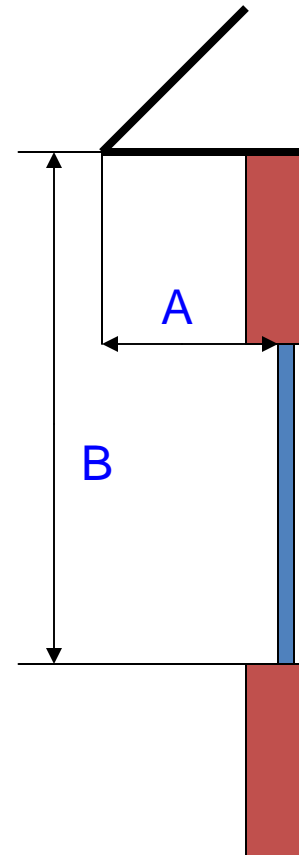
Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
<i>U</i>-Factor								
Framing materials other than metal with or without metal reinforcement or cladding								
<i>U</i> -Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront <i>U</i> -Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door <i>U</i> -Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other <i>U</i> -Factor ^a	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
Glass								
<i>U</i> -Factor	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
Plastic								
<i>U</i> -Factor	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.60
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

Performance Criteria

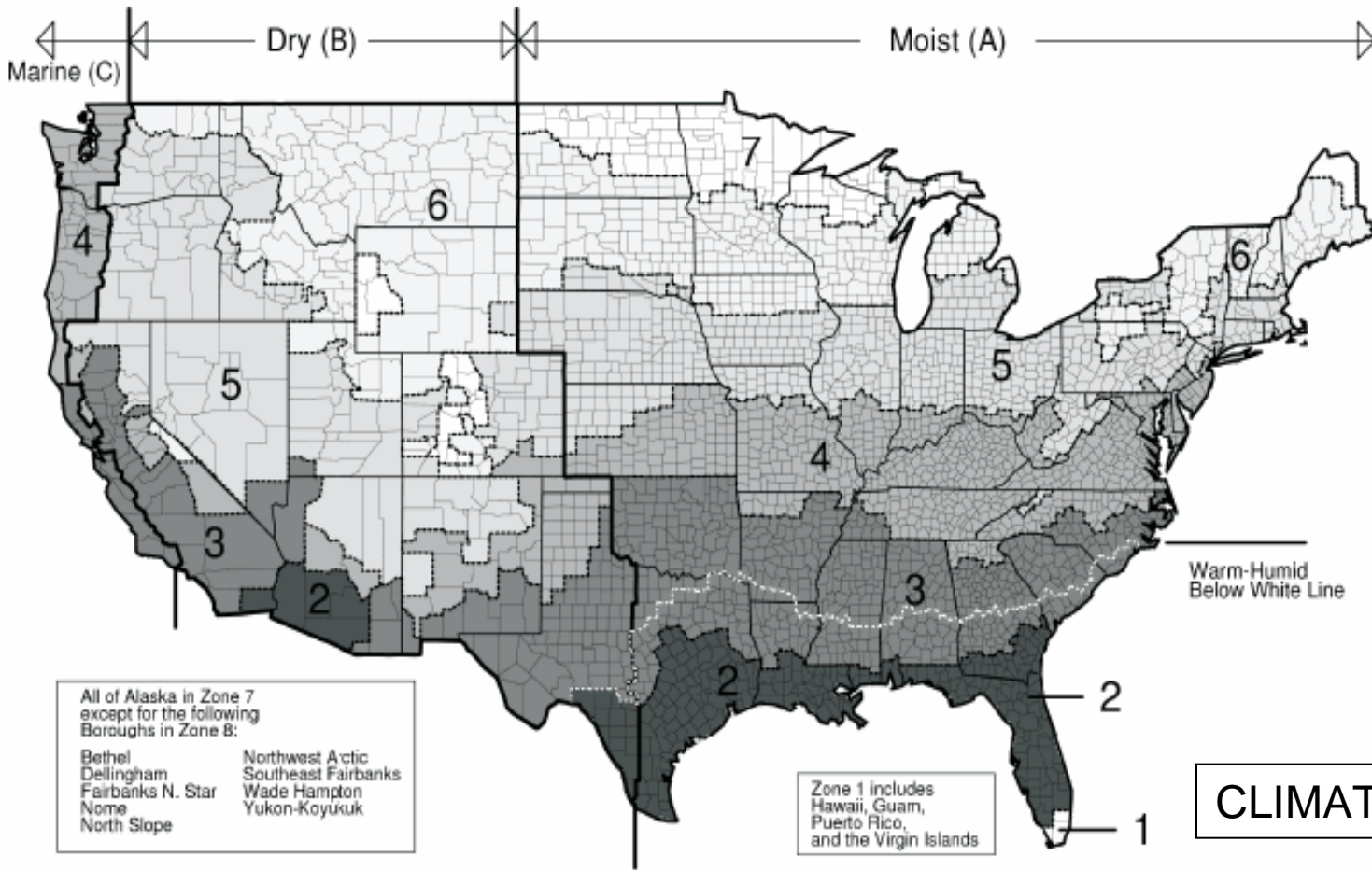
Thermal – IECC 2006

Projection Factor (PF)

- Measure of shading
- $PF = A/B$ (Equation 5-1) where:
 - A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
 - B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.



Performance Criteria Thermal – Climate Zones



Performance Criteria

Other Considerations

- Visible Light Transmittance (VT)
 - Measure of amount of visible light that passes through the glass.
 - Measured from 0 to 1. Most glass between 0.3 to 0.8.
- Forced Entry Resistance: ASTM F588 / ASTM F842
- Operating Force ASTM E2068
- Condensation Resistance Factor: AAMA 1503-98
- Acoustics: STC and O-ITC

AAMA Window Selection Example

- Low rise building located in Memphis, TN
- No impact resistance required
- No shelter or shading for windows

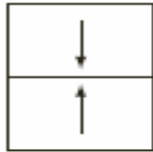


AAMA Window Selection

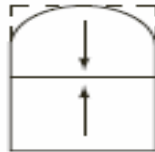
Step One

- Determine the size of the unit
- The largest operating sash window should determine selection
- Typically specify all windows for the project to meet the same criteria
- It may be necessary to separate “fixed” and “operable” units

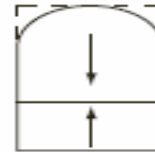
AAMA Window Selection Step One



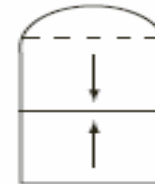
Maximum size tested is greater than or equal to minimum gateway test size



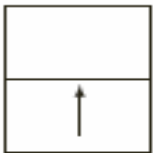
Qualified by maximum size tested



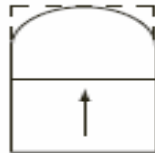
Not qualified by maximum size tested



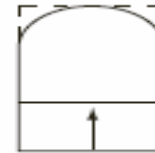
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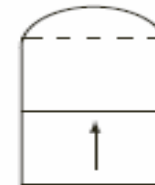
Maximum size tested is greater than or equal to minimum gateway test size



Qualified by maximum size tested



Not qualified by maximum size tested



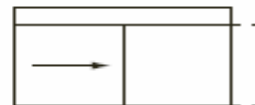
Not qualified by maximum size tested



Maximum size tested is greater than or equal to minimum gateway test size



Qualified by maximum size tested



Not qualified by maximum size tested



Not qualified by maximum size tested



AAMA Window Selection

Step One



Fixed window

Maximum size tested is greater than or equal to minimum gateway test size



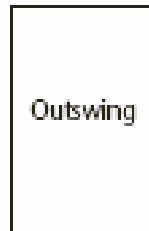
Qualified by maximum size tested



Qualified by maximum size tested



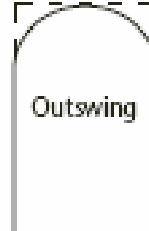
Not qualified by maximum size tested



Outswing

△

Maximum size tested is greater than or equal to minimum gateway test size



Outswing

Qualified by maximum size tested



Inswing

Not qualified by outswing test

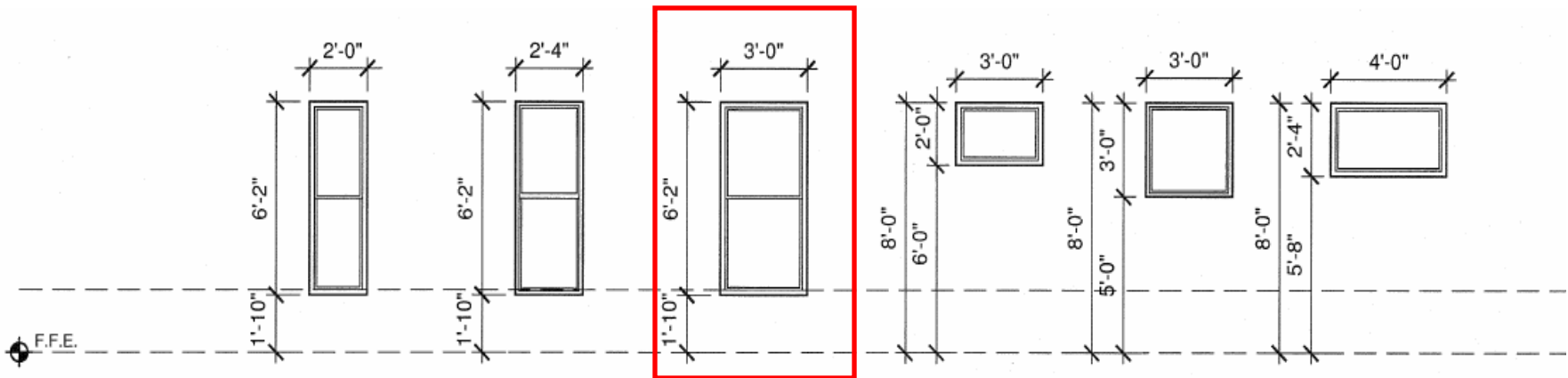








Outswing

Not qualified by maximum size tested

AAMA Window Selection Step One

Largest Operable = 36" x 74"



WIN. TYPE						
WINDOW SIZE	2'-0"x6'-0" SINGLE HUNG	2'-4"x6'-0" SINGLE HUNG	3'-0"x6'-0" SINGLE HUNG	3'-0"x2'-0" FIXED	3'-0"x3'-0" FIXED	4'-0"x2'-4" FIXED
GLAZING TYPE	INSULATED	INSULATED	INSULATED	INSULATED	INSULATED	INSULATED
NOTES						
FRAME COLOR						
FRAME COLOR-1						

AAMA Window Selection

Step Two

- Determine Operating Type

AP	=	Awning, Hopper, Projected Window
BW	=	Basement Windows
C	=	Casement Windows
DA	=	Dual Action Windows
DA-HGD	=	Dual Action Hinged Glass Doors
F	=	Fixed Windows
GH	=	Greenhouse Windows
H	=	Hung Windows (Single, Double, Triple)
HE	=	Hinged Egress Windows
HGD	=	Hinged Glass Doors
HP	=	Horizontally Pivoted Windows
HS	=	Horizontal Sliding Windows
J	=	Jalousie Windows
JA	=	Jal-Awning Windows
SHW	=	Side Hinged Inswinging Windows
SGD	=	Sliding Glass Doors
TA	=	Tropical Awning Windows
TH	=	Top Hinged Windows
VP	=	Vertically Pivoted Windows
VS	=	Vertical Sliding Windows

AAMA Window Selection

Step Three

Determine Design Pressure – Wind Load

1.03 WIND LOADS

BASIC WIND SPEED (3 SECOND GUST) 90 mph
 WIND IMPORTANCE FACTOR, I 1.0
 WIND EXPOSURE CATEGORY B
 INTERNAL PRESSURE COEFFICIENT +0.18/-0.18
 COEFFICIENTS AND PRESSURES.

	q_h psf	q_z psf	K_{zt}	K_h	K_z
BUILDINGS	16	11.9	1.00	0.771	0.575

COMPONENTS AND CLADDING

ROOF (FIELD) +7.0 psf/-17.1 psf
 ROOF (PERIMETER) +7.0 psf/-28.8 psf
 ROOF (CORNER) +7.0 psf/-43.3 psf
 WALL (FIELD) +15.7 psf/-17.0 psf
 WALL (CORNER) **+15.7 psf/-20.9 psf**

CORNER DISTANCE (MAX): MIXED USE BUILDING 11.4 ft
 TOWNHOUSES 5.9 ft

Requires Minimum 25 psf design pressure for wind load

AAMA Window Selection

Step Three

Determine Design Pressure – Rain Exposure

25 psf structural pressure:

- < 25 psf structural: 4.5 psf for water
- < 30 psf structural: 6.0 psf for water
- < 40 psf structural: 8.0 psf for water
- < 60 psf structural: 12.0 psf for water

4.5 psf * 10 = 45 psf Design Pressure

↑
Water field pressure @ 10% of design pressure (R, LC, C, or HC)

AAMA Window Selection Step Three

Determine Design Pressure

- Structural = 25 psf (min)
- Water Leakage = 45 psf (min) ← Governs

- Design Pressure = 45 psf

AAMA Window Selection

Step Four

Impact Resistance

- Miami-Dade / Broward: TAS 201/203
- AAMA 506 – accepted outside Miami-Dade / Broward

- None required for this example

AAMA Window Selection Step Five

Find a product that meets base criteria

- Operator Type: H
- Performance Class: R or better
- Performance Grade: ≥ 45
- No Impact Resistance Required
- H-R45 or better



AAMA Window Selection Step Five

Find a product that meets base criteria

- <http://www.aamanet.org/general.asp?sect=2&id=44>

Manufacturer:

Operator Type:

Perf. Class:

Perf. Grade: psf

Framing Material:

Impact Resistance: CHECK ALL THAT APPLY

TAS 201/203 (the only impact test accepted in Miami-Dade and Broward Counties, FL)

AAMA 506 (accepted outside Miami-Dade/Broward Counties, FL)

AAMA Window Selection Step Five

Find products that meet base criteria

Total Records: 633 (Currently Viewing: 1 to 25)

[Next »](#)

Manufacturer	Operator Type	Model Number	Perf Class	Framing Matl	Perf Grade	TAS 201/203	AAMA 506
ALSIDE WINDOW CO.-CENTRAL	H	0303/S301/E301 DH	R	PVC	45*	No	No
ALSIDE WINDOW CO.-CENTRAL	H	0301/S301/E301	R	PVC	50*	No	No
ALSIDE WINDOW CO.-CENTRAL	H	i201	R	PVC	50	No	Yes
ALSIDE WINDOW CO.-CENTRAL	H	07HP TRIPLE SH	R	PVC	50*	No	No
ALSIDE WINDOW CO.-CENTRAL	H	i201	R	PVC	45	No	No
ALSIDE WINDOW CO.-CENTRAL	H	0100/D100	R	PVC	45*	No	No
ALSIDE WINDOW CO.-CENTRAL	H	3100 TILT SH	R	PVC	50	No	Yes
ALSIDE WINDOW CO.-MIDWEST	H	07HP TRIPLE SH	R	PVC	50*	No	No
ALSIDE WINDOW CO.-MIDWEST	H	0301/S301/E301	R	PVC	50*	No	No

AAMA Window Selection Step Five


Find products that meet base criteria

Performance: 1111 **DP 50 38 1/2" x 74 1/2"**

DP 50 >= 45 **OK**

38 1/2" x 74 1/2" > 36" x 74" **OK**

1111 DP50
Superior Vinyl Windows



Performance: 1111 DP 50 35 1/2" X 71 1/2"
(*H-R 40 44" X 72")

*Operating Force	ASTM E2068	open	Measured	30 lbf
		close		30 lbf
*Air Infiltration	ASTM E283	1.57 pcf (25mph)	0.1 cfm/ft	0.3 cfm/ft
*Water Resistance	ASTM E547	WTF=6.00 pcf	no entry	no entry
Uniform Load Structural	ASTM E330			
		75.0 pcf exterior	0.029"	0.132"
		75.0 pcf interior	0.024"	0.132"
		60.0 pcf exterior	0.157"	0.166"
		60.0 pcf interior	0.059"	0.166"
			no entry	no entry

*H-R 40

*Forced Entry ASTM F588-97
Florida Approval # 3519 - 3
(Other Alenco Vinyl Product Florida Approvals 1214.1 / 1214.2 / 1262.1 / 1262.2)


Rough Openings: Square or Rectangle

Width	Exact	Opening
2'0"	23 1/2"	24"
2'4"	27 1/2"	28"
2'8"	29 1/2"	30"
2'8"	31 1/2"	32"
3'0"	35 1/2"	36"
3'0"	41 1/2"	42"
3'8"	43 1/2"	44"
4'0"	47 1/2"	48"
5'0"	50 1/2"	60"
6'0"	71 1/2"	72"

Rough Openings: Round Head (stand alone)

Width	Exact	Opening
2'0"	23 1/2" X 11 3/4"	24" X 12"
2'8"	31 1/2" X 15 3/4"	32" X 16"
3'0"	35 1/2" X 17 3/4"	36" X 18"
3'8"	43 1/2" X 21 3/4"	44" X 22"
4'0"	47 1/2" X 23 3/4"	48" X 24"
5'0"	59 1/2" X 29 3/4"	60" X 30"
5'4"	63 1/2" X 31 3/4"	64" X 32"
6'0"	71 1/2" X 35 3/4"	72" X 36"

Rough Openings:
For Table / Triple or Stacked Unit
Use Overall Call Out Size
example 3000 triple call outsize is 72" X 60"
rough opening is 72" X 60"
(Walls are 1/2" wide)



NFRC Thermal Performance: Glass w/muntins

		U Value	SHGC*	VLT**
1110 single - hung	clear	0.49	0.57	0.59
1110 single - hung	LoE 2	0.35	0.27	0.50
1101 fixed	clear	0.48	0.59	0.61
1101 fixed	LoE 2	0.34	0.29	0.53

* Solar Heat Gain Coefficient ** Visible Light Transmission

10/05

AAMA Window Selection Step Six

ENERGY REQUIREMENTS

**TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
U-Factor								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront U-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door U-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other U-Factor ^a	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
Glass								
U-Factor	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
Plastic								
U-Factor	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.60
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

AAMA Window Selection Step Six

ENERGY REQUIREMENTS

- U-Value : Require 0.40 or lower **OK**
- SGH Value: Require 0.40 or lower **OK**

1111 DP50 Superior Vinyl Windows



Performance: 1111 DP 50 35 1/2" X 71 1/2"
(*10'-0" 44" X 72")

*Operating Force	ASTM E2068	open	13 lbf	Measured	30 lbf
		close	22.0 lbf		30 lbf
*Air Infiltration	ASTM E283	1.57 pcf (25mph)	0.1 cfm/ft		0.3 cfm/ft
*Water Resistance	ASTM E547	WTF=6.00 pcf	no entry		no entry
Uniform Load Structural	ASTM E330				
		75.0 pcf exterior	0.029"		0.132"
		75.0 pcf interior	0.024"		0.132"
*H-R 40		80.0 pcf exterior	0.157"		0.166"
		80.0 pcf interior	0.050"		0.166"
*Forced Entry	ASTM F569-97		no entry		no entry
Florida Approval #	3519 - 3				
(Other Alenco Vinyl Products Florida Approvals 1214.1 / 1214.2 / 1262.1 / 1262.2)					

Rough Openings: Square or Rectangle

Width	Exact	Opening
20"	23 1/2"	24"
24"	27 1/2"	28"
26"	29 1/2"	30"
28"	31 1/2"	32"
30"	33 1/2"	34"
36"	41 1/2"	42"
38"	43 1/2"	44"
40"	47 1/2"	48"
50"	59 1/2"	60"
60"	71 1/2"	72"
Height	Exact	Opening
24"	27 1/2"	28"
30"	33 1/2"	34"
36"	41 1/2"	42"
40"	47 1/2"	48"
44"	51 1/2"	52"
50"	59 1/2"	60"
60"	71 1/2"	72"

Rough Openings: Round Head (stand alone)

Width	Exact	Opening
20"	23 1/2" X 11 3/4"	24" X 12"
28"	31 1/2" X 15 3/4"	32" X 16"
30"	35 1/2" X 17 3/4"	36" X 18"
38"	43 1/2" X 21 3/4"	44" X 22"
40"	47 1/2" X 23 3/4"	48" X 24"
50"	59 1/2" X 29 3/4"	60" X 30"
60"	71 1/2" X 35 3/4"	72" X 36"

Rough Openings:
For Double, Triple, or Stacked Unit
Use Overall Call Out Size
example 3050 twin call outsize is 72" X 60"
rough opening is 72" X 60"
(Mills are 1/2" wide)

NFRC Thermal Performance: Glass w/muntins	U Value	SHGC*	VLT**
1110 single - hung	clear	0.49	0.57
1110 single - hung	LoE 2	0.35	0.27
1101 fixed	clear	0.48	0.59
1101 fixed	LoE 2	0.34	0.29

* Solar Heat Gain Coefficient ** Visible Light Transmission



10.05

NFRC Thermal Performance: Glass w/muntins		U Value	SHGC*	VLT**
1110 single - hung	clear	0.49	0.57	0.59
1110 single - hung	LoE 2	0.35	0.27	0.50
1101 fixed	clear	0.48	0.59	0.61
1101 fixed	LoE 2	0.34	0.29	0.53

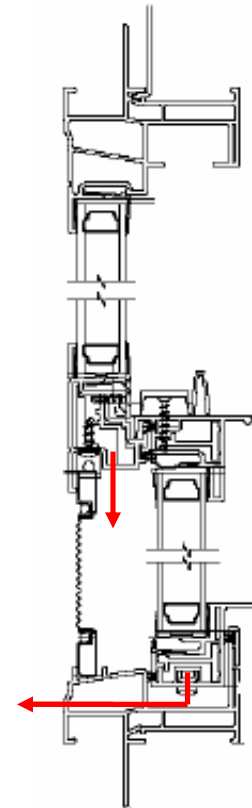
* Solar Heat Gain Coefficient

** Visible Light Transmission

AAMA Window Selection Step Seven

REVIEW WINDOW DESIGN

- Check drainage paths
- Make sure water that enters around operable can drain
- Make sure glazing pocket is weeped



AAMA Window Selection Step Seven

OTHER FACTORS

*Operating Force	ASTM E2068	open close	Measured 13 lbf 22.0 lbf
*Air Infiltration	ASTM E283	1.57 psf (25mph)	0.1 cfm/ft
*Water Resistance	ASTM E547	WTP=6.00 psf	no entry
Uniform Load Structural	ASTM E330		
		75.0 psf exterior	0.029"
		75.0 psf interior	0.024"
	*H-R 40	60.0 psf exterior	0.157"
		60.0 psf interior	0.059"
*Forced Entry	ASTM F588-97		no entry

1111 DP50 Superior Vinyl Windows



Performance: 1111 DP 50 35 1/2" X 71 1/2"
(*H-R 40 44" X 72")

*Operating Force	ASTM E2068	open close	Measured 13 lbf 22.0 lbf
*Air Infiltration	ASTM E283	1.57 psf (25mph)	0.1 cfm/ft
*Water Resistance	ASTM E547	WTP=6.00 psf	no entry
Uniform Load Structural	ASTM E330		
		75.0 psf exterior	0.029"
		75.0 psf interior	0.024"
	*H-R 40	60.0 psf exterior	0.157"
		60.0 psf interior	0.059"
*Forced Entry	ASTM F588-97		no entry

30 lbf	0.132"
30 lbf	0.132"
0.3 cfm/ft	0.166"
no entry	0.166"

Florida Approval # 3519 - 3
(Other Alenco Vinyl Product Florida Approvals 1214.1 / 1214.2 / 1262.1 / 1262.2)

Rough Openings: Square or Rectangle

Width	Exact	Opening
2'0"	23 1/2"	24"
2'4"	27 1/2"	28"
2'8"	29 1/2"	30"
2'8"	31 1/2"	32"
3'0"	35 1/2"	36"
3'8"	41 1/2"	42"
3'8"	43 1/2"	44"
4'0"	47 1/2"	48"
5'0"	59 1/2"	60"
6'0"	71 1/2"	72"
Height	Exact	Opening
2'4"	27 1/2"	28"
3'0"	29 1/2"	36"
3'8"	43 1/2"	44"
4'0"	47 1/2"	48"
4'4"	51 1/2"	52"
5'0"	59 1/2"	60"
6'0"	71 1/2"	72"

Rough Openings: Round Head (stand alone)

Width	Exact	Opening
2'0"	23 1/2" X 11 3/4"	24" X 12"
2'8"	31 1/2" X 15 3/4"	32" X 18"
3'0"	35 1/2" X 17 3/4"	36" X 18"
3'8"	43 1/2" X 21 3/4"	44" X 22"
4'0"	47 1/2" X 23 3/4"	48" X 24"
5'0"	59 1/2" X 29 3/4"	60" X 30"
5'4"	63 1/2" X 31 3/4"	64" X 32"
6'0"	71 1/2" X 35 3/4"	72" X 36"

Rough Openings:

For Twin / Triple or Stacked Unit
Use Overall Call Out Size
example 3050 twin call outsize is 72" X 60"
rough opening is 72" X 60".
(Mulls are 1/2" wide)



NFRC Thermal Performance: Glass w/muntins	U Value	SHGC*	VT**
1110 single - hung	clear	0.49	0.57
1110 single - hung	LoE 2	0.35	0.27
1101 fixed	clear	0.48	0.59
1101 fixed	LoE 2	0.34	0.29

* Solar Heat Gain Coefficient ** Visible Light Transmission

AAMA Summary

Advantages to specifying per AAMA

- Products are independently tested and performance confirmed
- Widely accepted standard for residential windows
- AAMA certification label defines performance expectations

AAMA Summary

Challenges when specifying per AAMA

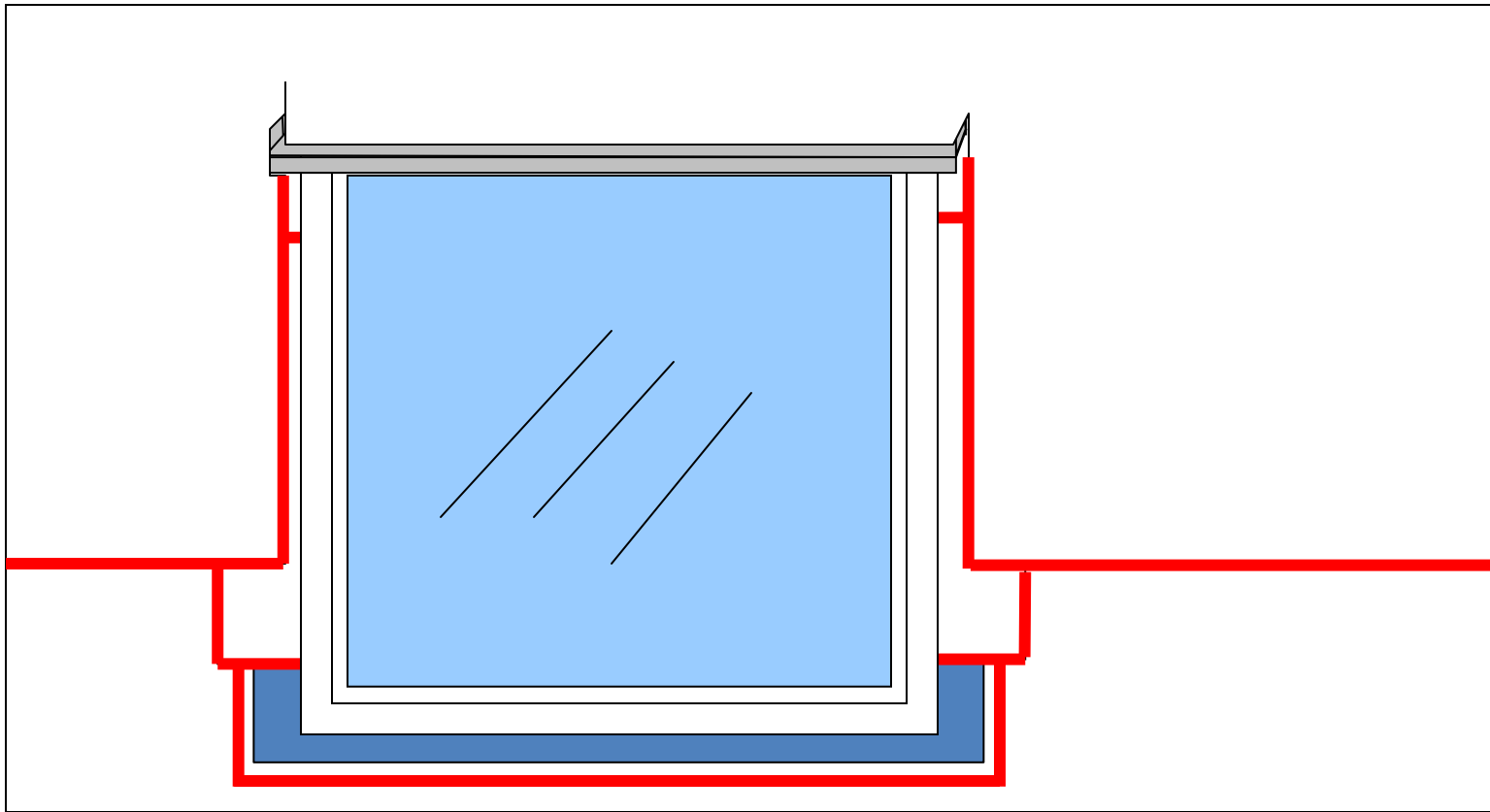
- Water and air leakage requirements are not explicit
- Requires “mental gymnastics” to determine actual field performance of specified window for water and air leakage.
- Improved water leakage performance requires specification of higher structural pressures.

Installation Details

- Considerations:
 - Weather Barrier Continuity
 - Air Barrier Continuity
 - Structural Attachment (wind loads)
 - Differential movements
 - Building deflections
 - Thermal expansion / contraction

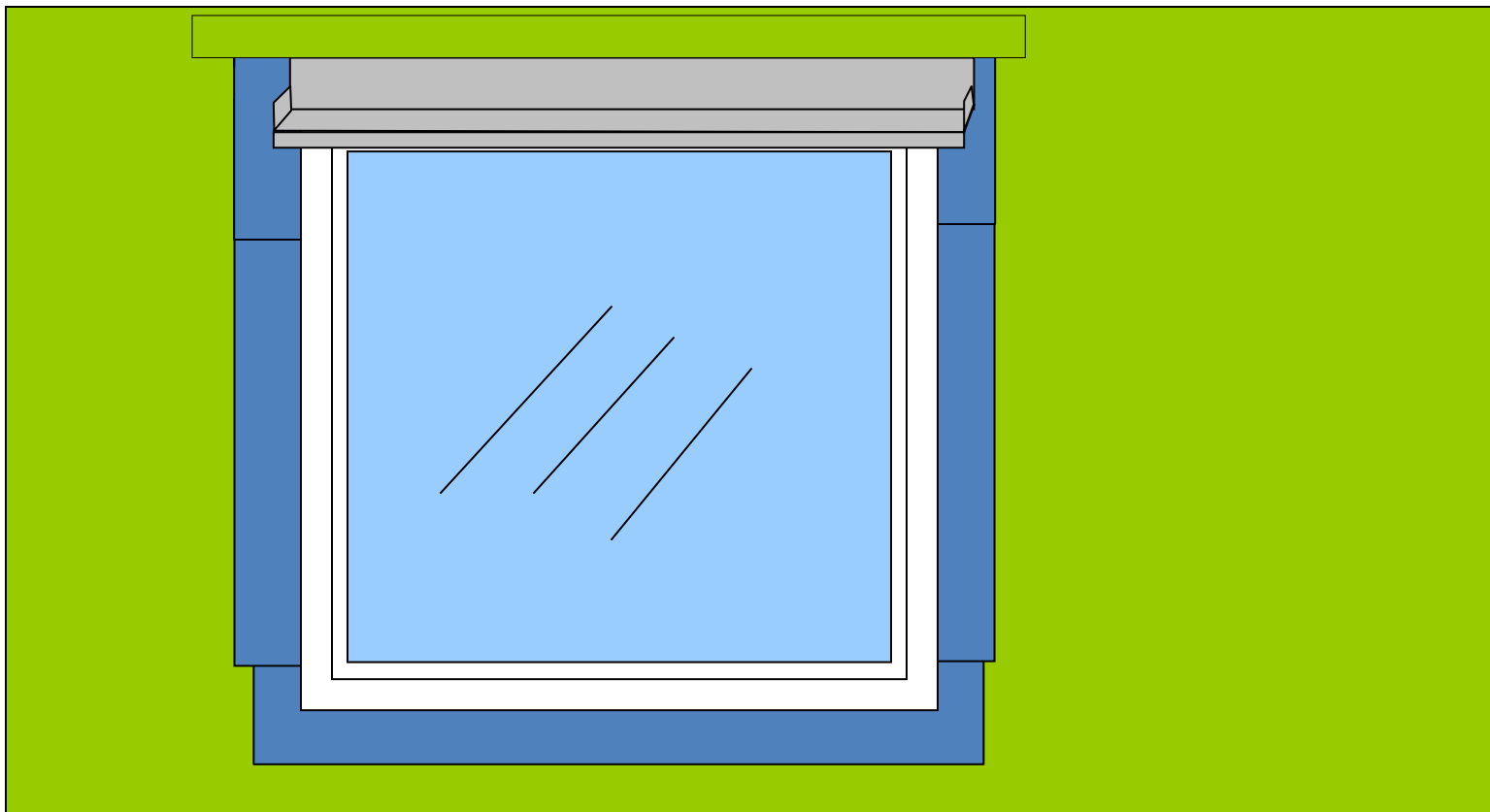
Installation Details

Installation Detail – Sheet WRB / AB



Installation Details

Installation Detail – Fluid WRB / AB



Test Methods

- Laboratory Testing
 - Structural ASTM E330
 - Tested to 150% of positive and negative design pressure
 - Water Penetration ASTM E331 / ASTM E547
 - Tested using negative air pressure chamber
 - Air Leakage ASTM E283
 - Tested @ 1.57 psf or 6.24 psf depending on AAMA class

Test Methods

- Field Testing
 - Water Penetration
 - ASTM E1105: Test using negative air pressure chamber
 - AAMA 502-02: Follows ASTM E1105, allows test to be run at 2/3 of design test pressure
 - AAMA 501.2: Spray pole testing. No induced air pressure
 - Air Leakage ASTM E783
 - Tested @ 1.57 psf or 6.24 psf depending on specifications



Specifying Field Testing Requirements

- Require third party testing agency
- Field water test per ASTM E1105
- Test window and interfaces
- State field test pressure explicitly
 - *“Field test at 4.5 psf static pressure”*
- Define pass/fail for water leakage requirements
 - *“No water leakage past a plane parallel to the glazing”*
- Air Leakage test per ASTM E783. Specify test pressure and allowed leakage
 - *“Test at a minimum static pressure of 1.57 psf. Maximum allowed air leakage rate of 0.20 cfm / ft²”*

Summary

- AAMA commonly used to specify residential windows
- Performance criteria
 - Structural Criteria, Water Leakage, Air Leakage
 - Thermal / Energy
 - Other Considerations
- Review window shops – drainage path key
- Installation detailing critical too performance
- Field test to confirm performance

Thank you for your time!

QUESTIONS?

**This concludes The American Institute of Architects
Continuing Education Systems Program**