CSA Group

AAMA/WDMA/CSA 101/1.S.2/A440-17
National Standard of Canada

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

American Architectural Manufacturers Association

WINDOW & DOOR MANUFACTURERS ASSOCIATION WDMA

Standards Council of Canada
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CSA Group
178 Rexdale Boulevard
Toronto, Ontario, M9W 1R3
Canada

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Standards Council of Canada
600-55 Metcalfe Street
Ottawa, Ontario, K1P 6L5
Canada

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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 to judge its suitability for their particular purpose.

National Standard of Canada

AAMA/WDMA/CSA 101/1.S.2/A440-17

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

American Architectural Manufacturers Association
1827 Walden Office Square, Suite 550
Schaumburg, Illinois
60173-4268 USA
www.aamanet.org

Window & Door Manufacturers Association
330 N. Wabash Avenue, Suite 2000
Chicago, Illinois
60611 USA;
2025 M Street NW, Suite 800
Washington, DC
20036 USA
www.wdma.com

CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard
Toronto, Ontario, Canada
M9W 1R3
1-800-463-6727 • 416-747-4000

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Contents

Preface

This is the fourth edition of AAMA/WDMA/CSA 101/I.S.2/A440 — *North American Fenestration Standard/Specification for windows, doors, and skylights*. It supersedes the previous edition published in 2011 under the same title. It is jointly published and maintained by the American Architectural Manufacturers Association (AAMA), the Window & Door Manufacturers Association (WDMA), and CSA Group.

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

a) *User Guide to AAMA/WDMA/CSA 101/I.S.2/A440* has been integrated into this Standard/Specification.
b) Labels have been added to clause titles to indicate the type of performance requirement addressed by the clause.

This Standard/Specification was developed as an advisory document and is published as a public service. AAMA, WDMA, CSA Group, 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 building officials, manufacturers, architects, engineers, consumers, builders, contractors, trade associations, test laboratories, specifiers, product evaluation and certification agencies, and government agencies. Two fundamental applications for this Standard/Specification are product comparison and code compliance. AAMA, WDMA and CSA Group 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 *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 this Standard/Specification for compliance in Canada. The *Canadian Supplement* is considered suitable for use for conformity assessment within the stated scope of the Standard/Specification. The *Canadian Supplement* was prepared by the CSA Group 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 Group 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, WDMA, CSA Group and other interested parties. This Standard/Specification has been formally approved by the members of the American Architectural Manufacturers Association, the members of the Window & Door Manufacturers Association, and by the CSA Group Technical Committee. The CSA Group Technical Committee is comprised of 5 members representing General Interest, 11 members representing Producer Interest, and 9 members representing User Interest. A list of the members of the CSA Group Technical Committee is available upon request.

This Standard/Specification has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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/Specification is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard/Specification 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 and WDMA standards are subject to periodic review. CSA Group Standards are subject to review within five years from the date of publication. Suggestions for their improvement will be referred to the appropriate committee.*
5) *All enquiries regarding this Standard/Specification, 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 CSA Group at inquiries@csagroup.org, or to the Window & Door Manufacturers Association, 330 N. Wabash Ave., Suite 2000, Chicago, Illinois 60611 USA; 2025 M Street NW, Suite 800, Washington, DC 20036 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 Group Directives and guidelines governing standardization and are published in CSA Group's periodical Info Update, which is available on the CSA Group Web site at standardsactivities.csa.ca, and by the American Architectural Manufacturers Association and the Window & Door Manufacturers Association.

AAMA/WDMA/CSA 101/1.S.2/A440-17 North American Fenestration Standard/ Specification for windows, doors, and skylights

0 Introduction

There is a commentary available for this Clause.

0.1 General

0.1.1 Applicability

There is a commentary available for this Clause.

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. It represents the continuing development of an internationally-accepted performance Standard/Specification for all windows, doors, SSPs, TDDs, roof windows, and unit skylights. The testing provisions of this Standard/ Specification apply to laboratory testing only.

0.1.2 Sustainability

There is a commentary available for this Clause.

This Standard/Specification does not endorse any specific sustainability program.

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. Below is an overview of the content contained in this Standard/Specification:

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 terms and 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, unit skylights, etc.) and Performance Classes in the U.S. and Canada.

Clause 9 contains the specific levels of performance and test methods required for each window, door, SSP, TDD, roof window, and unit skylight covered by this Standard/Specification. These levels of performance provide a gateway or passport into one of the four Performance Classes: R, LC, CW, and AW.

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 10 presents the material requirements applicable to windows, doors, SSPs, TDDs, roof windows, and unit skylights covered by this Standard/Specification. These include requirements for glazing, sash, panel, leaf, and frame materials.

Clause 11 presents the component requirements applicable to windows, doors, SSPs, TDDs, roof windows, and unit skylights covered by this Standard/Specification. 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 is commentary.

Annex B provides contact information for the organizations listed in Clause 2.

Annex C discusses some available certification processes.

Annex D summarizes the progress of this standard from its early predecessors.

The commentary might repeat but does not include requirements or alternate requirements. The purpose of the commentary is to add background information, explanatory language, examples, or further clarification to topics addressed by the referenced clause.

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). This classification system provides for several levels of performance. Unit skylights, roof windows, and TDDs are not identified with a Performance Class, but are expected to meet requirements similar to CW products.

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 summarized in Table 12.2.

0.2.2 Guidance for the specifier/purchaser

C There is a commentary available for this Clause.

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.

0.2.3 Performance Grade (PG) designations

C There is a commentary available for this Clause.

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.

0.2.4 Positive and negative design pressure (DP)

0.2.4.1 Uniform structural load test pressure

C There is a commentary available for this Clause.

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 Deflection limit

C There is a commentary available for this Clause.

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 class products and for all glass-glazed skylight (SKG) and roof window (RWG) product types. AW class 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 capped at 580 Pa (~12.11 psf). For Canadian applications, the water penetration resistance test pressure for all products is capped at 720 Pa (~15.04 psf).

Note: *See Tables 5.3, 6.3, 7.1, and 8.3 for additional details.*

0.2.5.2 Relationship between rain penetration and wind load

C There is a commentary available for this Clause.

Users of this Standard/Specification should consider the relationship between rain penetration and wind load.

0.2.6 Operation/cycling performance

C There is a commentary available for this Clause.

Users of this Standard/Specification should consider operation and cycling performance testing for side-hinged doors.

0.3 Short-form specification

C There is a commentary available for this Clause.

The following is an example of a short-form specification.

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/A440-17, be labeled with the AAMA, or WDMA label, or labeled as permitted by the Canadian National Code, 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 for horizontal sliding windows or AW-PG40-AP for projected windows.*

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 height less than or equal to the tested size.

1.2 Outside of scope

C There is a commentary available for this Clause.

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 excluded from the scope of 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 (see FM 4430);
d) sloped glazing (other than unit skylights or roof windows) (see AAMA TIR A7);
e) curtain walls and storefronts (see AAMA MCWM-1);
f) commercial entrance systems (see AAMA SFM-1);
g) sunrooms (see AAMA/NPEA/NSA 2100);
h) revolving doors; and

i) commercial steel doors rated per ANSI/SDI A250.8.

1.3 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, commentary and any notes not attached to figures and tables are non-mandatory.

1.4 Units of measurement

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

1.5 Clause labels

For the convenience of the user, clauses are labelled to indicate the type of performance requirement addressed by the clause. The following table explains the labels:

Label	Type of performance requirement addressed in clause	Additional information
AWS	Air, water and structural	• Outlines the primary performance requirements for safety, weather-ability and structural integrity applicable to assembled and glazed products. • In general, are the requirements mandated by Model Building Codes, adopted by authorities having jurisdiction, and enforced for specific projects. • Provides fenestration product manufacturers with protocols for verifying compliance through standard whole-product testing. • Provides certification bodies with a basis for developing detailed rules and procedures governing product variations, changes, and quality control of assembled and glazed products.
DL	Durability and longevity	• Outlines requirements for durability, longevity, and resistance to environmental exposure deemed critical by the industry consensus organizations authoring this Standard/Specification. • In general, requirements are mandated only by codes through reference to compliance with this Standard/Specification.

Label	Type of performance requirement addressed in clause	Additional information
		• Provides fenestration product manufacturers with protocols for verifying compliance through standard whole-product testing • Provides certification bodies with a basis for developing detailed rules and procedures governing product variations, changes, and quality control of assembled and glazed products.
CPM	Component parts and materials	• Outlines performance and prescriptive requirements for component parts and materials, including but not limited to, hardware, weather-seals, fasteners, reinforcing and material criteria. • Provides component and material suppliers with protocols for verifying suitability for use through standard component and material testing. • Provides fenestration manufacturers with a basis for component and material selection and qualification. • Cites industry standard test methods, which in turn could cite other test methods. **Note:** *These clauses do not supersede nor take precedence over manufacturers' or suppliers' quality processes or the testing protocols they contain.*
HS	Health and safety	• Outlines requirements for transparency in material ingredients reporting, environmental impact, handling, or disposal that might be applicable to fenestration products or component parts as related to sustainable building design, construction, operation and maintenance.
No label	Multiple performance requirements	• Outlines information regarding multiple performance requirements.

2 Reference publications

There is a commentary available for this Clause.

This Standard/Specification refers to the following publications, and where such reference is made, it shall be to the edition listed below.

AAI (The Aluminum Association, Inc.)
Aluminum Standards and Data — 2013

Aluminum Design Manual — 2015

AAMA (American Architectural Manufacturers Association)
AAMA 303-12
Voluntary Specification for Rigid Polyvinyl Chloride (PVC) Exterior Profiles