Your Last NAFS Presentation:

Specifying with NAFS under Part 5 and Part 9

BCBEC FALL CONFERENCE
SEPTEMBER 23, 2015
PRESENTED BY AL JAUGELIS

RDH

Topics covered

1. NAFS overview
2. What products does NAFS cover?
3. NAFS in the Code—Part 5
4. NAFS in the Code—Part 9
5. Specifying with NAFS

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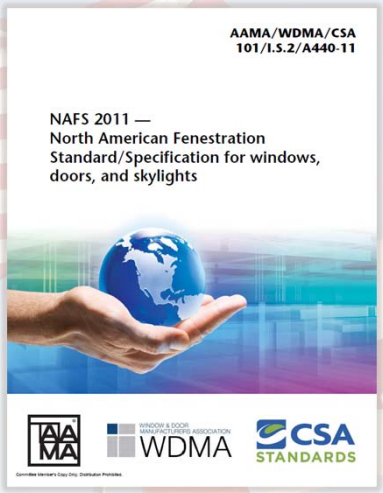
1. NAFS overview



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What is NAFS?

→ NAFS harmonizes Canadian and American fenestration standards:

AAMA/WDMA/CSA 101/I.S.2/A440-08, ***NAFS—North American Fenestration Standard****/Specification for windows, doors and skylights*

→ Called the **Harmonized Standard** in the Building Code

→ Called **NAFS** or **NAFS-08** by the fenestration industry

→ 2008 version referenced in BC codes

What is NAFS?

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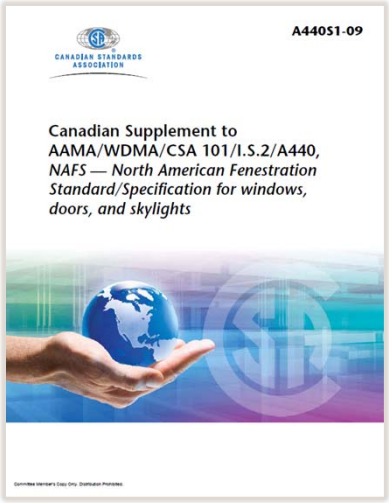
- NAFS mostly harmonizes Canadian and American fenestration standards:
- There are separate US and Canadian tables in NAFS
- NAFS application to Canada defined in CSA A440S1-09, the "Canadian Supplement" to NAFS



Can US-tested products be sold in Canada?

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- **ONLY** if they have been tested to the Canadian requirements in NAFS and additional tests in the Canadian Supplement
- Standards not completely harmonized
- US-rated products need to be re-tested to comply with the Canadian ratings

NAFS adoption across Canada

- → 2010 NBCC National Building Code of Canada
- → 2012 BCBC British Columbia Building Code
- → 2012 Ontario Building Code (eff. 2014)
- → 2014 VBBL Vancouver Building Bylaw
- → 2014 Alberta Building Code
- → Future Quebec Building Code

NAFS vs. CSA A440-00

No more ABC ratings . . .

- → Performance CLASS
- → Performance GRADE
- → Water Penetration Test Pressure
- → Air Infiltration/Exfiltration Level

NAFS vs. CSA A440-00

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No more ABC ratings . . .

→ Performance CLASS
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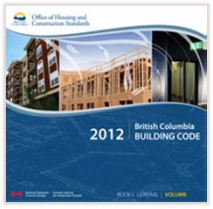

→ **Code is not concerned with Performance Class!**

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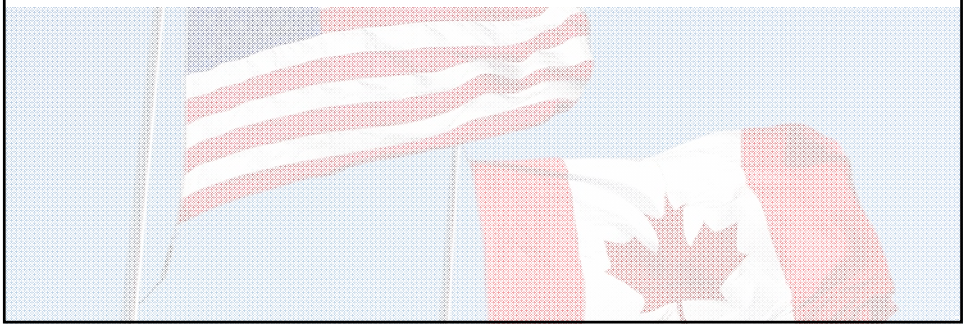
2. What products does NAFS cover?



What products does NAFS cover?

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1 Scope

1.1 General

This fenestration Standard/Specification applies to both operating and fixed, prime and replacement windows, doors, TDDs, and unit skylights installed into exterior building envelopes. This fenestration Standard/Specification establishes material-neutral, minimum, and optional performance requirements for windows, doors, TDDs, 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, TDDs, 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 and 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) sloped glazing (other than unit skylights or roof windows) (see AAMA TIR A7);

What products does NAFS cover?

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Many types of windows, doors, TDDs and unit skylights






What products does NAFS exclude?

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

(a) interior windows and 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) sloped glazing (other than unit skylights or roof windows) (see AAMA TIR A7);

6 *January 2008*

(d) curtain wall and storefront (see AAMA MCWM-1);
(e) storm windows and doors (except when incorporated in dual windows and dual doors) (see AAMA 1002.10, AAMA 1003, and AAMA 1102.7);
(f) commercial entrance systems (see AAMA SFM-1);
(g) sunrooms (see AAMA/NPEA/NSA 2100);
(h) revolving doors;
(i) site-built door systems; and
(j) commercial steel doors rated per SDI A250.8.

Note: *The reference Standards and technical publications furnished above 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.*

Products outside the scope of NAFS






Products outside the scope of NAFS

- For the most part, products outside the scope of NAFS are excluded with reference to other standards:
  - Sloped glazing (multiple-lite skylights): AAMA TIR A7
  - Curtainwall and storefronts: AAMA MCWM-1
  - Commercial entrance systems: AAMA SFM-1
  - Sunrooms: AAMA/NPEA/NSA 2100
  - Revolving doors
  - Commercial steel doors: SDI A250.8

What products does NAFS cover?

Why is the scope of NAFS important?

1. The code has explicitly different requirements for products inside—or outside—the scope of NAFS
2. Performance Class applies only to named products within the scope of NAFS

Performance Class

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
"Light Duty"	"Medium Duty"	"Heavy Duty"	"Severe Duty"




Performance Class

- Performance Class is the "key concept at the heart of NAFS"
- NAFS requires product types explicitly within its scope to be classified according to Performance Class
  - Performance Class applies only to specific product types named in NAFS Table 5
  - Exception: "Specialty Products" not identified in NAFS Table 5

NAFS product types

Table 5
Product types
(See Clauses 4.4.2.1, 4.4.2.2, 8.1, and 8.3.2.)

AP	=	Awning, hopper, projected window	LW SHD	=	Limited water side-hinged door
ATD	=	Architectural terrace door	RW	=	Roof window
BW	=	Basement window	SD	=	Sliding door
C	=	Casement window	SHD	=	Side-hinged door
DASHD	=	Dual-action side-hinged door	SHW	=	Side-hinged (inswinging) window
DAW	=	Dual-action window	SKG	=	Unit skylight — glass glazed
FD	=	Fixed door	SKP	=	Unit skylight — plastic glazed
FW	=	Fixed window	SLT	=	Side lite
GH	=	Greenhouse window	SP	=	Specialty product
H	=	Hung window	TA	=	Tropical awning window
HE	=	Hinged rescue window	TDD		
HP	=	Horizontally pivoted window	TH		
HS	=	Horizontal sliding window	TR		
J	=	Jalousie window	VP	=	Vertically pivoted window
JA	=	Jal-awning window	VS	=	Vertical sliding window
LW DASHD	=	Limited water dual-action side-hinged door			

Example Specialty Product: Folding-sliding doors

NAFS product types illustrated

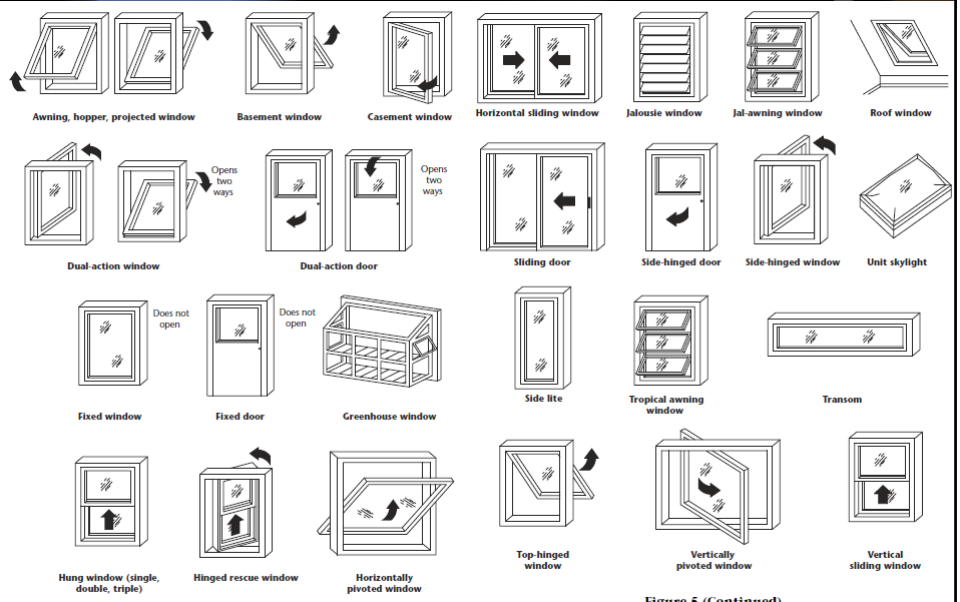


Figure 5
Product type illustrations

Figure 5 (Continued)

Performance Class qualification requirements

- 6 pages of tables for 30 product types in Table 5
- Lists all applicable classes and grades for each product type

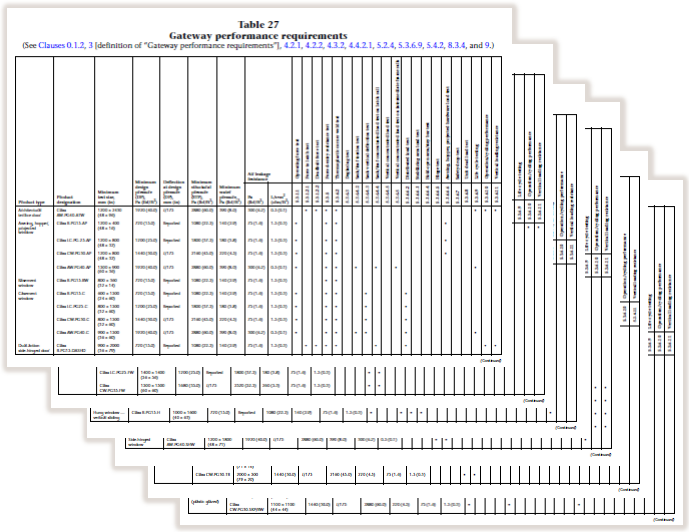
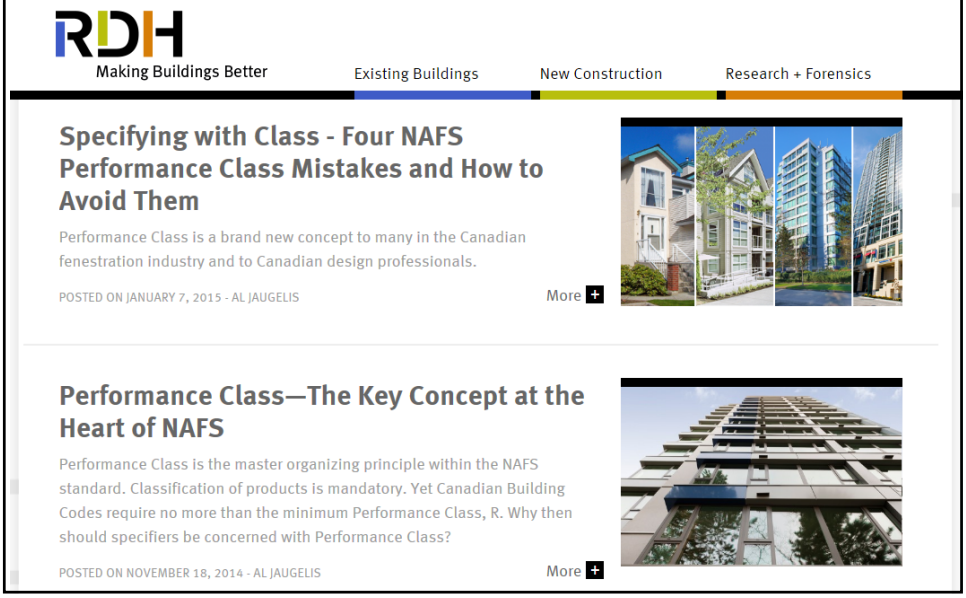


Table 27
Gateway performance requirements
(See Clauses 0.1.2, 3 [definition of "Gateway performance requirements"], 4.2.1, 4.2.2, 4.3.2, 4.4.2.1, 5.2.4, 5.3.6.9, 5.4.2, 8.3.4, and 9.)

More on the NAFS in Canada blog



3. NAFS in Part 5

NAFS in Part 5

5.10.2.2. Applicable Standards

(See Appendix A.)

1) Windows, doors and skylights shall conform to the requirements in

a) AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," and

b) CSA A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights."

2) Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement referenced in Clause (1)(b) so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed. ❮(See Sentence 1.1.3.1.(3).)❯

3) Windows, doors and skylights shall conform to the performance grades selected in Sentence (2) when tested in accordance with the Harmonized Standard referenced in Clause (1)(a).

5.10.2.3. Structural Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components shall be designed and constructed in accordance with

a) Article 5.1.4.1., Section 5.4. and Section 5.6., or

b) Article 5.10.2.2., where they are covered in the scope of the standards listed in Sentence 5.10.2.2.(1).❯

NAFS in Part 5

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5.1.4.1. Structural and Environmental Loads
(See Appendix A.)

1) *Building* material
exterior shall have s

Section 5.4. Air Leakage

(See Appendix A and Part 10.)

5.4.1. AIR BARR

Section 5.6. Precipitation

(See Appendix A and Part 10.)

5.6.1. PROTECTION FROM PRECIPITATION

5.10.2.3. Structural Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components shall be designed and constructed in accordance with

a) Article 5.1.4.1., Section 5.4. and Section 5.6., or

b) Article 5.10.2.2., where they are covered in the scope of the standards listed in Sentence 5.10.2.2.(1).

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(See Appendix A.)

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Products within the scope of NAFS

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Products outside the scope of NAFS

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NAFS in Part 5

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How do products conform to clause 5.10.2.3(1)(a)?

→ By design and construction for **air tightness**, **water tightness**, and "all **structural loads and the effects of those loads** that may be reasonably be expected"

→ Design by professional engineers/architects

→ Performance verification at discretion of engineers, *may include* lab test data, field review, and site testing

and . . . *for products in the scope of NAFS*

. . . by NAFS testing and labeling

NAFS in Part 5

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Is NAFS testing equivalent in scope to "design and construction to Part 5"?

→ Professional responsibility under Part 5 must include the interface with the wall

→ NAFS specifically excludes the interface with the wall from its scope:

NAFS in Part 5

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NAFS on test specimen installation

"These tests are used to evaluate the performance of the fenestration product only and are not intended to test the performance of the installation, particularly the perimeter sealants between the fixture and the test specimen and the anchoring of the test assembly to the test fixture . . . . Evaluation of actual field installation details is not part of this Standard/ Specification."

(excerpt from Clause 5.2.5 of NAFS-08, Clause 9.2.5 of NAFS-11 similar)

NAFS in Part 5

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Five reasons NAFS testing is no substitute for Part 5 design:

1. NAFS testing for wind load resistance is based on the fallacy that one can separate the structural performance of a product from how it is anchored to a particular substrate.
2. Because NAFS testing excludes anchoring from its scope, a registered professional must still design the anchorage of fenestration products to particular building substrates in a way that accommodates expected building movements and deformations.

NAFS in Part 5

3. NAFS structural testing evaluates only wind load resistance. However a fenestration product designed to Part 5 must also consider guard loads and human impact loads that affect windows with sills below guard height in most buildings.
4. NAFS testing only qualifies the framing system, hardware and weatherseals, not the glass. Glass must still be designed by a registered professional.

NAFS in Part 5

5. NAFS tested Performance Grade reports the air and water tightness of the product to the edges of its frame only . . .

   Additional measures such as professional review of installation detailing, field review, and possibly jobsite testing, are required to verify what NAFS does not.

NAFS in Part 5

Summary

- In Part 5, NAFS and the Canadian Supplement apply only to products within the scope of NAFS
- Many fenestration products used on buildings other than single family homes are outside the scope of NAFS
- NAFS testing alone does not address Part 5 compliance requirements, professional design and field review are still required

NAFS in Part 5

- For more information, the **NAFS in Canada** blog has a detailed article on NAFS in Part 5

4. NAFS in Part 9

NAFS in Part 9

NAFS is discussed in subsections 9.7.3, 9.7.4, and 9.7.5

- → Subsection 9.7.3 lays out the "general performance expectations" for fenestration in Part 9
  - → Compliance with 9.7.3 "performance requirements" shall be demonstrated by following 9.7.4, 9.7.5, or **"design and construction conforming to Part 5"**
- → Subsection 9.7.4 applies only to products within the scope of NAFS
- → Subsection 9.7.5 applies only to products outside the scope of NAFS
- → *"Design and construction conforming to Part 5" is always an option for fenestration performance in Part 9*

NAFS in Part 9

- What are some reasons to use Part 5 engineering under Part 9?
  - Architectural designs often require manufacturers to provide product sizes/configurations not previously tested by manufacturers
  - Custom homes as well as mixed use buildings often have window, door or skylight products that are outside the scope of NAFS
  - Canadian Supplement "simplified" design pressures (DPs) are typically higher than DPs calculated by engineers
  - ***Code allows manufacturers and builders to use engineering in place of NAFS testing/labeling when they deem it necessary***

NAFS in Part 9

9.7.3. <PERFORMANCE OF WINDOWS, DOORS AND SKYLIGHTS

9.7.3.1. General Performance Expectations

1) Except as provided in Sentences (2) to (4), windows, doors and skylights and their components separating *conditioned space* from unconditioned space or the exterior shall be designed, constructed and installed so that, when in the closed position, they

a) resist the ingress of precipitation into interior space,

b) resist wind loads,

c) control air leakage,

d) resist the ingress of insects and vermin,

e) where required, resist forced entry, and

f) are easily operable.

2) Skylights and their components shall be designed, constructed and installed so that they resist snow loads.

3) Main entrance doors and their components shall be designed, constructed and installed so that, when in the closed position, they

a) control air leakage,

b) resist the ingress of insects and vermin,

c) resist forced entry, and

d) are easily operable.

NAFS in Part 9

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4) Storm doors for sliding doors and their components shall be designed, constructed and installed so that, when in the closed position, they

a) resist wind loads,

b) control air leakage to a minimum allowable 5 m^3h/m and a maximum allowable 8.35 m^3h/m,

c) resist the ingress of insects and vermin, and

d) be easily operable.

5) Compliance with the performance requirements described in Sentences (1) to (4) shall be demonstrated by

a) complying with the requirements in

i) Subsection 9.7.4. or 9.7.5., and

ii) Subsection 9.7.6., or

b) design and *construction* conforming to Part 5.

NAFS in Part 9

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9.7.4. ‹MANUFACTURED WINDOWS, DOORS AND SKYLIGHTS›

9.7.5. ‹SITE-BUILT WINDOWS, DOORS AND SKYLIGHTS›

9.7.6. ‹INSTALLATION›

5) Compliance with the performance requirements described in Sentences (1) to (4) shall be demonstrated by

a) complying with the requirements in

i) Subsection 9.7.4. or 9.7.5., and

ii) Subsection 9.7.6., or

b) design and *construction* conforming to Part 5.

5.10.2.3. Structural Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components shall be designed and constructed in accordance with

a) Article 5.1.4.1., Section 5.4. and Section 5.6., or

b) Article 5.10.2.2., where they are covered in the scope of the standards listed in Sentence 5.10.2.2.(1).›

NAFS in Part 9

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9.7.4. ‹MANUFACTURED WINDOWS, DOORS AND SKYLIGHTS›

9.7.4.1. ‹Application

1) This Subsection applies to windows, doors and skylights covered in the scope of AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights" (Harmonized Standard).

9.7.4.2. General

1) Manufactured and pre-assembled windows, doors and skylights and their installation shall conform to

a) AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights" (Harmonized Standard),

b) A440S1, "Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights,"

c) the remainder of this Subsection, and

d) the applicable requirements in Subsection 9.7.6.

(See Appendix A.)›

9.7.4.3. ‹Performance Requirements›

1) ‹Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement referenced in Clause 9.7.4.2.(1)(b) so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed. (See Sentence 1.1.3.1.(3).)

NAFS in Part 9

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9.7.4. ‹MANUFACTURED WINDOWS, DOORS AND SKYLIGHTS›

9.7.4.1. ‹Application

1) This Subsection applies to windows, doors and skylights covered in the scope of AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights" (Harmonized Standard).

NAFS in Part 9

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9.7.5. ‹SITE-BUILT WINDOWS, DOORS AND SKYLIGHTS›

9.7.5.1. ‹Application and Compliance

1) Materials, design, *construction* and installation of windows, doors and skylights that separate *conditioned space* from unconditioned space or the exterior but that are not covered in the scope of AAMA/WDMA/CSA 101/I.S.2 /A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," shall conform







NAFS in Part 9

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9.7.5. ‹SITE-BUILT WINDOWS, DOORS AND SKYLIGHTS›

9.7.5.1. ‹Application and Compliance

1) Materials, design, *construction* and installation of windows, doors and skylights that separate *conditioned space* from unconditioned space or the exterior but that are not covered in the scope of AAMA/WDMA/CSA 101/I.S.2 /A440, "NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights," shall conform

a) to

i) the remainder of this Subsection or Subsection 9.7.4., and

ii) the applicable requirements in Subsection 9.7.6. or

9.7.4. ‹MANUFACTURED WINDOWS, DOORS AND SKYLIGHTS›

9.7.6. ‹INSTALLATION›

b) to Part 5.

5.10.2.3. Structural Loads, Air Leakage and Water Penetration

1) Windows, doors, skylights and their components shall be designed and constructed in accordance with

a) Article 5.1.4.1., Section 5.4. and Section 5.6., or

b) Article 5.10.2.2., where they are covered in the scope of the standards listed in Sentence 5.10.2.2.(1).›

NAFS in Part 9

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Summary

→ *"Manufactured products" (9.7.4)* within the scope of NAFS demonstrate compliance by testing and labeling to NAFS and the Canadian Supplement . . . or to Part 5!

NAFS in Part 9

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Summary

→ *"Site-built products" (9.7.5)* outside the scope of NAFS demonstrate compliance by "design and construction" conforming to Part 5

NAFS in Part 9

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Summary

- 9.7.3 sets forth the performance requirements for Part 9 fenestration, and recognizes several compliance paths:
  - Testing and labeling to NAFS, or
  - Part 5 engineering by registered professionals
- For product in scope of NAFS, testing and labeling the most common path, *but*
  - Engineering is permitted and is sometimes necessary
- For products outside scope of NAFS, engineering is the only practical alternative to address air-water-structural performance

NAFS in Part 9

- For more information, the **NAFS in Canada** blog has a detailed article on NAFS in Part 9

5. Specifying with NAFS

For the most part, we carry on as if NAFS was just another lab test standard . . .

Here are some issues you should consider

Specifying with NAFS

1. **Use Performance Class and Performance Grade to prequalify products and to evaluate proposed substitutions and alternates**
   - → This is the intended and only practical use for this attribute
   - → Require evidence of NAFS testing to the specified Performance Class and Grade performed to the Canadian requirements in NAFS and the Canadian Supplement
     - Canadian air tightness more stringent than in US
   - → OK to use Performance Grades determined using Canadian Supplement at the pre-tender stage

Specifying with NAFS

2. **Be aware of the limitations of Performance Grades determined using the Canadian Supplement and online calculators**

   Canadian Supplement recognizes 2 methods for design wind pressure:

   1. Detailed engineering calculations using Part 4 methods—most precise
   2. "Simplified method" using lookup tables provides "safe" (conservative) design pressures for any size/type building, *in most cases returns much higher design pressures than engineering calculations*

Specifying with NAFS

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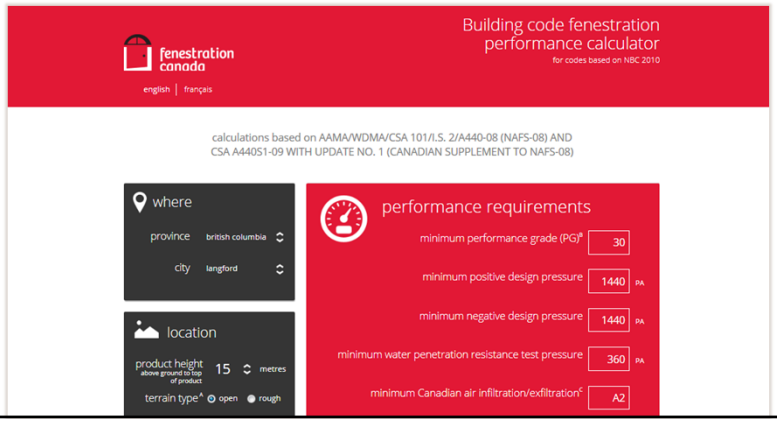
- All public online Performance Grade calculators use the conservative *simplified method* permitted by the Canadian Supplement



Specifying with NAFS

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- In specifications, can use the *simplified method embedded in online calculators* to determine a target Performance Grade used to prequalify products based on existing NAFS testing
  - When specifying acceptable Performance Class and Performance Grade
- For *product design purposes* continue to allow the fenestration supplier's engineer to determine the design pressures according to the requirements of the applicable code for the building type and location, as we do for products outside the scope of NAFS

Specifying with NAFS

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3. **NAFS testing is no substitute for professional design and field review of fenestration assemblies—code requires us to address:**
   - → All applicable structural loads—not just wind—as well as the effects of those loads . . .
     - Scope of design must include realistic anchorage to building substrates and glass design
   - → Continuity of air and water barriers between fenestration products and enclosure
     - Field testing for water penetration resistance at a minimum, and when necessary, for air tightness as well

Specifying with NAFS

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4. **Limitations of pre-existing NAFS testing**
   - → Applies only to products within NAFS scope
   - → Suppliers of curtainwall, storefront, commercial entrances, sloped glazing and commercial steel doors will NOT have prior NAFS testing for their products
   - → Performance Class attribute does not apply to products outside the scope of NAFS
   - → *NAFS tested results will not qualify real-world performance because they exclude test of anchoring to real-world conditions*

Specifying with NAFS

5. **Value of post-award testing: lab, mockup, and in the field**
   - NAFS testing could be used, but of no additional value over ASTM methods for products outside scope of NAFS
   - Testing for air-water-structural performance with reference to ASTM standards, including interface with wall, *under the supervision of a registered professional*, would provide better value
   - Test specifications can include Canadian air infiltration/exfiltration levels (A2, A3, Fixed) and should be based on responsible professional's design loads, not those using *simplified methods* of the Canadian Supplement

Specifying with NAFS

6. **Certification of NAFS ratings**
   - Certification requires individual product labeling, but . . .
   - NAFS labeling is not the primary means of complying with the air-water-structural requirements of Part 5, and . . .
   - Since code does not require certification, few Canadian manufacturers certify NAFS performance
   - Specifications requiring products to be certified to NAFS will reduce the number of available bidders, or will be ignored

Specifying with NAFS

7. **NAFS labeling of individual windows on large buildings is not practical, as most products will be qualified by engineering**
   - → Consider allowing NAFS performance ratings to be recorded on shop drawings
     - Preferred approach by local suppliers to large buildings
     - Tested ratings will apply to sizes tested, not necessarily on sizes/configurations on the building

More on the NAFS in Canada blog

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NAFS Labeling for Large Buildings

A client called with an interesting question: "We've been under the impression that all windows and exterior doors are supposed to be delivered with certified NAFS labels on them, and the labels are to be in place until the inspection is complete. On one of our current projects the window manufacturer wants to provide the [...]

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