AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

AAMA DOCUMENT ADDENDUM

DATE: **March 2007**

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

TITLE: **Standard/Specification for Windows, Doors, and Unit Skylights**

The following revisions have been formally approved and are marked by the symbol delta (Δ) in the margin on the attached replacement pages:

Revised	Contents, Clauses 3, 4.4.2.6.1, 5.3.1.2, 5.3.6.10, 5.3.6.11, and 6.2.1, Tables 6, 17, and 25, and Figure 6 (second-last diagram)
New	Clause 6.2.3.4.6
Deleted	None

AAMA/WDMA/CSA 101/I.S.2/A440-05 originally consisted of 129 pages, each dated February 2005. It now consists of the following pages:

February 2005	v–x, 1–18, 21–34, 39–50, 53–70, 75, 76, 79, 80, 83–110, and 115–119
March 2007	iii, iv, 19, 20, 35–38, 51, 52, 71–74, 77, 78, 81–82A, and 111–114

- Update your copy by inserting these revised pages.
- Keep the pages you remove for reference.

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Contents

Condensation — the deposition of moisture (liquid water or frost) on the surface of an object caused by warm, moist air coming into contact with a colder object.

Corrosion — the deterioration of a material by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals, or other agents or media.

Curtain wall — an external non-bearing wall, intended to separate the exterior and interior environments.

Deflection — displacement due to flexure of a member under an applied load.

Design pressure (DP) — the wind load pressure a product is rated to withstand.

Design wind load — the wind load pressure a product is required by the specifier to withstand in its end use application.

Divider — a member that divides glazing into separate vision areas. Dividers are either structural or decorative. Other common terms are muntin, true divided lite (TDL), simulated divided lite (SDL), grill, grid, or bar in glass.

Double-hung window — a hung window with two sash in which both sash are operable.

Dual-action side-hinged door — a door system consisting of one or more leaves contained within an overall frame and designed such that one of the leaves is operable in a swing mode and can be tilted inward from the top for ventilation.

Dual-action window — a window consisting of a sash that tilts from the top and swings inward from the side for cleaning of the outside surface. Also referred to as a tilt-turn window.

Dual door — a side-hinged door composed of one of the configurations listed in Clause 4.5.1 and offered by the manufacturer and/or pre-hanger as a complete factory pre-assembled, integral, or knocked down (KD) unit.

Dual window — a window composed of one of the configurations listed in Clause 4.5.1 and offered by the manufacturer as a complete factory pre-assembled or integral unit.

Fenestration — openings in the building envelope, such as windows, doors, and unit skylights, designed to permit the passage of air, light, or people.

Fixed door — one inoperable assembled leaf or sliding door panel within a door frame and threshold/sill.

Fixed window — a window designed to be non-operable and consist of a glazed frame or a non-operating sash within a frame. This category does not include non-operable unit skylights.

Float glass — flat glass that has been formed on molten metal, commonly tin. The surface in contact with the tin is known as the tin surface or tin side. The top surface is known as the atmosphere side or air side.

Forced-entry resistance (FER) — the ability of a window or door in the locked position to resist entry under a specified load and conditions.

Δ Force to latch door — the force required to close the door and fully engage the latch in accordance with Clause 5.3.1.2.1.

Frame — the enclosing structure of a window, door, or unit skylight which fits into or attaches to the wall or roof opening and receives either glass, sash, panels, leaves, or vents.

Fully tempered glass — flat or bent glass that has been heat treated to a high surface and/or edge compression to meet the requirements of ASTM C 1048 (kind FT) or CAN/CGSB 12.1. Fully tempered glass, if broken, will fracture into many small pieces (dice) which are more or less cubical. Fully tempered

glass is approximately four times stronger than annealed glass of the same thickness when exposed to uniform static pressure loads. Outside North America, it is sometimes called toughened glass.

Fusion welded — see Welded.

Garage door — see Vehicular-access door.

Garden window — see Greenhouse window.

Gateway performance requirements — the requirements for minimum gateway test size, air leakage resistance, structural design load and overload testing, water penetration testing, forced-entry resistance, and auxiliary testing which are the conditions permitting a product entry into a performance class. They are specifically indicated for each product operator type in Table 25.

Gateway test size — the test specimen size specified to enter a performance class.

Glass — a hard, brittle substance, usually transparent, made by fusing materials such as soda ash (NA_2CO_3), limestone ($CaCO_3$), and sand under high temperatures.

Glazing — (n): an infill material such as glass. (v): the process of installing an infill material into a prepared opening in windows, doors, or unit skylights.

Greenhouse window (garden window) — a window consisting of a three-dimensional, five-sided structure, with provisions made for supporting plants and flowers in the enclosed space outside the plane of the wall. Operating sash are allowed but are not required.

Handle — a component which enables the movement of a sash, leaf, or panel or which activates a mechanism which locks or unlocks a sash, leaf, or panel.

Hardware — all the necessary equipment to retain, operate, and lock or unlock the sash, leaf, or panel within the frame.

Head — the horizontal member forming the top of the frame.

Heat-strengthened glass — flat or bent glass that has been heat treated to a specific surface and/or edge compression range to meet the requirements of ASTM C 1048 (kind HS). Heat-strengthened glass is approximately two times as strong as annealed glass of the same thickness when exposed to uniform static pressure loads. Heat-strengthened glass is not considered safety glass and will not completely fracture into many small pieces (dice) as with fully tempered glass.

Heat treated — see Fully tempered glass and Heat-strengthened glass.

Hinged rescue window — any primary window that is mounted into a stationary perimeter frame and is permanently hinged at one jamb.

Hopper window — see Awning, hopper, and projected window.

Horizontally pivoted window — see Pivoted window.

Horizontal sliding window — a window consisting of units which contain manually operated sash which slide horizontally within a common frame. Operating sash (X) and a fixed lite (O) comprising a unit are termed single sliders (XO or OX). When two operating sash are separated by a fixed lite, the unit is termed a picture slide or end vent (XOX). When two fixed lites are separated by an operating sash, the unit is termed a center slide (OXO). When two bi-parting sash are located at the center of the unit, with fixed lites at each end, the unit is termed a bi-part center slide (OXXO). When adjacent sash bypass one another, the unit is termed a double slide (XX or XXO) or a double slide and vent (XXX).

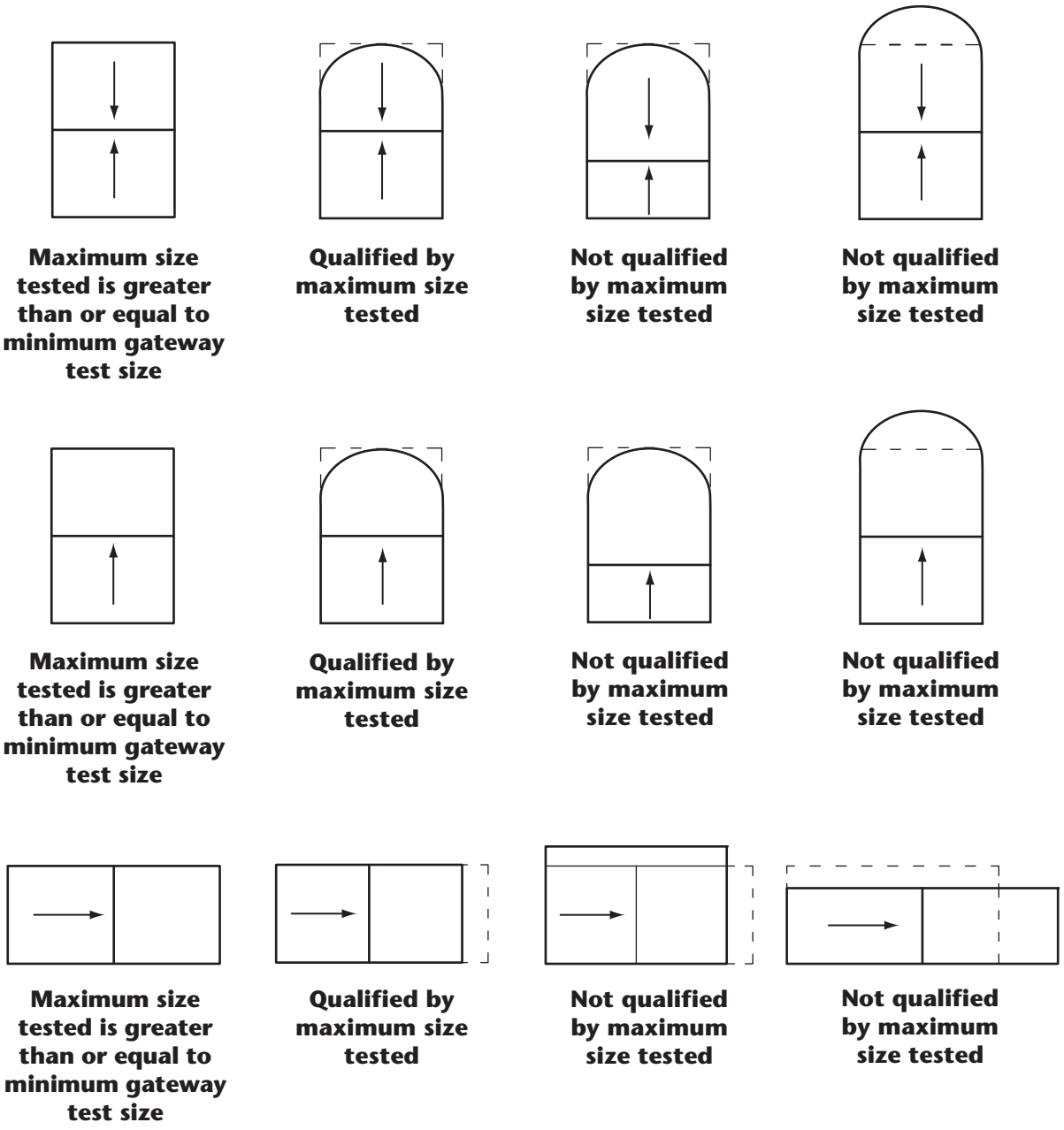

Figure 6
Examples of specialty products
(See Figure 5.)

(Continued)

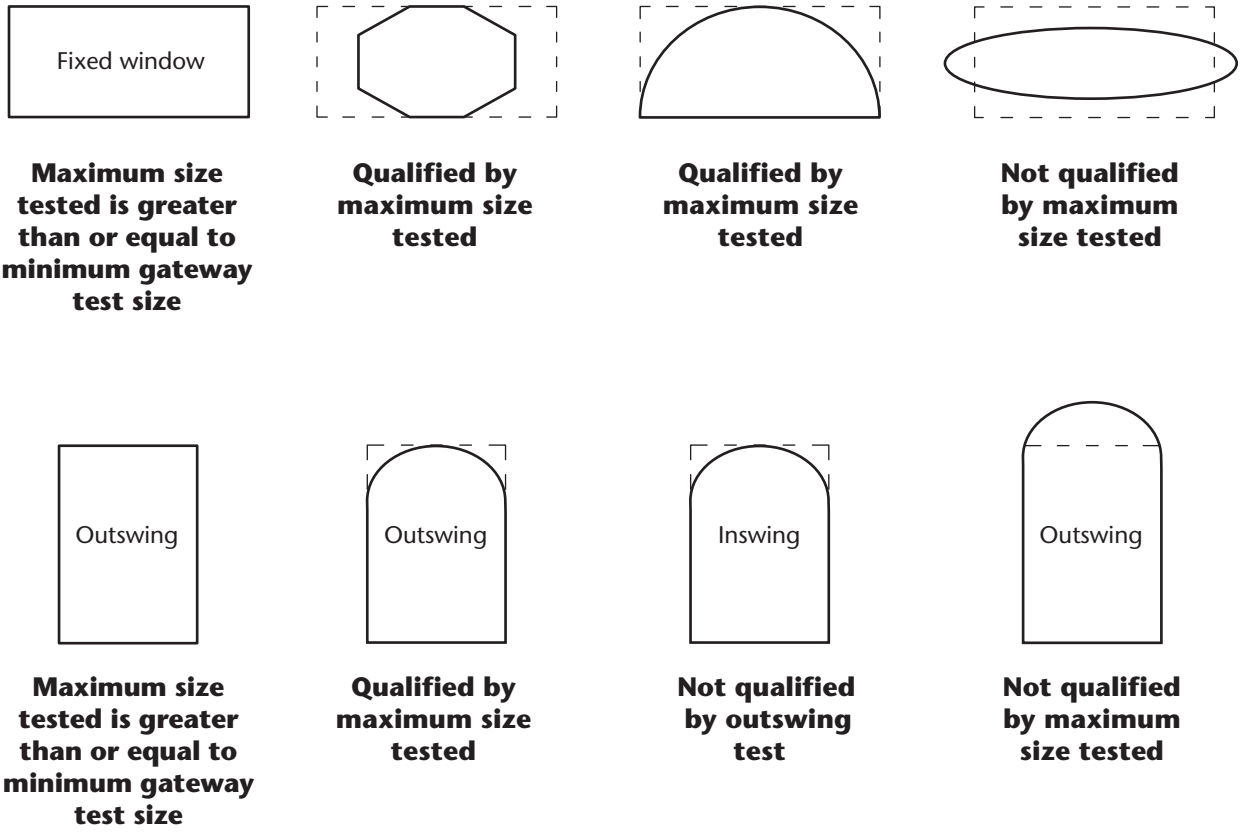

Figure 6 (Concluded)

4.4.2.6 Optional performance grades (design pressures)

Note: *This Clause contains additional requirements and tests for products that may be required by the specifier. It incorporates higher uniform load deflection and uniform load structural test pressures and higher water penetration resistance test pressures than those contained in Table 25.*

Δ 4.4.2.6.1

The following requirements shall apply to testing for optional performance grades:

(a) the original specimen shall be permitted to be tested; or

(b) another specimen of any size shall be permitted to be tested. If the specimen is smaller in width or height than the gateway size, an asterisk (*) shall be appended to the size designation (MST). (See Figure 3.) If the size of the additional specimen is larger in width or height than the gateway specimen size, then all tests in Clause 5 applicable to the product type shall be conducted.

4.4.2.6.2

Clause 4.4.2.6.1 shall be used in conjunction with Clause 8. All products tested under Clause 4.4.2.6.1 shall be required to conform to all of the particular requirements of Clauses 5 to 8 and Table 25 for the product designation under consideration. Prior to being considered for an optional performance grade (design pressure), a product shall

(a) comply with the general requirements of Clauses 5 to 7;

(b) comply with the gateway performance requirements for the minimum performance grade listed in Clause 8;

(c) comply with all of the specific product performance requirements specified in Clause 8 for that product type; and

(d) comply with all of the appropriate material and component requirements specified in Clauses 6 and 7.

After complying with all of the specified minimum requirements at the minimum gateway test size or larger test size for a product, the product shall be permitted to be tested in any test size for conformance to an optional performance grade (design pressure), within the same performance class, in multiple increments of 240 Pa (5.0 psf), as specified in Table 3. Optional performance grades (design pressures) shall not be allowed to exceed the minimum performance grades for design pressures greater than the gateway design pressure for the performance class by more than 2880 Pa (60.0 psf) except in the case of the highest performance class indicated in Tables 25 and 26 for each operator type. For example, R products shall not be rated at a design pressure greater than 3600 Pa (75.0 psf). LC products shall be capped at 4080 Pa (85.0 psf). C products shall be capped at 4320 Pa (90.0 psf), and HC products shall be capped at 4800 Pa (100 psf). AW product optional performance grades (design pressures) shall never be capped. See Clause 5.1 for testing sequence.

Table 3
Optional performance grades (design pressure)
(See Clauses 4.4.2.6.2 and 4.4.3.4.)

Performance class and optional performance grades					Design pressure		Structural test pressure		Water penetration resistance test pressure			
									R, LC, C, HC		AW	
R	LC	C	HC	AW	Pa	(psf)	Pa	(psf)	Pa	(psf)	Pa	(psf)
20	—	—	—	—	960	(20.00)	1 440	(30.00)	150	(3.00)	—	—
25	—	—	—	—	1 200	(25.00)	1 800	(37.50)	180	(3.75)	—	—
30	30	—	—	—	1 440	(30.00)	2 160	(45.00)	220	(4.50)	—	—
35	35	35	—	—	1 680	(35.00)	2 520	(52.50)	260	(5.25)	—	—
40	40	40	—	—	1 920	(40.00)	2 880	(60.00)	290	(6.00)	—	—
45	45	45	45	45	2 160	(45.00)	3 240	(67.50)	330	(6.75)	440	(9.00)
50	50	50	50	50	2 400	(50.00)	3 600	(75.00)	360	(7.50)	480	(10.00)
55	55	55	55	55	2 640	(55.00)	3 960	(82.50)	400	(8.25)	530	(11.00)
60	60	60	60	60	2 880	(60.00)	4 320	(90.00)	440	(9.00)	580	(12.00)
65	65	65	65	65	3 120	(65.00)	4 680	(97.50)	470	(9.75)	580	(12.00)
70	70	70	70	70	3 360	(70.00)	5 040	(105.00)	510	(10.50)	580	(12.00)
75	75	75	75	75	3 600	(75.00)	5 400	(112.50)	540	(11.25)	580	(12.00)
—	80	80	80	80	3 840	(80.00)	5 760	(120.00)	580	(12.00)	580	(12.00)
—	85	85	85	85	4 080	(85.00)	6 120	(127.50)	580	(12.00)	580	(12.00)
—	—	90	90	90	4 320	(90.00)	6 480	(135.00)	580	(12.00)	580	(12.00)
—	—	—	95	95	4 560	(95.00)	6 840	(142.50)	580	(12.00)	580	(12.00)
—	—	—	100	100	4 800	(100.00)	7 200	(150.00)	580	(12.00)	580	(12.00)
—	—	—	—	No limit*	No limit*	No limit*	1.5 × design pressure	1.5 × design pressure	580	(12.00)	580	(12.00)

(Continued)

Table 5 (Concluded)

Product type	Performance class	Point of force application	Direction of force	Maximum force to initiate motion, N (lbf)	Maximum force to maintain motion, N (lbf)
Casement or projecting window with rotary operator	R and LC	End of crank handle	Perpendicular to crank handle and screw	Report only	30 (7)
Casement or projecting window with rotary operator	C, HC, and AW	End of crank handle	Perpendicular to crank handle and screw	Report only	45 (10)
Casement or projecting window with lever-type operator	R and LC	End of lever	Perpendicular to lever in the plane of its motion	Report only	100 (22)
Casement or projecting window with lever-type operator	C, HC, and AW	End of lever	Perpendicular to lever in the plane of its motion	Report only	135 (30)
Other casement or projecting window	R and LC	Midpoint of sash opposite hinges or operating handles	Perpendicular to plane of glazing	Report only	100 (22)
Other casement or projecting window	C, HC, and AW	Midpoint of sash opposite hinges or operating handles	Perpendicular to plane of glazing	Report only	135 (30)
Roof window with rotary operator	R, C, and HC	End of crank handle	Perpendicular to crank handle and screw	Report only	45 (10)
Other roof window	R, C, and HC	Midpoint of sash opposite hinges or operating handles	Perpendicular to plane of glazing	Report only	135 (30)

Δ 5.3.1.2 Force to latch for side-hinged door systems

5.3.1.2.1
The force-to-latch test shall be performed by positioning the side-hinged door leaf so that the latch bolt is not farther than 150 mm (6 in) from contacting the strike plate. A tethered* force meter shall be applied perpendicular to the face of the door at a point 25 mm (1 in) from the lock-side door-leaf edge and within 75 mm (3 in) vertically of the latch bolt centerline. The door leaf shall be closed by applying the tethered force meter against the door leaf until the latch bolt fully enters the strike opening. The test door leaf shall not close upon a confined space such that air pressure differential slows movement. The maximum force to latch shall be measured and reported.
**A tether sufficient to stop force-meter travel from* 6 mm *(0.25 in) to* 12 mm *(0.5 in) before latch engagement.*

5.3.1.2.2
After the side-hinged door is latched, the deadbolt (if provided) shall be engaged. If necessary, a force shall be applied perpendicular to the door leaf at the location described in Clause 5.3.1.2.1 to facilitate engagement of the deadbolt. This force shall be measured and reported.

5.3.2 Air leakage resistance test

5.3.2.1 Method of test
With the test specimen closed and locked, it shall be subjected to an air leakage test in accordance with ASTM E 283. The test pressure and maximum allowable air leakage shall be as specified in Table 6.

Table 6
Maximum allowable air leakage
(See Clause 5.3.2.1.)

Performance class	Positive test pressure, Pa (psf)	Maximum allowable leakage, L/s□m^2 (cfm/ft^2)
R (jalousie windows only)	75 (1.6)	6.0 (1.2)
R, LC, and C (except for jalousie windows)	75 (1.6)	1.5 (0.3)
Δ HC	300 (6.2)	1.5 (0.3)
AW (sliding seal products)	300 (6.2)	1.5 (0.3)
AW (compression seal and fixed products)	300 (6.2)	0.5 (0.1)

5.3.2.2 Canadian (only) air infiltration/exfiltration (See Clause 4.4.3)
Performance can be measured in either liters per second per square meter (L/s•m^2) or cubic feet per minute per square foot (cfm/ft^2). Both infiltration and exfiltration using the secondary designator explained in Clause 4.4.3.5 shall be permitted to be recorded as indicated in Table 7. Two options are provided for measuring infiltration/exfiltration for all product operator types. An additional level is provided for measuring the performance of infiltration/exfiltration of fixed windows, which have the glazing directly glazed in the frame without the use of a sash surrounding the glazing.

Table 7
Canadian (only) air infiltration/exfiltration levels
(See Clause 5.3.2.2.)

		Infiltration/ exfiltration A2 level		Infiltration/ exfiltration A3 level		Infiltration/ exfiltration fixed level	
Performance class	Pressure difference, Pa (psf)	L/s□m^2	(cfm/ft^2)	L/s□m^2	(cfm/ft^2)	L/s□m^2	(cfm/ft^2)
R, LC, and C	75 (1.6)	1.5	(0.3)	0.5	(0.1)	0.2	(0.04)
HC and AW (sliding seal products)	300 (6.2)	1.5	(0.3)	0.5	(0.1)	0.2	(0.04)
AW (compression seal products)	300 (6.2)	0.5	(0.1)	0.5	(0.1)	0.2	(0.04)

5.3.2.3 Dual windows and dual doors

Dual windows and dual doors shall be tested with the test specimen in the winter mode (see Clause 3 for definition of “Winter mode”).

Table 17
Deflection limits for sash blocked operation test
(See Clause 5.3.6.6.7.)

Sash type	Performance class	Load, N (lbf)	Deflection limit, mm (in)*
Awning, hopper, projected	R and LC	70 (15)	Reported
Δ Awning, hopper, projected	C	140 (30)	38.3 × A (1.5 × B)

**A is the area of the tested sash in square meters; B is the area of the tested sash in square feet.*

At the conclusion of the test, the test specimen shall fully close and operate properly and shall show no distortion or failure. There shall be no glazing breakage.

This test shall be repeated for each different design of operable sash of the test specimen.

5.3.6.7 Safety drop test (non-hung vertical operating products only)

The test specimen shall be mounted in a test fixture.

For products with pre-set sash-retention positions, the test specimen shall be examined to identify the two adjacent positions with the maximum spacing. The operable sash shall be raised to the upper of these two positions and then allowed to free fall. This procedure shall be conducted for each operable sash. When dropped, the sash shall automatically stop at the lower of the two pre-set positions. There shall be no breakage or permanent deformation of any part of the test specimen that would impair its operation. There shall be no glazing breakage.

For products without pre-set sash-retention positions, the operable sash shall be raised to its fullest extent within the frame and then released. This procedure shall be conducted for each operable sash. When released, the sash shall travel not more than 25 mm (1 in) before coming to a complete stop. There shall be no breakage or permanent deformation of any part of the test specimen that would impair its operation. There shall be no glazing breakage.

Where a manufacturer offers or specifies either interior or exterior RMGPs in the primary sash, and it is desired to achieve conformance to this Standard/Specification both with and without the RMGPs installed, all safety drop tests shall be conducted with all RMGPs installed.

5.3.6.8 Unit dead load test (greenhouse windows only)

A uniform load of 40 kg/m^2 (8 lb/ft^2) of shelf area (including the bottom pan area) shall be applied simultaneously to each shelf and to the bottom pan of a glazed vertically mounted unit for a period of 5 minutes. The maximum vertical displacement of the specimen in relation to its mounting shall not be greater than *L*/175, *L* being defined as the width of the unit. (See Figure 24.)

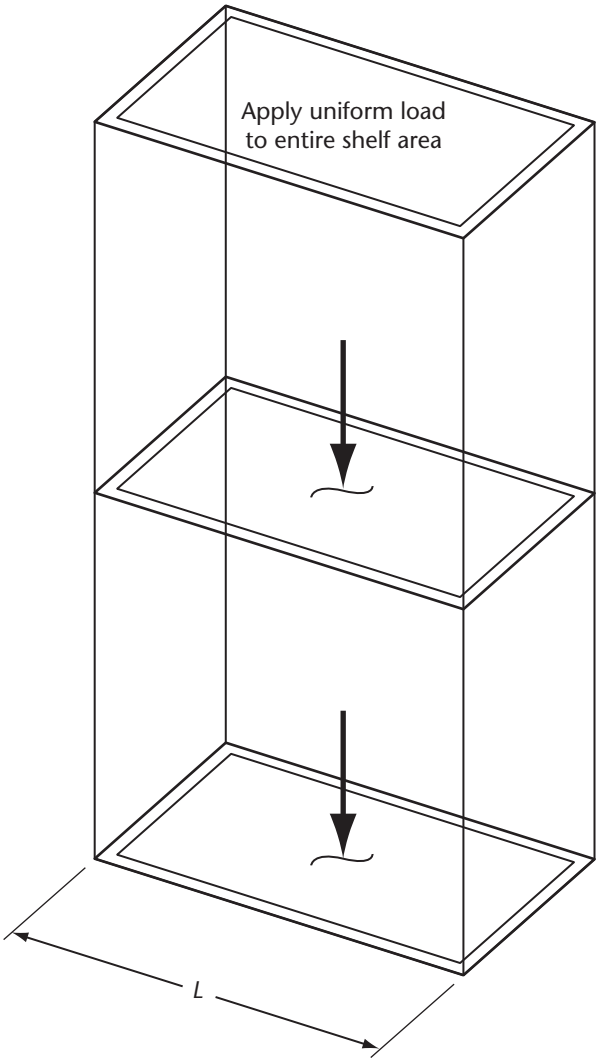

Figure 24
Set-up for unit dead load test
(See Clause 5.3.6.8.)

5.3.6.9 Life cycle testing (AW-designated operable products only)

When tested in accordance with AAMA 910, there shall be no damage to fasteners, hardware parts, or sash balances, or any other damage which would cause the specimen to be inoperable. Also, resistance to air leakage and water penetration resistance test results shall not exceed the gateway performance requirements specified in Table 25 for the class and grade for which compliance is sought.

Where a manufacturer offers or specifies either interior or exterior RMGPs in the primary sash, leaves, or sliding door panels, and it is desired to achieve conformance to this Standard/Specification both with and without the RMGPs installed, all life cycle testing shall be conducted with all RMGPs installed.

Δ 5.3.6.10 Operation/cycling performance (side-hinged door systems only)

Side-hinged door systems shall comply with AAMA 920 for the corresponding performance class requirements in Table 18, except that the cycle rate for R, LC, and C products shall be 12 to 24 cycles/min.

The glazing selection criteria for this test shall comply with Clause 6.2.3.4.6.

Table 18
Operation/cycling performance (side-hinged door systems)
(See Clause 5.3.6.10.)

Performance class	Number of cycles
R	25 000
LC	100 000
C	250 000
HC (except architectural terrace doors)	500 000
HC (architectural terrace doors)	25 000
AW (except architectural terrace doors)	1 000 000
AW (architectural terrace doors)	25 000

Δ 5.3.6.11 Vertical loading resistance (side-hinged door systems only)

Side-hinged door systems shall be tested to AAMA 925 for the corresponding performance class. The force to latch shall be determined and recorded in accordance with Clause 5.3.1.2.1.

5.3.7 Condensation resistance (optional)

The AAMA condensation resistance factor (CRF), the CSA temperature index (I), and the NFRC condensation resistance rating are rating numbers obtained under standard test conditions which allow for the prediction, within reasonable accuracy, of the condensation performance of a window, door, or unit skylight. The CRF rating number that is obtained by the procedure outlined in AAMA 1503, the I rating number that is obtained by the procedure outlined in CSA A440.2, and the condensation resistance rating that is obtained by the procedure outlined in NFRC 500 are not absolute values (i.e., the possibility exists that the rating numbers do not predict the precise condition under which, or the first location where, condensation occurs). However, they do provide a comparative performance rating for similar products.

5.3.8 Thermal transmittance (optional)

The total resistance to heat flow across the frame and glazing area of a window, door, or unit skylight is the sum of the inside surface-to-air resistance, the resistance of the frame and the glazing itself, and the outside surface-to-air resistance. The reciprocal of the sum of these resistances is the conductance. Product air-to-air heat conductance is also called heat transmittance. It is the heat that is conducted through 1 m^2 of product frame area in 1 second when the temperature difference across the product is 1 K (1 ft^2 of product frame area in 1 h when the temperature difference across the product is 1°F). This is written as W/m^2•K (Btu/h•ft^2•°F) and is referred to as the U-value or the U-factor.

When thermal performance characteristics are to be determined, products shall be evaluated under the procedures in AAMA 1503, ASTM E 1423, CSA A440.2, or NFRC 100.

5.3.9 Acoustical performance (optional)

5.3.9.1 General

The ability of windows, doors, and unit skylights to attenuate sound transmissions is important in locations where exterior noise is excessive or disruptive. Sound attenuation shall be measured and rated either as STC (Sound Transmission Class) for interior frequencies or OITC (Outdoor-Indoor Transmission Class) for exterior sound sources. STC is traditionally used to evaluate sound transmission through interior walls or barriers, whereas OITC is more useful for dealing with external noise, e.g., road, aircraft, and rail noises.

The AAMA and ASTM Specifications specified in Clause 5.3.9.2 shall be used to develop acoustical ratings for windows, doors, and unit skylights. AAMA TIR A1 is also a useful reference on acoustical performance and requirements.

5.3.9.2 Procedure

When acoustical performance characteristics are to be determined, all windows, doors, and unit skylights shall be tested in accordance with ASTM E 90, ASTM E 1425, or AAMA 1801. STC and OITC ratings shall be derived from ASTM E 413 and ASTM E 1332, respectively. Test specimen size for windows shall be the size tested for the gateway performance of this Standard/Specification but not larger than 2.2 m^2 (23.7 ft^2). Test specimen size for doors shall be as noted in the size tested for the gateway performance of this Standard/Specification, but not larger than 1.77 m^2 (19 ft^2) for single doors or 4.09 m^2 (44 ft^2) for pairs.

5.3.10 Impact performance (optional)

5.3.10.1 General

The ability of windows, doors, and unit skylights to resist impact by windborne debris is important in areas where high wind events, such as hurricanes, regularly occur. Governing building codes or other regulations in these areas frequently require that windows, doors, or unit skylights either be rated as impact resistant or be protected by impact-resistant devices.

5.3.10.2 Procedure

When impact performance is to be determined, all windows, doors, and unit skylights shall first comply with all other applicable requirements of this Standard/Specification. In addition, the product(s) shall comply with either ASTM E 1996 or AAMA 506. Specimen test sizes shall be the largest width and height for which compliance is desired. For purposes of compliance with either ASTM E 1996 or AAMA 506, specimen test sizes shall not be restricted by the gateway requirements of this Standard/Specification.

5.4 Laboratory test report

5.4.1

All test reports referencing this Standard/Specification shall include, as a first page, a “Summary of Results” containing, at a minimum, the information shown in Figure 25, in the order shown in Figure 25.

6 Materials

6.1 Material tolerance

Tolerances of the wall thickness and other cross-sectional dimensions of aluminum shall comply with Section 10 of ANSI H35.2.

Tolerances of PVC, ABS, fiberglass, cellular PVC, and fiber-reinforced PVC lineal profiles shall comply with AAMA 303, AAMA 304, AAMA 305, AAMA 308, and AAMA 310, respectively. The maximum allowable deviation from the nominal wall thickness shall be ± 10% or 0.3 mm (0.010 in), whichever is greater, for open die walls and ± 15% or 0.4 mm (0.015 in), whichever is greater, for closed die walls. The weight of profiles in these materials shall not exceed ± 10% of the design weight.

Manufacturing tolerances for cross-sectional dimensions of wood rails, stiles, heads, jambs, and sills shall not exceed ± 0.5 mm (0.020 in) for dimensions up to 100 mm (4 in) or ± 1.0 mm (0.040 in) for dimensions greater than or equal to 100 mm (4 in).

Note: *For overall product tolerances, see Clause 8.2.*

6.2 Glazing and glass

Δ 6.2.1 Reference Standards

Where any of the following glazing types are installed in windows, doors, and unit skylights, the glazing shall conform to the following Standards, if applicable:

(a) flat glass (float or sheet): ASTM C 1036, CAN/CGSB 12.2, or CAN/CGSB 12.3;
(b) heat-absorbing glass: CAN/CGSB 12.4;
(c) spandrel glass: CAN/CGSB 12.9;
(d) light- and heat-reflecting glass: CAN/CGSB 12.10;
(e) laminated glass: ASTM C 1172 or CAN/CGSB 12.1;
(f) heat-treated glass: ASTM C 1048 or CAN/CGSB 12.1;
(g) safety glazing: ANSI Z97.1, 16 CFR 1201, and CAN/CGSB 12.1;
(h) wired safety glass: CAN/CGSB 12.11;
(i) sealed insulating glass units: ASTM E 774, ASTM E 2190, or CAN/CGSB 12.8; and
(j) plastic glazing: ANSI Z97.1, 16 CFR 1201, and CAN/CGSB 12.12.

Note: *Most building codes require safety glazing to be used in door systems, unit skylights, and some windows in certain applications. Consult local codes for details.*

6.2.2 General requirements

The uniform load resistance (design pressure rating) of glazing furnished by the manufacturer shall meet or exceed the specified design pressure selected by the specifier. Where applicable, load resistance of the glazing shall be determined by ASTM E 1300 (applicable to one-, two-, three-, or four-sided firm support) or CAN/CGSB 12.20 (applicable to four-sided firm support only), with factors for heat-treated, laminated, and insulating glass load duration, etc., as applicable.

Note: *Sealed insulating glass units should be glazed in a manner that precludes the accumulation of water in the glazing cavity. If "dry" glazing is employed as the exterior seal, drainage of the glazing cavity to the exterior should be provided.*

Sealed insulating glass units shall conform to the requirements of ASTM E 774, Level A; CAN/CGSB 12.8; or ASTM E 2190.

Note: *On commercial projects, the architect or buyer will often specify the glazing. On residential projects, glazing selection, to meet the design pressure for the project is often deferred to the manufacturer. In either case, the selector should specify glazing in conformance with the Standards specified in Clause 6.2.1 and this Clause, as applicable.*

6.2.3 Glazing selection

6.2.3.1 General

Glazing selection is dependent on whether selection is being made for testing purposes or to meet required structural loads. When glazing selection is being made for the purpose of testing a fenestration assembly, it is the intent of this Standard/Specification that the glazing should be of a type intended for use in the end product and shall not strengthen or brace the sash, panel, leaf, or frame of the fenestration assembly or in any way enhance the structural performance of the assembly during testing. Therefore, the glazing selected for compliance testing shall be the weakest glazing in accordance with ASTM E 1300 or CAN/CGSB 12.20 for the test specimen size and the maximum design load to be tested, or any glazing that is weaker than that required by those Standards and meeting applicable safety glazing requirements. Glazing selection for testing purposes shall be based on firm, four-sided glass edge support, as stipulated in ASTM E 1300 or CAN/CGSB 12.20. Building codes can require safety glazing or fire-rated glazing for products such as doors or side lites. For testing purposes, the manufacturer shall be permitted to use the weakest glazing defined in the codes and also commercially available that is consistent with the intent of this Clause.

ASTM E 1300 was revised in 2002 to provide greater flexibility in selecting glass types and thickness to meet loading requirements. CAN/CGSB 12.20 was not similarly revised. Consequently, the selection of glazing for testing purposes shall be the weakest glass according to either glass strength Standard. Selection of glazing for projects shall be the glazing required in the building code having jurisdiction using the reference Standard specified in the building code.

The examples in Clause 6.2.3.3 will help to illustrate how to select the appropriate glass for test specimens.

6.2.3.2 Use of fully tempered or heat-strengthened glass in test specimens

Test specimens glazed with fully tempered glass shall not qualify production units glazed with heat-strengthened or annealed glass, nor shall test specimens glazed with heat-strengthened glass qualify production units glazed with annealed glass, unless the test specimen has less than or equal to *L*/175 deflection at the glass-supporting edge at the rated design pressure when tested in accordance with
Clause 5.3.4.2.

6.2.3.3 Examples of glazing selection for test specimens

Note: *The following are only examples, and apply only to glass selection for test specimens of the indicated size and aspect ratio. See Clauses 6.2.2 and 6.2.3.4 for information on glazing selection for production units.*

6.2.3.3.1 Example 1 (test specimens only)

Assume that a manufacturer has a casement window for which it desires to achieve a performance grade (design pressure) of 40. The test specimen has an actual glass size of 790 mm wide × 1700 mm tall (31 × 67 in). The actual design pressure to consider for glass selection is 1920 Pa (40 psf). The test specimen is to be glazed with sealed insulating glass. Considering the glass size and the design pressure, ASTM E 1300 for firm four-sided support dictates the allowable loads in Table 19

6.2.3.4.5 Glazing Exception 4

This Clause shall apply when the glazing material to be qualified is not within the scope of ASTM E 1300 or CAN/CGSB 12.20. Examples include, but are not limited to,

(a) plastic glazing materials;
(b) composite material panels; and
(c) wired safety glass.

Under this exception, a manufacturer shall be permitted to glaze a test specimen with any desired thickness and type of glazing material that is not within the scope of ASTM E 1300 or CAN/CGSB 12.20. When glazed in accordance with this Clause, the test results achieved shall apply to like products of a size equal to or smaller than the tested specimen, provided that the products contain glazing of the exact same material type and of a thickness equal to or greater than that used in the tested specimen. The test results achieved shall not apply to any like products containing a different glazing material, or containing thinner glazing, than that used in the tested specimen.

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6.2.3.4.6 Glazing Exception 5

This exception shall apply to glazing selection for side-hinged exterior door specimens to be cycle-slam tested in accordance with Clause 5.3.6.10. Such specimens shall use the heaviest glazing assembly to be qualified or shall have sufficient additional weight attached to the center of the glazing to make it equivalent to the heaviest glazing to be qualified. Successful testing of such specimens shall qualify the product with equal or lesser weight.

6.2.3.5

Since sealed insulating glass units typically provide significantly more strength and stiffness to sash and frame members than single glazing, products tested with sealed insulating glass units shall not qualify single-glazed products.

Products tested with single glazing shall qualify that product when glazed with insulating glass units, provided that the only change to the product is the glass-retaining members or stops, and provided that the product is not subject to the safety drop test in Clause 5.3.6.7.

6.2.3.6

Testing of unglazed door units shall not qualify glazed door units, and testing of glazed door units shall not qualify unglazed door units. Leaves with glazing shall be tested with the largest glazing area to be provided in the door system for which compliance is desired.

6.2.4 Removable multiple glazing panels

RMGPs shall contain glazing that fully conforms to the requirements of primary glazing specified in Clauses 6.2.1 to 6.2.3. If the RMGP is an interior panel and vented to the interior, these requirements shall not apply to the interior panel.

RMGPs may be installed on either the interior side or the exterior side of the primary glazing.

6.2.5 Plastic glazing

6.2.5.1 General

Plastic glazing materials, when used, shall meet all the requirements of this Clause and Clauses 6.2.5.2 to 6.2.5.7.

Products tested with plastic glazing materials shall not qualify glass-glazing materials, nor shall products tested with glass qualify plastic glazing materials.

Safety glazing plastic materials shall conform to ANSI Z97.1 or 16 CFR 1201.

6.2.5.2 Weatherability

Plastic glazing materials shall either be exposed for five years, at a minimum, in Florida with a southern exposure at a 45° angle, or tested using the operating procedure in ASTM G 155 and augmented in ASTM D 2565. When tested,

(a) apparatus shall be Type A and have a 6.5 kW water-cooled xenon-arc lamp and a light monitoring system;
(b) borosilicate glass inner and outer optical filters shall be used;
(c) test Procedure B, as detailed in ASTM D 2565, shall be used; and
(d) the specimen shall be exposed to a radiant flux of 0.035 W/m^2 (0.011 Btu/h/ft^2) at a wavelength of 340 nm for a total of 2900 hours.

6.2.5.3 Light transmittance

After the exposure specified in Clause 6.2.5.2, the plastic glazing material shall not change more than 10% of its original light transmittance value when tested per ASTM D 1003, and shall be described as follows:

% change = $A - B$

where
A = light transmittance before exposure, %
B = light transmittance after exposure, %

Prior to measurements, samples shall be cleaned in accordance with the plastic manufacturer's published instructions.

6.2.5.4 Impact strength requirements

Plastic glazing material shall be tested before and after exposure in accordance with ASTM D 6110, with the following exceptions:
(a) the specimen shall be tested with the exposed surface in tension;
(b) the specimen shall be exposed and tested in a horizontal position; and
(c) the specimen shall be reduced to 50 mm (2 in) for thin material that can slip through the supports without breaking.

The average of the five specimens shall not result in more than a 25% reduction in impact strength (as measured by the unnotched Charpy test) as a result of the outdoor exposure. If material does not indicate breaking both before and after weathering, it is deemed acceptable.

6.2.5.5 Smoke density requirements

Plastic glazing materials, when tested in accordance with ASTM E 84, the maximum smoke developed index shall be not greater than 450, or when tested in accordance with ASTM D 2843, the maximum smoke density rating shall be not greater than 75.

6.2.5.6 Self-ignition temperature requirements

Plastic glazing materials, when tested in accordance with ASTM D 1929, shall have a minimum self-ignition temperature of 343 °C (650°F).

6.2.5.7 Combustibility classification requirements

Plastic glazing materials, when tested in accordance with ASTM D 635, shall meet one of the combustibility classes listed in Table 20.

Table 20
Plastic glazing combustibility classes
(See Clause 6.2.5.7.)

Combustibility class	Requirements
CC1	Maximum extent of burning shall be 25 mm (1 in) or less
CC2	Average burning rate shall be 62 mm/minute (2-1/2 in/minute) or less

6.3 Framing/cladding materials

6.3.1 General

Finished framing and cladding materials shall contain not more than 0.02% lead by weight, as determined by ASTM E 1753.

Note: *Several chemical spot test kits are commercially available. Users should use kits with a sensitivity appropriate for the requirements of Clause 6.3.*

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Table 25 (Continued)

Product type	Product designation	Minimum test size, mm (in)	Minimum design pressure, Pa (lbf/ft^2)	Deflection at design pressure, mm (in)	Minimum structural pressure, Pa (lbf/ft^2)	Minimum water pressure, Pa (lbf/ft^2)	Air leakage resistance Pa (lbf/ft^2)	Air leakage resistance $L/s{\bullet}m^2$ (cfm/ft^2)	Operating force test 5.3.1.1	Force-to-latch test 5.3.1.2.1	Deadbolt force test 5.3.1.2.2	Forced-entry resistance test 5.3.5	Thermoplastic corner weld test 5.3.6.2	Deglazing test 5.3.6.3	Sash/leaf torsion test 5.3.6.4.2	Sash vertical deflection test 5.3.6.4.3	Sash/panel concentrated load test on latch rail 5.3.6.4.4	Vertical concentrated load test 5.3.6.4.5	Vertical concentrated load test on intermediate frame rails 5.3.6.5	Distributed load test 5.3.6.6.2	Stabilizing arm load test 5.3.6.6.3	Balance arm load test 5.3.6.6.4	Hold-open arm/stay bar test 5.3.6.6.5	Hinge test 5.3.6.6.6	Awning, hopper, projected hardware load test 5.3.6.6.7	Safety drop test 5.3.6.7	Unit dead load test 5.3.6.8	Life cycle testing 5.3.6.9	Operation/cycling performance 5.3.6.10	Vertical loading resistance 5.3.6.11
Δ Fixed window (continued)	FW-C30	1500 × 1500 (60 × 60)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	
	FW-HC40	1500 × 1800 (60 × 71)	1920 (40.0)	*L*/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)				•	•																	
	FW-AW40	1500 × 2500 (60 × 99)	1920 (40.0)	*L*/175	2880 (60.0)	390 (8.0)	300 (6.2)	0.5 (0.1)				•	•															•		
Greenhouse window	GH-R15	900 x 900 x 300 (36 × 36 x 12)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•														•			
Hinged rescue window	HE-R15	Varies	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•											•						
Horizontally or vertically pivoted window	HP/VP-R15	1100 × 1500 (44 × 60)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
	HP/VP-LC25	1200 × 1500 (48 × 60)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)				•	•																	
	HP/VP-C05	1200 × 2200 (48 × 87)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	
	HP/VP-HC40	1500 × 2500 (60 × 99)	1920 (40.0)	*L*/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)				•	•		•		•	•												
	HP/VP-AW40	1500 × 2500 (60 × 99)	1920 (40.0)	*L*/175	2880 (60.0)	390 (8.0)	300 (6.2)	0.5 (0.1)				•	•		•		•	•										•		
Horizontal sliding window	HS-R15	1600 × 1100 (63 × 44)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	HS-LC25	1800 × 1400 (71 × 56)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	HS-C30	1800 × 1500 (71 × 60)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	HS-HC40	2500 × 2000 (99 × 79)	1920 (40.0)	*L*/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)	•			•	•	•																
	HS-AW40	2500 × 2000 (99 × 79)	1920 (40.0)	*L*/175	2880 (60.0)	390 (8.0)	300 (6.2)	1.5 (0.3)	•			•	•	•														•		

(Continued)

Table 25 (Continued)

Product type	Product designation	Minimum test size, mm (in)	Minimum design pressure, Pa (lbf/ft²)	Deflection at design pressure, mm (in)	Minimum structural pressure, Pa (lbf/ft²)	Minimum water pressure, Pa (lbf/ft²)	Air leakage resistance		Operating force test	Force-to-latch test	Deadbolt force test	Forced-entry resistance test	Thermoplastic corner weld test	Deglazing test	Sash/leaf torsion test	Sash vertical deflection test	Sash/panel concentrated load test on latch rail	Vertical concentrated load test	Vertical concentrated load test on intermediate frame rails	Distributed load test	Stabilizing arm load test	Balance arm load test	Hold-open arm/stay bar test	Hinge test	Awning, hopper, projected hardware load test	Safety drop test	Unit dead load test	Life cycle testing	Operation/cycling performance	Vertical loading resistance
							Pa (lbf/ft²)	L/s•m² (cfm/ft²)	5.3.1.1	5.3.1.2.1	5.3.1.2.2	5.3.5	5.3.6.2	5.3.6.3	5.3.6.4.2	5.3.6.4.3	5.3.6.4.4	5.3.6.4.5	5.3.6.5	5.3.6.6.2	5.3.6.6.3	5.3.6.6.4	5.3.6.6.5	5.3.6.6.6	5.3.6.6.7	5.3.6.7	5.3.6.8	5.3.6.9	5.3.6.10	5.3.6.11
Hung window — vertical sliding	H-R15	1000 × 1600 (40 × 63)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	H-LC25	1100 × 1900 (44 × 75)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	H-C30	1400 × 2300 (56 × 91)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	H-HC40	1500 × 2500 (60 × 99)	1920 (40.0)	*L*/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)	•			•	•	•																
	H-AW40	1500 × 2500 (60 × 99)	1920 (40.0)	*L*/175	2880 (60.0)	390 (8.0)	300 (6.2)	1.5 (0.3)	•			•	•	•														•		
Jal-awning window	JA-R15	1400 × 1600 (56 × 63)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
Jalousie window	J-R15	900 × 1200 (36 × 48)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
Non-hung window — vertical sliding	VS-R15	1000 × 1600 (40 × 63)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)	•			•	•	•												•				
	VS-LC25	1100 × 1900 (44 × 75)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)	•			•	•	•												•				
	VS-C30	1400 × 2300 (56 × 91)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•			•	•	•												•				
Side-hinged door	SHD-R15	900 × 2000 (36 × 79)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)		•	•	•	•																•	•
	SHD-LC25	900 × 2100 (36 × 83)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)		•	•	•	•																•	•
	SHD-C30	1000 × 2100 (40 × 83)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)		•	•	•	•																•	•
	SHD-HC40	1000 × 2100 (40 × 83)	1920 (40.0)	*L*/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)		•	•	•	•																•	•
	SHD-AW40	1200 × 2400 (48 × 95)	1920 (40.0)	*L*/175	2880 (60.0)	390 (8.0)	300 (6.2)	0.5 (0.1)		•	•	•	•															•	•	•

(Continued)

Table 25 (Continued)

Product type	Product designation	Minimum test size, mm (in)	Minimum design pressure, Pa (lbf/ft2)	Deflection at design pressure, mm (in)	Minimum structural pressure, Pa (lbf/ft²)	Minimum water pressure, Pa (lbf/ft²)	Air leakage resistance Pa (lbf/ft²)	Air leakage resistance L/s•m² (cfm/ft²)	Operating force test 5.3.1.1	Force-to-latch test 5.3.1.2.1	Deadbolt force test 5.3.1.2.2	Forced-entry resistance test 5.3.5	Thermoplastic corner weld test 5.3.6.2	Deglazing test 5.3.6.3	Sash/leaf torsion test 5.3.6.4.2	Sash vertical deflection test 5.3.6.4.3	Sash/panel concentrated load test on latch rail 5.3.6.4.4	Vertical concentrated load test 5.3.6.4.5	Vertical concentrated load test on intermediate frame rails 5.3.6.5	Distributed load test 5.3.6.6.2	Stabilizing arm load test 5.3.6.6.3	Balance arm load test 5.3.6.6.4	Hold-open arm/stay bar test 5.3.6.6.5	Hinge test 5.3.6.6.6	Awning, hopper, projected hardware load test 5.3.6.6.7	Safety drop test 5.3.6.7	Unit dead load test 5.3.6.8	Life cycle testing 5.3.6.9	Operation/cycling performance 5.3.6.10	Vertical loading resistance 5.3.6.11
Side-hinged window	SHW-AW40	1200 × 1800 (48 × 71)	1920 (40.0)	L/175	2880 (60.0)	390 (8.0)	300 (6.2)	0.5 (0.1)				•	•															•		
Side lite	SLT-R15	400 × 2000 (16 × 79)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
	SLT-LC25	400 × 2100 (16 × 83)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)				•	•																	
	SLT-C30	500 × 2100 (20 × 83)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	
Sliding door	SD-R15	1800 × 2000 (71 × 79)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	SD-LC25	2200 × 2100 (87 × 83)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	SD-C30	2400 × 2100 (95 × 83)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•			•	•	•																
	SD-HC40	3100 × 2400 (123 × 95)	1920 (40.0)	L/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)	•			•	•	•																
	SD-AW40	3100 × 2400 (123 × 95)	1920 (40.0)	L/175	2880 (60.0)	390 (8.0)	300 (6.2)	1.5 (0.3)	•			•	•	•														•		
Top-hinged window	TH-C30	1200 × 1500 (48 × 60)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•				•						•							
	TH-HC40	1200 × 1500 (48 × 60)	1920 (40.0)	L/175	2880 (60.0)	290 (6.0)	300 (6.2)	1.5 (0.3)				•	•				•						•							
	TH-AW40	1500 × 2500 (60 × 99)	1920 (40.0)	L/175	2880 (60.0)	390 (8.0)	300 (6.2)	0.5 (0.1)				•	•				•											•		
Transom	TR-R15	1800 × 300 (71 × 12)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
	TR-LC25	1800 × 400 (71 × 16)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)				•	•																	
	TR-C30	2000 × 500 (79 × 20)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	

(Continued)

Table 25 (Continued)

Product type	Product designation	Minimum test size, mm (in)	Minimum design pressure, Pa (lbf/ft^2)	Deflection at design pressure, mm (in)	Minimum structural pressure, Pa (lbf/ft^2)	Minimum water pressure, Pa (lbf/ft^2)	Air leakage resistance Pa (lbf/ft^2)	Air leakage resistance L/s•m^2 (cfm/ft^2)	Operating force test 5.3.1.1	Force-to-latch test 5.3.1.2.1	Deadbolt force test 5.3.1.2.2	Forced-entry resistance test 5.3.5	Thermoplastic corner weld test 5.3.6.2	Deglazing test 5.3.6.3	Sash/leaf torsion test 5.3.6.4.2	Sash vertical deflection test 5.3.6.4.3	Sash/panel concentrated load test on latch rail 5.3.6.4.4	Vertical concentrated load test 5.3.6.4.5	Vertical concentrated load test on intermediate frame rails 5.3.6.5	Distributed load test 5.3.6.6.2	Stabilizing arm load test 5.3.6.6.3	Balance arm load test 5.3.6.6.4	Hold-open arm/stay bar test 5.3.6.6.5	Hinge test 5.3.6.6.6	Awning, hopper, projected hardware load test 5.3.6.6.7	Safety drop test 5.3.6.7	Unit dead load test 5.3.6.8	Life cycle testing 5.3.6.9	Operation/cycling performance 5.3.6.10	Vertical loading resistance 5.3.6.11
Tropical awning window (multiple vent)	TA-R15	1200 × 1600 (48 × 63)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
	TA-LC25	1400 × 2500 (56 × 99)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)				•	•																	
	TA-C30	1400 × 2500 (56 × 99)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	
Tropical awning window (single vent)	TA-R15	1200 × 600 (48 × 24)	720 (15.0)	Reported	1080 (22.5)	140 (2.9)	75 (1.6)	1.5 (0.3)				•	•																	
	TA-LC25	1400 × 700 (56 × 28)	1200 (25.0)	Reported	1800 (37.5)	180 (3.8)	75 (1.6)	1.5 (0.3)				•	•																	
	TA-C30	1400 × 700 (56 × 28)	1440 (30.0)	Reported	2160 (45.0)	220 (4.5)	75 (1.6)	1.5 (0.3)				•	•																	
Δ Unit skylight or roof window (glass glazed)	SKG/RW-R15	500 × 1100 (20 × 44)	720 (15.0)	Reported	1440 (30.0)	140 (2.9)	75 (1.6)	1.5 (0.3)	•				•							•										
	SKG/RW-C30	1100 × 1100 (44 × 44)	1440 (30.0)	Reported	2880 (60.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•				•							•										
	SKG/RW-HC40	1100 × 2400 (44 × 95)	1920 (40.0)	L/175	3840 (80.0)	290 (6.0)	300 (6.2)	1.5 (0.3)	•				•							•										
Δ Unit skylight or roof window (plastic glazed)	SKP/RW-R15	500 × 1100 (20 × 44)	720 (15.0)	Reported	1440 (30.0)	140 (2.9)	75 (1.6)	1.5 (0.3)	•				•							•										
	SKP/RW-C30	1100 × 1100 (44 × 44)	1440 (30.0)	Reported	2880 (60.0)	220 (4.5)	75 (1.6)	1.5 (0.3)	•				•							•										
	SKP/RW-HC40	1100 × 2400 (44 × 95)	1920 (40.0)	L/175	3840 (80.0)	290 (6.0)	300 (6.2)	1.5 (0.3)	•				•							•										

(Continued)