Specifying Windows and Doors Using Performance Standards
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Specifying Windows and Doors Using Performance Standards

Learning Objectives:

- Understand The Evolution Of Window and Door Standards and Code References
- Recognize How To Use The Standard To Specify Product Type, Performance Level And Key Performance Attributes
- Analyze Special Requirements for Different Window and Door Types
- Learn To Use the Short Form Specification
Standard/Specification for windows, doors, and unit skylights

The New Standard
AAMA/WDMA/CSA 101/I.S. 2/A440-05
Getting to 101-05

1947  
The first Guide Specification for Aluminum Windows was released.

1950  
Performance levels for different applications were first defined.

1962  
AAMA 302 aluminum window standard was released.

1968  
AAMA “101” standard for aluminum windows and doors was released.

1985  
AAMA “101” standard for aluminum windows and doors was released.

1988  
AAMA “101” standard for aluminum windows and doors is updated from 1985 document and released.

1986  
AAMA “101” standard for vinyl windows and doors was released.

1993  
AAMA “101” standards for aluminum and vinyl windows and doors combined and released.

1994  
AAMA and NWWDA begin work to consolidate the two major U.S. standards for windows and glass doors.

1997  
ANSI/AAMA/NWWDA 101/I.S. 2-97 was released, encompassing products made of aluminum, vinyl, fiberglass or wood, as well as those with aluminum- or vinyl-clad wood framing members.

1997  
ANSI/AAMA/WDMA 101/I.S. 2/NAFS - 02, was released, which incorporates skylights, sidelites and transoms for the first time.

2002  
ANSI/AAMA/WDMA/CPSA 101/I.S. 2/A440-05 was released, fully consolidating U.S. and Canadian standards and adding four more operator types, eight additional materials and requirements for side-hinged doors.

2005  
AAMA/WDMA/CSA 101/I.S. 2/A440-05 was issued, fully consolidating U.S. and Canadian standards and adding four more operator types, eight additional materials and requirements for side-hinged doors.
Key Features of AAMA/WDMA/CSA 101/I.S. 2/A440–05

- Performance Based
Key Features of AAMA/WDMA/CSA 101/I.S. 2/A440–05

- Performance Based
- Material Neutral
Key Features of AAMA/WDMA/CSA 101/I.S. 2/A440–05

- Performance Based
- Material Neutral
- Referenced by IBC and IRC
Key Features of AAMA/WDMA/CSA 101/I.S. 2/A440–05

- Performance Based
- Material Neutral
- Referenced by IBC and IRC
- Multinational in Scope
Using 101/I.S. 2/A440-05

- What type of product?
- What application?
- Performance level?
What Type of Product?
Product Types

30 Product Types are Identified in the 2005 Standard by a Specific Letter Code.
Application: What Kind of Building?
Performance Class
## Performance Grade

<table>
<thead>
<tr>
<th>Product Performance Class</th>
<th>Minimum Performance Grade</th>
<th>Minimum Design Pressure (psf)</th>
<th>Wind Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows and Doors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>15</td>
<td>720 (15.0)</td>
<td>77</td>
</tr>
<tr>
<td>LC</td>
<td>25</td>
<td>1200 (25.0)</td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>1440 (30.0)</td>
<td>109</td>
</tr>
<tr>
<td>HC</td>
<td>40</td>
<td>1920 (40.0)</td>
<td>126</td>
</tr>
<tr>
<td>AW</td>
<td>40</td>
<td>1920 (40.0)</td>
<td>126</td>
</tr>
</tbody>
</table>
Product Designation System

HS – R 15 – 63x44

A
B
C
D

PRODUCT KEY

A = Product Type: Horizontal Siding Window (HS)
B = Performance Class: R
C = Performance Grade: Design Pressure = 15 psf
D = Maximum Size Tested: Width x Height (63x44)
AAMA Label

QUALITY CONTROL & TESTING
AAMA CERTIFICATION PROGRAM
ACCREDITED BY: AMERICAN NATIONAL STANDARDS INSTITUTE
VALIDATOR: ALI®

Series: XXX XX
AAMA/WDMA/CSA 101/I.S.2/A440-05
HS-R15-1600 x 1100 (63 X 44)
Basic Performance Requirements

- Structural adequacy to withstand design wind loads
- Resistance to water penetration
- Resistance to air infiltration
- Resistance to forced entry
ASCE Design Wind Load Map
## Design Wind Load Table (psf)

<table>
<thead>
<tr>
<th>Mean Roof Height (ft.)</th>
<th>Positive Pressure All Areas</th>
<th>Negative Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area 5</td>
</tr>
<tr>
<td><strong>BASIC WIND SPEED – 70 MPH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>16.6</td>
<td>-17.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-22.6</td>
</tr>
<tr>
<td>20</td>
<td>18.0</td>
<td>-19.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-24.6</td>
</tr>
<tr>
<td>25</td>
<td>19.2</td>
<td>-20.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-26.2</td>
</tr>
<tr>
<td>30</td>
<td>20.3</td>
<td>-21.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-27.7</td>
</tr>
<tr>
<td>40</td>
<td>21.9</td>
<td>-23.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-29.9</td>
</tr>
<tr>
<td>50</td>
<td>23.4</td>
<td>-24.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-31.9</td>
</tr>
<tr>
<td>60</td>
<td>24.6</td>
<td>-26.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-33.6</td>
</tr>
<tr>
<td>70</td>
<td>25.7</td>
<td>-27.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-35.0</td>
</tr>
<tr>
<td>80</td>
<td>26.7</td>
<td>-28.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-36.4</td>
</tr>
<tr>
<td>90</td>
<td>27.7</td>
<td>-29.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-37.8</td>
</tr>
</tbody>
</table>

*Excerpt from ASCE-7 and AAMA TIR-A10*
Structural Loading
Minimum Performance Requirements Listed by Class

<table>
<thead>
<tr>
<th>Window/Door Classes</th>
<th>Design Pressure (psf)</th>
<th>Structural Test Pressure (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>15</td>
<td>22.5</td>
</tr>
<tr>
<td>LC</td>
<td>25</td>
<td>37.5</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>45.0</td>
</tr>
<tr>
<td>HC</td>
<td>40</td>
<td>60.0</td>
</tr>
<tr>
<td>AW</td>
<td>40</td>
<td>60.0</td>
</tr>
</tbody>
</table>
Uniform Load Deflection Test at the Design Pressure

A minimum uniform design pressure load is applied to the test specimen, first to the exterior surface (positive) and then to the interior surface (negative).

Deflection at design pressure is reported for all products. For HC and AW products, the deflection must not exceed L/175.
Structural Load Requirements

1997 Version
Uniform Load Structural Test

There can be no permanent deformation of any mainframe, sash, panel or sash member in excess of 0.4% of its span for R, LC, C or HC class products or 0.2% of its span for AW class products.
Structural Load Requirements

2002 and 2005 Versions
Uniform Load Structural Test

There can be no permanent deformation of any mainframe, sash, sash member, leaf or threshold/ sill in excess of 0.4% of its span for R, LC class products, 0.3% of its span for C and HC class products, or 0.2% of its span for AW class products.
Water Penetration
Water Test Pressure

- 20% of Design Pressure
- 15% of Design Pressure (or 2.9 minimum as shown)
- 8.0 min.

Bar chart showing minimum design pressures:
- R: 15, 2.9 min.
- LC: 25, 3.8 min.
- C: 30, 4.5 min.
- HC: 40, 6.0 min.
- AW: 40, 8.0 min.

Legend: psf (min.)
# Minimum Performance Requirements Listed by Class

<table>
<thead>
<tr>
<th>Window/Door Classes</th>
<th>Design Pressure (psf)</th>
<th>Structural Test Pressure (psf)</th>
<th>Water Resistance Test Pressure (psf)</th>
<th>Required Percentage For Water Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>15</td>
<td>22.5</td>
<td>2.9</td>
<td>*</td>
</tr>
<tr>
<td>LC</td>
<td>25</td>
<td>37.5</td>
<td>3.8</td>
<td>15%</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>45.0</td>
<td>4.5</td>
<td>15%</td>
</tr>
<tr>
<td>HC</td>
<td>40</td>
<td>60.0</td>
<td>6.0</td>
<td>15%</td>
</tr>
<tr>
<td>AW</td>
<td>40</td>
<td>60.0</td>
<td>8.0</td>
<td>20%</td>
</tr>
</tbody>
</table>

* R15 products are tested at 2.9 psf, which is higher than the 15% of design pressure, as required for other higher ratings within the R class.
Performance Considerations Related to Design Pressure

Performance Grade = Design Pressure

Structural Test Pressure = 1.5 Design Pressure

Water Resistance Test Pressure = 0.15 Design Pressure for R, LC, C and HC
0.20 Design Pressure for AW
Air Infiltration

Air Infiltration Control Panel
Air Infiltration Test Pressure

FOR VARIOUS PERFORMANCE CLASSES

- R: 1.6 psf
- LC: 1.6 psf
- C: 1.6 psf
- HC: 6.2 psf
- AW: 6.2 psf
Maximum Air Infiltration

FOR VARIOUS PERFORMANCE CLASSES AND GRADES

Field air infiltration is permitted to be 1.5 times values shown below.
Resistance to Forced Entry

ASTM F 588
ASTM F 842
AAMA 1304
Window Testing
# Minimum Test Size Requirements

**Test Sample Requirements**
*(Example: Casement Windows)*

<table>
<thead>
<tr>
<th>Window Designation</th>
<th>2005 Minimum Frame Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-R15</td>
<td>24&quot; (600 mm) x 60&quot; (1500 mm)</td>
</tr>
<tr>
<td>C-LC25</td>
<td>32&quot; (800 mm) x 60&quot; (1500 mm)</td>
</tr>
<tr>
<td>C-C30</td>
<td>32&quot; (800 mm) x 60&quot; (1500 mm)</td>
</tr>
<tr>
<td>C-HC40</td>
<td>36&quot; (900 mm) x 60&quot; (1500 mm)</td>
</tr>
<tr>
<td>C-AW40</td>
<td>36&quot; (900 mm) x 60&quot; (1500 mm)</td>
</tr>
</tbody>
</table>
Minimum Test Sizes

Must include all intermediate members to be qualified.
Higher Performance Grades?
### Optional Performance Grades

<table>
<thead>
<tr>
<th>Optional Performance Grade</th>
<th>Applicable Product Designation</th>
<th>Design Pressure</th>
<th>Structural Test Pressure</th>
<th>Water Resistance Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>psf (Pa)</td>
<td>psf (Pa)</td>
<td>R, LC, C and HC psf (Pa)</td>
</tr>
<tr>
<td>20</td>
<td>R</td>
<td>20.0 (960)</td>
<td>30.0 (1440)</td>
<td>3.00 (150)</td>
</tr>
<tr>
<td>25</td>
<td>R</td>
<td>25.0 (1200)</td>
<td>37.5 (1800)</td>
<td>3.75 (180)</td>
</tr>
<tr>
<td>30</td>
<td>R, LC</td>
<td>30.0 (1440)</td>
<td>45.0 (2160)</td>
<td>4.50 (220)</td>
</tr>
<tr>
<td>35</td>
<td>R, LC, C</td>
<td>35.0 (1680)</td>
<td>52.5 (2520)</td>
<td>5.25 (260)</td>
</tr>
<tr>
<td>40</td>
<td>R, LC, C</td>
<td>40.0 (1920)</td>
<td>60.0 (2880)</td>
<td>6.00 (290)</td>
</tr>
<tr>
<td>45</td>
<td>R, LC, C, HC, AW</td>
<td>45.0 (2160)</td>
<td>67.5 (3240)</td>
<td>6.75 (330)</td>
</tr>
<tr>
<td>50</td>
<td>R, LC, C, HC, AW</td>
<td>50.0 (2400)</td>
<td>75.0 (3600)</td>
<td>7.50 (360)</td>
</tr>
<tr>
<td>55</td>
<td>R, LC, C, HC, AW</td>
<td>55.0 (2640)</td>
<td>82.5 (3960)</td>
<td>8.25 (400)</td>
</tr>
<tr>
<td>60</td>
<td>R, LC, C, HC, AW</td>
<td>60.0 (2880)</td>
<td>90.0 (4320)</td>
<td>9.00 (440)</td>
</tr>
</tbody>
</table>

Optional Performance Grades higher than those shown on the table may be used in increments of 5 psf. Water resistance test pressures are capped at 15 psf in the 2002 version of the standard. Ratings are capped at the entry level plus 60 psf in the 2002 & 2005 version of the standard, except for the AW class.
### Optional Performance Grades (cont'd)

<table>
<thead>
<tr>
<th>Optional Performance Grade</th>
<th>Applicable Product Designation</th>
<th>Design Pressure</th>
<th>Structural Test Pressure</th>
<th>Water Resistance Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>psf</td>
<td>Pa</td>
<td>psf</td>
</tr>
<tr>
<td>65</td>
<td>R,LC,C, HC, AW</td>
<td>65.0</td>
<td>3120</td>
<td>97.5</td>
</tr>
<tr>
<td>70</td>
<td>R,LC,C, HC, AW</td>
<td>70.0</td>
<td>3360</td>
<td>105.0</td>
</tr>
<tr>
<td>75</td>
<td>R,LC,C, HC, AW</td>
<td>75.0</td>
<td>3600</td>
<td>112.5</td>
</tr>
<tr>
<td>80</td>
<td>LC,C, HC, AW</td>
<td>80.0</td>
<td>3840</td>
<td>120.0</td>
</tr>
<tr>
<td>85</td>
<td>LC,C, HC, AW</td>
<td>85.0</td>
<td>4080</td>
<td>127.5</td>
</tr>
<tr>
<td>90</td>
<td>C, HC, AW</td>
<td>90.0</td>
<td>4320</td>
<td>135.0</td>
</tr>
<tr>
<td>95</td>
<td>HC, AW</td>
<td>95.0</td>
<td>4560</td>
<td>142.5</td>
</tr>
<tr>
<td>100</td>
<td>HC, AW</td>
<td>100.0</td>
<td>4800</td>
<td>150.0</td>
</tr>
</tbody>
</table>

Optional Performance Grades higher than those shown on the table may be used in increments of 5 psf. Water resistance test pressures are capped at 15 psf in the 2002 version of the standard. Ratings are capped at the entry level plus 60 psf in the 2002 & 2005 version of the standard, except for the AW class.
Optional Performance Grades

Must meet ALL minimum gateway performance requirements before testing at optional higher grades.
Optional Performance Grades Examples

1. Tested Design Pressure @ 80 psf
   Tested Water Resistance @ 8.00 psf
   AW40 / HC50 97/02/05

2. Tested Design Pressure @ 50 psf
   Tested Water Resistance @ 12.00 psf
   AW50 / HC50 97/02/05

3. Tested Design Pressure @ 75 psf
   Tested Water Resistance @ 12.00 psf
   AW75 / HC75 97 & 05 only
   AW60 / HC75 02 only

The performance grade assigned must be consistent with the lowest test level achieved.
Special Requirements Per Window Type?
Deglazing
Life Cycle Testing
Concerns Addressed by AAMA 910 Life Cycle Testing

- Carelessness by the occupants or maintenance personnel.
- Unawareness of proper operating or maintenance procedures.
- Operating force beyond the limits of normal physical ability.
- Attempted operation without proper keys or devices.
AAMA 910 Life Cycle Testing Excludes:

- Vandalism
- Improper installation/handling practices
- Intentional abuse
- Detention or psychiatric applications
Requirements for Mullions
Mullions or Other Structural Members

- Products assembled at the factory are tested as a single complete unit per the 2005 standard or its predecessors.

- Products stacked or combined in the field must be tested for mullion integrity per AAMA 450.
Mullions and Other Structural Members

- Must withstand the full design load for the project site.
- Deflection for all AW and HC products cannot exceed 1/175 of the span length in the 2005 version.
- Evidence of compliance may be by structural analysis or AAMA 450.
Glass and Glazing Materials

- ASTM E 1300 “Standard Practice For Determining The Minimum Thickness And Type Of Glass Required To Resist A Specified Load”
- Glass furnished by the manufacturer must meet the values given in ASTM E 1300 for the design pressure rating of the product
Performance Requirements For Side-Hinged Entry Doors
Laboratory and Field Testing
Short Form Specification

All (windows) (doors) (unit skylights) shall conform to the ___________ voluntary specification(s) in AAMA/WDMA/CSA 101/I.S. 2/A440-05, be labeled with the AAMA, CSA or WDMA label, have the sash arrangement(s), leaf arrangement(s), or sliding door panel arrangement(s) and be of the size(s) shown on the drawings and be as manufactured by ______________ or approved equal.
Short Form Specification

All (windows) (doors) (unit skylights) shall conform to the **HS-LC25** voluntary specification(s) in AAMA/WDMA/CSA 101/I.S. 2/A440-05, be labeled with the AAMA, CSA or WDMA label, have the sash arrangement(s), leaf arrangement(s), or sliding door panel arrangement(s) and be of the size(s) shown on the drawings and be as manufactured by **XYZ Windows** or approved equal.
The New Standard
AAMA/WDMA/CSA 101/I.S. 2/A440-05
Specifying Windows and Doors Using Performance Standards

American Architectural Manufacturers Association
Seminar Evaluation

Please take a moment to complete the evaluation form. Thank You.