NAFS and the Building Code

New ratings, new concepts, new terminology

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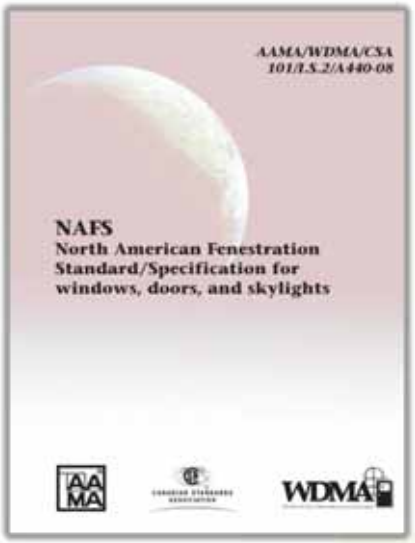
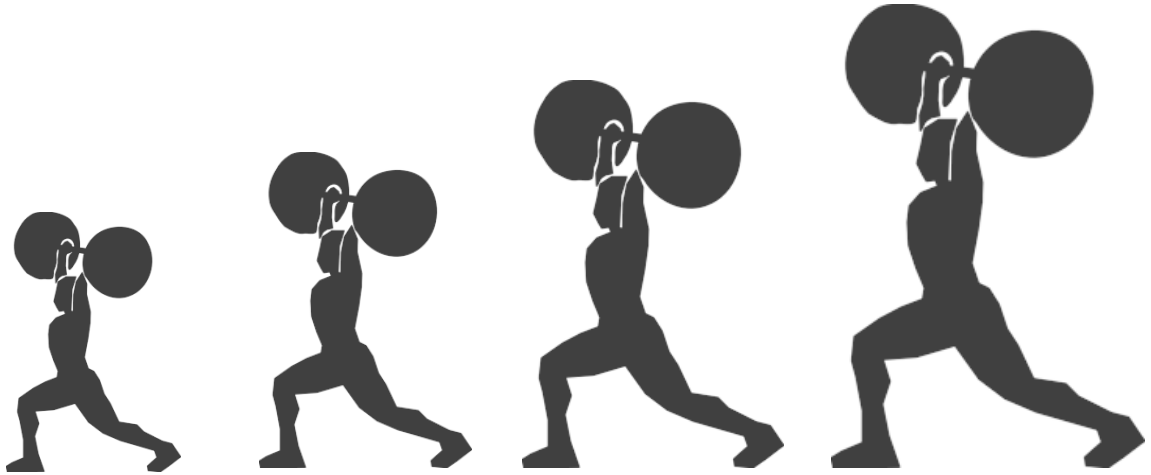
What is NAFS?

- A NEW STANDARD for testing and rating fenestration product performance



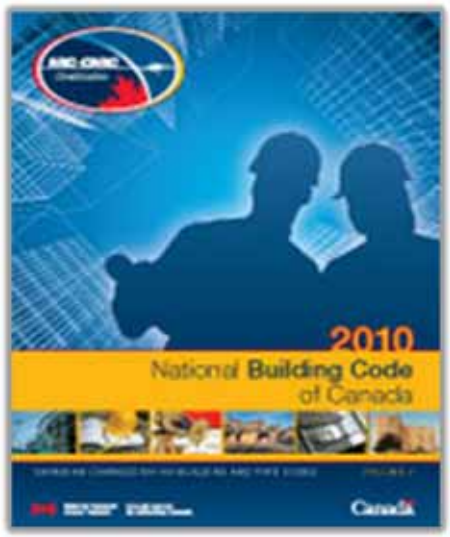
What is different about NAFS?

- Changes how we SPECIFY fenestration
- ADDS a new performance attribute:
  - Performance Class



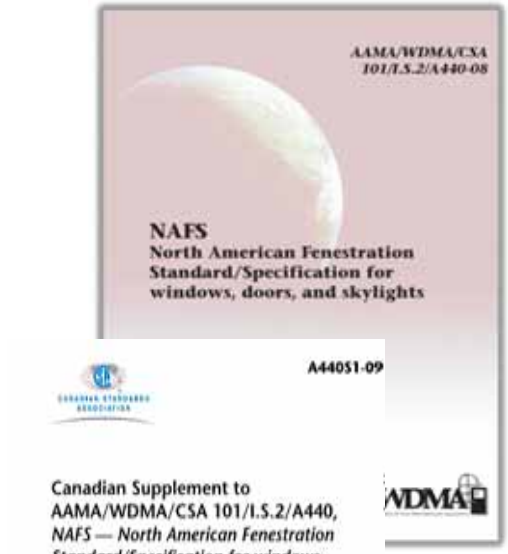
Why do I need to learn about NAFS?

- It is a new requirement in the 2010 National Building Code (Part 9 and Part 5)
- Part 5 clarifies designer's role



What NEW fenestration attributes do I need to specify?

- Performance Class
- Performance Grade
- Water Penetration Test Pressure
- Air infiltration/exfiltration level
  - Using the Canadian Supplement



NAFS changes everything . . .

- No more ABC's
- New concepts
- New terminology
- New rating system
- New product labels

- Need to learn new language to talk about it!

Topics covered

- 1. NAFS in building codes
- 2. NAFS compared to CSA A440-00
- 3. New concepts in NAFS
- 4. Review

- Break

1. NAFS in building codes

- NAFS in building codes
- NAFS in 2010 NBCC
- NAFS and the Canadian Supplement

What is NAFS?

- A new, comprehensive standard addressing performance and quality requirements of windows, doors and skylights

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-08** by the fenestration industry
- 2011 version not referenced in Canadian codes

NAFS-08 in Building Codes

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

- 2012 I-Codes (United States)

- Future Alberta and Quebec Building Codes

"*A Cross-Canada, and International Standard*"

NAFS in NBCC Part 9

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,"

NAFS in NBCC Part 5

5.10.2.2. Applicable Standards

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."

Continued . . .

NAFS in NBCC Part 5

1) 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.

2) 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).

↓

= NAFS-08

NAFS requires lab testing to rate performance

" 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)."

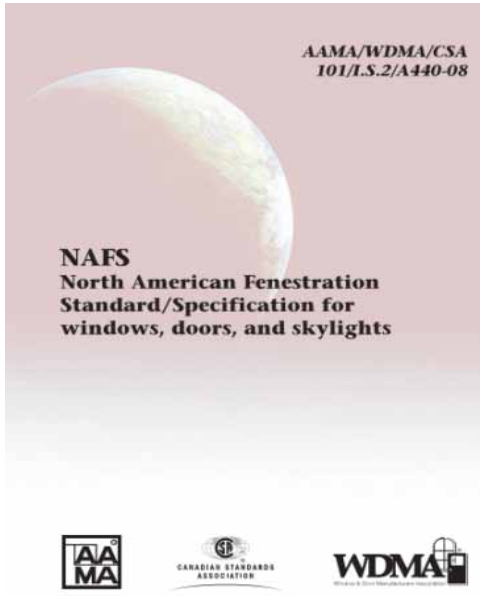
What does NAFS test?

- Ease of operation (operating and latching force)
- Air tightness
- Water tightness
- Wind load resistance
- Forced entry resistance
- Durability
  - Doors: cycle testing

- Compliance with NAFS and Canadian Supplement goes beyond lab testing:
  - Material and component quality and testing requirements
  - Not covered by lab test reports

What does NAFS give us?

- Harmonizes—mostly—Canadian and American testing and rating standards
- . . . but needs to be used with the Canadian Supplement in Canada
- A more precise testing, rating and labeling system . . .
- . . . that is **unfamiliar and more complicated** than what we have previously used in Canada

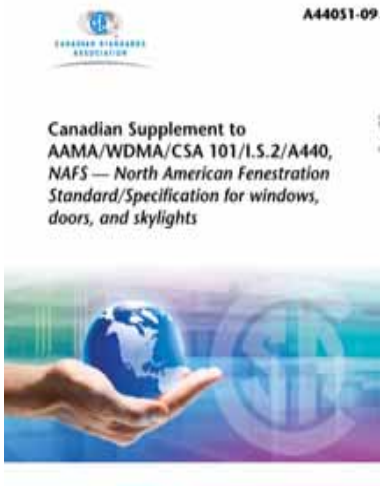


Why are there Canadian tables in NAFS-08?

Not everything could be harmonized:

- Air leakage testing
  - US tests infiltration only, Canada tests both infiltration and exfiltration to arrive at A2, A3 or Fixed levels
- Operating force
  - Canadian products easier to operate
  - Operating force can affect air and water tightness!
- Water test pressure
  - US: 15 – 20% of design pressure, capped at 12 psf (580 Pa)
  - Canada: water test pressure specified separately from DP, determined by building height, terrain, and location; capped at 15 psf (720 Pa)

Why is there a Canadian Supplement?



Not everything could be harmonized:

1. Canadian insect screen test
2. Canadian labeling requirements ("markings")
   - Permanent label identifying manufacturer
   - Temporary label with product performance
3. **Provides environmental data and simplified methods for determining appropriate performance grades for buildings anywhere in Canada, like the User's Guide to the A440-00 did.**

Can US-tested products be sold in Canada?

- **ONLY** if they have been tested to the Canadian requirements in NAFS and to the tests in the Canadian Supplement
- Standards not completely harmonized
- US-rated products must be re-tested and specially labeled to show the Canadian ratings

Do Side Hinged Doors need to be NAFS tested in the US?

- No . . .
- NAFS approach originated in the US
- NAFS-08 first referenced in US I-Codes in 2009, but . . .
- US prehanger lobby headed by AMD lobbied to exempt side hinged doors from NAFS

- US prehangers and suppliers have not addressed NAFS performance issues

Why do doors need to comply with NAFS in Canada?

- 2010 NBCC the first code to reference NAFS *without* a side hinged door exemption
- BC one of the first provinces to tackle the challenge of NAFS compliance for doors
- Tested product now coming into market
- Testing shows today's doors DO NOT MEET code wind loads, have no water penetration resistance

Review – NAFS in Building Codes

- NAFS is a new standard for testing, rating, and quality of fenestration products
- NAFS replaces all former standards that applied to fenestration products
- Covers a wider variety of products than any previous Canadian standard
- Introduces new performance attribute: Performance Class
- Is used with the Canadian Supplement in Canada
  - US NAFS ratings not sufficient for code compliance in Canada

Review – NAFS in Building Codes

- NAFS applies to side hinged doors, and unprotected doors must have same water resistance as windows
- Protected doors may have Limited Water (LW) rating

- For code compliance purposes, minimum Performance Class is R for all products

2. NAFS compared to CSA A440-00 and earlier Canadian Standards

What products does NAFS apply to?

- Windows, doors and unit skylights installed into exterior building envelopes
- New and replacement products
- NAFS excludes itself from:
  - Curtain wall and storefront
  - Commercial entrance systems
  - Revolving doors
  - Site-built door systems
  - Commercial steel doors
  - Sloped glazing (other than unit skylights, roof windows, TDDs)
  - Storm windows and doors
  - Vehicular access doors
  - Sunrooms

How are NAFS-08 ratings different?

CSA A440-00	NAFS-08
	Product Class (R, LC, CW, AW)
Air infiltration/exfiltration A1, A2, A3 or Fixed	Air infiltration/exfiltration A2, A3 or Fixed
Water penetration resistance B1 – B7	Water penetration resistance 140 – 730 Pa (in 19 steps)
Wind load resistance C1 – C5	Performance Grade PG15 – PG100 (in 19 steps)
Resistance to forced entry	Resistance to forced entry
Insect screen test	Insect screen test is in Canadian Supplement

What standards does NAFS replace?

Previous Standards (4 products)	NAFS-08 (31 products)
CSA-A440-00, Windows (fixed or operable)	Windows (specific requirements for 19 types)
CAN/CGSB-82.1-89, Sliding Glass Doors	Sliding glass doors
CGSB 82.5-M88, Insulated Steel Doors	Side hinged doors (7 operating types, all materials)
CGSB 63.14-M89, Plastic Skylights	Skylights (glass, plastic) plus Roof Windows and Tubular Daylighting Devices
	Special Products (anything not listed above that is not explicitly excluded from NAFS)

What products does NAFS address?

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	=	Tubular daylighting device
HP	=	Horizontally pivoted window	TH	=	Top-hinged window
HS	=	Horizontal sliding window	TR	=	Transom
J	=	Jalousie window	VP	=	Vertically pivoted window
JA	=	Jal-awning window	VS	=	Vertical sliding window
LW DASHD	=	Limited water dual-action side-hinged door			

NAFS product types illustrated

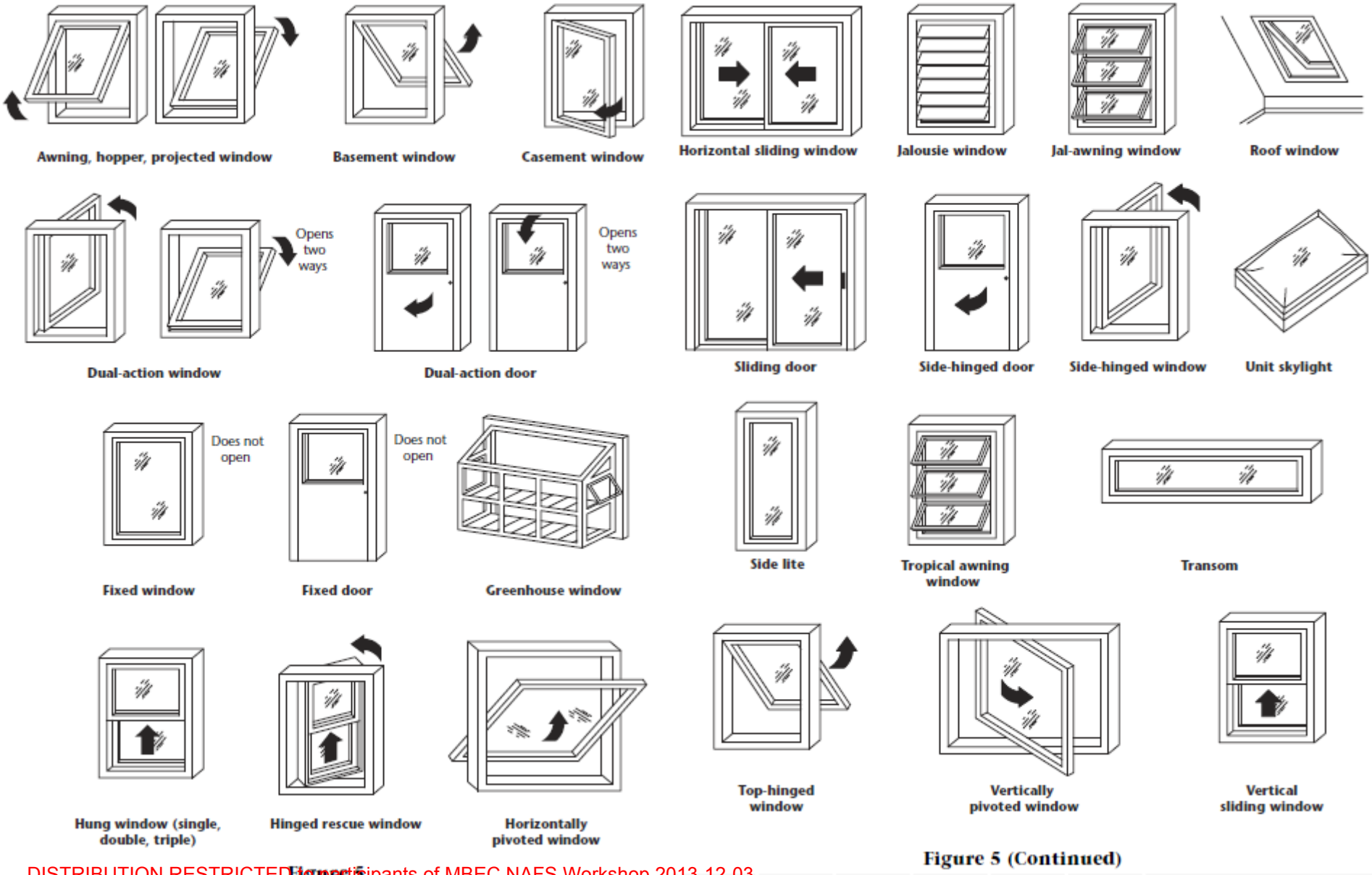
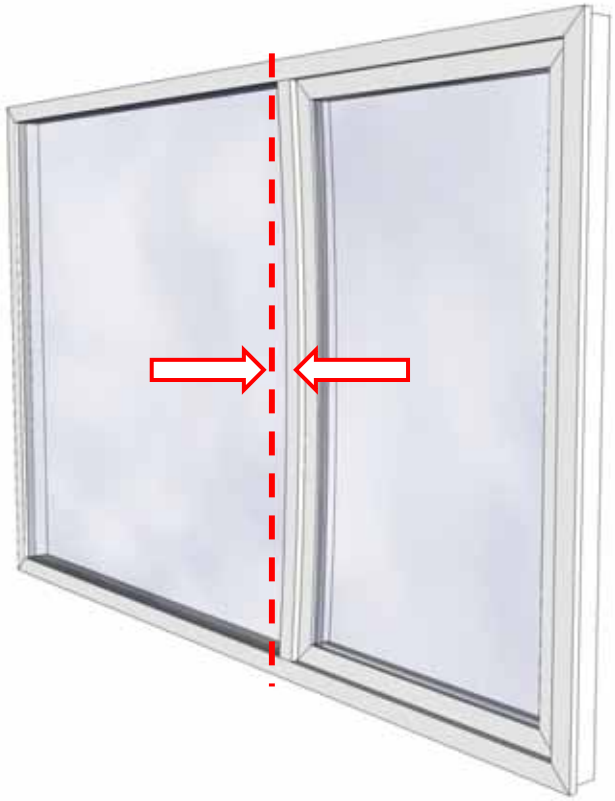


Figure 5 (Continued)

Figure 5
Product type illustrations

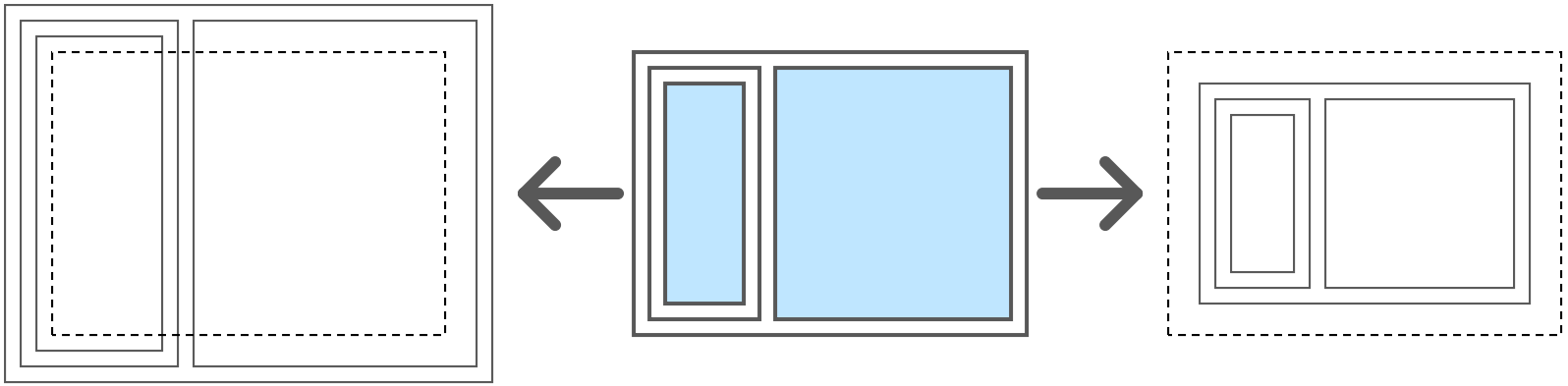
How does NAFS handle mullion deflection?

- A440-00 had mullion deflection limits
  - L/175 mullions
  - L/125 sash members
  - (But no one tested mullions . . . .)
- NAFS-08:
  - CW and AW have L/175 frame and sash deflection limit
  - R and LC Class have NO mullion or frame deflection limits
  - But you must test all products with mullions!



NAFS-08 vs. CSA A440-00

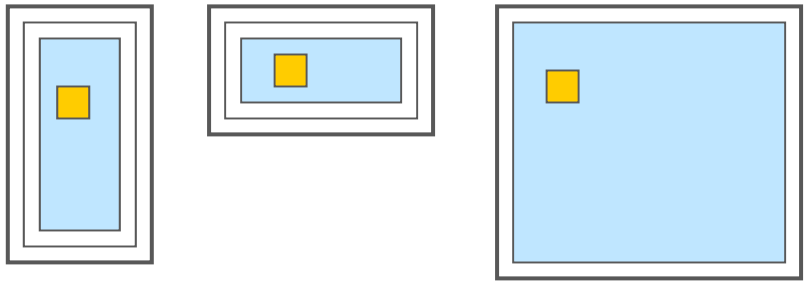
- CSA A440 ratings applied to sizes up to 25% larger than tested size
  - NAFS and Canadian Supplement **ratings apply only to tested size or smaller**



CSA A440-00 Tested size NAFS-08

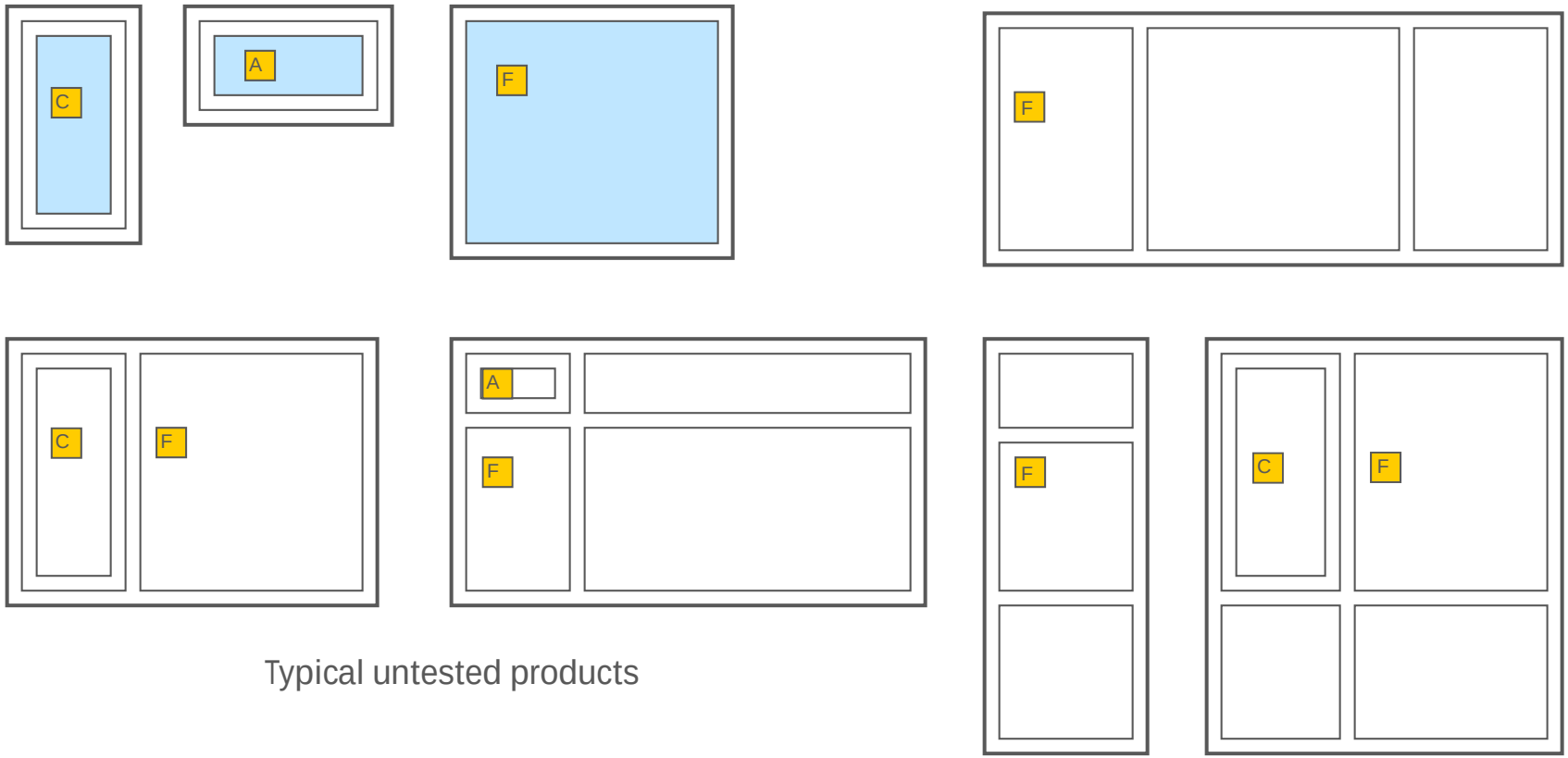
NAFS-08 vs. CSA A440-00

- CSA A440-00: mullion testing requirements were not clear
- Most manufacturers, certifiers ignored mullions, tested single operators only



NAFS-08 vs. CSA A440-00

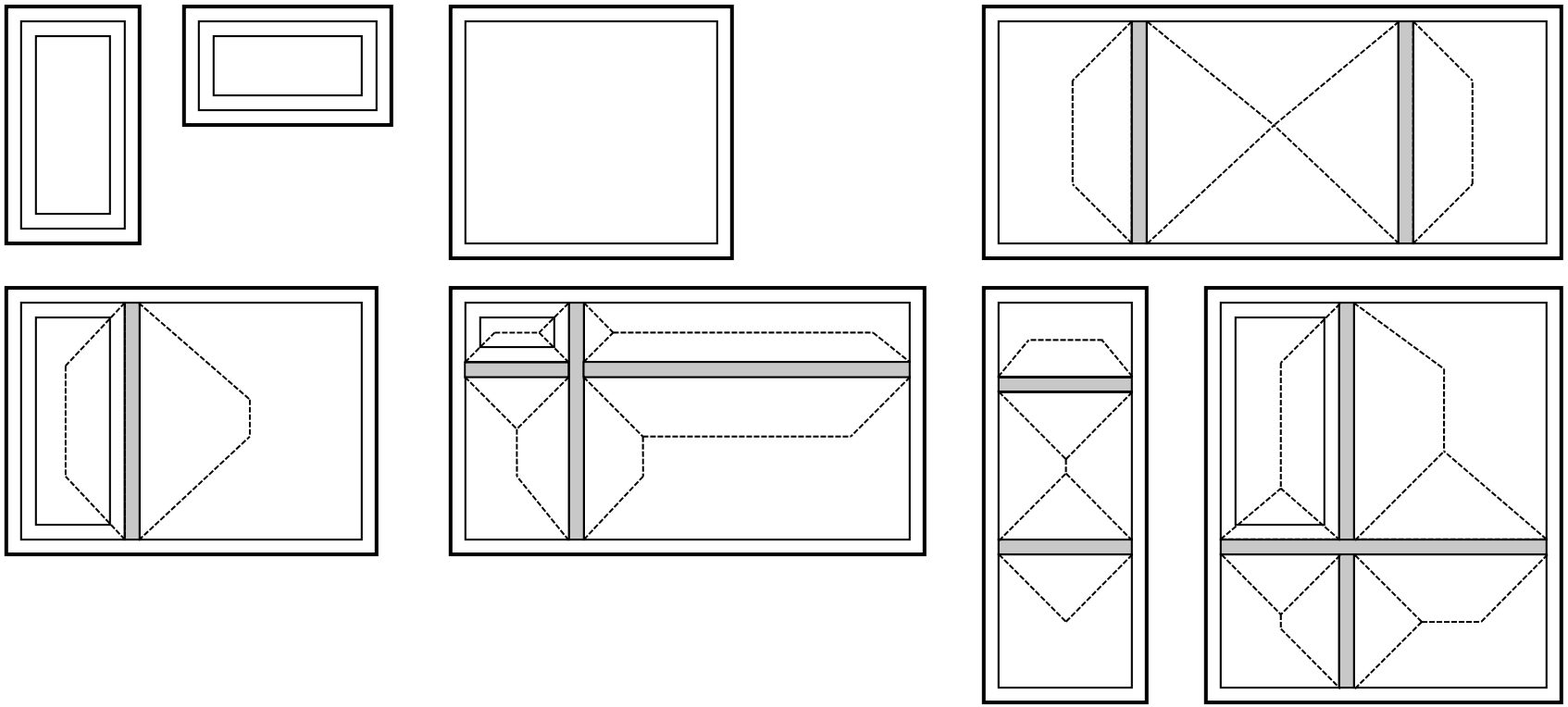
- Single operator labels were applied to untested mullion configurations, with multiple labels that did not represent the performance of the actual product



Typical untested products

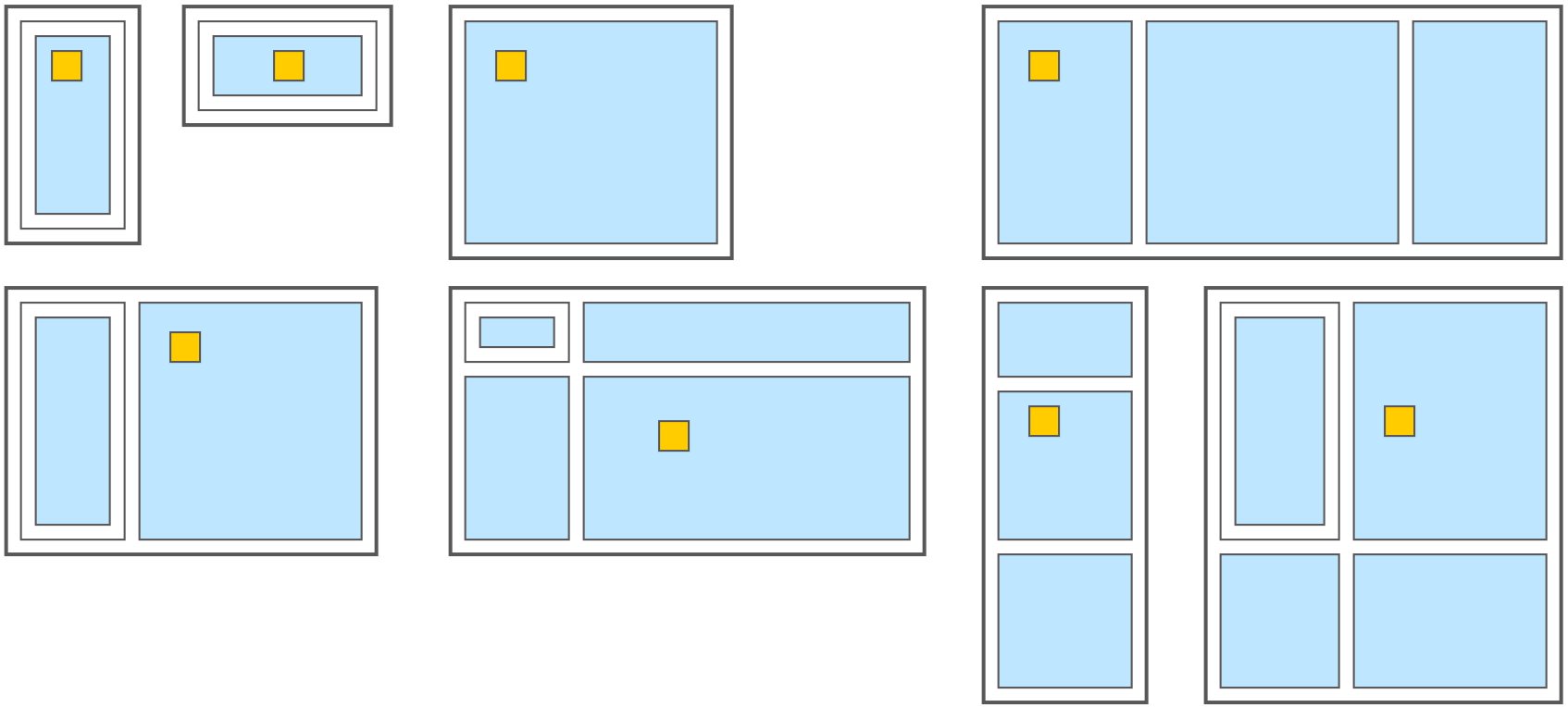
NAFS-08 vs. CSA A440-00

- Mullions are the most heavily loaded structural members
- They increase crack length affecting air and water leakage



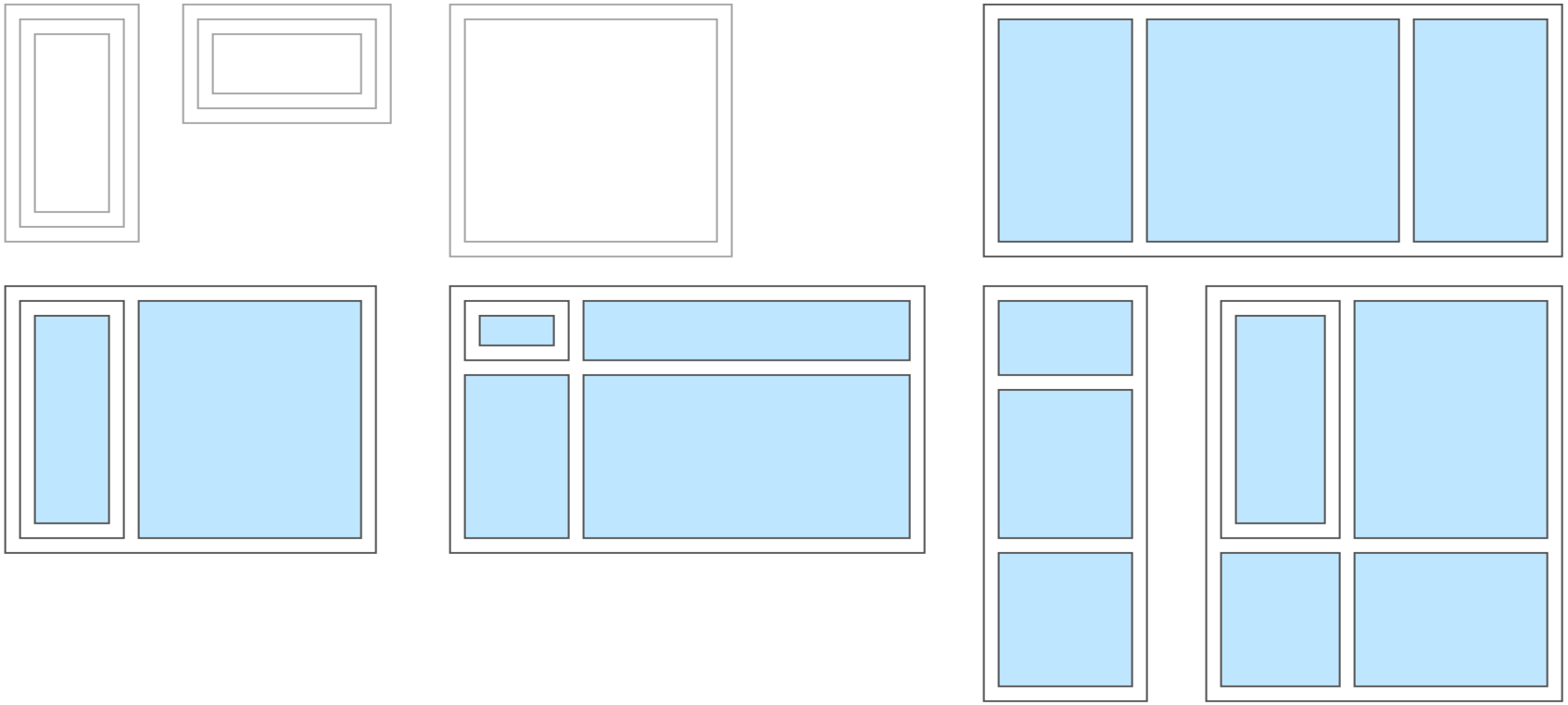
NAFS-08 vs. CSA A440-00

- NAFS explicitly requires all configurations with mullions to be tested, and only one valid RATING per product
- “No member may be longer in any dimension than tested”



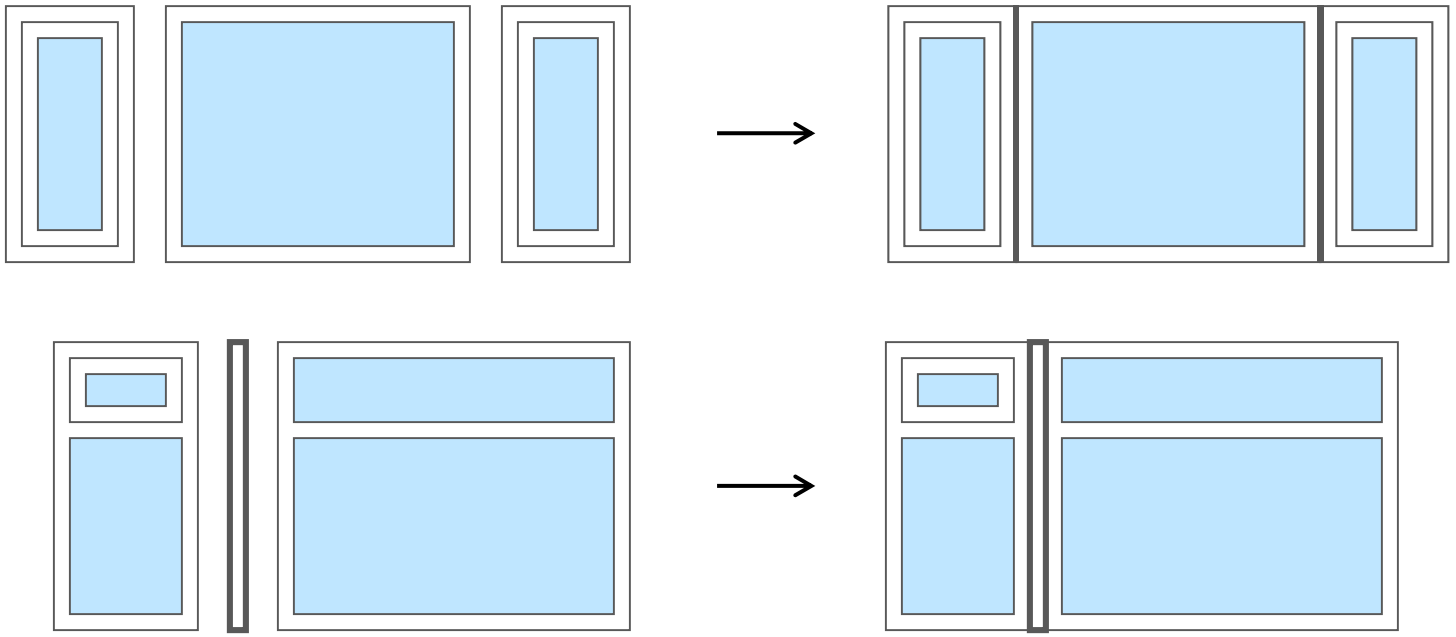
NAFS-08 and mullions—Composite Unit

- **Composite unit**: two or more sashes, leaves, lites, or sliding panels within a single frame and utilizing integral mullions – **must be tested as one unit**



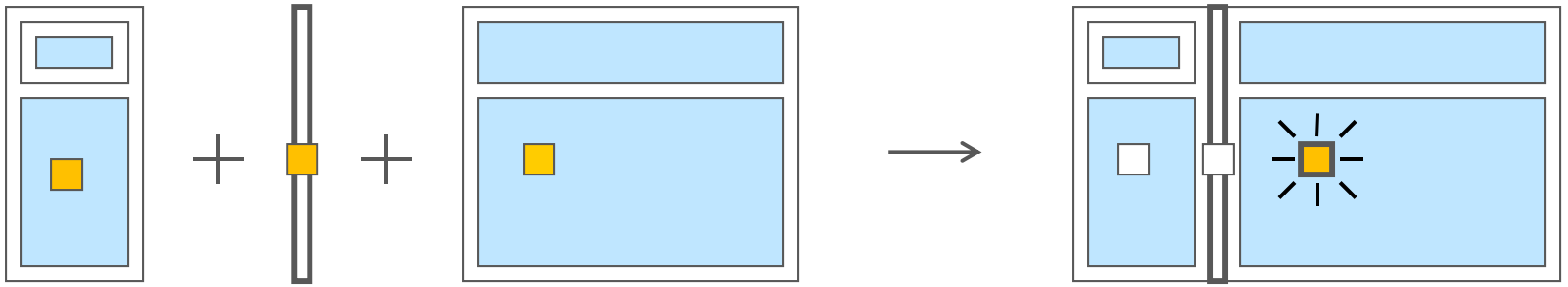
NAFS-08 and mullions—Combination Assembly

- **Combination assembly**: two or more separate fenestration products joined with mullion or clips
- Can test as an assembly, or test each component separately.
- Mullion PG ratings may be determined by licensed structural engineer using AAMA 450



Combination Assembly may have multiple labels, but single valid rating

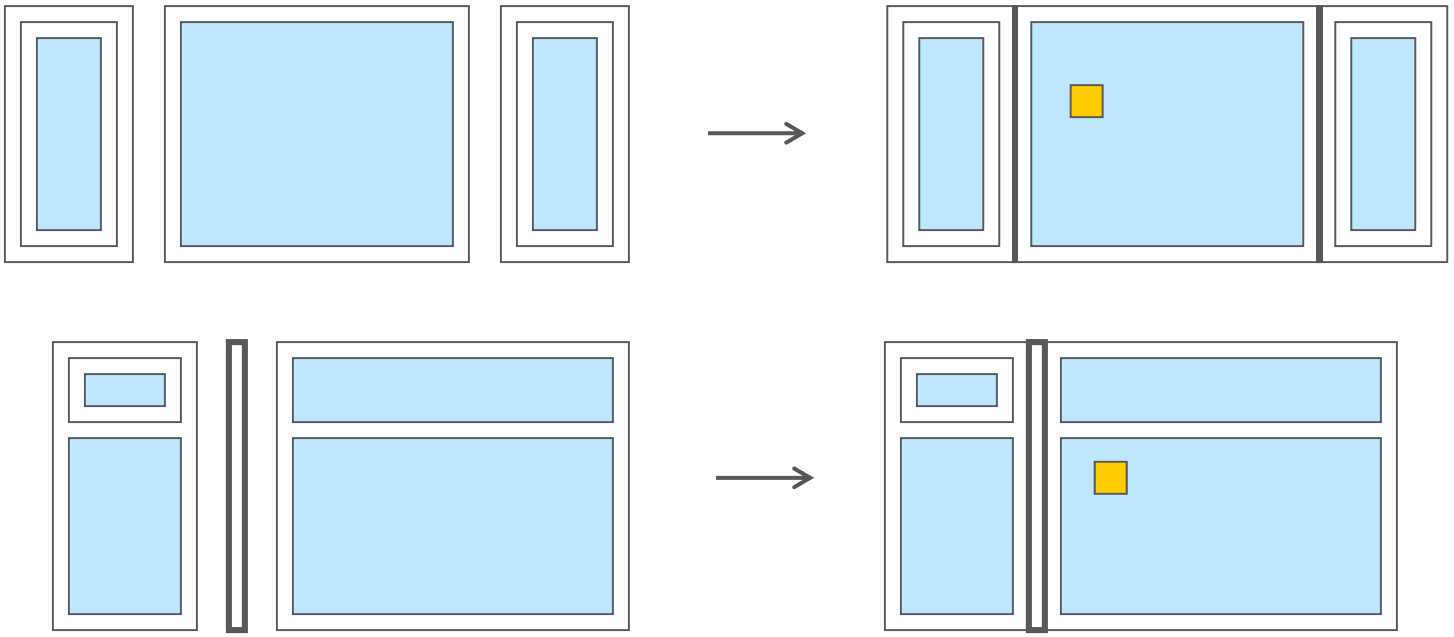
- **When tested as separate components,** can have separate labels for each of the mulled components, including the mullion connector.
- The **Performance Grade of the weakest element is the Performance Grade of the assembly** for code compliance.



Labels must show air, water and structural performance!

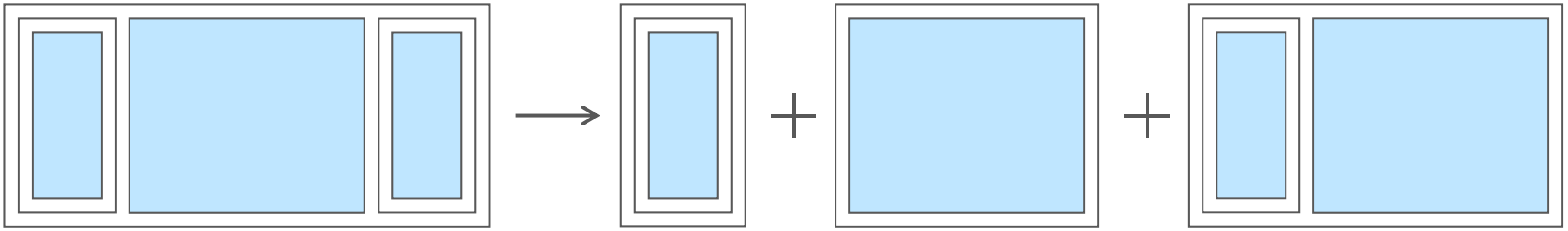
NAFS-08 Combination Assembly – in BC

- Local test labs / certification agencies Intertek and QAI do not do AAMA 450 mullion ratings
- Test Combination products same as Composite products
- Label products to NAFS-11, using Mullion Assembly (MA) designation



NAFS-08 vs. CSA A440-00

- NAFS allows testing of complex combinations to qualify simpler combinations
- NAFS ratings and labels apply ONLY if no member – in any direction – is longer than the tested configuration



Review – NAFS-08 vs. CSA A440-00

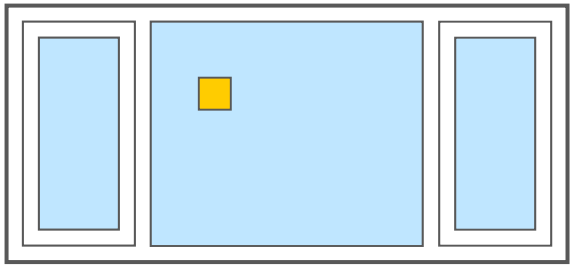
- NAFS applies to a wider range of products and has explicit requirements for 31 product types
- NAFS has different performance ratings:
  - Product Class: R, LC, CW, AW
  - Performance Grade: PG15 – PG100 (720 Pa – 4800 Pa)
  - Water Penetration Resistance Test Pressure: 140 Pa – 730 Pa
  - Air infiltration/exfiltration level: A2, A3, Fixed
- NAFS has clear requirements for testing and rating products with mullions
  - Requires manufacturers to test many more configurations

Review – NAFS-08 vs. CSA A440-00

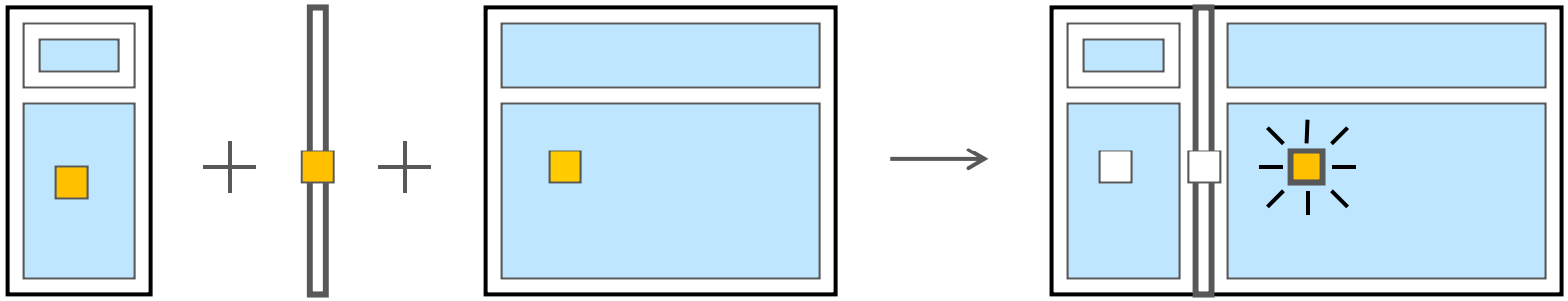
- Like A440-00, NAFS excludes itself from “commercial” products such as storefront, curtain wall, steel doors
- No minimum requirements defined for these products

Review – NAFS-08 vs. CSA A440-00

- NAFS distinguishes Composite Units from Combination Assemblies, has different testing requirements for each



Composite Unit



Combination Assembly

3. New concepts in NAFS

- Performance CLASS
- Performance GRADE
- GATEWAY Requirements
- Optional Performance Grades
- Rating system—Primary and Secondary designators
- NAFS labeling for Canada

New concept in NAFS: Performance Class

- Four categories for rating product "durability"

Table 1
Gateway requirements

(See Clauses 0.2.1, 0.2.6.1, 4.2.1, 4.4.2.3, 4.4.3.2–4.4.3.4, 5.3.3.1, 5.3.4.2, and 5.3.4.3.)

Product performance class	Minimum performance grade (PG)	Minimum design pressure (DP), Pa (psf)	Minimum structural test pressure (STP), Pa (psf)	Minimum water resistance test pressure, Pa (psf)
Windows and doors				
R	15	720 (15.0)	1080 (22.5)	140 (2.90)
LC	25	1200 (25.0)	1800 (37.5)	180 (3.75)
CW	30	1440 (30.0)	2160 (45.0)	220 (4.50)
AW	40	1920 (40.0)	2880 (60.0)	390 (8.00)
Unit skylights, tubular daylighting devices, and roof windows				
R	15	720 (15.0)	1440 (30.0)	140 (2.90)
CW	30	1440 (30.0)	2880 (60.0)	220 (4.5)

New concept in NAFS: Performance Class

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
Light Duty 1-2 family residential	Medium Duty Low-rise/Mid-rise › size, › wind load	Heavy Duty Low-rise/Mid-rise › size, › wind load, deflection limit, **heavy use**	Severe Duty **Mid-rise/High-rise** **› size, › wind load,** **deflection limit,** **frequent/extreme use**

NAFS “suggestions” for use of Performance Classes

0.2.1 Performance classes

This Standard/Specification defines requirements for four performance classes. **The performance classes are designated R, LC, CW, and AW.** This classification system provides for several levels of performance. It is important to note that although **general suggestions for use** are specified [below], **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.**

New concept in NAFS: Performance Class

Class	Connotation	"Suggested" Application	Canadian Application?
R	"Light Duty"	One and Two family dwellings	Part 9 buildings
LC	"Moderate Duty"	Low-rise and mid-rise multi-family dwellings and other buildings where larger sizes and higher loading requirements are expected	Part 9 buildings
CW	"Heavy Duty"	Low-rise and mid-rise buildings where larger sizes, higher loading requirements, limits on deflection, and heavy use are expected	Part 3 buildings
AW	"Severe Duty"	Mid and high 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.	Part 3 buildings

- Code minimum is Class R, but specifiers may choose any class they wish

New concept in NAFS: Performance Class

Class	Connotation	"Suggested" Application	Canadian Application?
R	"Light Duty"	One and Two family dwellings	Part 9 buildings
LC	"Moderate Duty"	Low-rise and mid-rise multi-family dwellings where higher loading requirements are expected	Part 9 buildings
CW	"Heavy Duty"	Low-rise and mid-rise buildings where larger sizes, higher loading requirements, limits on deflection, and heavy use are expected	Part 3 buildings
AW	"Severe Duty"	Mid and high 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.	Part 3 buildings

Have no deflection limit

Have L/175 deflection limit

- Code minimum is Class R, but specifiers may choose any class they wish

New concept in NAFS: Performance Class

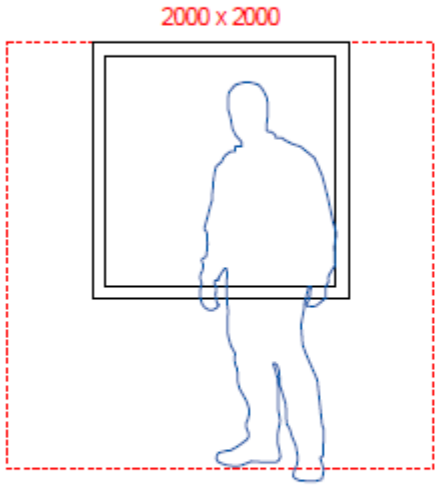
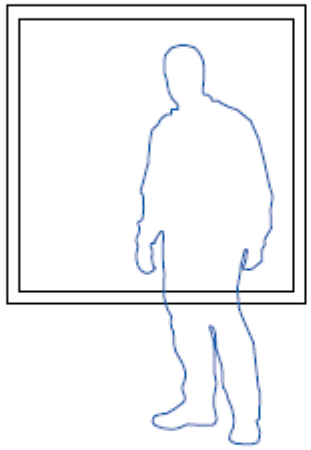
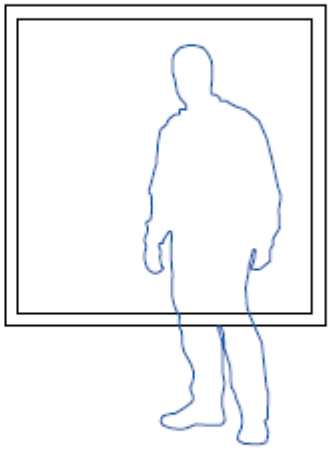
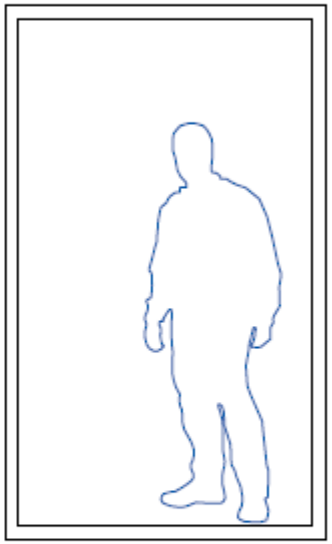
- Products MUST be classified by Performance Class
- Performance Class defined by Gateway requirements:
  - Minimum test specimen size
  - Minimum Performance Grade
  - Successful completion of auxiliary tests
- Products are compared within a Performance Class, not across performance classes
- **Gives architects ability to specify a new property, independently of "air, water, structural" performance**

A closer look at Performance Class

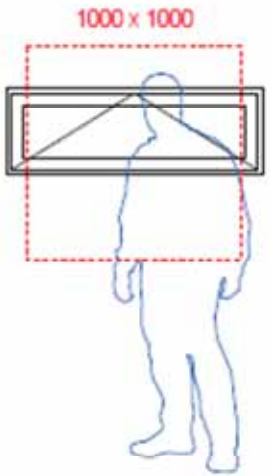
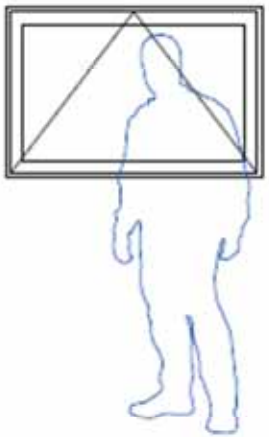
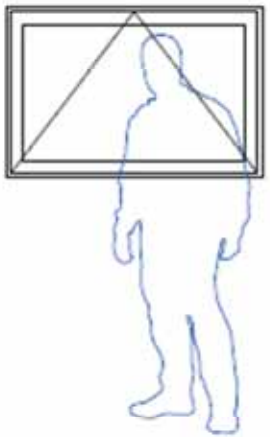
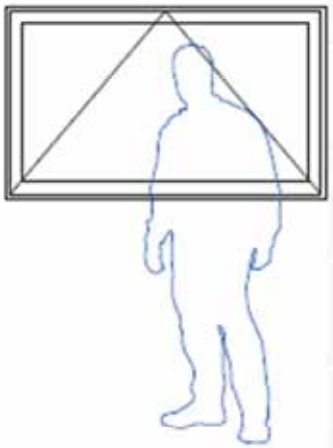
New concept in NAFS: Performance Class

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
Light Duty 1-2 family residential	Medium Duty Low-rise/Mid-rise Multifamily or > size, > wind load	Heavy Duty Low-rise/Mid-rise > size, > wind load, deflection limit, heavy use	Severe Duty Mid-rise/High-rise > size, > wind load, deflection limit, frequent/extreme use

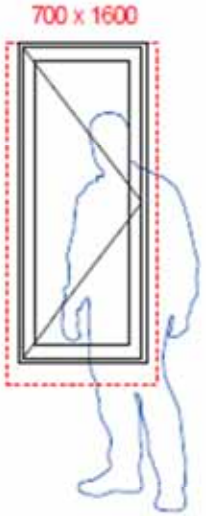
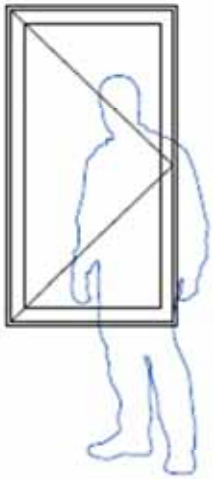
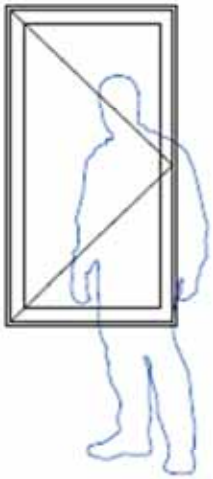
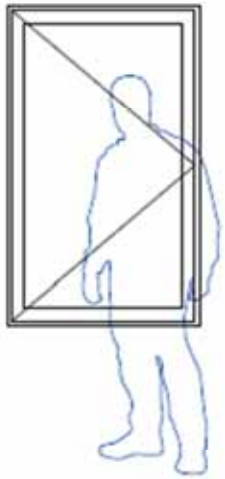
FW Fixed Window classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
1200 x 1200	**1400 x 1400**	**1500 x 1500**	**1500 x 2500**
			
Min DP: 720 Pa	**Min DP: 1200 Pa**	**Min DP: 1440 Pa**	**Min DP: 1920 Pa**
Defl: Report Only	**Defl: Report Only**	**Defl: L/175**	**Defl: L/175**
Min Struct: 1080 Pa	**Min Struct: 1800 Pa**	**Min Struct: 2160 Pa**	**Min Struct: 2880 Pa**
Min Water Test: 140 Pa (15% DP)	**Min Water Test: 180 Pa (15% DP)**	**Min Water Test: 220 Pa (15% DP)**	**Min Water Test: 390 Pa (20% DP)**
Air Leakage: 1.5 L/s*m2 @ 75Pa	**Air Leakage: 1.5 L/s*m2 @ 75Pa**	**Air Leakage: 1.5 L/s*m2 @ 75Pa**	**Air Leakage: 0.5 L/s*m2 @ 300 Pa**

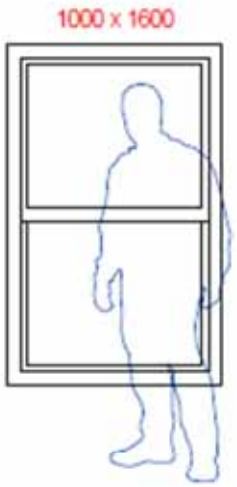
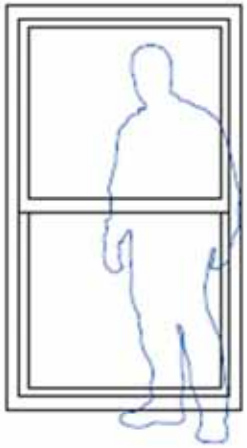
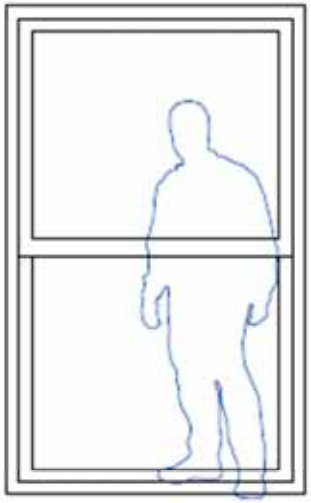
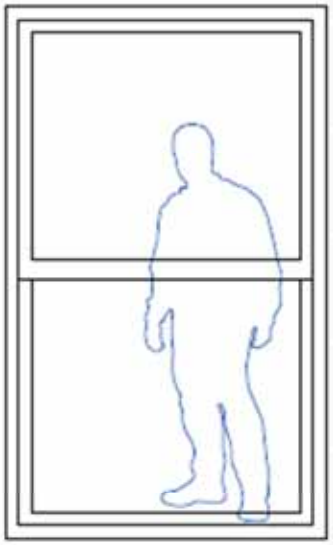
AP Awning/Hopper/Projected classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
1200 x 400	1200 x 800	1200 x 800	1500 x 900
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 0.5 L/s*m2 @ 300 Pa

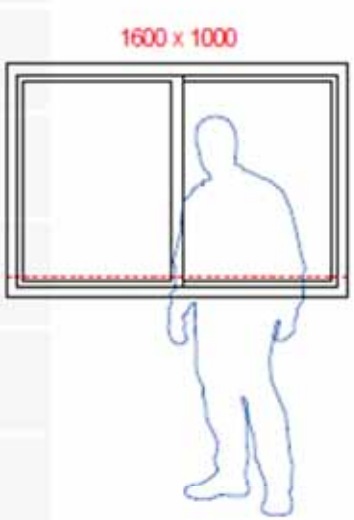
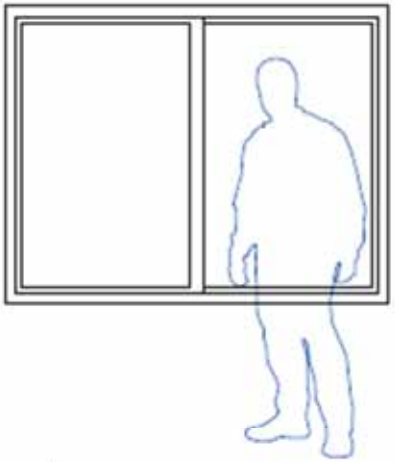
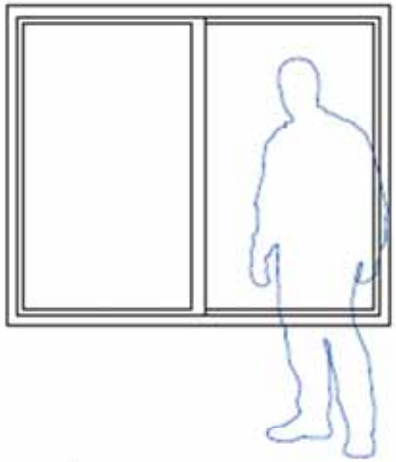
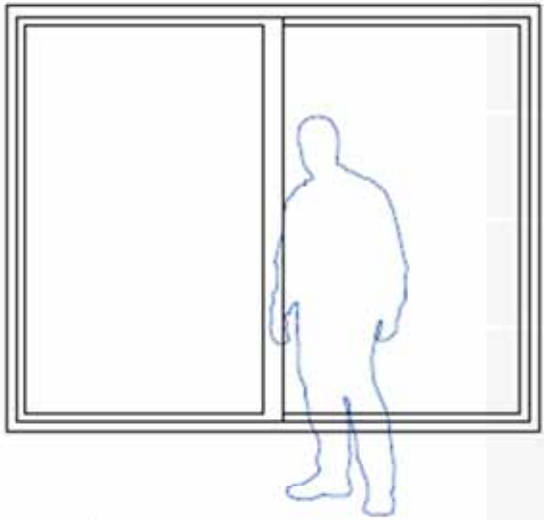
C Casement Window classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
600 x 1500	800 x 1500	800 x 1500	900 x 1500
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 0.5 L/s*m2 @ 300 Pa

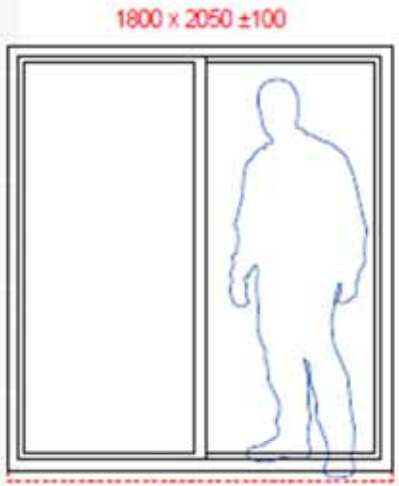
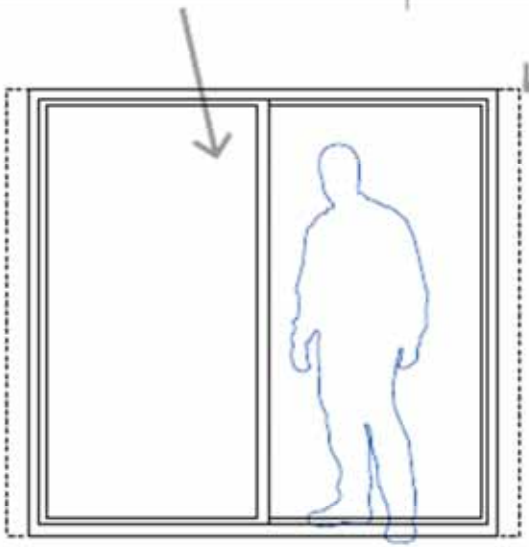
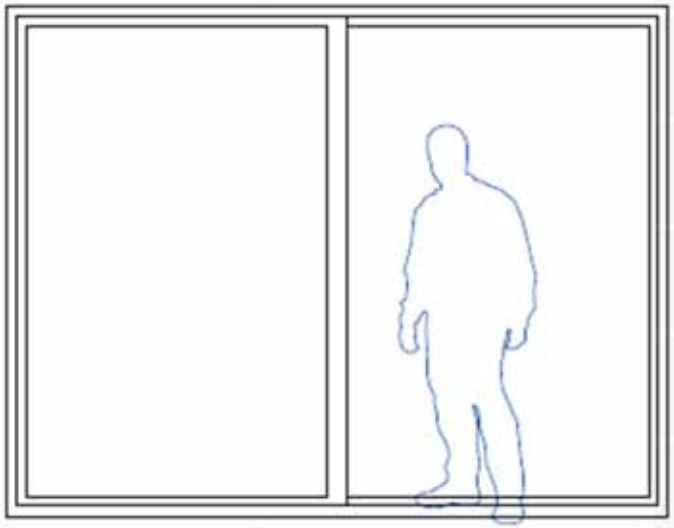
H Hung/Vertical Sliding Window classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
1000 x 1600	1100 x 1900	1400 x 2300	1500 x 2500
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 300 Pa

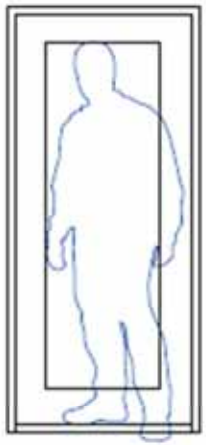
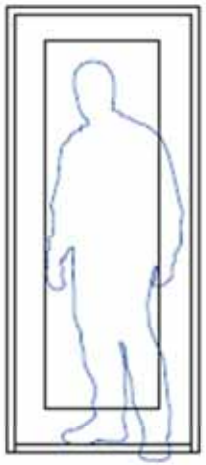
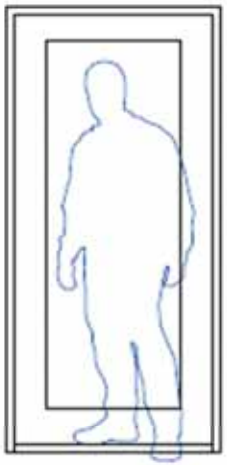
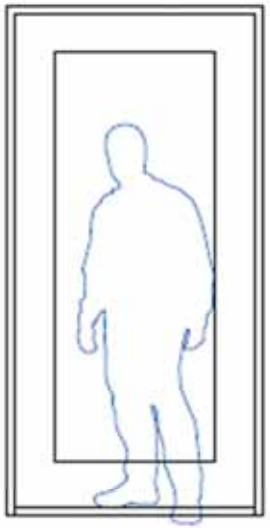
HS Horizontal Sliding Window classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
1600 x 1100	1800 x 1400	1800 x 1500	2500 x 2000
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 300 Pa

SD Sliding Door classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
1800 x 2000	2200 x 2100	2400 x 2100	3100 x 2400
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 300 Pa

SHD Side Hinged Door classes

R	LC	CW	AW
PG 15	PG 25	PG30	PG40
900 x 2000	900 x 2100	1000 x 2100	1200 x 2400
			
Min DP: 720 Pa	Min DP: 1200 Pa	Min DP: 1440 Pa	Min DP: 1920 Pa
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 1.5 L/s*m2 @ 75Pa	Air Leakage: 0.5 L/s*m2 @ 300 Pa

Performance Class – more than size and pressure

- Product Class also defined by 21 auxiliary tests applied to specific products:
  - 3 Ease of operation tests
  - Forced entry resistance tests
  - Fabrication quality tests
  - 9 Frame and sash stiffness and stress tests
  - 4 Hardware load tests
  - Operation / cycling and durability tests

Performance Class – auxiliary/durability tests

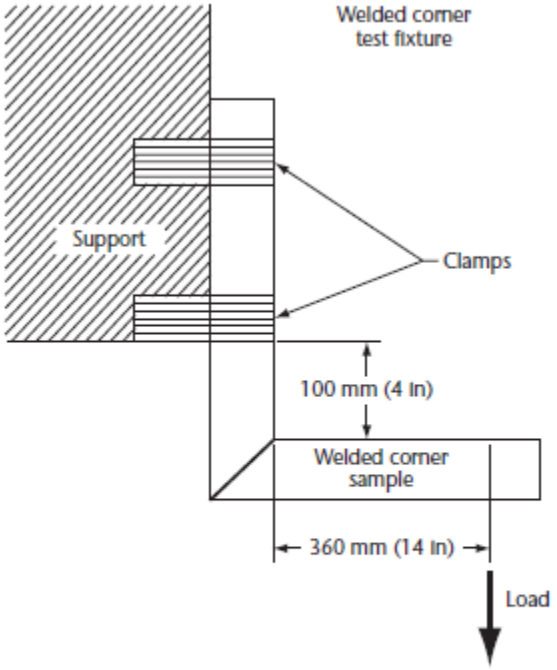


Figure 12
Set-up for thermoplastic corner weld test
(See Clause 5.3.6.2.)

5.3.6.4.2 Sash/leaf torsion test

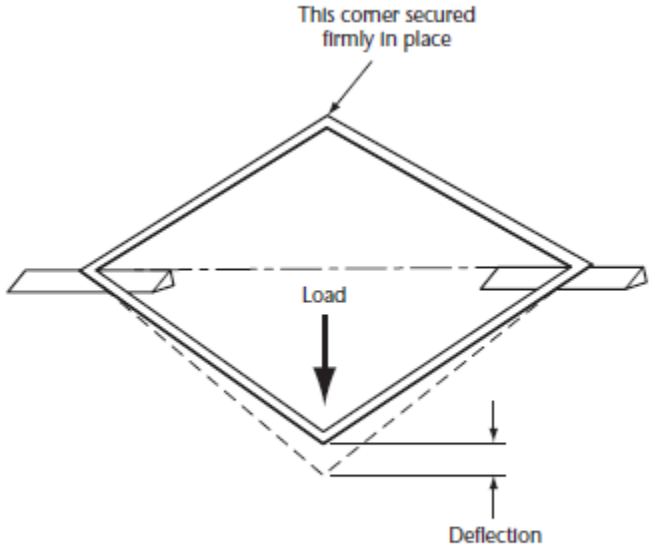


Figure 13
Set-up for sash/leaf torsion test
(See Clause 5.3.6.4.2.)

Performance Class – auxiliary/durability tests

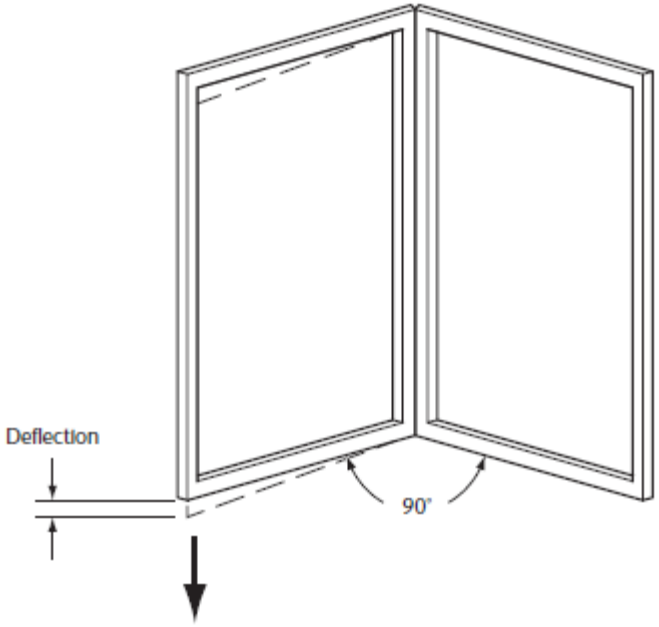


Figure 14
Set-up for sash vertical deflection test
(See Clause 5.3.6.4.3.)

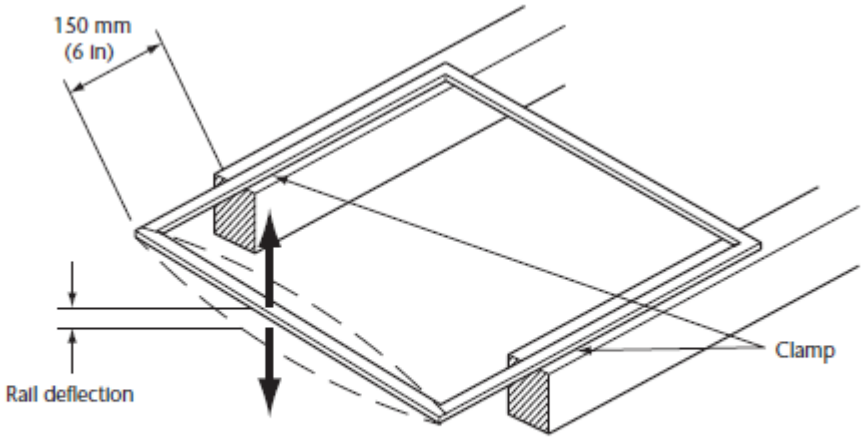


Figure 15
Perpendicular load for sash/leaf concentrated load test on latch rail
(See Clause 5.3.6.4.4.)

Performance Class – auxiliary/durability tests

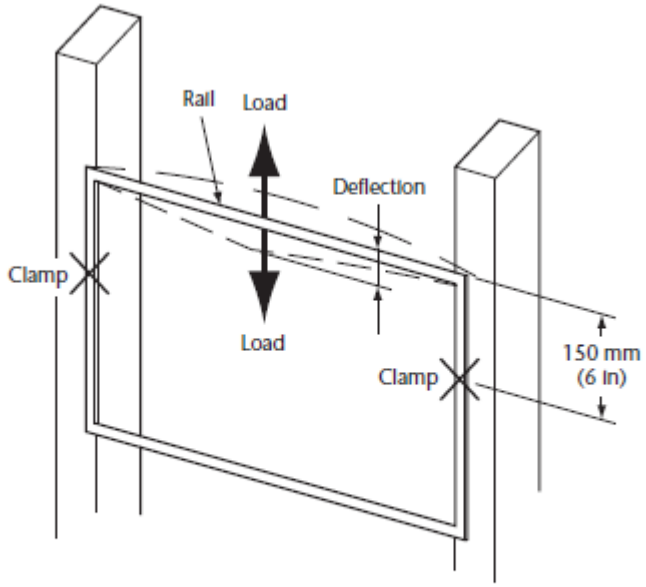


Figure 16
Parallel load for sash/leaf concentrated load test on latch rail
(See Clause 5.3.6.4.4.)

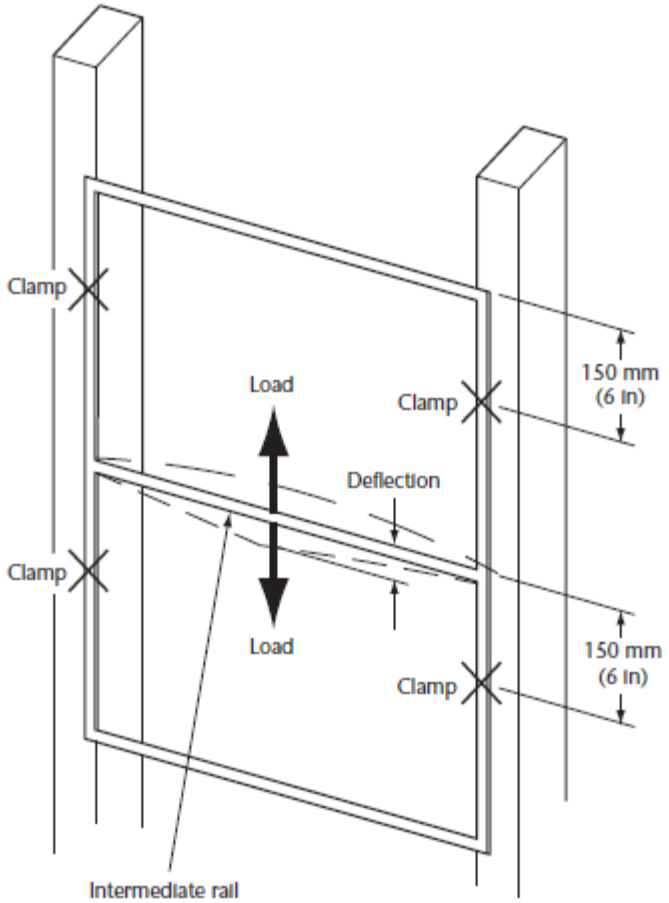


Figure 18
Set-up for vertical concentrated load test on intermediate frame rails
(See Clause 5.3.6.5.)

Performance Class – auxiliary/durability tests

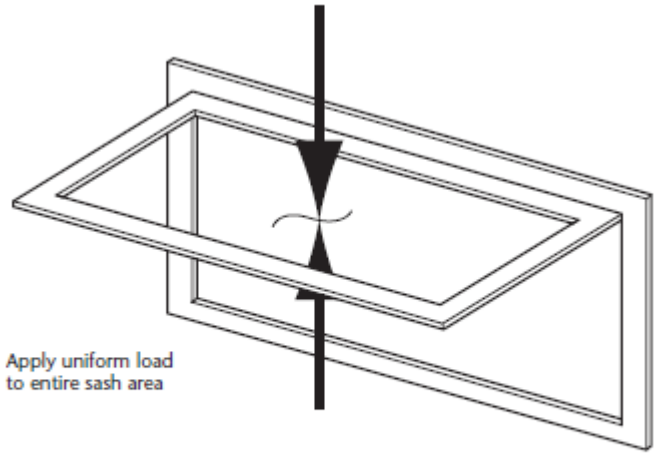


Figure 19
Set-up for distributed load test
(See Clause 5.3.6.6.2.)

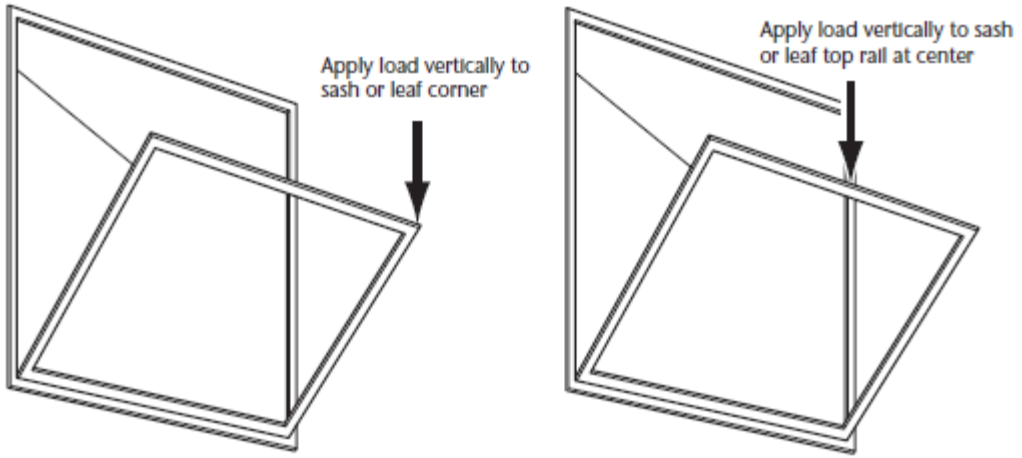


Figure 20
Set-up for stabilizing arm load test
(See Clause 5.3.6.6.3.)

Performance Class – auxiliary/durability tests

Table 19
Operation/cycling performance (side-hinged door systems)
(See Clause 5.3.6.10.)

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

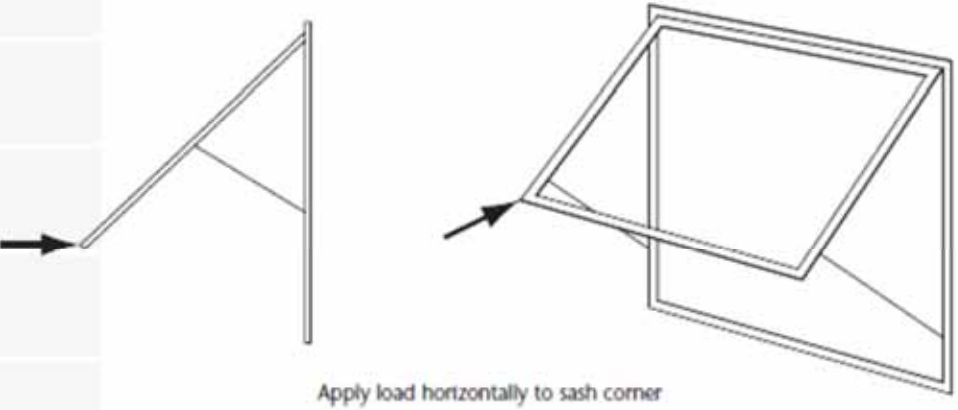


Figure 21
Set-up for hold-open arm/stay bar test
(See Clause 5.3.6.6.4.)

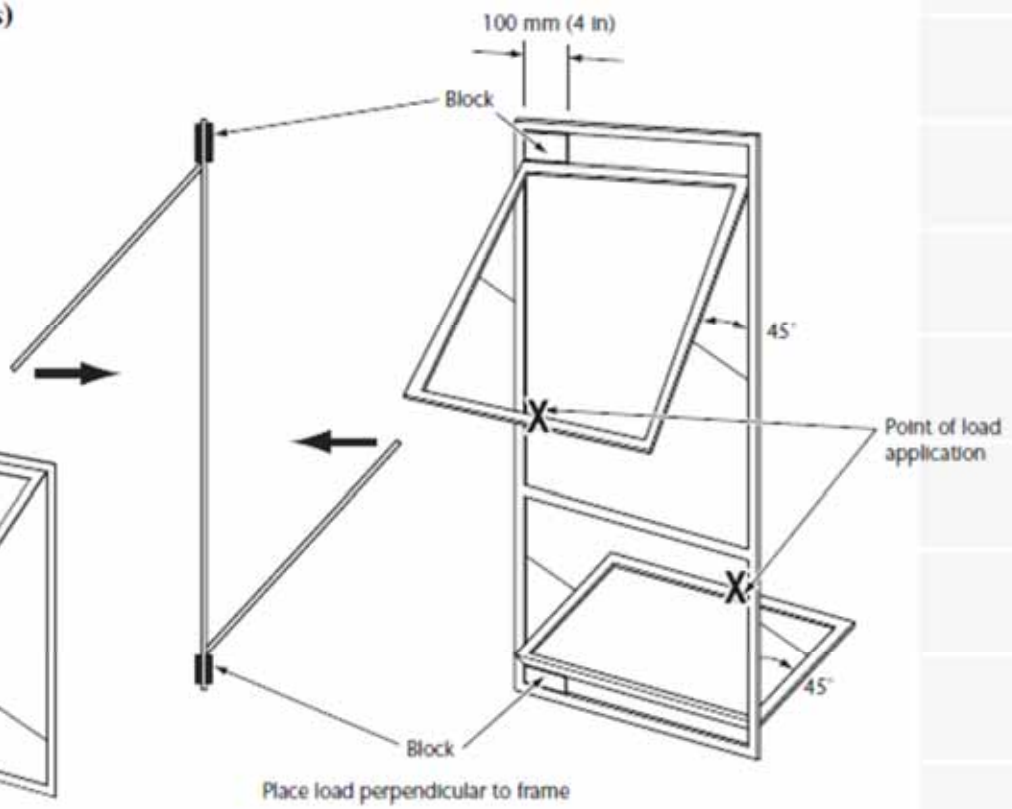


Figure 22
Set-up for awning, hopper, projected hardware load test
(See Clause 5.3.6.6.6.)

Performance Class implications

- Products sold and labeled as belonging to a Performance Class MUST be identical in every respect (but glass) to the test specimen that achieved the Class designation, regardless of whether those features are “needed” to meet code design loads!
- Products may therefore have more reinforcing, hardware than needed for project wind loads

Performance Class – conclusion and implications

- Performance Classes define categories of products that did not exist before in Canada
- They differentiate products on the basis of progressively severe physical tests
- Performance Classes influences frame material
  - AW product lines are, for all practical purposes, aluminum only
- Performance Class influences cost
  - Expect significant cost increases from class to class, especially from LC to CW and AW
  - Over-specifying can be costly!

New concept in NAFS: Performance Grade

- A **single numeric designation** combining structural and water penetration resistance properties

- Performance Grades are based on design pressure as determined by
  - Architect
  - Municipal building department
  - Using Canadian Supplement

- Grades range from 720-4800 Pa (15-100 psf in US)
- Grades reported in increments of 240 Pa (5 psf US)

New concept in NAFS: Performance Grade

Table 1
Gateway requirements
(See Clauses 0.2.1, 0.2.6.1, 4.2.1, 4.4.2.3, 4.4.3.2–4.4.3.4, 5.3.3.1, 5.3.4.2, and 5.3.4.3.)

Product performance class	Minimum performance grade (PG)	Minimum design pressure (DP), Pa (psf)	Minimum structural test pressure (STP), Pa (psf)	Minimum water resistance test pressure, Pa (psf)
Windows and doors				
R	15	720 (15.0)	1080 (22.5)	140 (2.90)
LC	25	1200 (25.0)	1800 (37.5)	180 (3.75)
CW	30	1440 (30.0)	2160 (45.0)	220 (4.50)
AW	40	1920 (40.0)	2880 (60.0)	390 (8.00)
Unit skylights, tubular daylighting devices, and roof windows				
R	15	720 (15.0)	1440 (30.0)	140 (2.90)
CW	30	1440 (30.0)	2880 (60.0)	220 (4.5)

New concept in NAFS: optional Performance Grades

Table 3
Canada (only) optional performance grades (PG)
(See Clauses 0.2.6.1, 4.3.2.2, 4.4.3.2–4.4.3.4, 5.3.3.1, 5.3.4.2, and 5.3.4.3.)

Performance class and optional performance grade (PG)				Design pressure (DP)		Structural test pressure (STP)		Water penetration resistance test pressure			
								R, LC, CW		AW	
R	LC	CW	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	2 160	(45.00)	3 240	(67.50)	330	(6.75)	440	(9.00)
50	50	50	50	2 400	(50.00)	3 600	(75.00)	360	(7.50)	480	(10.00)
55	55	55	55	2 640	(55.00)	3 960	(82.50)	400	(8.25)	530	(11.00)
60	60	60	60	2 880	(60.00)	4 320	(90.00)	440	(9.00)	580	(12.00)

Assigned in 240 Pa (5 psf) increments ONLY

New concept in NAFS: optional Performance Grades

- Gateway requirements qualify a product to enter a Product Class
- Can test bigger than the gateway size, not smaller*
- Can test to higher pressures than gateway—but can rate products using Optional Performance Grades only
- Once qualified for a Class, can test smaller size of same product to get a higher Performance Grade at the smaller size

* Exception: R Class Alternative Minimum Sizes

New concept in NAFS: product-specific ratings

- NAFS-08 lists 31 different product types for which there are performance ratings (Table 5)
- Covers all major product types (except folding doors*)
- Abbreviated product type codes may be used on NAFS labels in place of longer descriptions
- Each Product Type is rated by Performance Class, and Performance Grade

New concept in NAFS: product-specific ratings

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	=	Tubular daylighting device
HP	=	Horizontally pivoted window	TH	=	Top-hinged window
HS	=	Horizontal sliding window	TR	=	Transom
J	=	Jalousie window	VP	=	Vertically pivoted window
JA	=	Jal-awning window	VS	=	Vertical sliding window
LW DASHD	=	Limited water dual-action side-hinged door			

New concept in NAFS: product-specific ratings

- Each product type has one or more Performance Classes
- Each Performance Class has a set of Gateway Requirements
- Exception: Specialty Product type (SP) used for products not in Table 5, or products of non-standard geometric shape
  - SP products are rated by Performance Grade but do not have a Performance Class or minimum Gateway requirements
  - Folding doors can report their performance as Specialty Products

New concept in NAFS: Gateway requirements

- Table 1 introduces Gateway Requirements

Table 1
Gateway requirements

(See Clauses 0.2.1, 0.2.6.1, 4.2.1, 4.4.2.3, 4.4.3.2–4.4.3.4, 5.3.3.1, 5.3.4.2, and 5.3.4.3.)

Product performance class	Minimum performance grade (PG)	Minimum design pressure (DP), Pa (psf)	Minimum structural test pressure (STP), Pa (psf)	Minimum water resistance test pressure, Pa (psf)
Windows and doors				
R	15	720 (15.0)	1080 (22.5)	140 (2.90)
LC	25	1200 (25.0)	1800 (37.5)	180 (3.75)
CW	30	1440 (30.0)	2160 (45.0)	220 (4.50)
AW	40	1920 (40.0)	2880 (60.0)	390 (8.00)
Unit skylights, tubular daylighting devices, and roof windows				
R	15	720 (15.0)	1440 (30.0)	140 (2.90)
CW	30	1440 (30.0)	2880 (60.0)	220 (4.5)

New concept in NAFS: Gateway requirements

- Gateway requirements
  - Each Performance Class has:
    - A minimum Performance Grade
    - A minimum test specimen size
    - May be subject to additional auxiliary requirements
  - Products may be tested to sizes and performance grades greater than the minimum!
  - Table 27 has detailed gateway requirements for all products

Table 27—detailed Gateway requirements

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

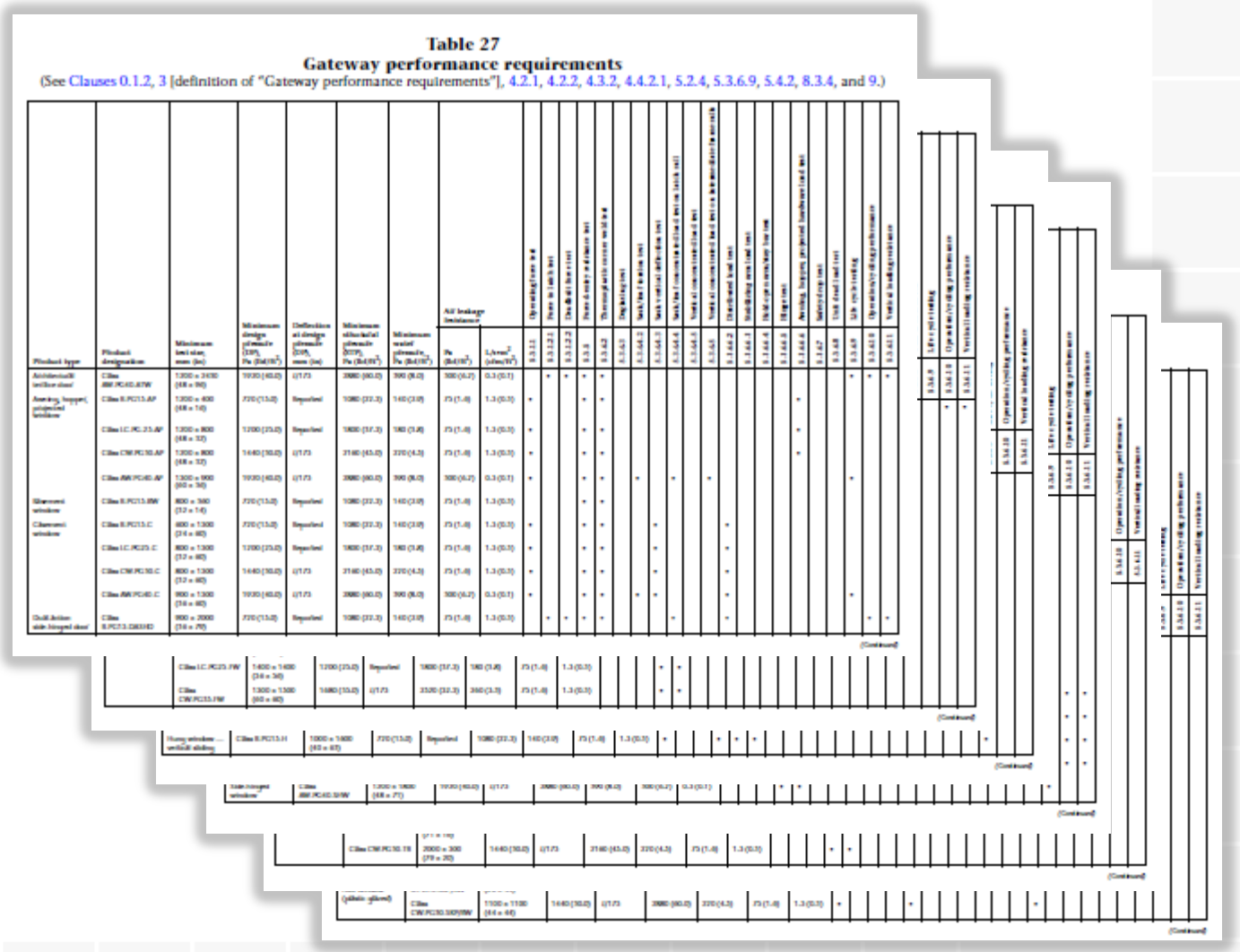


Table 27
Gateway performance requirements
(See Clauses 0.1.2, 3 [definition of "Gateway performance requirements"], 4.2.1, 4.2.2, 4.3.2, 4.4.2.1, 5.2.4, 5.3.6.9, 5.4.2, 8.3.4, and 9.)

NAFS Canadian air leakage ratings

- US measures air infiltration only at Gateway level, equal to Canada's A2. Canadian products must be tested for both infiltration and exfiltration
- Canadian ratings are: A2, A3 and Fixed

Table 9
Canadian (only) air infiltration/exfiltration levels
(See Clause 5.3.2.2.)

Performance class	Pressure difference, Pa (psf)	Infiltration/exfiltration					
		A2 level		A3 level		Fixed level	
		L/s•m²	(cfm/ft²)	L/s•m²	(cfm/ft²)	L/s•m²	(cfm/ft²)
R, LC, and CW	75 (1.6)	1.5	(0.3)	0.5	(0.1)	0.2	(0.04)
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)

New concept in NAFS: rating system (IP and metric)

- **Primary Designator**: Performance Class, Performance Grade and size tested
- Example—Fixed Window (IP):
  - Class R – PG 15: Size tested 48 x 48 in
  - Class LC – PG 25: Size tested 56 x 56 in – FW*
  - Class CW – PG 30: Size tested 60 x 60 in – Type FW*
  - Class AW – PG 40: Size tested 60 x 99 in – Fixed*

A primary designator is sufficient to describe product performance in the U.S.

** Addition of product type to primary designator is optional*

New concept in NAFS: rating system (IP and metric)

- **Primary Designator**: single line indicating Performance Class, Performance Grade and size tested
- Example—Fixed Window (metric):

  Class R – PG 720(metric): Size tested 1200 x 1200 mm

  Class LC – PG 1200(metric): Size tested 1400 x 1400 mm – FW*

  Class CW – PG 1680(metric): Size tested 1500 x 1500 mm – Type FW*

  Class AW – PG 1920(metric): Size tested 1500 x 2500 mm – Fixed*

** Addition of product type to primary designator is optional*

New concepts in NAFS: rating system

- **Secondary Designator**: a multiline listing of additional performance attributes

Positive Design Pressure	1200 Pa
Negative Design Pressure	1440 Pa
Water Penetration Resistance Test Pressure	220 Pa
Canadian Air Infiltration/Exfiltration	A3

- A secondary designator is mandatory in Canada, but is optional in the US
- Secondary designator must be used in conjunction with a primary designator

Canadian labeling requirements

Canadian Supplement section 6.4

- A permanent marking identifying manufacturer
- A Performance Rating label declaring the product's:
  - conformance to NAFS-08 and the Canadian Supplement
  - the primary designator
  - the secondary designator

Canadian temporary label elements

Manufacturer name – series/model of product

Primary — Class CW – PG30: Size Tested 800 x 1500 mm – Type C

Secondary

Positive Design Pressure (DP)	2400 Pa
Negative Design Pressure (DP)	2400 Pa
Water Penetration Resistance Test Pressure	360 Pa
Canadian Air Infiltration/Exfiltration	A3 Level

Conforms to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09

Both primary and secondary designators must appear on Canadian NAFS performance labels

Example Canadian temporary label

Manufacturer name – series/model of product

Class CW – PG30: Size Tested 800 x 1500 mm – Type C

Positive Design Pressure (DP)	2400 Pa
Negative Design Pressure (DP)	2400 Pa
Water Penetration Resistance Test Pressure	360 Pa
Canadian Air Infiltration/Exfiltration	A3 Level

Conforms to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09

No CSA, AAMA or other certification marks permitted unless products are CERTIFIED by those bodies!

Example temporary labels

Product Manufacturer – Series/Model identifier

Class R – PG1200 (metric): Size Tested 800 x 1500 mm

Positive Design Pressure: 1200 Pa

Negative Design Pressure: 1200 Pa

Water Penetration Resistance Test Pressure: 220 Pa

Canadian Air Infiltration/Exfiltration: A3 Level

Tested to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09

Product Manufacturer – Series/Model identifier

Class R – PG25: Size Tested 31.5 x 59 in. (800 x 1500 mm) – Casement

DP: +1200 / -1200 Pa

Water Penetration Resistance Test Pressure: 220 Pa

Canadian Air Infiltration/Exfiltration: A3 Level

Tested to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09

Product Manufacturer – Series/Model identifier

Class LC – PG2400 (metric) – Size tested 900 x 2100 mm – Limited Water Side-Hinged Door

Design Pressure: +2400 Pa / -2640 Pa

Water Penetration Resistance Test Pressure: 0 Pa

Canadian Air Infiltration/Exfiltration: A3 Level

Tested to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09

Example US manufacturer's Canadian label

Indicates performance certified by 3rd Party (AAMA)

Tested to NAFS-08 and Canadian Supplement

NAFS – more than lab testing

Material and component specifications in Clauses 6 and 7:

- Glass used in test specimens
- Material requirements for wood, vinyl, aluminum, fiberglass, steel, cellulosic composite materials, plastics used for door lite insert frames, etc.
- Performance and testing requirements for hardware, fasteners, reinforcing, weather stripping, insect screens, sealants, PAINT COATINGS, and MULLION RATINGS

- Material and component compliance with these specifications are not addressed in lab test reports!

New concepts in NAFS – review

- Performance CLASS grades products by strength and durability: R, LC, CW, AW
- Performance GRADE: DP, DP x 1.5, minimum water resistance
  - In Canada water test pressure specified separately from Performance Grade
- GATEWAY requirements define minimum qualifications for Performance Class
  - Can test beyond minimum
- Optional Performance Grades = allowable ratings only
- Ratings expressed with Primary and Secondary designators

New concepts in NAFS – review

- Performance Classes define categories of products that did not exist before in Canada
  - Architects will likely welcome this capability
- Performance Class influences frame material
  - AW product lines are, for all practical purposes, aluminum only
- Performance Class influences cost
  - Expect significant cost increases from class to class, especially from LC to CW and AW

Questions?

Thank-you!

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