CASCADIA
WINDOWS & DOORS

NAFS-08
&
CSA A440S1-09

Fenestration Standards

FIBERGLASS INNOVATION

Introduction to Cascadia

- Manufacturer of fiberglass construction products
  - Fiberglass windows
  - Fiberglass doors
  - Fiberglass cladding support systems
- Manufacturing plant located in Langley, BC
- In operation since 2008
- Main client base:
  - BC, Yukon, Washington, Oregon, California, Alaska

Background - Mike Battistel

- Glazier/Carpenter – 1990 to 1998
  - Journeyman glazier
  - Journeyman carpenter
- BCIT Building Science Diploma – 1998 to 2000
- Building Envelope Consultant– 2000 to 2008
  - Principal - RDH Building Engineering
- BCIT Part Time Instructor – 2002 to Current
  - Building Envelope Performance Course 3050
  - Building Envelope Solutions Course 1137
  - Construction Materials and Methods 2 – 2050
  - Various others
- Fiberglass Window Manufacturing – 2008 to Current
  - Vice President - Cascadia Windows

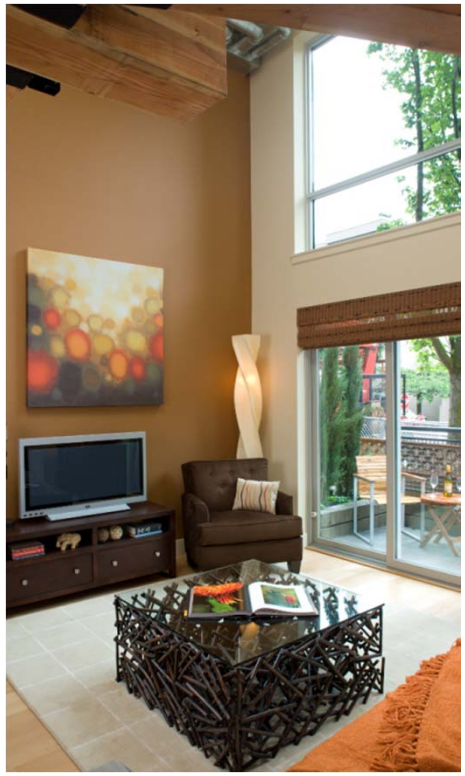
Special Guests

- Robert Baker, AScT, RBO. – Assistant Chief Inspector at Township of Langley

- Michael Bousfield – Technical Representative at Cascadia Windows Ltd.

Today's Agenda

- What is NAFS?
- Other Window and Door Regulations?
- NAFS in Part 9 and Part 5
- The Canadian NAFS Supplement
- Understanding the Standard
- How to Properly Confirm Performance Grade
- Canadian Labeling Requirements
- Composite and Combination Windows
- Delay to Code Enforcement of NAFS for Part 9 Buildings
- Performance Grade Determination Workshop



What is NAFS-08?

- A newer fenestration standard addressing performance and quality requirements of windows, doors and skylights
- 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*

- Adopted for use in the BCBC 2012
- Called the "**Harmonized Standard"** in the Building Code
- In Canada, NAFS-08 must be used in conjunction with the Canadian Supplement - **CSA A440S1-09**

What Assemblies are covered by NAFS?

Has there been a delay to Code enforcement of NAFS?

- NAFS and the 2012 BCBC originally took effect for building permits applied for after Dec. 19, 2012

- **NAFS enforcement on Part 9 buildings only, now delayed to Dec. 20, 2013**

- **Products installed in Part 9 buildings up to Dec 19 may comply with old or new code, regardless of BP application date**

- **Products installed in Part 9 buildings after Dec 19 must comply with 2012 code and NAFS**

- **NO DELAY FOR NAFS ENFORCEMENT OF PART 5 BUILDINGS!**

What is NAFS-08?

- NAFS is applicable for testing and rating performance of five primary requirements:
  - Structural Adequacy
  - Resistance to Water Penetration
  - Resistance to Air Leakage
  - Operating Force
  - Forced Entry Resistance

Other Window & Door Regulations?

- Other standards/acts/code provisions that may affect selection of fenestration products to demonstrate BCBC 2012 compliance include:
  - ASHRAE 90.1
  - BC Energy Efficiency Act
  - Upcoming introduction of BCBC 9.36 Energy Efficiency – Required Thermal Characteristics of Fenestration and Doors (effective December 19th, 2014)
- These other regulations address thermal characteristics exclusively, and are unrelated to NAFS-08.

NAFS in BCBC 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,"

Note: Installation was supposed to be regulated by CSA A440.7, but was opted to be excluded from BCBC 2012. NAFS nor the Canadian Supplement regulate installation

NAFS in BCBC 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

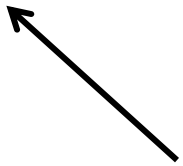
   b) **CSA A440S1**, "**Canadian Supplement to** AAMA/WDMA/CSA 101/I.S.2/A440, **NAFS** – North American Fenestration Standard/Specification for Windows, Doors, and Skylights."

Continued on
Next Page

NAFS in BCBC Part 5

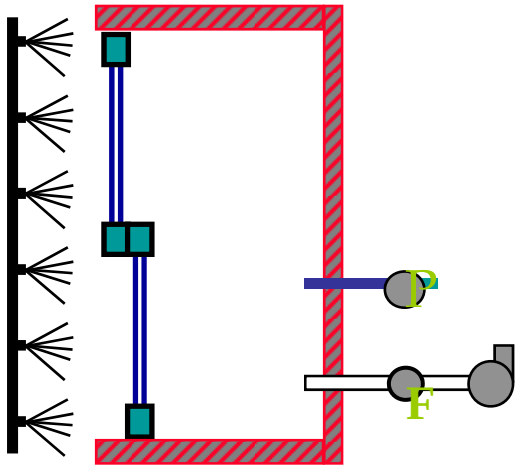
2) Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement referenced in Clause (1)(b) so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed.

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).

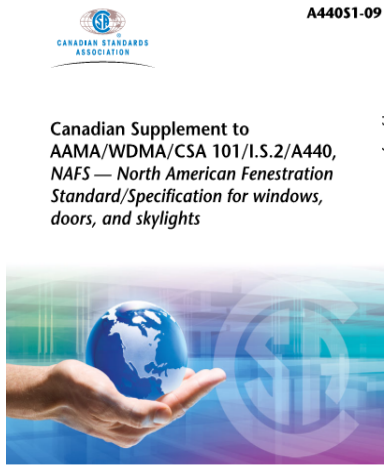


= NAFS-08

Various Lab Tests Are Performed to Confirm Ratings



Why is There a Canadian Supplement?



Not everything could be harmonized, including:

1. Different maximum water test pressures
2. Different air leakage testing requirements
3. Insect screen serviceability test in Canada
4. Different maximum operating force
5. Canadian labeling requirements ("markings")
6. The Canadian Supplement provides environmental data and simplified methods for determining appropriate performance grades for buildings anywhere in Canada.

Understanding the Standard

Key Terms:

- Performance Class
- Performance Grade
- Gateway Sizes
- Product Specific Ratings
- Selecting Appropriate Performance Levels for Specific Projects

Key performance ratings

- NAFS and Canadian Supplement:
  - **Performance CLASS:** R, LC, CW, AW
  - **Performance GRADE**: PG 15, PG720(metric)
  - **Size tested**
  - **Air infiltration / exfiltration**: Fixed, A2, A3
  - **Water penetration test pressure** in: Pa (Pascals)
  - **Design Pressure: + and - test pressure** in: Pa (Pascals)

Performance Class

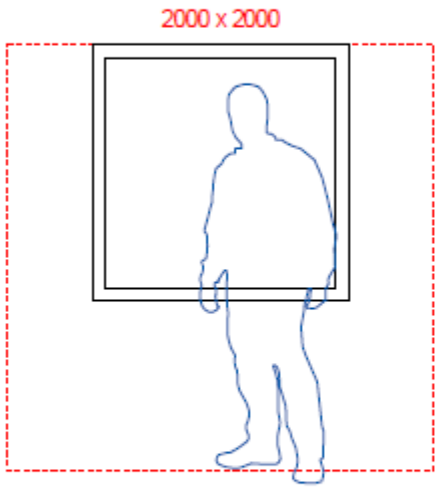
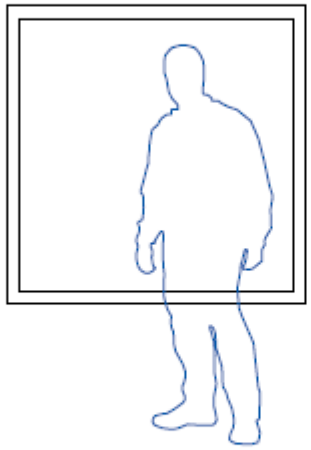
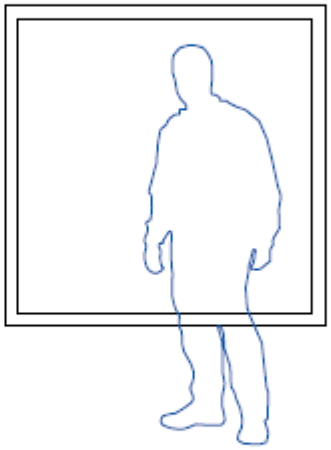
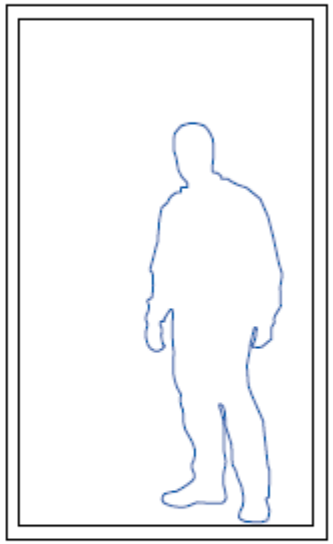
R	LC	CW	AW
PG 15	PG 25	PG30	PG40

Performance Class

Designation	NAFS Application
R	One and Two family dwellings
LC	Low-rise and mid-rise multifamily dwellings
CW	Low-rise and mid-rise buildings with heavy use and deflection limits
AW	Mid-rise and high-rise buildings, where frequent and extreme use is expected

- Physical performance now summarized by a *Performance Class*
- All that's needed based on the prescriptive requirements of the 2012 Building Code for Part 9 buildings is Class R.
- Classes have related *guidance* to designers for typical application and exposure (not a mandate)

Performance Class vs Minimum Size

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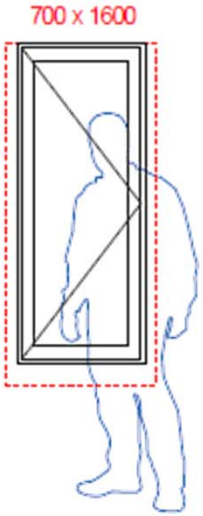
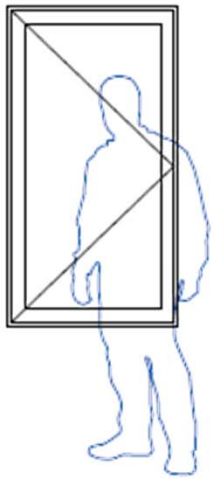
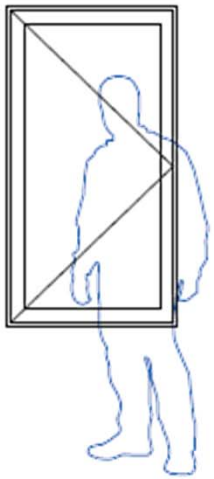
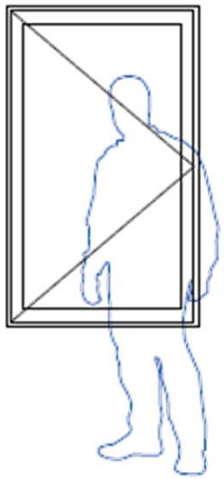
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air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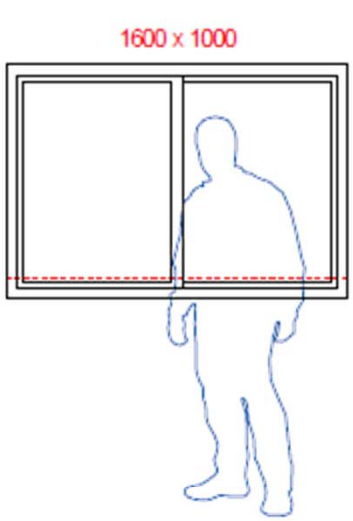
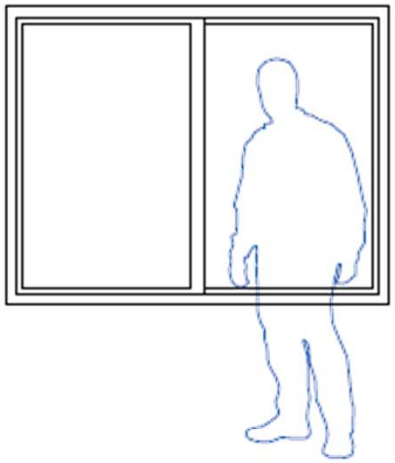
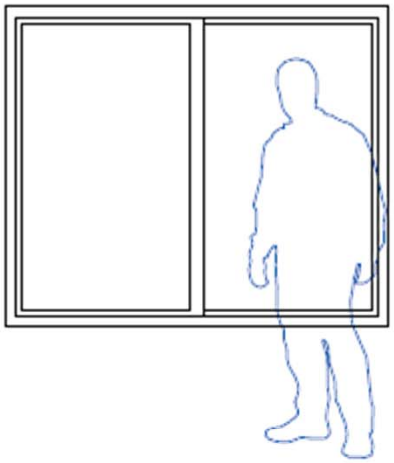
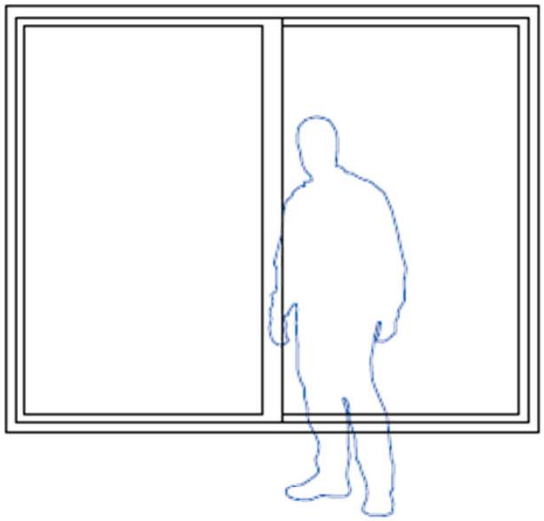
Defl: Report Only	Defl: Report Only	Defl: L/175	Defl: L/175
Min Struct: 1080 Pa	Min Struct: 1800 Pa	Min Struct: 2160 Pa	Min Struct: 2880 Pa
Min Water Test: 140 Pa (15% DP)	Min Water Test: 180 Pa (15% DP)	Min Water Test: 220 Pa (15% DP)	Min Water Test: 390 Pa (20% DP)
Air Leakage: 1.5 L/s*m2 @ 75Pa	Air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

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**
			
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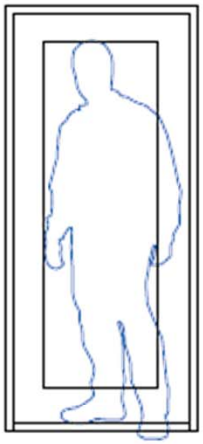
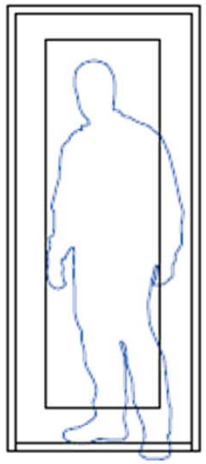
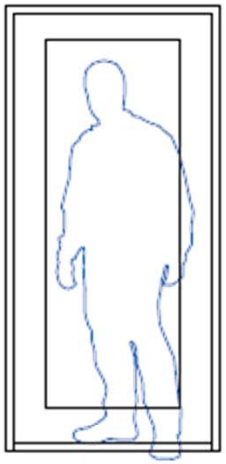
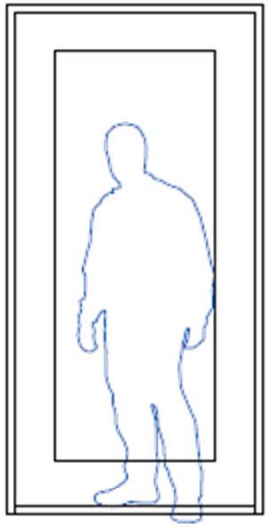
Defl: Report Only	**Defl: Report Only**	**Defl: L/175**	**Defl: L/175**
Min Struct: 1080 Pa	**Min Struct: 1800 Pa**	**Min Struct: 2160 Pa**	**Min Struct: 2880 Pa**
Min Water Test: 140 Pa (15% DP)	**Min Water Test: 180 Pa (15% DP)**	**Min Water Test: 220 Pa (15% DP)**	**Min Water Test: 390 Pa (20% DP)**
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 Grade (PG)

- A single numeric designation based on design pressure but representing a number of performance attributes:
  - Uniform load tests (structural tests)
  - Air and water penetration tests
  - 21 categories of 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 Grade (PG)

- Performance Grades are based on design pressure as determined using Canadian Supplement by:
  - Part 9 = Designer
    - Verified by AHJ as a prescriptive solution for code compliance
  - Part 5 = Architect/Engineer
    - Verification is typically provided through letters of assurance, as a performance based solution

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

Gateway Requirements for Performance Classes

- Gateway requirements
  - Each Performance Class has:
    - A minimum Performance Grade
    - A minimum test specimen size
    - May be subject to additional auxiliary requirements
  - Each Product Type may be rated for one or more Performance Classes
  - **Products may be tested to sizes and performance grades greater than the minimum for a Performance Class!**

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)

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)

Table 27—Detailed Gateway Requirements

- 6 pages of tables for product types
- Lists all applicable classes and grades for each product type
- Indicates which tests are required

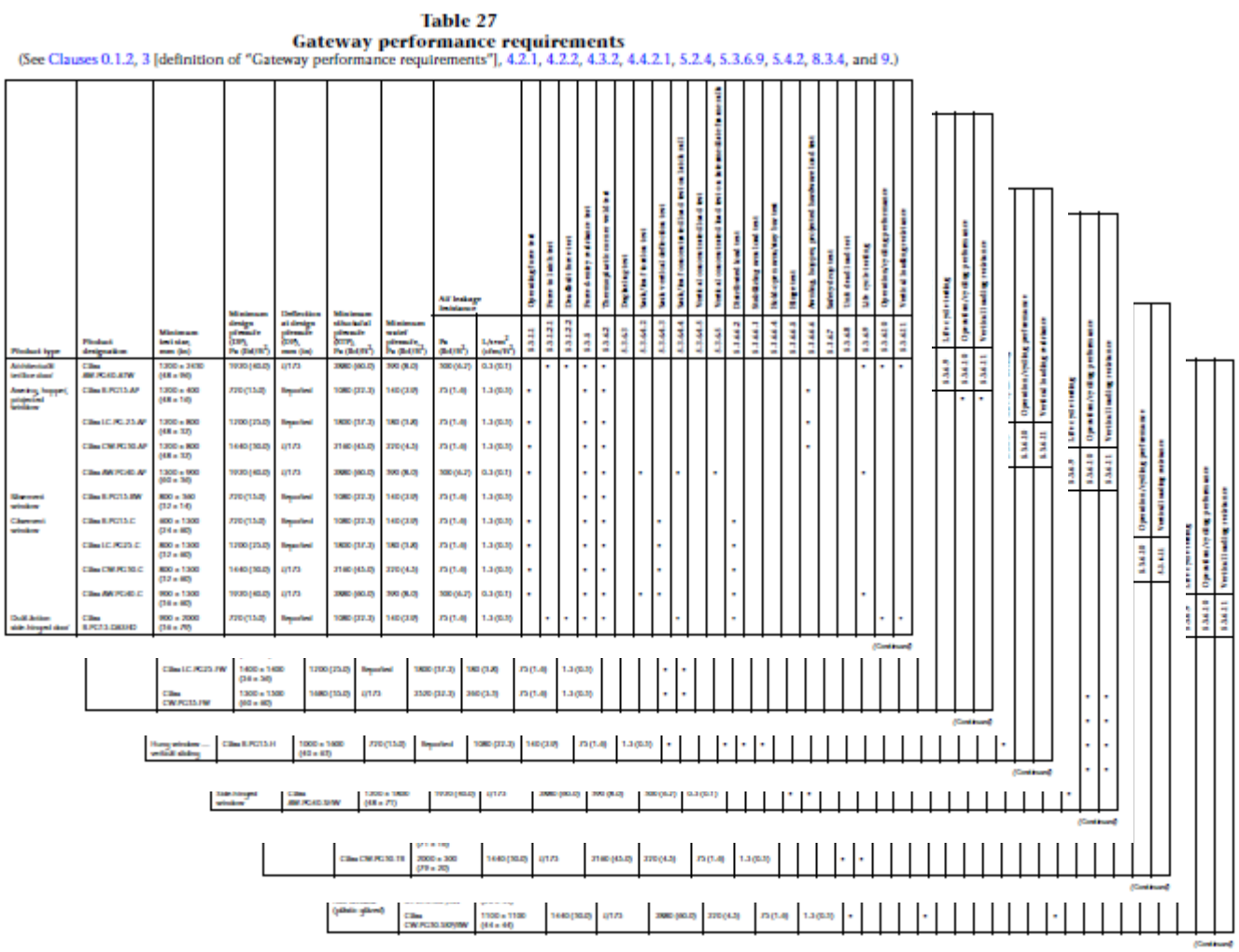


Table 27
Gateway performance requirements
(See Clauses 0.1.2, 3 [definition of "Gateway performance requirements"], 4.2.1, 4.2.2, 4.3.2, 4.4.2.1, 5.2.4, 5.3.6.9, 5.4.2, 8.3.4, and 9.)

Product-specific Ratings

- NAFS-08 lists 30 different product types for which there are performance ratings (Table 5)
- 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
- 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

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

NAFS-08 Exclusions

- Interior windows and doors
- Vehicular access doors
- Sloped glazing other than unit skylights
- Curtainwall and Storefront
- Storm windows and doors
- Commercial entrance systems
- Sunrooms
- Revolving doors
- Site built door systems
- Commercial steel doors

How to properly specify performance

- Use the Canadian Supplement (A440S1-09) to determine Performance Grade (PG) and water penetration resistance test pressures for the building location/exposure/height
- Specifiers must also choose a preferred air infiltration/exfiltration level
  - Standard minimum:
    - A2 for operable products
    - Fixed for non-operable windows
- All of these properties must appear on Canadian “non-permanent” (temporary) labels

Example Building
Calculating Performance Grade and Water Resistance Test Pressure

Objective

- Determine the performance requirements for a 30m high multifamily building in Abbotsford located in open terrain with large casement windows
- Objective:
  - Performance Grade
  - Water resistance test pressure

CSA A440S1-09

- Canadian Supplement inputs:
  - Geographic location
  - Terrain
  - Building height
- Supplement has environmental data, simplified methods to determine:
  - Design pressure
  - Driving Rain Wind Pressure (DRWP)

See page 21 of Supplement

1. Building information

Location (see Table A.1): _____

Terrain:	Open	DRWP (see Table A.1, Column A)	_____ Pa
	Rough	HWP (see Table A.1, Column B)	_____ Pa
Height	_____ m	Snow load (see Table A.1, Column C)	S_s _____ Pa
			S_r _____ Pa
Importance factor (see Clause 4.2.3) (I_w): 0.75		JDT (see Table A.1, Column D)	_____ °C

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	_____(Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	_____Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	_____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

3. Air infiltration/exfiltration

(a) Choose the appropriate level of airtightness performance (for operable windows and unit skylights only) in accordance with Clause 5.3.2.2 and Table 9 of AAMA/WDMA/CSA 101/I.S.2/A440, as follows:
- A2 — 1.5 L/(s•m^2) or 0.5 L/(s•m^2) for AW compression seal products
- A3 — 0.5 L/(s•m^2)
- Fixed — 0.2 L/(s•m^2)

(b) Insert the performance level in the summary table in Step 2.

4. Water penetration resistance

(a) Use Table 1 for open terrain or Table 2 for rough terrain.
(b) Using the location DRWP (round up) and the height of the window, door, or unit skylight, determine the p_r value.
(c) Insert the resultant specified DRWP in the summary table in Step 2.

5. Positive pressure — Wind load

(a) Use Table 3 for open terrain or Table 4 for rough terrain.
(b) Using the HWP for the building location (round up) and the height of the window, door, or unit skylight, determine the p value.
(c) Insert the resultant specified wind load in the summary table in Step 2.

6. Positive pressure — Snow load

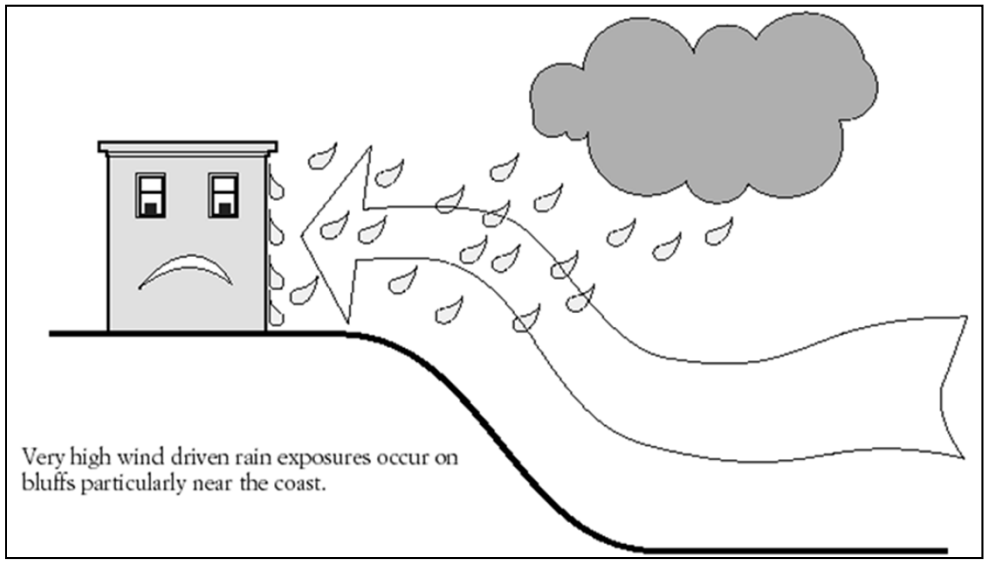
(a) For unit skylights whose entire roof width does not exceed 4.3 m, multiply the ground snow load (S_s) by 0.45 and add the associated rain load (S_r); for all other roofs, multiply S_s by 0.55 and add the associated S_r.
(b) Insert the resultant specified snow load in the summary table in Step 2. For windows and doors, enter zero.

Figure A.1
Checklist for selecting performance levels for windows, doors, and unit skylights
(See Clause A.4.4.)

Terrain?

- Open Terrain = level terrain with relatively few buildings, trees, or obstructions, and relatively little water or shoreline
- Rough Terrain = suburban, urban, or wooded terrain which extends upwind from a building and is uninterrupted for minimum of 1km, or 10 times the building height, whichever is greater.

Terrain?



Open Terrain

Rough Terrain

Example step 1

- Step 1: fill in building information

1. Building information

Location (see Table A.1): Abbotsford

Terrain: Open / Rough

Height: 30 m

Importance factor (see Clause 4.2.3) (I_w): 0.75

DRWP (see Table A.1, Column A): 200 Pa

HWP (see Table A.1, Column B): 620 Pa

Snow load (see Table A.1, Column C): S_s 2000 Pa; S_r 300 Pa

JDT (see Table A.1, Column D): _____ °C

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A: Driving rain wind pressure (DRWP), Pa, 1/10	Column B: Hourly wind pressure (HWP), kPa, 1/50	Column C: Snow load, kPa, 1/50 — Ground snow load, S_s	Column C: Snow load, kPa, 1/50 — Associated rain load, S_r	Column D: January design temp. (JDT), °C, 2.5%
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Example step 2

- Step 2 is actually the summary, completed after the other steps

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	_____(Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	_____Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 3

- Choose air infiltration/exfiltration level
  - At specifier's discretion
  - Keep available product performance in mind
  - Fixed level applies to non-operable windows only

3. Air infiltration/exfiltration

(a) Choose the appropriate level of airtightness performance (for operable windows and unit skylights only) in accordance with Clause 5.3.2.2 and Table 9 of AAMA/WDMA/CSA 101/I.S.2/A440, as follows:

- A2 — 1.5 L/(s•m^2) or 0.5 L/(s•m^2) for AW compression seal products
- A3 — 0.5 L/(s•m^2)
- Fixed — 0.2 L/(s•m^2)

(b) Insert the performance level in the summary table in Step 2.

Example step 3

- Add air tightness level to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	_____Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 4

- Determine Driving Rain Wind Pressure (DRWP)

4. Water penetration resistance

(a) Use Table 1 for open terrain or Table 2 for rough terrain.

(b) Using the location DRWP (round up) and the height of the window, door, or unit skylight, determine the p_r value.

(c) Insert the resultant specified DRWP in the summary table in Step 2.

Example step 4

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A	Column B	Column C		Column D
	Driving rain wind pressure (DRWP), Pa, 1/10	Hourly wind pressure (HWP), kPa, 1/50	Snow load, kPa, 1/50		January design temp. (JDT), °C, 2.5%
			Ground snow load, S_s	Associated rain load, S_r	
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Table 1
Specified DRWP (p_r) for open terrain
(See Clauses 4.2.1 and A.4.2.1 and Figure A.1.)

	p_r, Pa																				
	1/10 DRWP, Pa																				
Height, m	40	60	80	100	120	140	160	180	200	220	240	260	280	300	350	400	450	500	550	600	650
10	49	73	98	122	146	171	195	220	244	268	293	317	342	366	427	488	549	610	671	732	793
15	53	79	106	132	159	185	212	238	265	291	318	344	370	397	463	529	595	662	728	794	860
20	56	84	112	140	168	196	224	252	280	308	336	364	392	420	490	561	631	701	771	841	911
25	59	88	117	147	176	205	234	264	293	322	352	381	410	440	513	586	659	733	806	879	952
30	61	91	122	152	182	213	243	274	304	334	365	395	426	456	532	608	684	760	836	912	988

Example step 4

- Add Specified Driving Rain Wind Pressure to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 5

- Determine positive pressure

5. Positive pressure — Wind load

(a) Use Table 3 for open terrain or Table 4 for rough terrain.

(b) Using the HWP for the building location (round up) and the height of the window, door, or unit skylight, determine the *p* value.

(c) Insert the resultant specified wind load in the summary table in Step 2.

Example step 5

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A	Column B	Column C		Column D
	Driving rain wind pressure (DRWP), Pa, 1/10	Hourly wind pressure (HWP), kPa, 1/50	Snow load, kPa, 1/50		January design temp. (JDT), °C, 2.5%
			Ground snow load, S_s	Associated rain load, S_r	
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Table 3
Specified wind load (p) for windows, doors, and positive loads on unit skylights — Open terrain
(See Clauses 4.2.2 and A.4.2.2 and Figure A.1.)

Height, m	p, kPa 1/50 Hourly wind pressure, kPa																					
	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25
10	0.56	0.70	0.84	0.98	1.13	1.27	1.41	1.55	1.69	1.83	1.97	2.11	2.25	2.39	2.53	2.67	2.81	2.95	3.09	3.23	3.38	3.52
15	0.61	0.76	0.92	1.07	1.22	1.37	1.53	1.68	1.83	1.98	2.14	2.29	2.44	2.59	2.75	2.90	3.05	3.20	3.36	3.51	3.66	3.81
20	0.65	0.81	0.97	1.13	1.29	1.45	1.62	1.78	1.94	2.10	2.26	2.42	2.58	2.75	2.91	3.07	3.23	3.39	3.55	3.72	3.88	4.04
25	0.68	0.84	1.01	1.18	1.35	1.52	1.69	1.86	2.03	2.20	2.36	2.53	2.70	2.87	3.04	3.21	3.38	3.55	3.72	3.88	4.05	4.22
30	0.70	0.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10	2.28	2.45	2.63	2.80	2.98	3.15	3.33	3.50	3.68	3.85	4.03	4.20	4.38

Example step 5

- Add Specified wind load to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	kPa (Step 8)
Specified wind load — Positive	2·28 kPa (Step 5)	Condensation resistance	(Step 9)
Specified snow load	Pa (Step 6)	Other	PVC, natural beige (Step 10)
Design pressure — Positive	Pa (Step 7)		

- Snow load and negative pressure apply only to skylights
- Condensation resistance outside scope of example
- Other: frame material, finish, etc.

Determine PG and water test pressure

Specified Wind Load = 2·28 kPa

Specified DRWP = 304 Pa

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)
65	65	65	65	3 120	(65.00)	4 680	(97.50)	470	(9.75)	630	(13.00)
70	70	70	70	3 360	(70.00)	5 040	(105.00)	510	(10.50)	680	(14.00)

But . . . water penetration test pressure cannot be lower than required for PG
(it CAN however be higher, which is why it is specified separately from PG!)

Determine PG and water test pressure

Specified Wind Load = 2·28 kPa

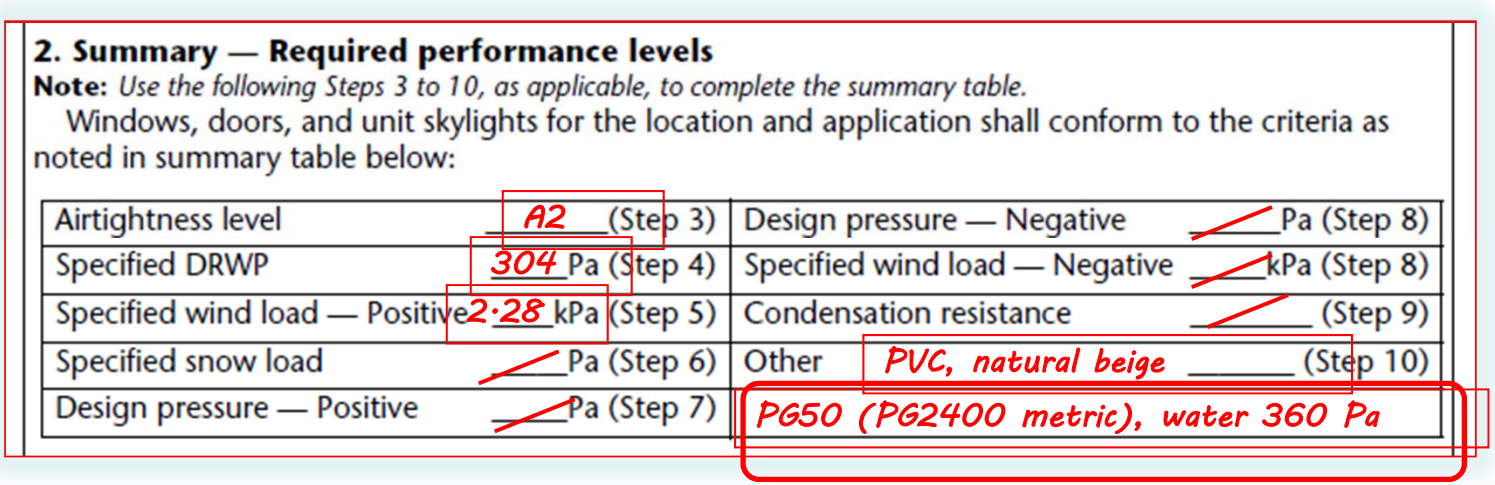
Specified DRWP = 304 Pa

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)
65	65	65	65	3 120	(65.00)	4 680	(97.50)	470	(9.75)	630	(13.00)
70	70	70	70	3 360	(70.00)	5 040	(105.00)	510	(10.50)	680	(14.00)

Minimum Performance Grade PG50 (PG2400 metric), water test pressure 360 Pa

Example step 6

- Add Performance Grade and water test pressure to Summary



2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	kPa (Step 8)
Specified wind load — Positive	2·28 kPa (Step 5)	Condensation resistance	(Step 9)
Specified snow load	Pa (Step 6)	Other	PVC, natural beige (Step 10)
Design pressure — Positive	Pa (Step 7)	PG50 (PG2400 metric), water 360 Pa	

- Snow load and negative pressure apply only to skylights
- Condensation resistance outside scope of example
- Other: optional information specifier may use

Conclusion: Using the Canadian Supplement

- Determine the performance requirements for a 30m high commercial building in Abbotsford located in open terrain with large casement windows
- Result
  - PG50 or PG 2400(metric)
  - Canadian water penetration resistance test pressure: 360 Pa
  - Canadian air infiltration/ exfiltration level = A2

Temporary label example

Manufacturer name – series/model of product

Class __ – PG50: Size Tested 800 x 1500 mm – Type C

Positive Design Pressure (DP) 2400
Negative Design Pressure (DP) 2400 Pa
Water Penetration Resistance Test Pressure 360 Pa
Canadian Air Infiltration/Exfiltration A2 Level

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

Minimum Performance Grade PG50 (PG2400 metric), water test pressure 360 Pa.

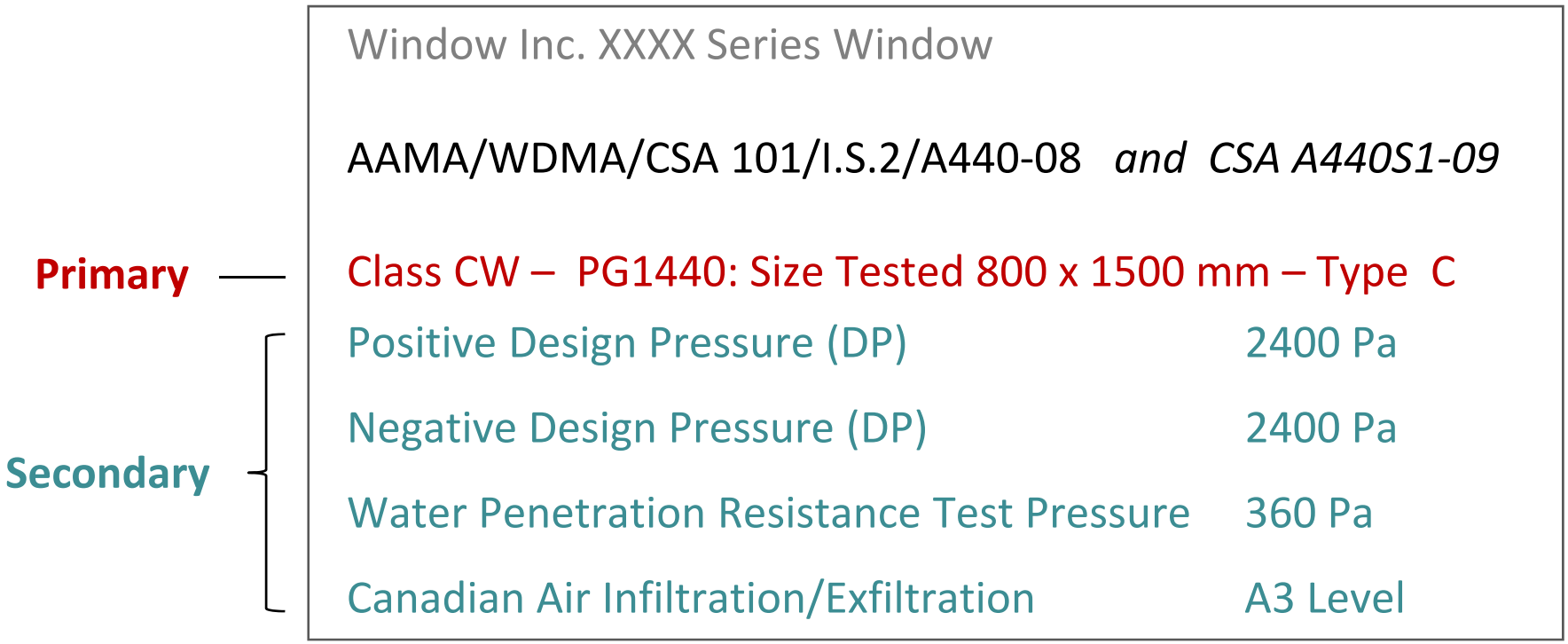
Performance Class is up to designer/specifier for Part 5!
R Class minimum for code compliance for Part 9.

Canadian Labeling Requirements

Canadian Supplement section 6.4 requires:

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

Canadian Temporary Label Elements



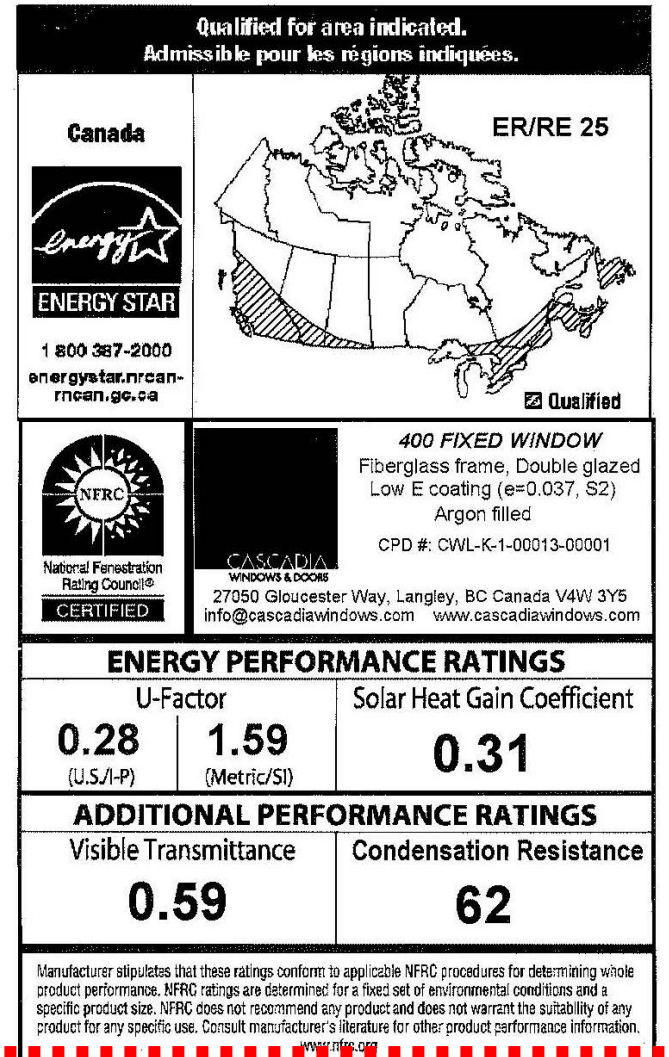
Both primary and secondary designators must appear on Canadian NAFS performance labels

Various Labeling Formats

- Cascadia self-certified NAFS-08 label example
- Can be combined with NFRC and Energy Star Labeling

CASCADIA WINDOWS LTD.
400 FIXED
NFRC - CWL - K - 1

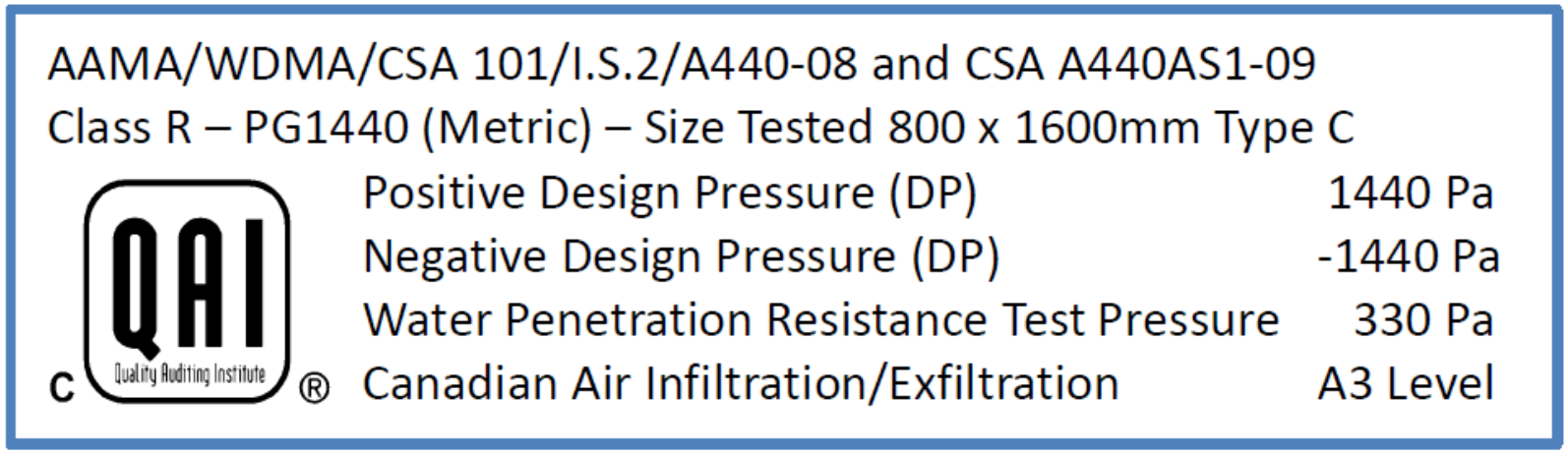
Permanent label



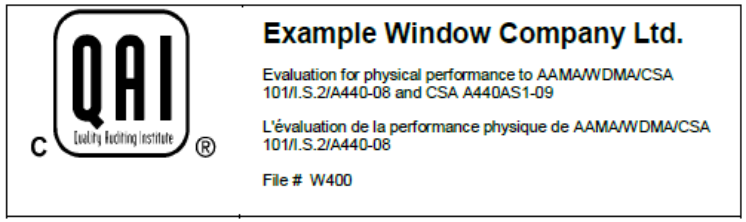
Temporary label

Sample QAI NAFS-08 label

- Example of Certification Agency Label



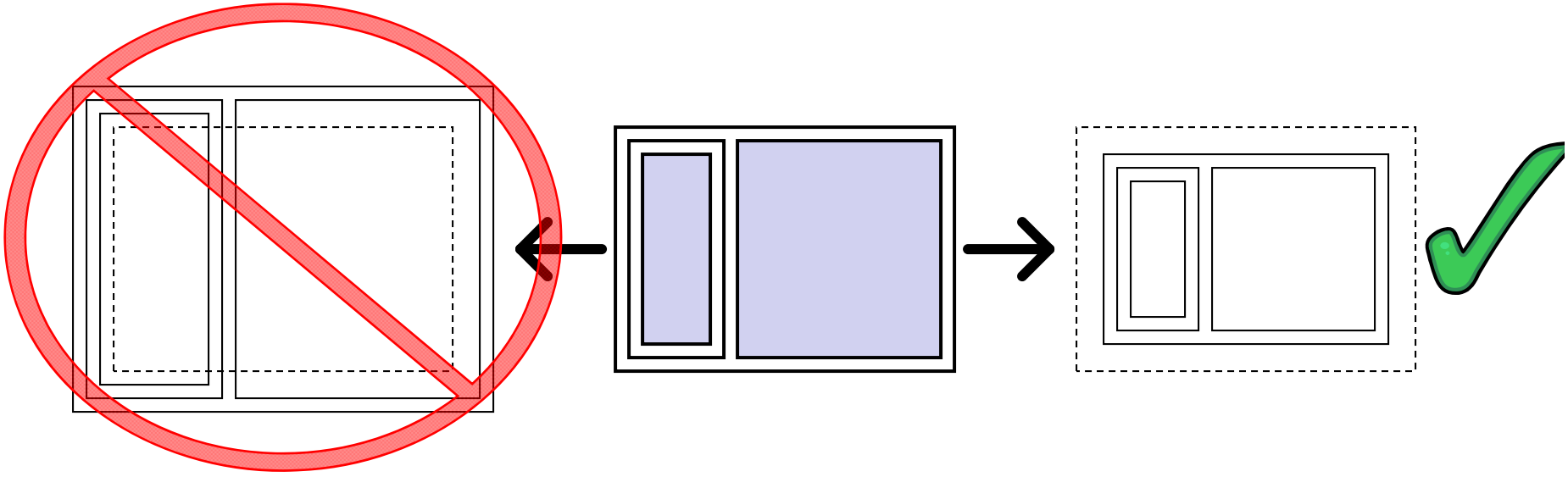
Temporary label



Permanent label

NAFS-08 labeling of windows

- NAFS and Canadian Supplement **ratings apply only to tested size or smaller**



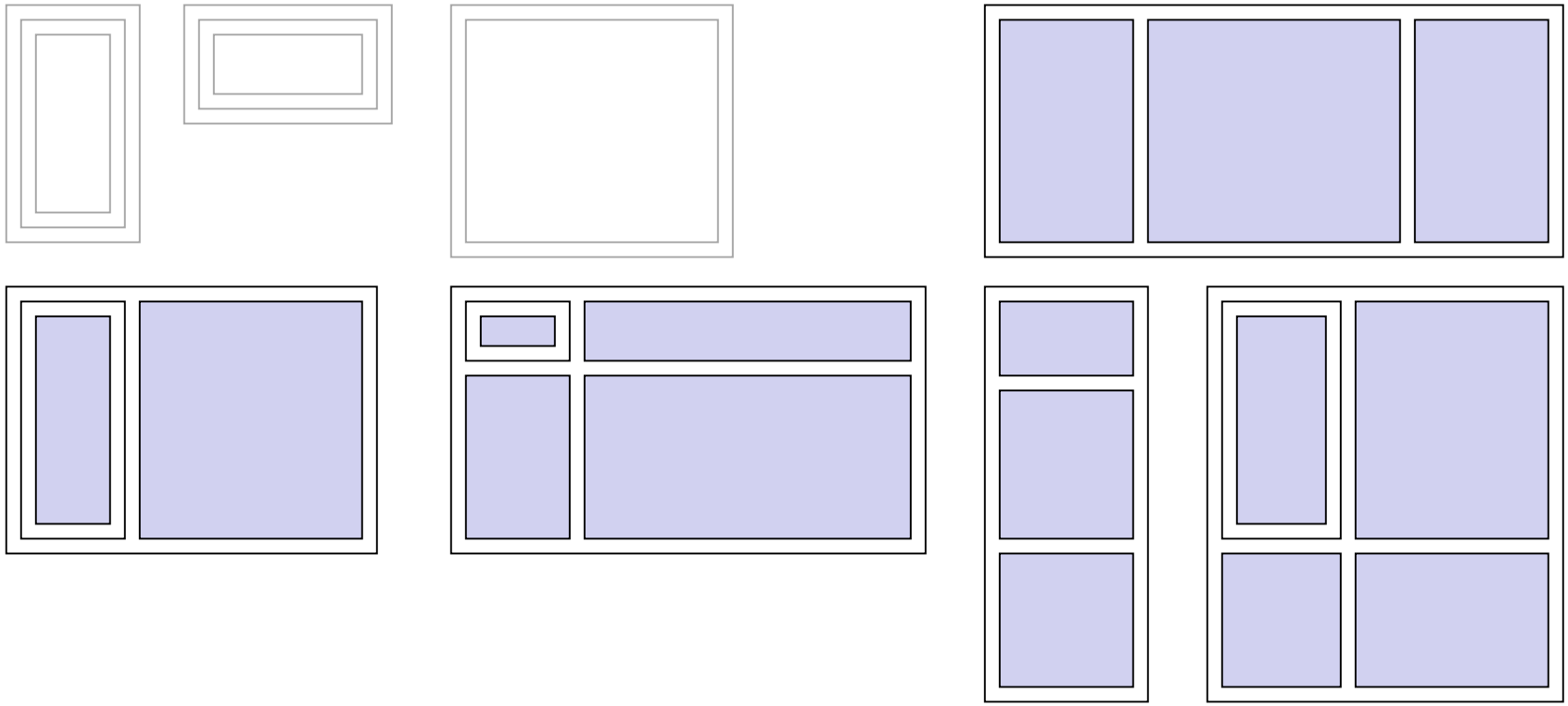
Larger than tested size

Tested size

NAFS-08

NAFS-08 and mullions - Composite Units

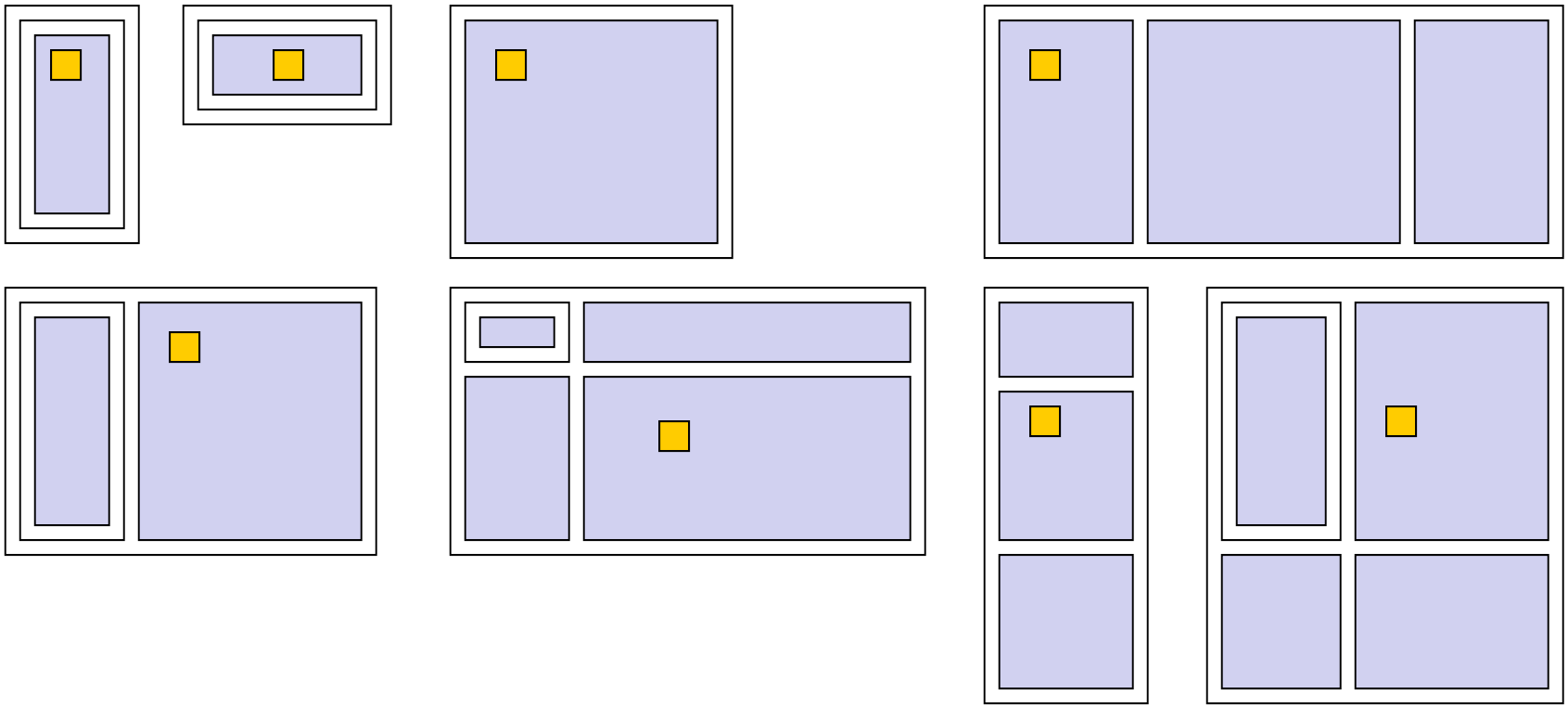
- **Composite unit**: two or more sashes, leaves, lites, or sliding panels within a single frame and utilizing integral mullions – **must be tested as one unit**



Linfield
College

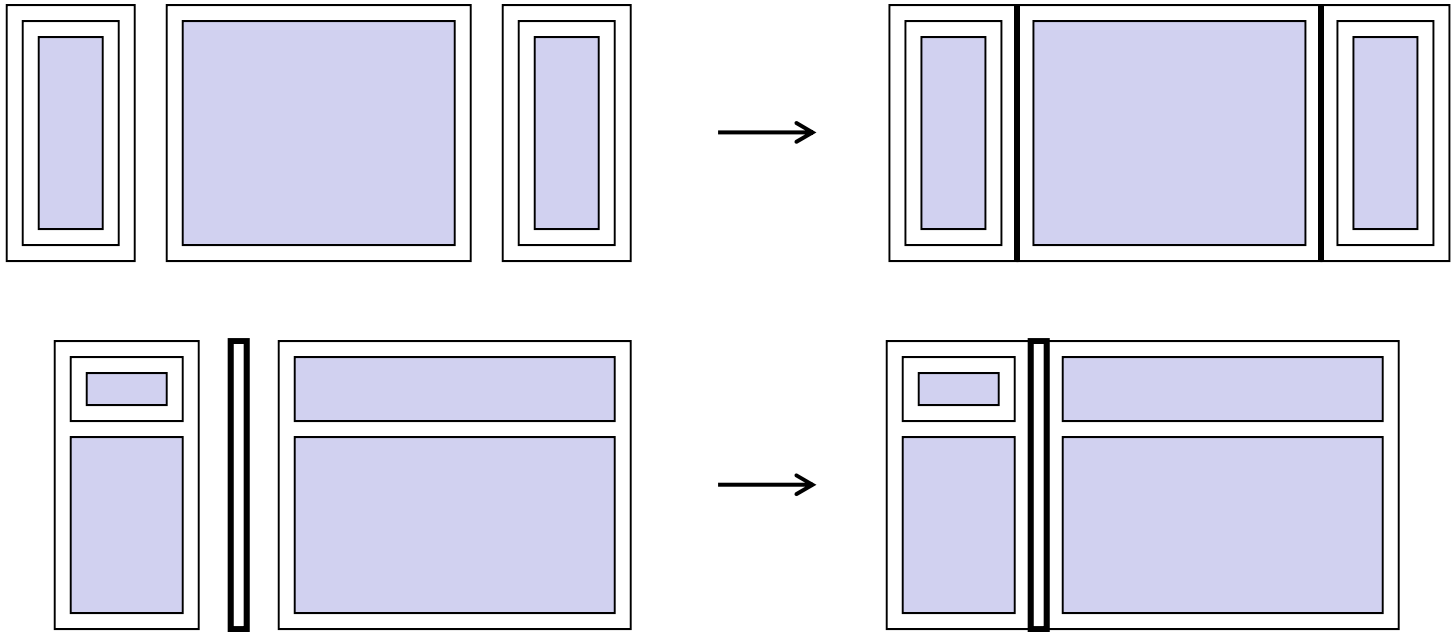
NAFS-08 vs. CSA A440-00

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



NAFS-08 and mullions - Combination Assembly

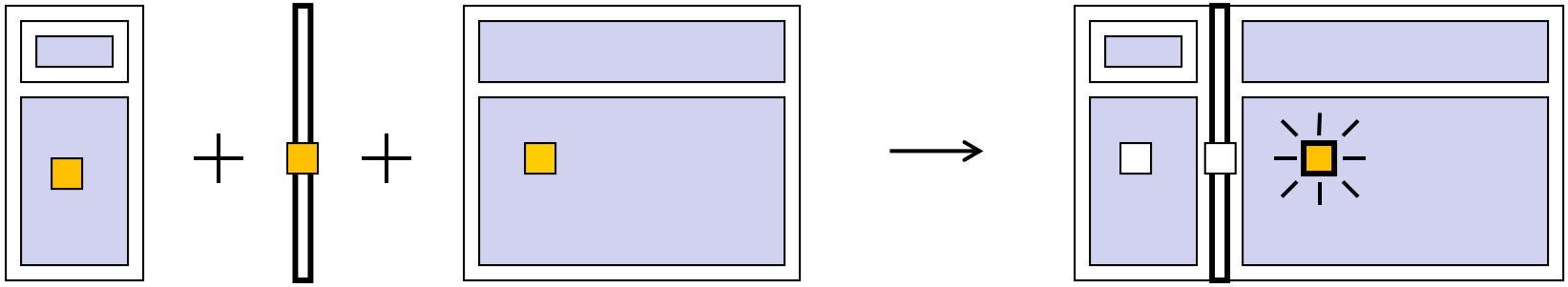
- **Combination assembly**: two or more separate fenestration products joined with mullion or clips
- Can test as an assembly, or each test each component separately.
- Mullion PG ratings may be determined by licensed structural engineer using AAMA 450



5075

Combination Assembly allows mullion ratings

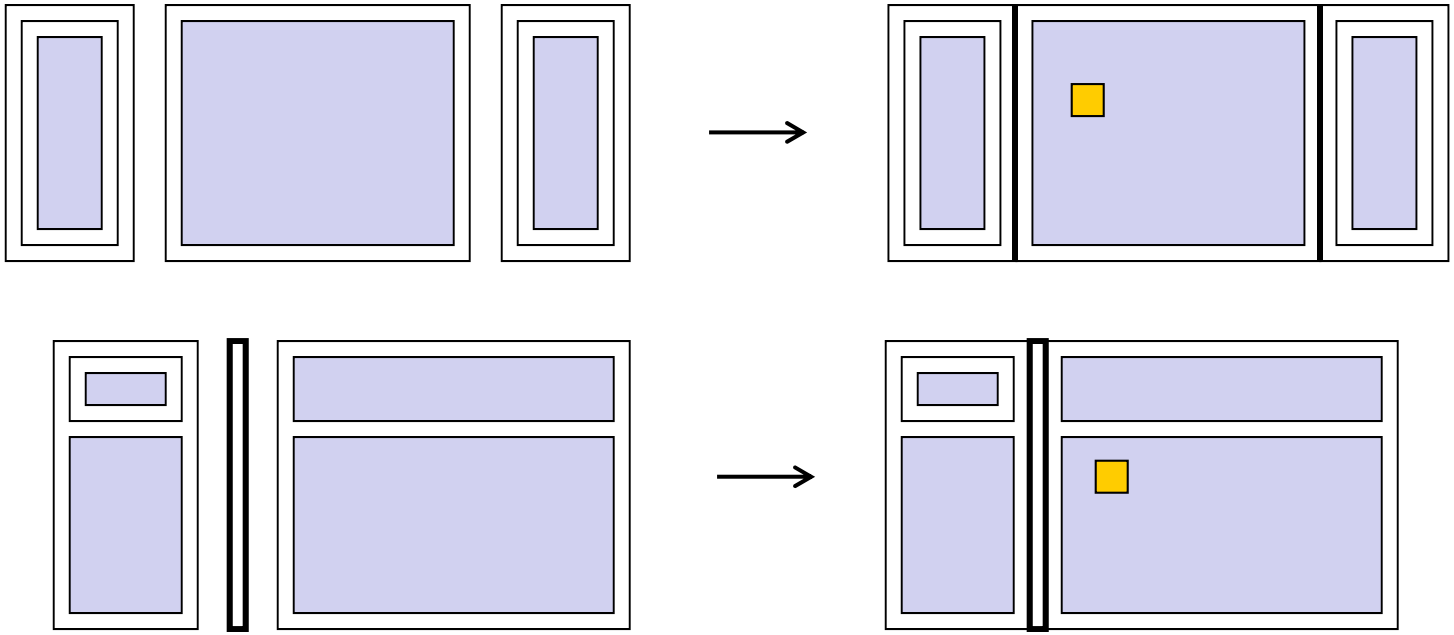
- **When tested as separate components,** can have separate labels for each of the mulled components, including the mullion connector.
- The **Performance Grade of the weakest element is the Performance Grade of the assembly** for code compliance.



Labels must show air, water and structural performance!

NAFS-08 Combination Assembly – in BC

- Local test labs / certification agencies such as Intertek and QAI do not do AAMA 450 mullion ratings
- They test Combination products same as Composite products
- One sticker ok for combination assemblies as long as lowest performance ratings are shown



Workshop Time!

- Using the **CSA A440S1-09** Canadian Supplement to determine the appropriate Performance Grade and Water Penetration Resistance Test Pressure.

Objective

- Determine the performance requirements for a 30m high multifamily building in Abbotsford located in open terrain with large casement windows
- Objective:
  - Performance Grade
  - Water resistance test pressure

Example step 1

- Step 1: fill in building information

1. Building information

Location (see Table A.1): Abbotsford

Terrain: Open / Rough

Height: 30 m

Importance factor (see Clause 4.2.3) (I_w): 0.75

DRWP (see Table A.1, Column A): 200 Pa

HWP (see Table A.1, Column B): 620 Pa

Snow load (see Table A.1, Column C): S_s 2000 Pa; S_r 300 Pa

JDT (see Table A.1, Column D): _____ °C

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A: Driving rain wind pressure (DRWP), Pa, 1/10	Column B: Hourly wind pressure (HWP), kPa, 1/50	Column C: Snow load, kPa, 1/50 — Ground snow load, S_s	Column C: Snow load, kPa, 1/50 — Associated rain load, S_r	Column D: January design temp. (JDT), °C, 2.5%
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Example step 2

- Step 2 is actually the summary, completed after the other steps

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	_____(Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	_____Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 3

- Choose air infiltration/exfiltration level
  - At specifier's discretion
  - Keep available product performance in mind
  - Fixed level applies to non-operable windows only

3. Air infiltration/exfiltration

(a) Choose the appropriate level of airtightness performance (for operable windows and unit skylights only) in accordance with Clause 5.3.2.2 and Table 9 of AAMA/WDMA/CSA 101/I.S.2/A440, as follows:

- A2 — 1.5 L/(s•m^2) or 0.5 L/(s•m^2) for AW compression seal products
- A3 — 0.5 L/(s•m^2)
- Fixed — 0.2 L/(s•m^2)

(b) Insert the performance level in the summary table in Step 2.

Example step 3

- Add air tightness level to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	_____Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 4

- Determine Driving Rain Wind Pressure (DRWP)

4. Water penetration resistance

(a) Use Table 1 for open terrain or Table 2 for rough terrain.

(b) Using the location DRWP (round up) and the height of the window, door, or unit skylight, determine the p_r value.

(c) Insert the resultant specified DRWP in the summary table in Step 2.

Example step 4

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A	Column B	Column C		Column D
	Driving rain wind pressure (DRWP), Pa, 1/10	Hourly wind pressure (HWP), kPa, 1/50	Snow load, kPa, 1/50		January design temp. (JDT), °C, 2.5%
			Ground snow load, S_s	Associated rain load, S_r	
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Table 1
Specified DRWP (p_r) for open terrain
(See Clauses 4.2.1 and A.4.2.1 and Figure A.1.)

	p_r, Pa																				
	1/10 DRWP, Pa																				
Height, m	40	60	80	100	120	140	160	180	200	220	240	260	280	300	350	400	450	500	550	600	650
10	49	73	98	122	146	171	195	220	244	268	293	317	342	366	427	488	549	610	671	732	793
15	53	79	106	132	159	185	212	238	265	291	318	344	370	397	463	529	595	662	728	794	860
20	56	84	112	140	168	196	224	252	280	308	336	364	392	420	490	561	631	701	771	841	911
25	59	88	117	147	176	205	234	264	293	322	352	381	410	440	513	586	659	733	806	879	952
30	61	91	122	152	182	213	243	274	304	334	365	395	426	456	532	608	684	760	836	912	988

Example step 4

- Add Specified Driving Rain Wind Pressure to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	_____Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	_____kPa (Step 8)
Specified wind load — Positive	____kPa (Step 5)	Condensation resistance	_____ (Step 9)
Specified snow load	_____Pa (Step 6)	Other	_____ (Step 10)
Design pressure — Positive	_____Pa (Step 7)		

Example step 5

- Determine positive pressure

5. Positive pressure — Wind load

(a) Use Table 3 for open terrain or Table 4 for rough terrain.

(b) Using the HWP for the building location (round up) and the height of the window, door, or unit skylight, determine the *p* value.

(c) Insert the resultant specified wind load in the summary table in Step 2.

Example step 5

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Table A.1
Climate design data for selected locations in Canada
(See Clauses 4.1, A.4.1, A.4.2.1, A.4.2.2, and A.4.2.4 and Figure A.1.)

Location	Column A	Column B	Column C		Column D
	Driving rain wind pressure (DRWP), Pa, 1/10	Hourly wind pressure (HWP), kPa, 1/50	Snow load, kPa, 1/50		January design temp. (JDT), °C, 2.5%
			Ground snow load, S_s	Associated rain load, S_r	
British Columbia					
Abbotsford	200	0.62	2.0	0.3	–10

Table 3
Specified wind load (p) for windows, doors, and positive loads on unit skylights — Open terrain
(See Clauses 4.2.2 and A.4.2.2 and Figure A.1.)

Height, m	p, kPa 1/50 Hourly wind pressure, kPa																					
	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25
10	0.56	0.70	0.84	0.98	1.13	1.27	1.41	1.55	1.69	1.83	1.97	2.11	2.25	2.39	2.53	2.67	2.81	2.95	3.09	3.23	3.38	3.52
15	0.61	0.76	0.92	1.07	1.22	1.37	1.53	1.68	1.83	1.98	2.14	2.29	2.44	2.59	2.75	2.90	3.05	3.20	3.36	3.51	3.66	3.81
20	0.65	0.81	0.97	1.13	1.29	1.45	1.62	1.78	1.94	2.10	2.26	2.42	2.58	2.75	2.91	3.07	3.23	3.39	3.55	3.72	3.88	4.04
25	0.68	0.84	1.01	1.18	1.35	1.52	1.69	1.86	2.03	2.20	2.36	2.53	2.70	2.87	3.04	3.21	3.38	3.55	3.72	3.88	4.05	4.22
30	0.70	0.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10	2.28	2.45	2.63	2.80	2.98	3.15	3.33	3.50	3.68	3.85	4.03	4.20	4.38

Example step 5

- Add Specified wind load to Summary

2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	kPa (Step 8)
Specified wind load — Positive	2·28 kPa (Step 5)	Condensation resistance	(Step 9)
Specified snow load	Pa (Step 6)	Other	PVC, natural beige (Step 10)
Design pressure — Positive	Pa (Step 7)		

- Snow load and negative pressure apply only to skylights
- Condensation resistance outside scope of example
- Other: frame material, finish, etc.

Determine PG and water test pressure

Specified Wind Load = 2·28 kPa

Specified DRWP = 304 Pa

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)
65	65	65	65	3 120	(65.00)	4 680	(97.50)	470	(9.75)	630	(13.00)
70	70	70	70	3 360	(70.00)	5 040	(105.00)	510	(10.50)	680	(14.00)

But . . . water penetration test pressure cannot be lower than required for PG
(it CAN however be higher, which is why it is specified separately from PG!)

Determine PG and water test pressure

Specified Wind Load = 2·28 kPa

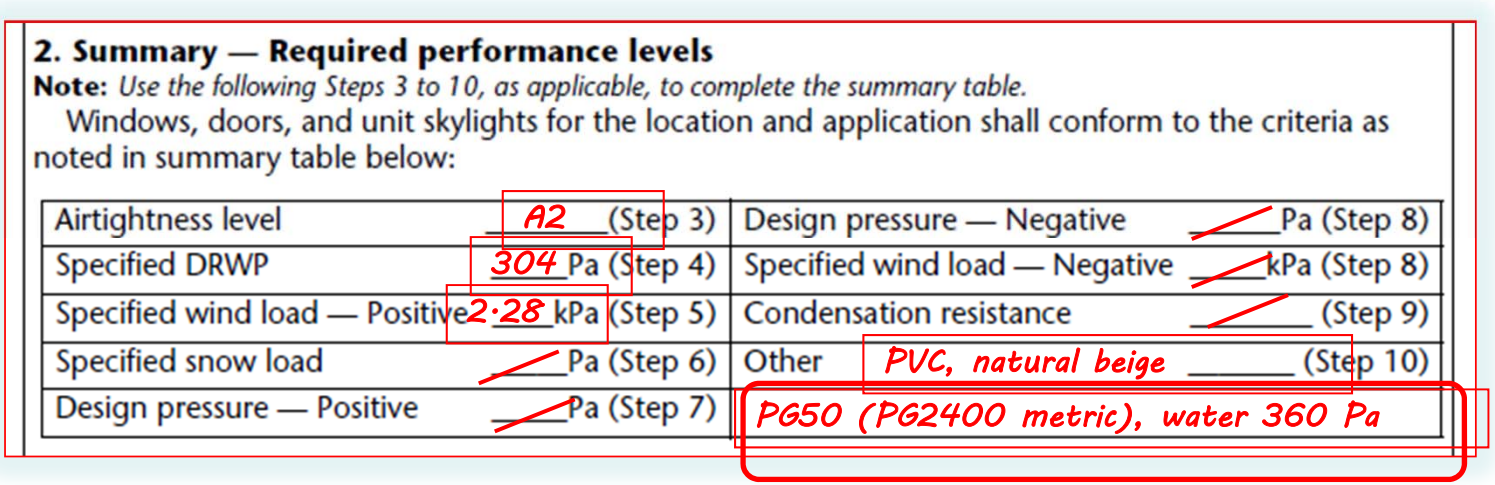
Specified DRWP = 304 Pa

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)
65	65	65	65	3 120	(65.00)	4 680	(97.50)	470	(9.75)	630	(13.00)
70	70	70	70	3 360	(70.00)	5 040	(105.00)	510	(10.50)	680	(14.00)

Minimum Performance Grade PG50 (PG2400 metric), water test pressure 360 Pa

Example step 6

- Add Performance Grade and water test pressure to Summary



2. Summary — Required performance levels

Note: *Use the following Steps 3 to 10, as applicable, to complete the summary table.*

Windows, doors, and unit skylights for the location and application shall conform to the criteria as noted in summary table below:

Airtightness level	A2 (Step 3)	Design pressure — Negative	Pa (Step 8)
Specified DRWP	304 Pa (Step 4)	Specified wind load — Negative	kPa (Step 8)
Specified wind load — Positive	2·28 kPa (Step 5)	Condensation resistance	(Step 9)
Specified snow load	Pa (Step 6)	Other	PVC, natural beige (Step 10)
Design pressure — Positive	Pa (Step 7)	PG50 (PG2400 metric), water 360 Pa	

- Snow load and negative pressure apply only to skylights
- Condensation resistance outside scope of example
- Other: optional information specifier may use

Online Calculators

- Cascadia Windows has developed an online calculator
- QAI has also developed an online calculator
- Fenestration Canada is in the process of developing one too.

www.cascadiawindows.com

2013 August Update to the CSA A440S1-09

Changes likely happening

- The climatic data used in the Cascadia Calculator is the data currently referenced by the BC Building Code.
- However, there is more current data available, which is not yet authorized by the BC Minister to be used.
- There is a pending ministerial order to adopt the more current climatic data.
- The Cascadia Calculator will be immediately updated with the new data when/if the ministerial order is issued.

Workshop Time Continued!

- Using the **CSA A440S1-09** Canadian Supplement to determine the appropriate Performance Grade and Water Penetration Resistance Test Pressure.

- Determine the performance requirements for a 9m high SFD building located in open terrain with large casement windows
  - Cashe Creek
  - Masset

- Confirm:
  - Performance Grade
  - Water resistance test pressure

www.cascadiawindows.com