AAMA/WDMA/CSA 101/I.S.2/A440-11

NAFS 2011 — North American Fenestration Standard/Specification for windows, doors, and skylights

AAMA

WINDOW & DOOR MANUFACTURERS ASSOCIATION
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AAMA/WDMA/CSA 101/I.S.2/A440-11

NAFS — North American Fenestration Standard/Specification for windows, doors, and skylights

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Preface

This is the third edition of AAMA/WDMA/CSA 101/I.S.2/A440, *NAFS — North American Fenestration Standard/Specification for windows, doors, and skylights*. It supersedes the previous editions, published in 2008 under the same title and published in 2005 under the title *Standard/Specification for windows, doors, and unit skylights*. It is jointly published by the American Architectural Manufacturers Association (AAMA), the Window & Door Manufacturers Association (WDMA), and the Canadian Standards Association (CSA).

The following significant changes from the previous edition of this Standard/Specification have been made:

(a) a thorough restructuring of this Standard/Specification, with separate sections for products and materials and components;
(b) addition of requirements on lead content for hardware;
(c) reorganized mullion provisions, with new ratings and designations;
(d) addition of parallel opening windows;
(e) expansion of tubular daylighting device (TDD) products to include closed ceiling and open ceiling options;
(f) updated tables; and
(g) addition of criteria for secondary storm products (SSPs) throughout this Standard/Specification.

This Standard/Specification was developed as an advisory document and is published as a public service. AAMA, CSA, WDMA, the individual members of the CSA Technical Committee on Performance Standard for Windows, and the U.S.A./Canada Joint Document Management Group (JDMG) disclaim all liability for the use, application, or adaptation of the material published in this Standard/Specification.

Intended users of this Standard/Specification include code officials, manufacturers, architects, engineers, consumers, builders, contractors, trade associations, test labs, specifiers, and government agencies. Two fundamental applications for this Standard/Specification are product comparison and code compliance. AAMA, CSA, and WDMA intend for this Standard/Specification to be referenced in U.S. International Building Codes and in the *National Building Code of Canada*. This Standard/Specification presents provisions addressing fenestration product requirements, under the control of the unit manufacturer, contained in those codes.

CSA A440S1-09, *Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS — North American Standard/Specification for windows, doors, and skylights,* provides additional requirements to AAMA/WDMA/CSA 101/I.S.2/A440 for compliance in Canada. The Canadian Supplement is considered suitable for use for conformity assessment within the stated scope of the Standard. The Canadian Supplement was prepared by the CSA Technical Committee on the Performance Standard for Windows, under the jurisdiction of the Strategic Steering Committee on Building Products and Systems, and has been formally approved by the Technical Committee.

This Standard/Specification was jointly prepared by the CSA Technical Committee on Performance Standard for Windows, under the jurisdiction of the Strategic Steering Committee on Building Products and Systems, and by the U.S.A./Canada Joint Document Management Group (JDMG). This body includes representatives from AAMA, CSA, WDMA, and other interested parties. This Standard/Specification has been formally approved by the members of the American Architectural Manufacturers Association, by the CSA Technical Committee, and by the members of the Window & Door Manufacturers Association. A list of the members of the CSA Technical Committee is available upon request.

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Notes:

(1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

(2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*

(3) *This publication was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority,*

but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.

(4) *AAMA, WDMA, and CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*

(5) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to the American Architectural Manufacturers Association, 1827 Walden Office Square, Suite 550, Schaumburg, Illinois 60173-4268 USA, to the Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6, or to the Window & Door Manufacturers Association, 401 N. Michigan Ave., Suite 2200, Chicago, Illinois 60611-4267 USA.*

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;
(b) provide an explanation of circumstances surrounding the actual field condition; and
(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are published in CSA's periodical* Info Update*, which is available on the CSA Web site at standardsactivities.csa.ca, and by the American Architectural Manufacturers Association and the Window & Door Manufacturers Association.*

AAMA/WDMA/CSA 101/I.S.2/A440-11
NAFS — North American Fenestration Standard/Specification for windows, doors, and skylights

0 Introduction
Note: *This Clause is not a mandatory part of this Standard/Specification.*

0.1 General

0.1.1 Applicability
This Standard/Specification is applicable for use in testing and rating windows, doors, secondary storm products (SSPs), tubular daylighting devices (TDDs), roof windows, and unit skylights, and represents the continuing development of an internationally accepted performance Standard/Specification for all windows, doors, SSPs, TDDs, roof windows, and unit skylights. This Standard/Specification may also be used as a principal document for third-party certification of these products. The testing provisions of this Standard/Specification apply to laboratory testing only. Field testing in the U.S. can be performed by following AAMA 502 and should be used for applications covered by that document.

This Standard/Specification is structured to promote clarity and ease of use; this format is indicative of the document authors' continued commitment to improvement in the testing and rating of windows, doors, SSPs, TDDs, roof windows, and unit skylights.

0.1.2 Sustainability
While this Standard/Specification does not endorse any specific program, the attributes and performance requirements of this Standard/Specification are key to sustainable design of buildings and their sub-systems. As building codes and rating systems evolve, the durability, air and water leakage resistance, and material provisions in this Standard/Specification will provide a solid, proven basis of fenestration product evaluation.

0.1.3 Content
This Standard/Specification establishes levels of performance for windows, doors, SSPs, TDDs, roof windows, and unit skylights, regardless of the material used in the frame or sash members. It consists of 12 Clauses and an Annex.

Clause 1 outlines the Scope of this Standard/Specification.

Clause 2 provides a listing of all other Standards referenced in this Standard/Specification.

Clause 3 contains a list of definitions used in this Standard/Specification.

Clause 4 provides an explanation of the rating system used in this Standard/Specification and guidelines on this Standard/Specification's use. Important concepts such as gateway, Performance Grade (PG), Performance Class, design pressure (DP), maximum test size, optional Performance Grade (PG), dual windows and doors, and mullions are outlined in this Clause.

Clauses 5 to 8 provide requirements and test protocols specific to certain overall product families (windows, side-hinged doors, skylights, etc.) and Performance Classes in the U.S. and Canada. These are called "Product Sections" since, for convenience of use and updating, they are based on product characteristics. Products should meet both the general requirements of this Standard/Specification and these specific requirements.

Clause 9 contains the specific levels of performance and test methods for each window, door, SSP, TDD, and unit skylight covered by this Standard/Specification. These levels of performance provide a gateway or passport into one of the four performance classes. There are five primary performance requirements:
(a) structural strength (e.g., wind, snow, dead loads, and any other anticipated loads);
(b) water penetration resistance;
(c) air leakage;
(d) operating force (where appropriate); and
(e) forced-entry resistance (where appropriate).
Clause 9 also includes optional test methods to evaluate acoustical performance, impact performance, condensation resistance, and thermal transmittance.

Clause 10 presents the material requirements applicable to all windows, doors, SSPs, TDDs, roof windows, and unit skylights. These include requirements for glazing, sash, panel, leaf, and frame materials.

Clause 11 presents the component requirements applicable to all windows, doors, SSPs, TDDs, roof windows, and unit skylights. These include requirements for hardware, fasteners, weatherstripping, insect screens, reinforcing members, sealants, coatings and finishes, adhesives, integral ventilating systems/devices, between-glass shades, setting blocks, attachments, and preservatives.

Clause 12 presents the specific product performance requirements appropriate to each type of window, door, SSP, TDD, roof window, and unit skylight. These include requirements for test specimens, such as product tolerance and qualifying the test specimen for variations of design and assembly.

Table 12.2 contains a summary of all performance requirements included in this Standard/Specification. These requirements are presented in tabular format for easy use by the specifier and include references to the applicable Clauses of this Standard/Specification, organized by product type.

Annex A provides contact information for the standards development organizations listed in Clause 2.

0.2 Performance Classes and Grades

0.2.1 General

This Standard/Specification defines requirements for four Performance Classes. The Performance Classes are designated R, LC, CW, and AW for windows, doors, and secondary storm products (SSPs). Skylights, roof windows, and TDDs are not identified with a Performance Class, but are treated in a way similar to specialty products. This classification system provides for several levels of performance. It is important to note that although general suggestions for use are specified in Items (a) to (d), product selection is always based on the performance requirements of the particular project and not solely on these suggestions. The Performance Class ratings should be regarded as an indication of the level of performance, with the least stringent requirements established for the R Performance Class and the most stringent for the AW Performance Class. The following descriptions can be used as a general guide in helping to determine which class is likely best suited for a particular application:
(a) R: commonly used in one- and two-family dwellings.
(b) LC: commonly used in low-rise and mid-rise multi-family dwellings and other buildings where larger sizes and higher loading requirements are expected.
(c) CW: commonly used in low-rise and mid-rise buildings where larger sizes, higher loading requirements, limits on deflection, and heavy use are expected.
(d) AW: commonly used in high-rise and mid-rise buildings to meet increased loading requirements and limits on deflection, and in buildings where frequent and extreme use of the fenestration products is expected.

Minimum Performance Grades (PG), design pressures (DP), structural test pressures (STP), and water penetration resistance test pressures for all Performance Classes are specified in Table 12.2.

Table 0.1 lists those Clauses, Tables, and Figures in the 2008 edition of this Standard/Specification that have been moved to a different location in the current edition of this Standard/Specification. It does not list Clauses, Tables, and Figures that have been renumbered but not relocated.

Table 0.1
Table of correspondences — 2008 and 2011 editions of this Standard/Specification

(See Clause 0.2.1.)

2008 edition	2011 edition	Topics	Comments
Clause 4 Table 1	Clause 5 Table 5.7 Clause 6 Table 6.5 Clause 7 Table 7.7 Clause 8 Table 8.7	Gateway requirements	Abridged to include only those product types covered by each Product Section
Clause 4.2.2	Clause 5.3.4	Alternative minimum test sizes for Performance Class R products (optional)	Applies only to Performance Class R
Clause 4 Table 2	Clause 5 Table 5.1 Clause 6 Table 6.1 Clause 7 Table 7.1 Clause 8 Table 8.3	U.S. (only) optional Performance Grades (PG)	Abridged to include only those product types covered by each Product Section
Clause 4 Table 3	Clause 5 Table 5.4 Clause 6 Table 6.3 Clause 7 Table 7.4	Canadian (only) optional Performance Grades (PG), except TDDs, roof windows, and unit skylights	Abridged to include only those product types covered by each Product Section
Clause 4 Table 4	Clause 8 Table 8.6	Canadian (only) optional Performance Grades (PG) for TDDs, roof windows, and unit skylights	U.S. and Canadian requirements are harmonized
Clause 4 Figure 4	Clause 6 Figure 6.2	Primary designator (Example 3) limited water (LW) side-hinged doors	Moved to applicable Product Section
Clause 4.4.3.5	Clause 5.2.2 Clause 6.3.2 Clause 7.2.2 Clause 8.3.2	Canadian air infiltration/exfiltration level	Duplicated in each Product Section
Clause 4.4.3.6.2 Figure 7 Clause 4.4.3.6.3 Figure 8 Clause 4.4.3.6.4 Figure 9	Clause 6.3.3 Figure 6.1 Clause 7.2.3 Figure 7.1 Clause 8.4.2 Figure 8.1	Secondary designator examples	Moved to applicable Product Sections

(Continued)

Table 0.1 (Continued)

2008 edition	2011 edition	Topics	Comments
Clauses 5.1 to 5.3.5 (except as otherwise noted)	Clauses 9.1 to 9.3.5	General testing requirements	Moved to General Testing Section
Clause 5 Tables 6 and 7	Tables 5.2 and 5.5 Tables 7.2 and 7.5 Tables 8.1 and 8.4	Operating force requirements — U.S. and Canadian (only)	Abridged to include only those product types covered by each Product Section
Clause 5.3.1.2	Clause 6.4.5	Force to latch for side-hinged door systems	Moved to applicable Product Section.
Clause 5.2.5 Figure 11	Clause 5.3.2 and Figure 5.1 Clause 6.4.3 Clause 7.3.2 Clause 8.4.3 and Figure 8.2 Clause 9.2.5 and Figures 9.1 and 9.2	Test specimen installation	Abridged to include only those product types covered by each Product Section. General information moved to General Testing Section.
Clause 5.3.2.1 Table 8	Clause 5 Table 5.3 Clause 6 Table 6.2 Clause 7 Table 7.3 Clause 8 Table 8.2	Maximum allowable air leakage	Abridged to include only those product types covered by each Product Section
Clause 5.3.2.2 Table 9	Clause 5.2.2 and Table 5.6 Clause 6.3.2 and Table 6.4 Clause 7.2.2 and Table 7.6 Clause 8.3.2 and Table 8.5	Canadian (only) air infiltration/exfiltration levels	Abridged to include only those product types covered by each Product Section
Clause 5.3.2.4	Clause 8.4.4	TDDs, roof windows, and unit skylights — Air leakage testing	Moved to applicable Product Section
Clause 5.3.3.1	Clause 6.4.4	Limited water (LW) testing for side-hinged doors	Moved to applicable Product Section
Clause 5.3.3.4 Clause 5.3.3.4.1 Clause 5.3.3.4.2	Clause 8.4.5	TDDs, roof windows, and unit skylights — Water penetration testing	Moved to applicable Product Section
Clause 5.3.4.1.2	Clause 8.4.6.2	Roof windows and unit skylights — Uniform load testing clarifications	Moved to applicable Product Section
Clause 5.3.4.1.5	Clause 8.4.6.1	TDDs — Uniform load testing clarifications	Moved to applicable Product Section

(Continued)

Table 0.1 (Continued)

2008 edition	2011 edition	Topics	Comments
Clause 5.3.4.2 (last paragraph only)	Clause 7.3.3 Clause 8.4.6.2	Uniform load deflection test at design pressure (DP)	Moved to applicable Product Sections
Clause 5.3.6.4.2 Table 10	Clause 7.3.4.2 and Table 7.9	Sash/leaf torsion tests for Performance Classes CW and AW	Moved to applicable Product Section
Clause 5.3.6.2	Clause 9.3.6.2 Figure 9.3	Thermoplastic corner weld test	Moved to General Testing Section
Clause 5.3.6.4.3 Figure 14	Clause 9.3.6.4.2 Figure 9.4	Sash vertical deflection test — Casement windows	Moved to General Testing Section
Clause 5 Table 11	Clause 5 Table 5.9 Clause 7 Table 7.8	Deflection limits for sash vertical deflection test — Casement windows	Abridged to include only those product types covered by each Product Section
Clause 5.3.6.4.4 Figure 15 Figure 16	Clause 9.3.6.4.3 Figure 9.5 Figure 9.6	Sash/leaf concentrated load test on latch rail	Moved to General Testing Section
Clause 5 Table 12	Clause 5 Table 5.10 Clause 6 Table 6.6 Clause 7 Table 7.10	Deflection limits for sash/leaf concentrated load test on latch rail	Abridged to include only those product types covered by each Product Section
Clause 5.3.6.4.5 Table 13 Figure 17	Clause 7.3.4.3 Figure 7.3 Table 7.11	Vertical concentrated load test — Pivoted windows	Moved to applicable Product Section
Clause 5.3.6.5 Table 14 Figure 18	Clause 7.3.4.4 Figure 7.4 Table 7.12	Vertical concentrated load on intermediate frame rails	Moved to applicable Product Section
Clause 5.3.6.6.2 Figure 19	Clause 9.3.6.5.2 Figure 9.7	Distributed load test (now sash and hardware load test)	Moved to General Testing Section
Clause 5 Table 15	Clause 5 Table 5.11 Clause 7 Table 7.13	Loads for distributed load test (now concentrated load test)	Abridged to include only those product types covered by each Product Section
Clause 5.3.6.6.3 Figure 20	Clause 9.3.6.5.3 Figure 9.8	Stabilizing arm load test — Bottom-hinged windows or dual-action hinged doors	Moved to General Testing Section
Clause 5 Table 16	Clause 5 Table 5.12 Clause 6 Table 6.7 Clause 7 Table 7.15	Loads for stabilizing arm load test — Bottom-hinged windows or dual-action hinged doors	Abridged to include only those product types covered by each Product Section
Clause 5.3.6.6.4 Table 17 Figure 21	Clause 7.3.4.5 Figure 7.5 Table 7.14	Hold open arm/stay bar test — Top-hinged windows	Moved to applicable Product Section

(Continued)

Table 0.1 (Concluded)

2008 edition	2011 edition	Topics	Comments
Clause 5.3.6.6.5	Clause 9.3.6.5.4	Hinge test (hinged rescue windows only)	Moved to General Testing Section
Clause 5.3.6.6.6 Figure 22	Clause 9.3.6.5.5 Figure 9.9	Awning, hopper, projected hardware load test	Moved to General Testing Section
Clause 5 Table 18	Clause 5 Table 5.13 Clause 7 Table 7.16	Deflection limits for awning, hopper, projected hardware load test	Abridged to include only those product types covered by each Product Section
Clause 5.3.6.7	Clause 5.3.6	Safety drop test (non-hung vertical operating products only)	Moved to applicable Product Section
Clause 5.3.6.8 Figure 23	Clause 5.3.7 Figure 5.1	Unit dead load test (greenhouse windows only)	Moved to applicable Product Section
Clause 5.3.6.10 Table 19	Clause 6.4.7 Table 6.8	Operation/cycling-slam test performance (side-hinged door systems only)	Moved to applicable Product Section
Clause 5.3.6.11	Clause 6.4.8	Vertical loading resistance (side-hinged door systems only)	Moved to applicable Product Section
Clause 7.8	Clause 4.6	Mullions	Moved to General Requirements for all product types
Clause 7.12.1	Clause 12.3.4.1	True divided lites (TDLs)	Moved to applicable Product Section
Clause 9 Table 26	Clause 5.3.4 Table 5.8	Alternative minimum test sizes (and Performance Grades [PG]]) for Class R products (optional)	Applies only to Performance Class R

0.2.2 Guidance for the specifier/purchaser

The purchaser or specifier selects the appropriate level of performance, depending on climatic conditions, height of installation, type of building, type of window, door, secondary storm product, TDD, roof window, or unit skylight, durability, etc. In some cases, the appropriate level of performance classification does not correspond with the general use of the building or the use group occupancy assigned to the building in accordance with the local building code. For example, certain residential building applications require CW and/or AW Performance Class fenestration products, whereas some commercial building applications have been known to successfully use R and/or LC Performance Class fenestration products.

0.2.3 Performance Grade (PG) designations

To qualify for a given Performance Grade (PG), one or more representative specimens of the product need to pass all required performance tests for the following, in addition to all required auxiliary (durability) tests for the applicable product type and desired Performance Class:

(a) operating force (if applicable);
(b) air leakage resistance;
(c) water penetration resistance;
(d) uniform load deflection test;
(e) uniform load structural test; and
(f) forced-entry resistance (if applicable).

Performance Grades (PG) are designated by a number following the type and class designation. For example, a Class R window designated Class R-PG15 indicates a Performance Grade (PG) of 15. This incorporates the design pressure (DP) of 720 Pa or approximately 15 psf.

0.2.4 Positive and negative design pressure (DP)

0.2.4.1

The uniform load structural test pressure (STP) is

(a) 150% of the design pressure (DP) for windows and doors, and for uplift on unit skylights, roof windows, and TDDs; and

(b) 200% of the design pressure (DP) for download on unit skylights, roof windows, and TDDs.

For Canada, design pressure (DP) for vertical fenestration is to be interpreted as referring to specified wind load.

0.2.4.2

Current model building codes require windows, doors, TDDs, roof windows, and unit skylights to be designed and installed to sustain prescribed loads on components and cladding. These loads are affected by a number of factors, including

(a) geographic wind speed;
(b) building exposure;
(c) building height;
(d) location of the window, door, TDD, roof window, or unit skylight on the building; and
(e) snow load.

0.2.4.3

Geographic wind speed will affect the overall value of the wind pressure that the window, door, TDD, roof window, or unit skylight will be anticipated to sustain. Positive and negative wind pressures will be increased or decreased with geographic wind speed.

0.2.4.4

Building exposure will also affect the overall value of the wind pressure, and in addition can affect local conditions across the building's surface by an increased or decreased presence of wind turbulence. Turbulence is caused when the wind is forced to change direction by an object in its path. The building exposure can affect the amount of turbulence based on the number of buildings, objects, or topography immediately surrounding the building. Wind speed increases greatly as height above mean ground level increases, increasing the anticipated wind pressure that the building will be expected to sustain. Exposure also influences the factored snow load that the building surfaces need to resist.

0.2.4.5

Location of the window, door, SSP, TDD, roof window, or unit skylight on the building has the potential of significantly affecting the anticipated wind pressure on a single window, door, SSP, TDD, roof window, or unit skylight. Wind flow patterns are affected by building shape. Wind encountering a building is redirected to flow around and over the building. Wind traveling around the corners of the building separates from the building surface, causing turbulence and local negative structural pressures. Location can also influence the factored drifting or sliding snow loads that the building surfaces need to resist.

0.2.4.6

Wind loads on components and cladding are not the same as main wind force-resisting-system (building structure) wind loads, in that components and cladding experience localized higher pressure (peak load) in a relatively small area. Wind gusts can cause short-duration peak pressures on a small area of the building's surface. The wind pressure calculation for components and cladding loads accounts for these

short-duration peak loads. The highest localized loads are believed to occur near the corners of the building, roof edges, and roof peaks. Windows, doors, SSPs, TDDs, roof windows, or unit skylights are often located in these zones on the building.

0.2.4.7

Positive wind pressure most commonly occurs on a component or cladding product when it is located on the windward side of a building. Negative wind pressure most commonly occurs on a component or cladding product when it is located on the leeward side of a building, and/or within a specified distance from a building corner, roof edge, or roof peak on a side or leeward building surface.

0.2.4.8

ASCE/SEI 7 states that "Each component and cladding element should be designed for the maximum positive and negative pressures (including applicable internal pressures) acting on it. The pressure coefficient values should be determined for each component and cladding element on the basis of its location on the building and the effective area for the element." It should be noted that ASCE/SEI 7 will not necessarily apply in all jurisdictions. Loads on structures and their components are determined in accordance with the requirements of the applicable building code.

Note: *Positive or negative design pressure (DP) refers to "allowable stress design" (as opposed to "strength design"), as referenced in ASCE/SEI 7.*

0.2.4.9

Through this analysis, the positive and negative wind loading demands of a window, door, SSP, TDD, roof window, or unit skylight product are frequently different; the negative wind load will almost always be higher than the positive. As such, codes and building authorities that reference ASCE/SEI 7 or other means of determining positive and negative loads require the product to meet both the positive and negative design constraints of the application. This Standard/Specification incorporates a system for rating windows, doors, SSPs, TDDs, roof windows, and unit skylights with an appropriate separate positive and negative design pressure (DP).

Notes:

(1) *Where snow load is significant, it is not unusual for the positive load to be much higher than the negative.*

(2) *Positive or negative DP refers to "allowable stress design" (as opposed to "strength design"), as referenced in ASCE/SEI 7.*

0.2.4.10

A maximum deflection limit of *L*/175 (where *L* is the length of the unsupported span) under the uniform load deflection test has also been established for all AW and CW products and for all glass-glazed SKG products. Generally, improved water penetration resistance and air leakage requirements have been specified for AW products compared to those specified for CW products. AW products are also required to pass the life cycle testing in AAMA 910.

0.2.5 Water penetration resistance testing and performance

0.2.5.1 General

Clause 9 specifies that, except for side-hinged door systems, the minimum water penetration resistance test pressure to achieve a given Performance Grade (PG) is as follows:

(a) For Performance Classes R, LC, and CW: 15% of the positive design pressure (DP) associated with the Performance Grade (PG).

(b) For Performance Class AW: 20% of the positive design pressure (DP) associated with the Performance Grade (PG).

For all product types other than side-hinged door systems, the water penetration resistance test pressure is never less than 140 Pa (~2.92 psf). For U.S. applications, the water penetration resistance test pressure for all products is never more than 580 Pa (~12.11 psf). For Canadian applications, the water penetration resistance test pressure for all products is never more than 720 Pa (~15.04 psf).

Note: *See Tables 5.1, 5.4, 5.7, 6.1, 6.3, 6.5, 7.1, 7.4, 7.7, 8.3, and 8.5 to 8.7 for additional details.*

0.2.5.2 Relationship between rain penetration and wind load

AAMA RPC states that "Three things are required to move water through a surface, a source of water, a path for the water to follow, and a force to drive the water through the opening. If any one of these items is absent, leakage cannot occur. The forces which can drive leakage are generally considered to be kinetic forces: gravity, capillary action, surface tension, and pressure differentials. In some circumstances only one or two of these forces may be present, but in a windy rainstorm all of them will likely be acting to move the water through any available leakage path. A pressure difference can drive water through any small leakage paths including those having a limited upward slope." The direction of the flow is from the side with higher pressure to the side with lower pressure. Except for side-hinged exterior doors, this Standard/Specification requires that the minimum water penetration resistance test pressure be determined as a percentage of the positive design pressure (DP) because this condition renders the biggest pressure difference between internal pressure of the building, external wind pressure, and the conditions to drive water to the interior of the building. For Canada, driving rain wind pressure (DRWP) data are used to determine whether testing of the specified percentage of design wind load is adequate for the application.

0.2.6 Operation/cycling performance

The multitude of factors that a fenestration product experiences in a real world application makes prediction of lifespan extremely complex. A side-hinged door, for example, has an operating frequency throughout its service life that is much higher than a window, secondary storm window, TDD, roof window, or unit skylight in the same building. While a window may be operated once or twice in a week, a side-hinged door may be opened and closed a half dozen or more times a day. Over a period of time, the exterior door system has to remain intact and operable if it is to remain resistant to environmental factors. For this reason, side-hinged door systems are cycle tested a minimum number of times and evaluated for component wear/degradation. This is not intended to predict the life of the product but to act only as a qualification that the interaction of the door components as a system will not cause premature failure of those components or the system.

0.3 Short-form specification

To simplify the writing of performance specifications for windows, doors, SSPs, TDDs, roof windows, and unit skylights, the authors have prepared a "short-form specification" (see Figure 1.1) which is recommended for use whenever possible. It may be used for most common types and classes of windows, doors, SSPs, TDDs, roof windows, and unit skylights by merely inserting the applicable Standard/Specification designation(s).

All (windows) (doors) (secondary storm products) (tubular daylighting devices) (roof windows) (unit skylights) shall conform to the _____ (see Note below) requirements of the voluntary specification(s) in AAMA/WDMA/CSA 101/I.S.2/A440-11, 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.

Note: *The specification writer shall insert the product type Performance Class and Performance Grade (PG) for the window, door, SSP, TDD, roof window, or unit skylight desired by specification designation such as R-PG15-HS or R-PG720 (SI)-HS for horizontal sliding windows or AW-PG40-AP or AW-PG1920 (SI)-AP for projected windows.*

Figure 1.1
Short-form specification
(See Clause 0.3.)

1 Scope

1.1 General

This fenestration Standard/Specification applies to both operating and fixed, new construction and replacement windows, doors, SSPs, TDDs, roof windows, and unit skylights installed into exterior building envelopes. This fenestration Standard/Specification establishes material-neutral, minimum, and optional performance requirements for windows, doors, SSPs, TDDs, roof windows, and unit skylights. This Standard/Specification concerns itself with the determination of Performance Grade (PG), design pressure (DP), and related performance ratings for windows, doors, SSPs, TDDs, roof windows, and unit skylights.

Performance requirements are used in this Standard/Specification when possible. Prescriptive requirements are used when necessary. When products are tested to the gateway requirements, or to the gateway and optional requirements, a rating is determined and a test report may be issued.

Certification procedures are not part of this Standard/Specification. This Standard/Specification applies to testing and rating products. The tested rating applies to products of identical construction, with width and/or height less than or equal to the tested size.

Various systems have been developed or are proposed for determining a product energy rating based on such factors as U-factor, solar heat gain coefficient, condensation resistance, and visible transmittance (visible light transmission). These rating systems are beyond the scope of this Standard/Specification.

Fenestration products not intended to be tested to this Standard/Specification include

(a) interior windows, interior accessory windows (IAWs), and interior doors;
(b) vehicular-access doors (garage doors) (see ANSI/DASMA 105, ANSI/DASMA 108, ANSI/DASMA 109, ANSI/DASMA 115, or other applicable DASMA Specifications);
(c) roof-mounted smoke and heat-relief vents;
(d) sloped glazing (other than unit skylights or roof windows) (see AAMA TIR A7);
(e) curtain walls and storefronts (see AAMA MCWM-1);
(f) folding door systems;
(g) commercial entrance systems (see AAMA SFM-1);
(h) sunrooms (see AAMA/NPEA/NSA 2100);
(i) revolving doors; and
(j) commercial steel doors rated per SDI A250.8.

Note: *The reference Standards and technical publications specified in this Clause for products not within the scope of this Standard/Specification are for the convenience of the reader and are not intended to be considered complete or all-inclusive.*

1.2 Terminology

In this Standard/Specification, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Standard/Specification; "should" is used to express a recommendation or that which is advised but not required; "shall be permitted to be" is used to express an option or that which is permissible within the limits of the Standard/Specification; and "can" is used to express possibility or capability. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and shall be permitted to be written as requirements. Legends to equations and figures are considered requirements. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

The Preface, Clause 0, and any Notes not attached to figures and tables are non-mandatory.

1.3 Units of measurement

The values given in SI (metric) units are the standard. The values given in parentheses are for information only.