CAN/CGSB-12.8-2026
Supersedes CAN/CGSB-12.8-2017

Insulating glass units

Developed by the Canadian General Standards Board

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CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE. La version française de la présente norme est intitulée *Vitrages isolants*

Canadian General Standards Board
Committee on Glass
(***Voting membership at date of ballot***)

Special acknowledgment to Amy Becker (Fenestration and Glazing Industry Alliance/FGIA), Bill Lingnell (Lingnell Consulting), and Olivia Aubin and Katrina Stafford (Administrative Management Systems/AMS) for their strong contribution to the development of this new edition.

Translation of this National Standard of Canada was conducted by the Government of Canada.

Preface

This National Standard of Canada CAN/CGSB-12.8-2026 supersedes CAN/CGSB-12.8–2017 (Reaffirmed 2022) *Insulating glass units*.

Changes since the previous edition

- Editorial changes have been made
- Normative references updated
- Addition of terms and definitions section
- Detailed requirements separated to general and detailed requirement sections
- Options section removed
- Addition of insulating glass units with a VIG lite (hybrid units)
- Allowance for additional glass thicknesses
- Addition of quadruple-glazed IGU with glass lites
- Some revisions to this standard have been made to address the increase in extreme climate events across Canada
- Revised testing methodology for High Humidity and Weathering Cycling
- Revised viewing methodology for Volatile Fog
- Revised Gas Concentration testing methodology
- Addition of Internal Components
- New annex on Climate Resiliency
- New annex on Rapid Assessment Chamber (RAC)
- New annex on Internal Components
- Removed Annex on Optional Initial Seal Test
- Removed Annex on Failure Analysis for Gas-Filled IG Units (water immersion technique)

The following definitions apply in understanding how to implement this National Standard of Canada:

- “shall” indicates a **requirement**;
- “should” indicates a **recommendation**;
- “may” is used to indicate that something is **permitted**;
- “can” is used to indicate that something is **possible**, for example, that an organization is able to do something.

Notes accompanying clauses do not include requirements or alternative requirements. The purpose of a note accompanying a clause is to separate explanatory or informative material from the text. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

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Insulating glass units

1 Scope

This standard applies to sealed Insulating Glass Units (IGUs) consisting of two or more lites of glass, used in windows, doors and skylights in building envelopes. It includes requirements for the testing of samples for the integrity and durability of the unit's hermetic seal and if applicable, gas concentration. The requirements also apply to IGUs with coated glass, have internal components (such as, muntin bars) within the cavities, a Vacuum Insulating Glass (VIG) lite and contain air or argon gas within the cavities.

Excluded from this standard are IGUs in which the cavity is permanently vented to the atmosphere, such as with a capillary tube, IGUs used in non-vision applications, such as in spandrel panels in a curtain wall assembly, and IGUs glazed with the perimeter sealants exposed to UV radiation.

The requirements of this standard are not sufficient, on their own, to qualify IGUs for structurally glazed applications. Factors such as sealant longevity when exposed to long term ultraviolet light and the structural properties of the sealant to resist wind loads without the support of exterior frame components must be reviewed for these applications.

In addition to the requirements of this standard, IGUs for structural sealant glazing applications should comply with specification ASTM C1369 *Standard Specification for Secondary Edge Sealants for Structurally Glazed Insulating Glass Units*, guide ASTM C1249 *Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications*, and test method ASTM C1265 *Standard Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications*.

There are third party testing and certification programs that verify compliance to the standard. Insulating Glass Manufacturers may find it beneficial to obtain a certification through one of these available programs.

A user's guide is found in Annex D as an aid in the application of this standard.

Canada, like many regions around the world, is experiencing the impacts of climate change. These effects include increased wildfires, flooding, stronger winds as well as other extreme weather events that are affecting ecosystems and communities across the country. Users of this standard are encouraged to assess the environmental conditions specific to their location. For further guidance on climate resiliency, please refer to Annex E.

Some quantities and dimensions used in this standard are given in SI units with imperial equivalents shown in brackets, where appropriate. All imperial measurements are industry standard nominal measurements. All metric references are closest conversions to industry standard, and, unless otherwise specified, have been rounded to the nearest appropriate unit. Unless otherwise stated, standard industry tolerances apply. In the event of a dispute, the imperial units are regarded as being official.

The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

2 Normative references

The following normative documents contain provisions that, by reference in the text, constitute provisions of this National Standard of Canada.

Note: The contact information provided below was valid at the date of publication of this standard.

An undated reference is to the latest edition or revision of the reference or document in question, unless otherwise specified by the authority applying this standard. A dated reference is to the specified revision or edition of the reference or document in question.

2.1 Canadian General Standards Board (CGSB)

CAN/CGSB-12.1 — *Safety glazing*

CAN/CGSB-12.20 — *Structural Design of Glass for Buildings*

2.1.1 Contact information

The above may be obtained from the Canadian General Standards Board. Telephone: 1-800-665-2472. Email: ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site: https://www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html.

2.2 ASTM International

ASTM C1036 — *Standard Specification for Flat Glass*

ASTM C1249 — *Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications*

ASTM C1265 — *Standard Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications*

ASTM C1369 — *Standard Specification for Secondary Edge Sealants for Structurally Glazed Insulating Glass Units*

ASTM E546 — *Standard Test Method for Frost/dew Point of Sealed Insulating Glass Units*

ASTM E2188 — *Standard Test Method for Insulating Glass Performance*

ASTM E2189 — *Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units*

ASTM E2190 — *Standard Specification for Insulating Glass Unit Performance and Evaluation*

ASTM E2649 — *Standard Test Method for Determining Argon Concentration in Sealed Insulating Glass Units Using Spark Emission Spectroscopy*

2.2.1 Contact information

The above may be obtained from ASTM International. Telephone: 1-877-909-2786 (USA and Canada). Web site: https://www.astm.org.

2.3 Fenestration and Glazing Industry Alliance (FGIA)

IGMA TB-1200 *Guidelines for Insulating Glass Dimensional Tolerances*

2.3.1 Contact information

The above may be obtained from U.S. – Headquarters. Telephone: (847) 303-5664. 1900 E. Golf Rd., STE 1250 Schaumburg, IL 60173 at https://fgiaonline.org.

2.4 National Research Council of Canada

National Building Code of Canada - Part 4: Structural Design

2.4.1 Contact information

The above may be obtained from the National Research Council Canada at http://www.nrc-cnrc.gc.ca/eng/publications/codes_centre/codes_guides.html.

3 Terms and definitions

For the purposes of this National Standard of Canada, the following terms and definitions apply.

baseline set
a set of specimens, submitted for testing to this specification, all fabricated at the same time, with the same insulating glass construction (same sealants, same spacer, same glass thickness, same cavity thickness, etc.) but without internal components.

cavity
the space within an insulating glass unit created by the sealing system where water vapour is controlled to prevent the formation of condensation. Cavities may be air-filled or inert gas-filled.

durability testing
For the purposes of this standard, durability testing refers to weather cycling and high humidity testing.

fog
visible deposits present after testing in accordance with ASTM E2189 *Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units* that were not present prior to testing. Fog does not include defects in a glass coating or the glass substrate when examined prior to testing.

frost/dew point
The saturation temperature of a vapour at a given pressure. For IGUs, it is the temperature at which liquid water, or frost begins to appear on the interior cavity surface of an insulating glass unit.

hybrid VIG insulating glass unit
a insulating glass unit with one of the monolithic glass lites replaced with a VIG unit. This standard specification does not apply to VIG unit performance and durability other than as one of the lites in an insulating glass unit.

insulating glass unit
a preassembled unit, comprised of lites of glass, which are sealed at the edges and separated by dehydrated space(s), intended for vision areas of buildings.

internal components
the components in an insulating glass unit that do not contribute to water vapour control or gas retention of the cavity. Internal components may be decorative such as false muntins or brass caming, or may be functional such as internal blinds.

lites
layer of glass in an insulating glass unit, also called pane (sometimes referred to as “light”), or a term for a single pane of glass used in either monolithic or insulating glass units.

safety glazing materials
glazing materials so constructed, treated, or combined with other materials that, if broken by human contact, the likelihood of cutting or piercing injuries that might result from such contact is reduced.

sealing system
the components of an insulating glass unit that together function to create the cavity and control cavity water vapour content. Sealing system components typically include a spacer, a desiccant, and sealant(s).

separator (spacer)
The linear material that separates and maintains the space between the glass surfaces of insulating glass units.

tempered glass
glass of any shape that has been subjected to a thermal treatment process characterized by uniform heating followed by rapid uniform cooling to produce compressively stressed surface layers.

Note: For the purposes of this standard, tempered glass refers to fully tempered glass pursuant to ASTM C1048 *Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass***.** See 4.2 for further information.

vacuum insulating glazing (VIG)
A fabricated assembly of at least two lites of glass, hermetically sealed at the edges, with a narrow, highly evacuated space which is typically created by spacers (also known as "pillars")

4 General requirements

4.1 Size[1]

4.1.1 Maximum size

The insulating glass units shall have size limitations as specified in Part 4 of the National Building Code of Canada, CAN/CGSB-12.20, and by provincial, municipal or other authorities having jurisdiction.

4.1.2 Tolerances

The tolerances on length and width dimensions and the cavity width of IGUs shall comply with IGMA TB-1200 *Guidelines for Insulating Glass Dimensional Tolerances* and applies only to rectangular shapes.

4.2 Glass Type

The glass used in the units shall be in accordance with CAN/CGSB-12.1 — *Safety glazing* and/or ASTM C1036 *Standard Specification for Flat Glass*. The interior cavity glass surfaces of the units shall be clean and there shall be no sealant at a distance greater than 3 mm above the separator[2].

4.3 Separators

The separators shall be made of a corrosion-resistant material.

[1] These sizes apply to units that are sold commercially and not to the test samples detailed in clause 5.
[2] A "separator" may also be known as a "spacer".

4.4 Marking

Each unit, regardless of participation in a certification program, shall be legibly and permanently marked (e.g., etched or sandblasted) on the glass or on the separator, so that the marking is visible after installation of the unit:

- the manufacturer's name or tradename
- plant location
- year of manufacture
- If applicable, the certification program trademark

Note 1: Further details and information by the manufacturer are permitted.

Note 2: Abbreviations, codes or other marking formats may be used for the required labeling, as long as the abbreviated manufacturer's name and location still clearly identify the manufacturer and its location.

4.5 Temporary cavity venting

Where transportation of sealed units involves shipping through significantly different altitudes from that of manufacture, the unit cavities may at the manufacturer's discretion be temporarily vented to allow for pressure equalization during transport. They shall be resealed upon arrival at the job site by the manufacturer or authorized representative.

5 Detailed requirements

Performance requirements of test specimens

5.1 Initial frost/dew point

Determine the initial frost/dew point for six specimens in accordance with 6.3.1.

5.2 Initial argon gas concentration (if applicable)

Gas concentration testing for argon shall be in accordance with ASTM E2649 *Standard Test Method for Determining Argon Concentration in Sealed Insulating Glass Units Using Spark Emission Spectroscopy*. Argon-filled units shall be filled by standard manufacturing procedures to an average minimum volume of 90% of argon gas. Six test specimens will be selected for the durability testing (high humidity and weathering). New test specimens shall be submitted when the average concentration of argon gas for the six units does not meet the minimum concentration of 90%. Report the percentage of argon gas.

For triple-glazed IGUs, each outside cavity is measured for initial gas content before the first high humidity and final gas content after the final high humidity. The gas concentration will be measured for both cavities.

5.3 Quadruple-glazed units with interior glass lites

Each specimen will be constructed with 4 lites and 3 cavities. The two interior lites shall include openings for pressure equalization and cavity gas concentration equalization across the cavities. The low-e coating will be on surface #3 and #6.

Each outside cavity is measured for initial gas content before the first high humidity and final gas content after the final high humidity. The cavity equalization drill holes allow for the equalization of the gas content across the three airspaces of the unit.

Note: One method for providing openings for pressure equalization is to drill a 3 mm hole with a diamond tipped bit into each of the interior lites. The cavity equalization drill holes should be located on the long centerline of each interior lite, 30 mm from the sightline, or 38 mm from edge of glass. This allows for gas content equalization and establishes an edge seal pressure consistent with the requirements of this standard.

5.4 Volatile fogging

The two specimens not used for durability testing shall show no evidence of fogging or residue when tested and viewed in accordance with 6.3.2.

5.5 Final argon gas concentration (if applicable)

After determining the final frost/dew points of the six test specimens for durability, measure the argon gas concentration of each of the same six specimens. The argon gas concentration shall be measured using either Test Method ASTM E2649 or gas chromatography (See Annex A).

For triple-glazed units, the argon gas concentration shall be determined for all cavities. Any cavity of a multiple-cavity IGU that measures <50% would be considered a failure of the specimen. The average of all cavities shall be calculated for both initial and final gas concentration.

The pass/fail criteria for final gas concentration shall be greater than 80% with no test specimen less than 50%.

See 5.3 for Quadruple-glazed units.

5.6 Frost/dew point, after durability testing

The six specimens shall not show a frost/dew point temperature warmer than -40 °C when tested in accordance with 6.3.3.

6 Inspection

6.1 Sampling

The extent of sampling for routine acceptance inspection and testing shall be left to the discretion of the inspection authority, unless otherwise specified. The test samples for complete inspection and testing shall consist of the following:

- One set of specimens consisting of at least 12 insulating glass units, 14 test specimens for triple-glazed and 18 for quadruple-glazed test specimens with outside dimensions of 355 mm x 505 mm (± 6 mm) per 6.1.1 and hermetically sealed cavities. If the units are to be tested for argon gas concentration, then all the specimen units in the set shall be filled with argon gas.

- All test specimen lites shall be optically transparent sheet or float glass with or without a coating to facilitate frost/dew point measurements. Surface #3 and #6 shall be coated for quad-glazed units

  Note 1: the dimensions for test IGUs and thickness of glass lites is based on research at the National Research Council of Canada, the Norwegian Building Research Institute (merged with SINTEF, January 2006), and PPG Industries in the 1960s. The failure rate of such units during laboratory weathering tests correlated well to the failure rate of IGUs installed in buildings and exposed to natural weathering cycles. Decades of subsequent experience with the CAN/CGSB-12.8 test program have shown that the testing of such units is sufficient to predict successful in-field performance of IGUs, even though the test size is often very much smaller than IGUs installed in the field.

  Note 2: If the required glass constructions as listed in 4.1 are not available from the submitting manufacturer, then thicker glass or wider cavities, or both, shall be allowed. (For example, using 6 mm nominal glass with 12 mm cavity.). This may result in a more rigorous test.

  Note 3: Although the specimens are as detailed above, the results of the tests are considered to be valid for units with a larger number of coated lites than allowed above.

6.1.1 Test specimen size

Each test specimen shall measure 355 x 505mm (± 6mm).

6.1.2 IGU specimen construction

- Double-glazed : 4mm nominal glass with 12mm cavity or 5mm nominal glass with 6mm cavity.
- Triple-glazed: 4mm nominal glass with 6mm cavities.
- Quadruple-glazed: 4mm nominal glass with 6mm cavities.
- An exception is made for the gap width of VIG where the gap is per manufacturer specification.
- Cavity tolerance shall be 2.5 mm.

The overall thickness of a sealed unit for testing shall not exceed 40 mm to accommodate existing apparatus. The specimens shall be fully representative of manufacturer's standard production units with regard to design and construction.[3]

6.2 Optional cavity pressure balancing

The units made at an altitude significantly different from that of the testing laboratories (e.g., more than 600 m) may be balanced at the test location at 23 °C ± 3 °C and to an ambient atmospheric pressure and humidity, if desired by the manufacturer. This is accomplished by venting the sealed cavity to the atmosphere, allowing the pressure equilibrium to be established and then resealing by the manufacturer or authorized representative. Specimens are to be tested after a minimum of four weeks from date of manufacture to allow for stabilization.

6.3 Testing

All specimen units shall be inspected upon receipt by the testing agency and broken units shall be removed from the set. Any other damage or flaws shall be recorded. The required number of specimen units shall be randomly selected and numbered for testing. The units shall be conditioned at room temperature (23 °C ± 3 °C) for not less than 24 h before testing. The units with temporary edge channels or caps intended for handling purposes shall have these removed for the durability testing and volatile fogging tests. The adhesively bonded edge protectors shall remain on the units during testing. Whenever the specimens are not under test, they shall be stored in a vertical position, resting on the longer side with all lites supported. No stickers or labels, other than those of the inspection and/or testing agencies, shall be affixed on the test specimens. A suggested sample data sheet is shown in Table 1.

Annex C, Rapid Assessment Chamber (RAC), provides information about a new, proposed testing methodology developed by Administrative Management Services (AMS) on behalf of the Insulating Glass Certification Council (IGCC).

6.3.1 Frost/dew point determination

Frost/dew point determination shall be in accordance with ASTM E546 *Standard Test Method for Frost/dew Point of Sealed Insulating Glass Units*.

The frost/dew point, ± 1 °C, is the temperature at which a faint deposit of frost or condensation occurs. The frost/dew point shall be determined for both cavities of the triple-glazed units[4] and the outside cavities of quad-glazed units.

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[3] Further specimens may be requested, at the discretion of the inspection authority, for the inspection of the construction details.

[4] It is recommended that the outer surface(s) of the glass be wiped with alcohol to facilitate viewing of the condensation area.

Table 1 – Sample data sheet for this specification

Manufacturer ____________ Date Code ____________ Report No. ____________

Address ____________

Attention ____________ Telephone No. ____________

Description of Test Specimens:

Size (width by height) ____________ Glass thickness and type ____________

Type of Spacer and Finish ____________

Type and Amount of Desiccant ____________

Type of Sealant(s) ____________

Other Features (band, barrier coat, corner, etc.) ____________

Manufacture Date (month/year) ____________

Date Received at Laboratory ____________ Date testing Started ____________

	CAN/CGSB-12.8 Fogging Test		Initial Measurements				CAN/CGSB-12.8 Weathering and Gas Filling Intermittent Measurements (1)				Intermittent Measurements (2)				Final Measurements			
							Post 1st High Humidity Phase (14 days)				Post Weather Cycle Phase (252 cycles)				Post 2nd High Humidity Phase (28 days)			
	(7 Days)		Frost/dew Point		Ar Concentration		Frost/dew Point		Ar Concentration		Frost/dew Point		Ar Concentration		Frost/dew Point		Ar Concentration	
	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)	Cavity 1	Cavity 2 (if reqd.)
Test Unit #	Fog Present Yes/No	Fog Present Yes/No	◦C	◦C	%	%	◦C	◦C	%	%	◦C	◦C	%	%	◦C	◦C	%	%
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
					(Ave. of all cavities)				(Ave. of all cavities)				(Ave. of all cavities)				(Ave. of all cavities)	
					Initial Ave. Ar Conc.												Final Ave. Ar Conc.	

Note: Table 1 reprinted, with permission, from ASTM E2190 *Standard Specification for Insulating Glass Unit Performance and Evaluation,* copyright ASTM International. A copy of the complete standard may be obtained from www.astm.org.

6.3.2 Volatile fogging testing (VFT) without internal components

Mount two of the selected specimens within a volatile fog test apparatus similar to that shown in Figures 1a and 1b. For units with low-e coatings, the cold plate shall be located on the low-e coated lite. Maintain the sealed unit top edge temperature (the edge location shown in Figure 1b) at 58 °C ± 3 °C. The box shall be equipped with a small circulating fan so that the maximum temperature gradient across the lower face of the unit shall not exceed 12 °C. The maximum air temperature within the box shall be maintained within 60 °C ± 3 °C. Maintain the temperature of the cooling water at 22 °C ± 3 °C. Determine the temperature of the cooling water immediately where it leaves the test apparatus (as seen in Figure 1b).

The voltage to the lamp shall be 230 +/- 10 VAC[5]. Randomly select two double-glazed units or four triple-glazed/quadruple-glazed units for testing. For double-glazed units with low-e coatings, the cooling plate shall be placed on the low-e coated lite. For triple-glazed/quadrupled-glazed units both cavities shall be tested (two units shall be tested with the exterior lite, two units shall be tested with the interior lite). Expose the units for seven days, then remove them from the apparatus. Clean both sides of the units using a suitable glass cleaner if necessary to remove any scum or marks from the glass. Standing 1 m from the viewing box, evaluate the specimens for the presence of fog in the viewing box as shown in Figures 2a and 2b, in such a way that the observer views the unit through the surface on which the cooling plate was placed during the volatile fogging tests. View the specimen to any angle necessary using both reflected and transmitted light to thoroughly check the surface of the glass for fogging. For optimal inspection, darken the room, if needed, to eliminate glare on the unit. With the box lamps turned on, stand 1 m directly in front of the test unit so that the mid-height of the unit is at your eye level. Carefully observe the interior (cavity) glass surface from all angles, not just perpendicular to the lite, for any signs of fogging, or other residue. The observer shall observe the unit at any angle necessary, using both reflected and transmitted light, to thoroughly check the surface of the glass for fogging. Wipe the exterior glass surfaces with alcohol to confirm that the residue is located on the interior surfaces. If one specimen fails this test, two other units shall be tested, and both shall be required to pass.

If fog is observed, record. Store the units for 24 h at room temperature. After 24 h, re-examine the units. If fog is not observed, record and the test is complete. If fog is observed at the 24 h mark, record. Store the units for an additional six days. After day seven, re-examine the units. If fog is observed, record. Whether fog is observed or not, the test is complete.

If internal components are to be tested, the procedures in Annex B shall be followed.

6.3.3 Initial high-humidity test

Following initial frost/dew point readings, place six of the selected specimen units in a humidity cabinet (initial high humidity) and expose them to humid air flow induced by water sprayed between the cabinet wall and a baffle (see Figure 3). Leave at least 6 mm (1/4 in) clearance all around each unit.

Expose the test specimens at 60 °C ± 3°C and 85% to 95°% relative humidity for 336 h test ± 8 h (14 days)

6.3.4 Weather cycling test

Place the same six selected specimen units in a laboratory weathering apparatus as described in ASTM E2188, and as shown in Figures 4a and 4b, so that one exterior surface of the units is exposed to the weather cycling conditions. Install the units without glazing compound so that the edges are exposed to the weathering conditions, taking care that no stress is induced in the units by the method of fastening.

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[5] The ultraviolet lamp may be an Osram Ultra Vitalux 300 W lamp, or an equivalent product, with an UV output of a minimum of 0.4 mW/cm^2 when measured at a distance of 300 mm with a sunlamp tester or an equivalent instrument such as a radiometer unit with UV x 36 probe. The UV output is checked at the beginning of each test.

Equip the accelerated weather cycle chamber with one or more temperature sensors and a continuous temperature recording device placed in an area that measures the representative air temperature at any time inside the chamber.

The 252 test cycles shall consist of the following:

- 60 ± 5 min decrease room temperature (23°C ± 3 °C) to cooling -29 ± 3 °C;
- 60 ± 5 min maintain -29 ± 3◦C
- 60 ± 5 min raise to room temperature (23°C ± 3 °C);
- Start 60 min water or mist supply;
- Start UV for 90 min;
- 60 ± 5 min raise to 60 ± 3 °C;
- 60 ± 5 min maintain 60 ± 3 °C;
- 60 ± 5min decrease to room temperature (23°C ± 3 °C).

6.3.5 Final high humidity test

Following the completion of the weather cycling test, dew point measurement and argon gas concentration measurement, place the units in the high humidity cabinet and expose them to humid air flow in following the same procedure as specified in 6.3.3.

Expose the test specimens at 60 ± 3°C and 85 to 95% relative humidity for 672 h test ± 8 h (28 days).

6.3.6 Glass breakage

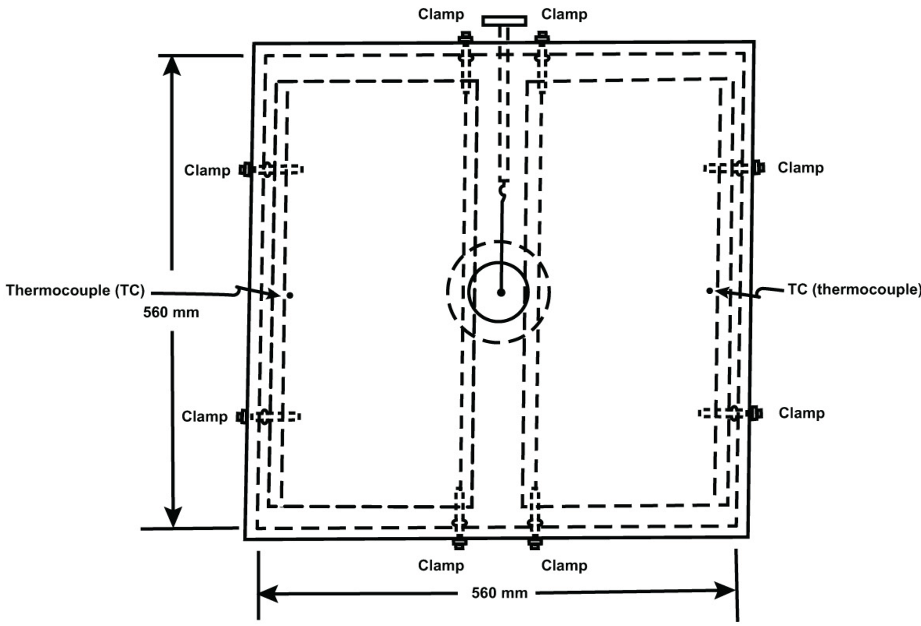
A maximum total of two specimens with glass breakage (not including any breakages occurring during the volatile fog test) is permitted in the weather cycling and high-humidity cycling tests described in 6.3.3 and 6.3.5.

The glass breakage of any unit under test shall not constitute a failure. The broken unit shall be freely replaced and the test restarted for with the replacement unit.

The units with glass breakage occurring during the first 50 cycles shall be replaced with new units and the cycle count then continued. The units with glass breakage occurring after 50 cycles shall be replaced with new units and the cycle count restarted for the replacement units. Remove the units from the apparatus after cycling and condition for not less than 24 h at 23 ± 3 °C before measuring the final frost/dew point as described in 6.3.1.

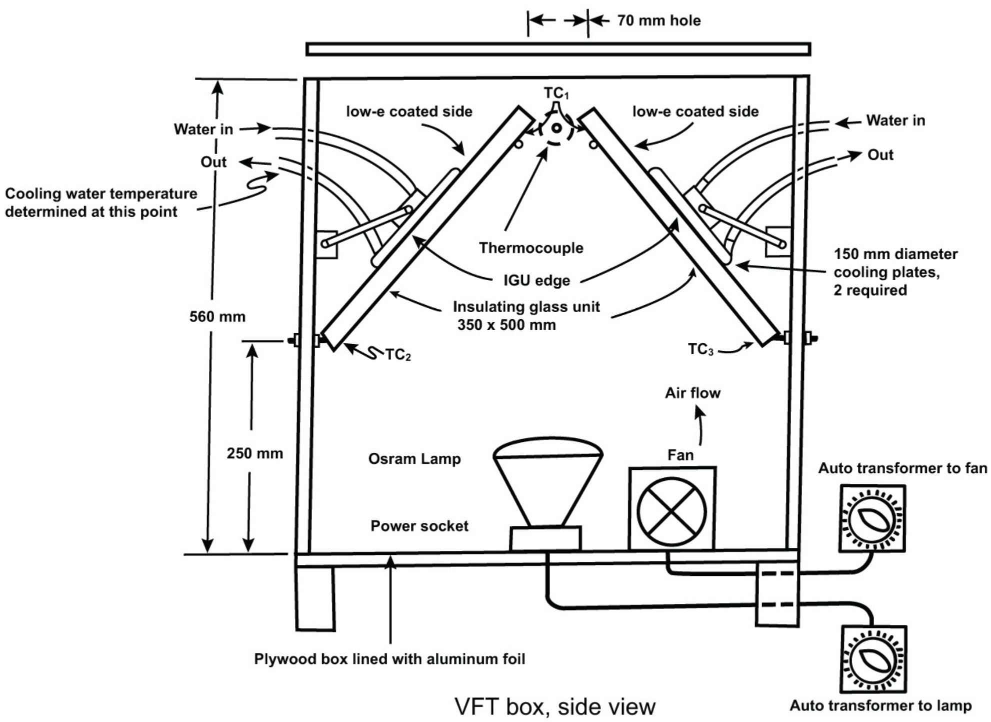
For locations of ultraviolet light source refer to figure 4b.

Figure 1a



VFT box, top-down view

Figure 1b

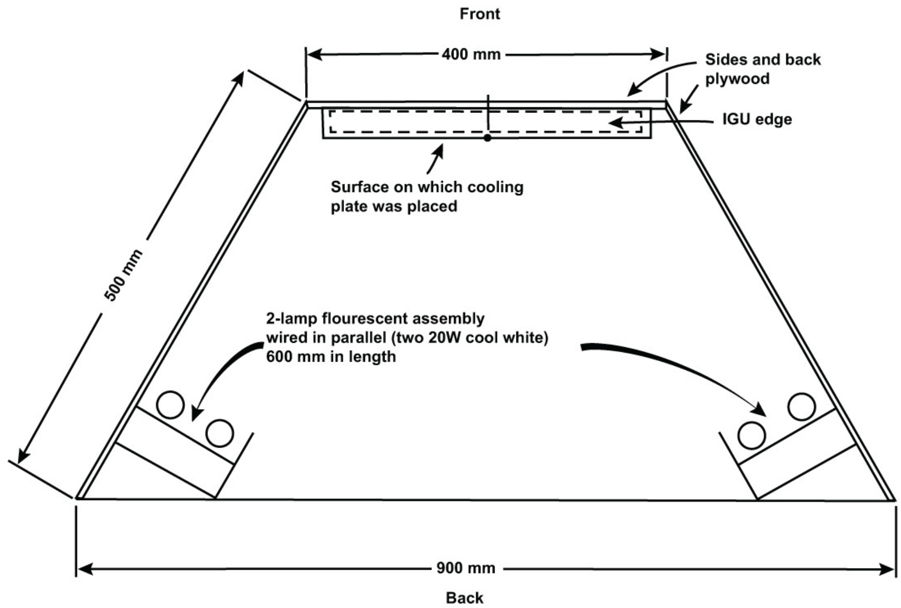


VFT box, side view

Figure 1 — Volatile fogging exposure box

Viewing box for volatile fogging exposure test

Figure 2a: viewing box, top-down view



NOTE: view the unit through the surface on which the cooling plate was placed during the volatile fogging test

Figure 2b

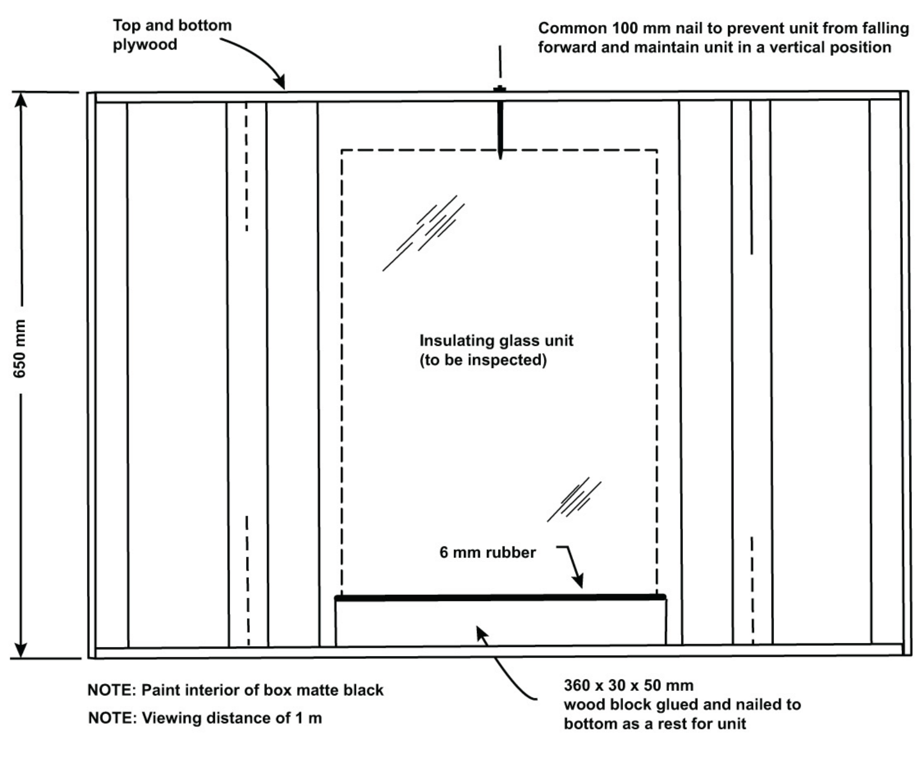


Figure 2 ─ Viewing box for volatile fogging exposure test

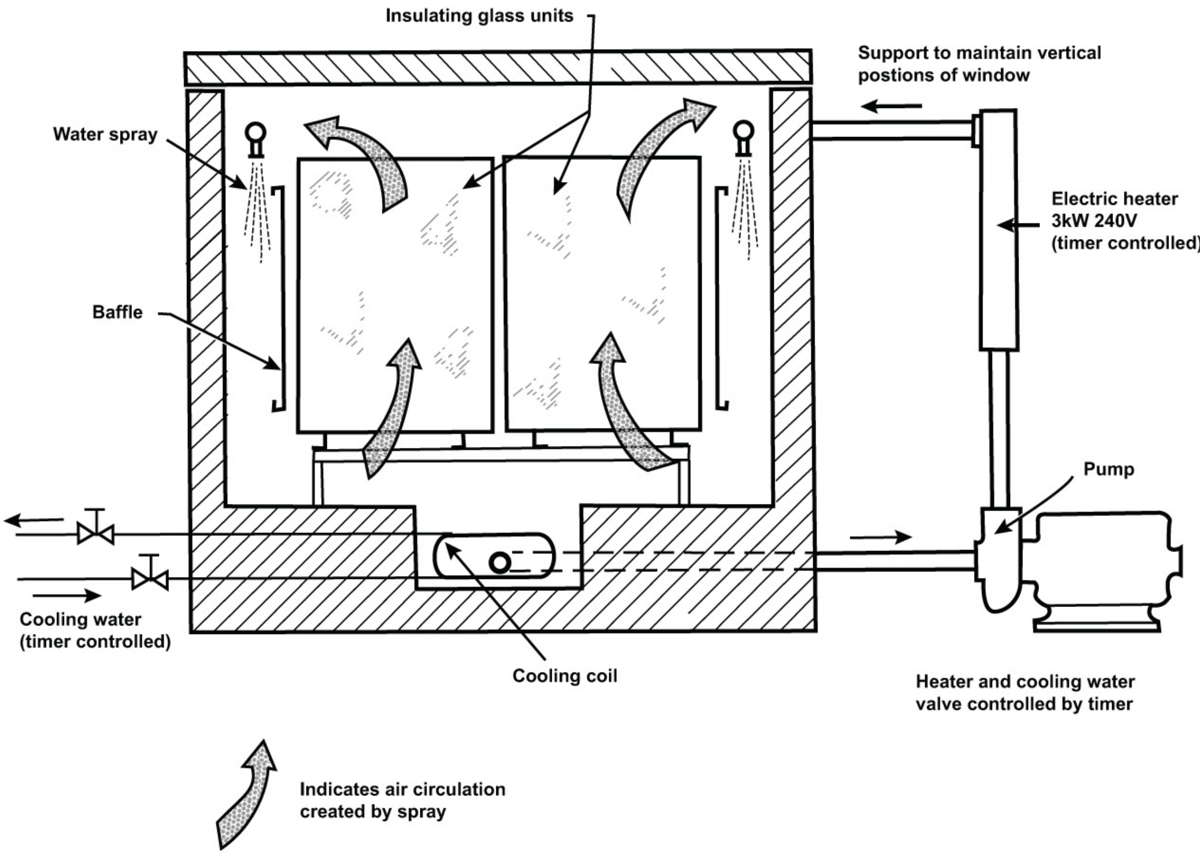


Figure 3 ─ High-humidity cycling cabinet

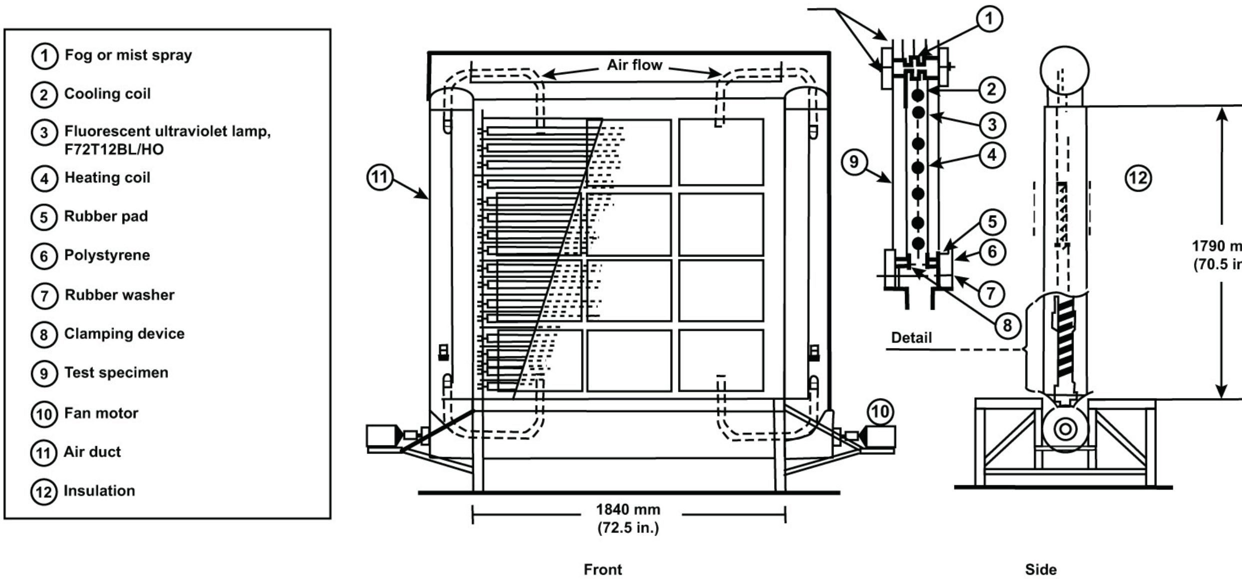


Figure 4a ─ Schematic Drawing of Typical Accelerated Weathering Chamber

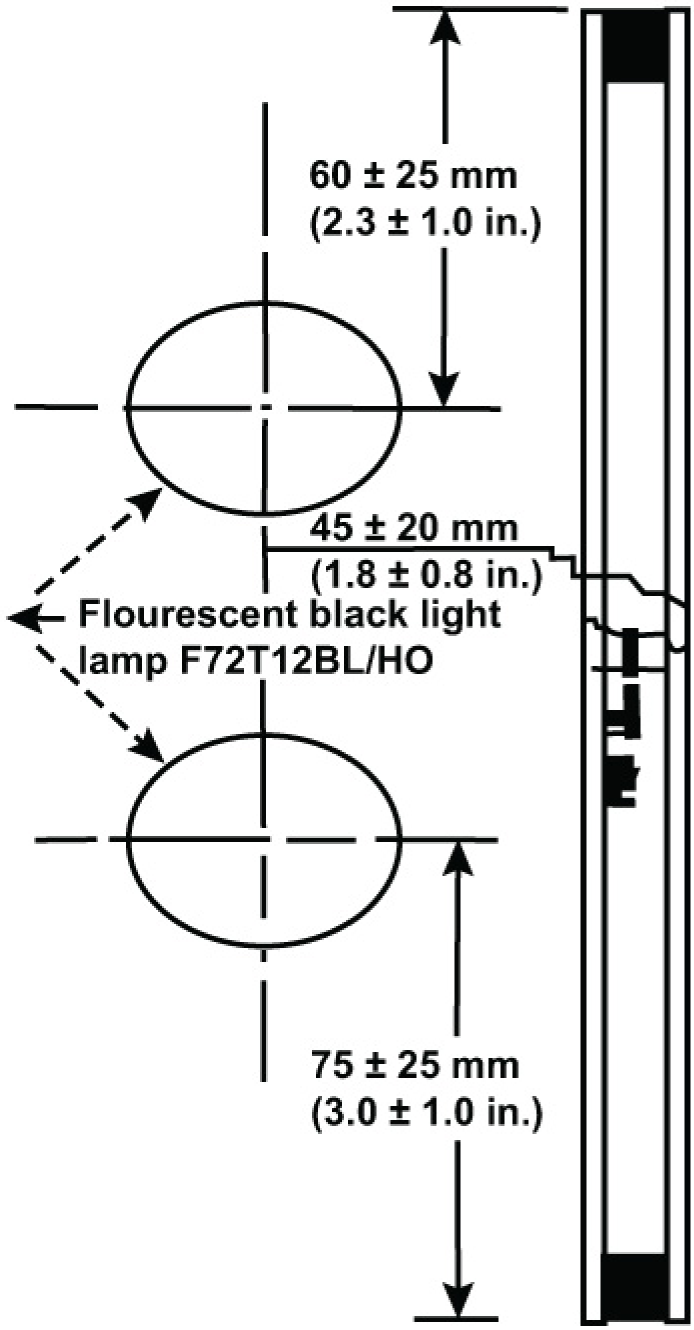


Figure 4b - Location of Fluorescent Ultraviolet Lamp Relative to the Test Specimen

Note: Figures 4a and 4b reprinted, with permission, from *ASTM E2188 — Standard Test Method for Insulating Glass Performance*, *,* copyright ASTM International. A copy of the complete standard may be obtained from www.astm.org

Annex A
(normative)
Test method for the determination of gas content other than argon concentration[6]

A.1 Introduction

Noble gases, nitrogen and oxygen are physically separated by gas chromatography and compared to corresponding components separated under similar conditions from a reference standard mixture or mixtures of known similar composition. The composition of the sample shall be calculated from its chromatogram by comparing the area under the curve of each component with the area under the curve of the corresponding component on the reference standard chromatogram.

A.2 Apparatus

Gas chromatograph: consists of a gas sampling valve[7] (100 to 250 µL capacity), an adsorption column (Haysep® DB[8], or equivalent), a thermal conductivity detector (TCD) and an integrator. The apparatus shall separate the noble gas, oxygen and nitrogen as indicated by the return of the recorded peak to the baseline between each successive peak. This is generally done at sub-ambient temperatures (e.g.,-30 °C). The chromatograms shall be reproducible so that successive runs of a reference standard agree on each component peak area within ± 0.1%.

A.3 Reagents and materials

A.3.1 Materials

A cylinder of Helium carrier gas, a cylinder of compressed air for valve actuation, a cylinder of liquid CO_2 with a dip tube for cooling the column oven, and a 10 mL gas tight syringe.

A.3.2 Reference standard mixtures

These are gas mixtures that contain known percentages of the specific noble gas, oxygen, and nitrogen that are required for calibration purposes. The concentrations of each component in the reference samples must encompass the expected concentration range of the corresponding component in the tested samples. The suitable standard mixtures can be obtained with a certificate of analysis of each mixture, from reputable commercial supplier. The accuracy of the results depends upon the availability of accurate calibration standards.

A.4 Calibration and standardization

A.4.1 Apparatus preparation

Prepare the gas chromatograph for use as directed by the manufacturer. The following operating conditions have been found to be satisfactory for this application however, any combination of conditions that result in a complete separation as indicated in the apparatus section is also satisfactory.

[6] This test method was developed by the National Research Council (NRC) – Institute for Research in Construction (IRC) in cooperation with the Insulating Glass Manufacturers Association of Canada (IGMAC).
[7] The gas sampling valves offer a precise way of introducing the gas samples into the gas chromatograph.
[8] The Haysep® DB adsorption column can be purchased from Hayes Separations Inc., P.O. Box 1674, Bandera, TX 78003, U.S.A. Telephone: 830-796-4512. Hayes Separations Inc. Profile

Carrier gas	Helium, 30 mL/min.
Column	Haysep® DB,
	100 – 120 mesh
Column size	9.1 m by 3.2 mm (nominal) stainless steel
Column (oven), temperature	30 °C
Sampling loop temperature	100 °C
Detector temperature	105 °C
Sample volume	250 µL

A.4.2 Reference standard introduction and separation[9]:

Fill the 10 mL gas-tight syringe[10] from the cylinder containing the reference standard. Remove the syringe from the cylinder outlet and evacuate the syringe to purge any contaminants that it may have contained; then refill the syringe with the reference standard gas. Close the syringe valve and remove it from the cylinder. Introduce the reference standard sample(s) into the gas chromatograph sampling port, as outlined in section A.5.

A.5 Test procedure

Introduction and separation

Using the gas-tight syringe, insert the needle in the in-situ sampling (Santoprene[11] or equivalent) plug of the IG unit. Fill the syringe with the interspace gas then flush its contents back into the gas space. Repeat the flushing twice and fill the syringe barrel with a gas sample by withdrawing the plunger (slowly) as far back as it can go. Close the syringe valve and carefully grip the needle at its base and pull it out of the gas space. Insert the needle into the gas sampling inlet and open the syringe valve. Inject the contents of the syringe into the column via a septum connected at the inlet of the gas sampling valve and record the chromatogram[12]. Under the conditions listed above, the approximate elution times are nitrogen at 7.8 min, oxygen at 8.8 min and argon at 9.2 min.

[9] The standardization is to be repeated daily or more often if chromatograph operating conditions are changed.

[10] Although the volume of the gas sampling loop may be a few hundred microlitres or less, a sufficient volume of the reference sample gas passes to ensure that all traces of the previous sample have been removed. Twenty times the volume of the valve and the connecting tubing are generally considered adequate for this purpose.

[11] Details of the availability, installation and use of the Santoprene plug may be obtained from the Fenestration Glazing Industry Alliance (FGIA) U.S. – Headquarters, 1900 E. Golf Rd., STE 1250, Schaumburg, IL 60173. https://fgiaonline.org

[12] For the proper operation of the gas chromatograph, and the correct procedure to obtain a chromatogram, refer to the operation manual of the gas chromatograph and the integrator.

Annex B
(normative)
Internal Components

B.1 Baseline testing to CAN/CGSB-12.8 volatile fog test shall be performed on units identical to those fabricated for durability testing (high humidity / weather cycling).

B.2 Sets of three (3) double-glazed, five (5) multiple cavity test specimens shall be constructed for the volatile fogging test as described in this standard or internal component performance testing utilizing all components of an internal components (IC) system, which are used in the ultimate product.

B.3 Only the volatile fogging test as described in this standard shall be required in each of the following categories of internal components. The specific internal component to test in each category shall be worst case product or highest sales volume product, at the IGU manufacturer's discretion:

- Bars, grills or muntins
- Blinds
- Glass or other glazing materials
- Other internal components not in the above categories

B.4 When testing muntins or grills, test samples shall be fabricated dividing the sample into 1 X 1 offset, with 10cm as demonstrated in Figure B.1 Muntin Bar Test Samples Configuration.

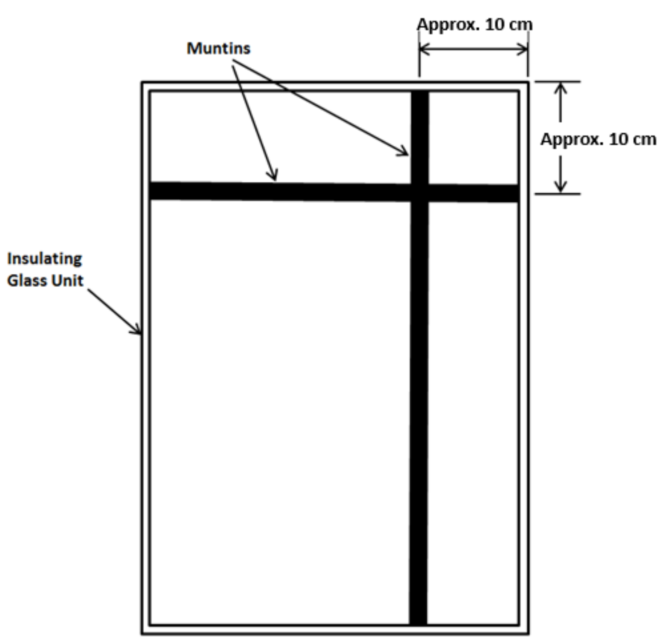


Figure B.1 Muntin Bar Test Sample Configuration

B.5 Cavity Inserts (decorative or other)

Units for IC testing of inserts (glass, film, leaded glass, electrical panels, or other) shall include all components of the insert system. Non-transparent glazing or material should be replaced with transparent material with care taken not to obstruct the center viewing area of the unit. Inserts for fog test units shall approximate inserts used in actual production.

B.6 Grooved Spacer for Internal Components

Some frame/spacer systems are grooved to accommodate the cavity insert but do not generally create two separate sealed cavities and, as such, shall be considered and tested as a single cavity unit. For proper durability testing of these units, the groove may need to be filled and at the fabricator's discretion may use the same insert as the fog test units, a center insert of clear glass, or a simplified center insert. In these cases, the center groove should be filled with an insert of appropriate thickness to support the spacer during testing and compression to help facilitate "wet-out".

B.7 Blinds

Units for IC testing of blinds between the glass lites (BBG) shall include all components of the blind system as would normally be done by the IGU manufacturer, although the blinds do not need to be operational. Components may be placed in the unit with care taken to not obstruct the center viewing area of the unit. Any frame modifications (i.e., holes, clips or brackets for operators) shall be included. Other than cleaning BBG ICs of oils and residue created by cutting or slicing components in correct proportions, BBG ICs used for testing shall not to be treated or shall not undergo processing that differs from normal production processes, i.e., pre-conditioning with high heat or chemical treatments not used in the production process).

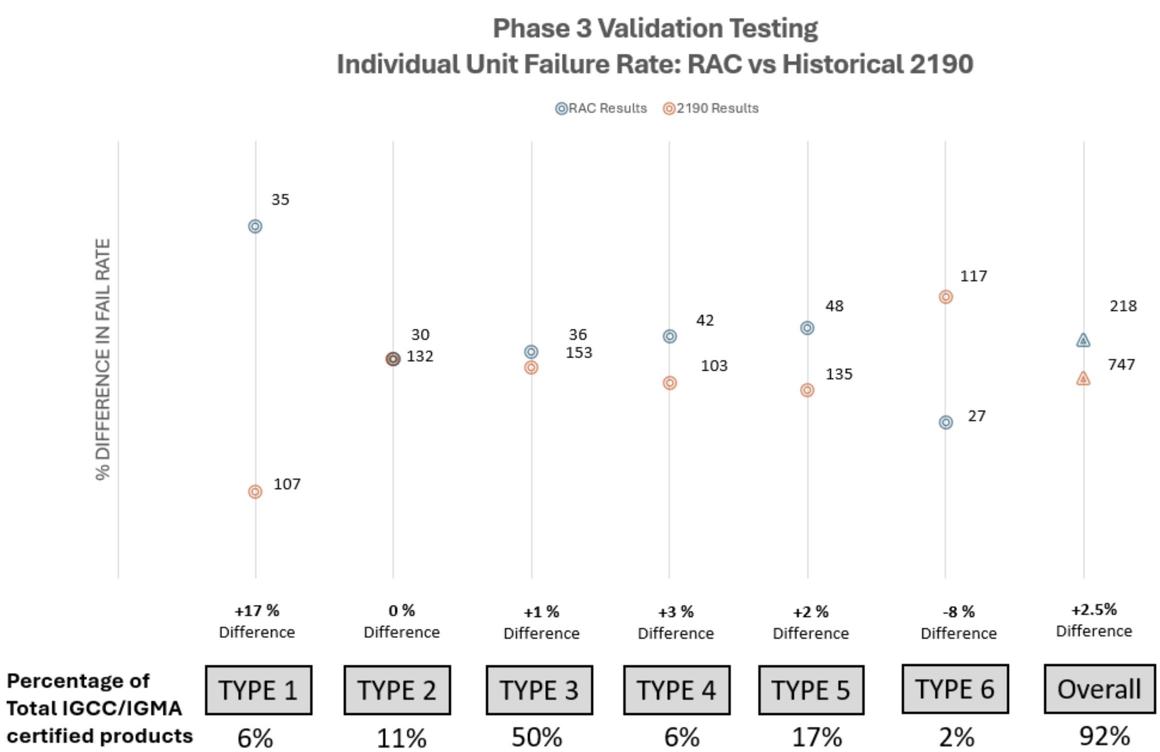
Annex C
(informative)
Rapid Assessment Chamber (RAC)

C.1.1 Developed by the Insulating Glass Certification Council (IGCC), a 501 (c)(3)[13] not for profit organization, the Rapid Assessment Chamber (RAC) was developed, funded and patented by IGCC, with financial and technical support from the Insulating Glass Industry, including the Insulating Glass Manufacturers Alliance (IGMA). The impetus for the development of the RAC was to create a faster, technically justifiable alternative to existing ASTM test methods for the evaluation of Insulating Glass Units (IGUs).

The test procedure is not intended to be an alternative to the evaluation procedure required by this standard at this time.

C.1.2 The RAC has undergone 3 phases of validation to constitute the appropriate parameters of IGU exposure. Phase 1 was a process of optimizing chamber validity within a 14-day test exposure. Phase 2 was a design of experiment (DOE) that utilized various operating conditions to determine testing parameters within the RAC. Phase 3 was a verification process between the phase 2 operating conditions, and the historical pass and failure rates of ASTM E2190. Verification was conducted on 6 IGU types that represent 92% of IGCC's historically certified products, as shown in Table C.1.

Table C.1 – Phase 3 Validation Testing Results

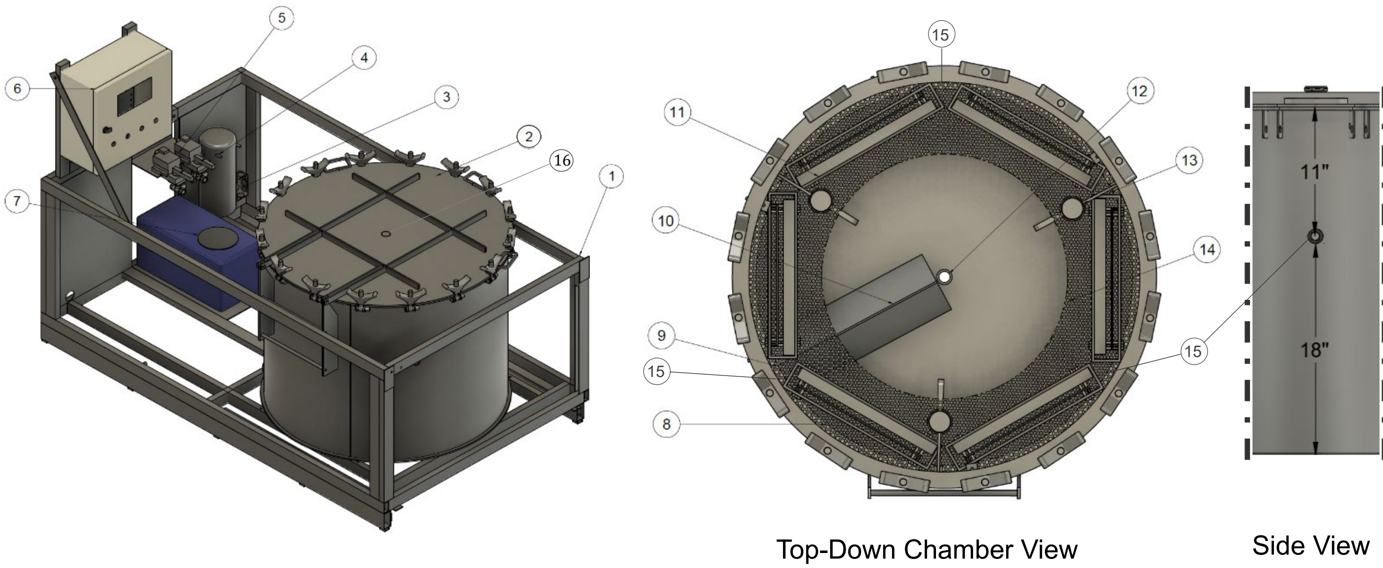


13 The RAC patent is assigned to the Insulating Glass Certification Council (IGCC). Patent _US 11,460,393 B2, October 4, 2022.

C.2 Apparatus

C.2.1 A rapid assessment chamber shall encompass controlled temperature, pressure cycling, high humidity, and UV exposure in a full immersion test providing consistent exposure to each specimen. The apparatus shall be constructed from materials that maintain pressure parameters defined in section C.3.2. An example apparatus is shown in Figures C.1 and C.2.

Note: Figures C.1, C.2, and C.3 and Tables C.1 and C.2 are courtesy of Administrative Management Systems (AMS).



Description: (*1*) Support Frame; (*2*) Rapid assessment chamber (RAC); (*3*) Solid State Relay; (*4*) Compressor; (*5*) Valves; (*6*) Programable Logic Controller (PLC); (*7*) Moisture Drainage Tank; (*8*) Float; (*9*) Heating Element; (*10*) Steam Guard; (*11*) Unit Mounting Support; (*12*) Drain; (*13)* Fluorescent ultraviolet lamp, F24T12/BL/HO; *(14)* Perforated Plate; (15) Temperature Measuring Device; (16) Viewing Port

Figure C.1 Schematic Drawing of Rapid Assessment Chamber & Components

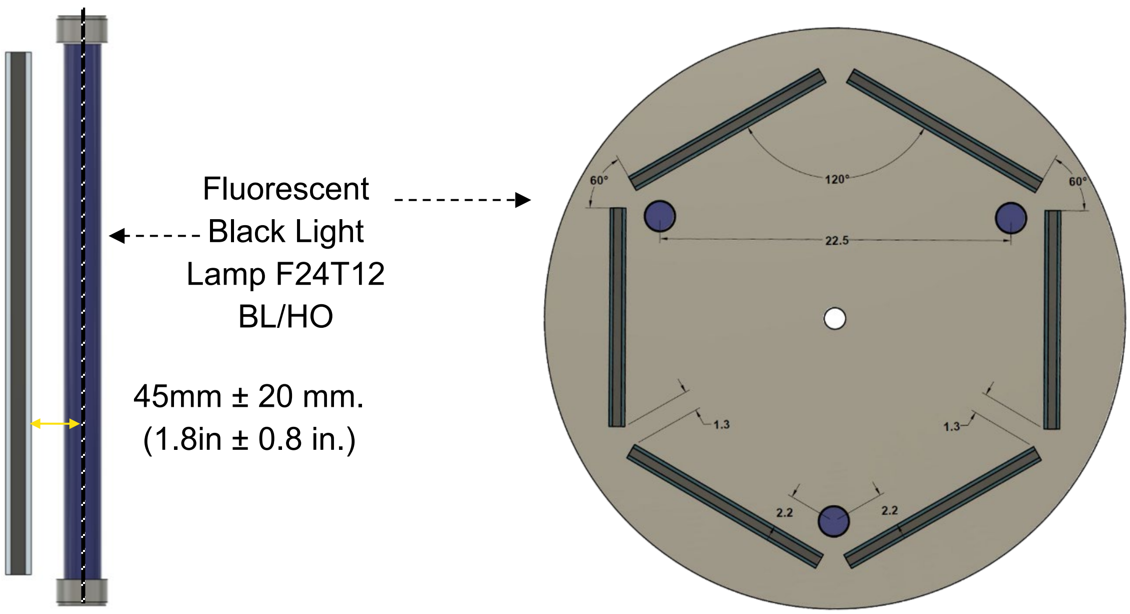


Figure C.2 Location of Fluorescent Ultraviolet Lamps Relative to the Test Specimen

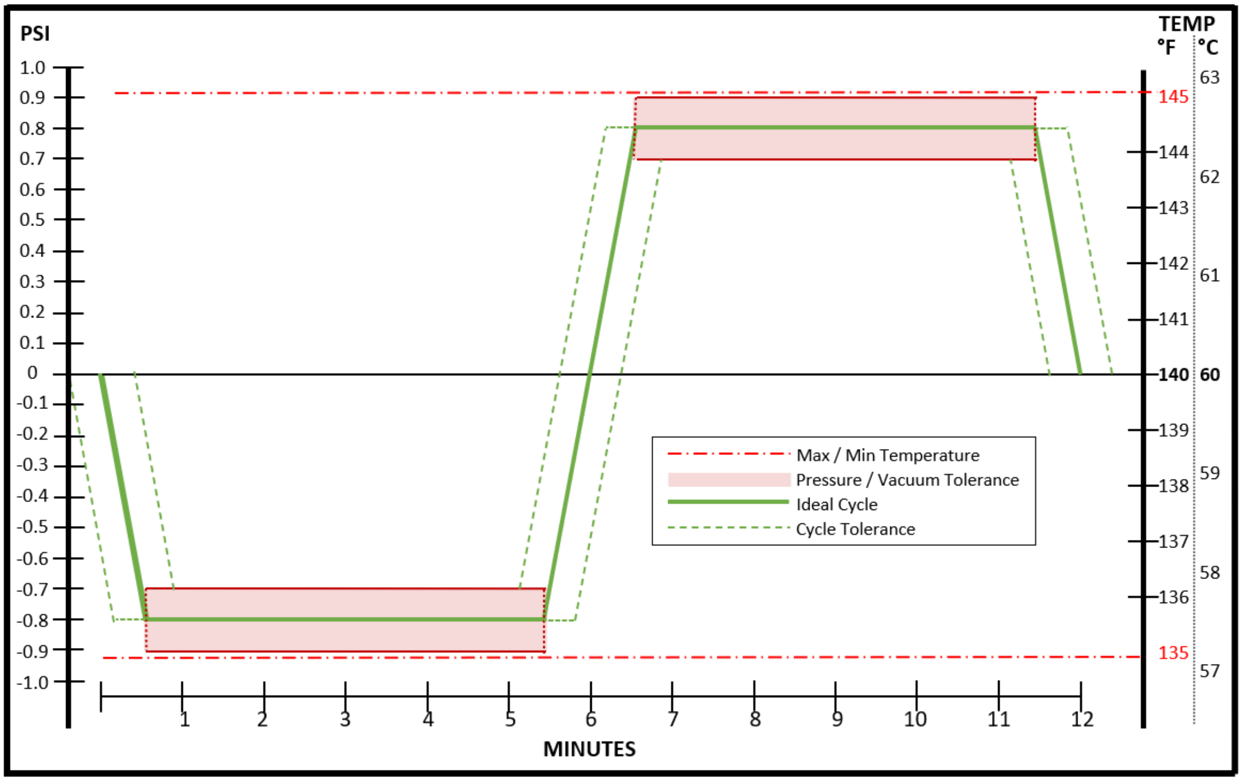
C.3 Test Procedures

C.3.1 Randomly select 6 specimens and determine the initial frost/dew point on all cavities on the specimens submitted using an approved method for measuring argon gas. If argon filling is specified, determine argon gas concentrations of each specimen cavity in accordance with the manufacturer's stated specifications or a minimum of 90% if for certification purposes. For multi-cavity specimens, the argon gas concentration shall be determined for all cavities. Calculate and record the average argon gas concentration of all measured specimen cavities to the nearest whole percent. This is the initial average argon gas concentration for the set.

C.3.2 RAC Exposure Conditions

Place the six randomly selected specimens that were fabricated in accordance with CAN/CGSB-12.8 or ASTM E2190 into the RAC. Ensure they are set vertically into the chamber so as to evenly support the specimens while preventing glass to metal contact.

Expose the six specimens in the RAC to 60°C ± 3°C (140°F ± 5°F), no less than 90% relative humidity, constant UV exposure, and 1,680 pressure cycles. The cycles shall consist of +5.5kPa ± 0.7kPa (+0.8psig ± 0.1psig) and -5.5kPa ± 0.7kPa (-0.8psig ± 0.1psig) with a mean dwell time of at least 5 minutes each. The total time for one cycle shall be 12 minutes ± 30 seconds. One cycle shall be as shown in Figure C.3.



Note: This figure represents the ideal cycle described in this test method. Any pressure or temperature variation within the tolerance zone shown is acceptable.

Figure C.3 Schematic Drawing of Each Rapid Assessment Cycle

C.3.3 Table C.2 demonstrates the testing parameters of ASTM E2188 vs. RAC

Table C.2 - Testing Parameter Comparison – ASTM E2188 vs. RAC

Parameter	ASTM E2190	RAC[a]
Test Specimens		
Width	355 ± 6mm	355 ± 6mm
Height	505 ± 6mm	505 ± 6mm
Number for weathering	6	6
Number for high humidity	Uses same 6	0
Number for volatile fog	2	2
Evaluation Criteria		
Frost point test	E546 with dry ice or CAN/CGSB-12.8 method	E546 with dry ice or CAN/CGSB-12.8 method
Max. frost point	-40 °C	-40 °C
Visible fog	No fog at arm's length	No fog at arm's length
Gas initial	≥90%	≥90%
Gas final	≥80%	≥80%
Gas Test equipment	SES	SES
Accelerated Weather Cycle Test	**ASTM E2188**	**RAC**
high temperature	60 °C ± 3 °C	60 °C ± 3 °C
low temperature	-29 °C ± 3 °C	(constant temperature)
UV source	F72T12BL/HO	F24T12BL/HO
UV output	2000–6000 μW/cm^2	2000–6000 μW/cm^2
moisture	30 min. spray	Steam
%RH	Min. 90%	95% ± 5%
Pressure		+5.5kPa ± 0.7kPa & -5.5kPa ± 0.7kPa
time per cycle	6 hr.	12 minutes

# of cycles	252	1 680
total time	63 days	14 days
Volatile Fog Test	**ASTM E2189**	
Type	Full Immersion box	
Glass temp at corner	50 °C ± 3 °C	
Glass temp at other locations	50 °C ± 3 °C[b]	
Cooling plate temp	21 °C ± 2 °C	
Cooling plate area	0.018m^2 (150mm dia.)	
UV lamp	Osram Ultra Vitalux 300w	
Lamp output	400 $\mu W/cm^2$ @ 355 nm	

a: RAC testing encompasses high humidity and accelerated weathering within one 14-day test.

b: CAN/CGSB-12.8 glass temperatures is 60°C.

Annex D
(informative)
User's guide

D.1 Durability of IGU seal

D.1.1 The standard CAN/CGSB-12.8 deals with the integrity and durability of the IGU seal only without the influence of other building products, actual environmental condition, particular design of the glazing system or the synergistic effects of the different elements present.

D.1.2 Fenestration products (windows, doors, skylights, window walls, curtain walls, etc.) consist of many different components. For fenestration products to perform well, it is appropriate to caution users of insulating glass units against the most common causes of seal failure.

D.1.3 It is well-known in the industry that normal, well-made units using recognized materials will pass the requirements of the CAN/CGSB-12.8 tests without difficulty. However, the same units, if installed in a poorly designed glazing system, if not installed according to good industry practice or if incompatible materials are used, may fail within a relatively short period of time. The most common causes of seal failure in well-made insulating glass units are outlined in Section D.2.

D.2 Common causes for seal failure of IGUs

D.2.1 Water and high humidity

All fenestration products should be designed to keep the unit seals as dry as possible and prevent extended periods of exposure to liquid water. If exposed to liquid water for extended periods of time, all sealed units will fail in a relatively short period of time. The length of time will vary depending on the environmental conditions and the type of sealing system used.

The best defence against water is the use of fenestration products that use the rain-screen principle with a well-drained glazing cavity (to the outside). An air-tight and water-tight seal at the warm, room-side face of the IGU, in combination with drainage to the exterior, reduces the likelihood of wind-driven rain entry into the glazing cavity. On the room side there should be an effective air barrier to prevent warm moist room air from reaching the cool surfaces in the glazing cavity where condensation could occur. A water-tight seal should also be provided on the warm side of the unit to prevent water that has condensed on the interior glass surface during cold winter conditions from draining into the glazing cavity.

A well-vented glazing cavity will also keep the relative humidity around the perimeter of the IGU much lower. The moisture transfer rate through the perimeter sealants of an IGU is much higher from a humid glazing cavity, especially at higher temperatures, which can occur under the influence of solar gain. An elevated moisture transfer rate will shorten the life span of an insulating glass units. The moisture transfer rate through the perimeter sealants of an IGU is much higher from a humid glazing cavity, especially at higher temperatures, which can occur under the influence of solar gain, which can be expected to shorten the life span of an insulating glass unit, regardless of its construction.

IGMA TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use provides guidance on proper IGU installation, frame drainage and venting to promote long IGU life span.

D.2.2 Compatibility of materials

Common materials used for the edge-seals are very durable, however, they all have their limitations and compatibility with other materials that they come in contact with should be assured for proper performance. If in doubt about the compatibility, contact your supplier of insulating glass units. In cases where no data or information exists, compatibility testing should be done. This is usually done by the sealant supplier. The common tests for compatibility are ASTM C510, *Standard Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants*, ASTM C794 *Standard Test Method for Measuring the Adhesion-in-Peel of elastomeric joint sealants*, and ASTM C1087 *Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems*.

D.2.3 UV light and chemicals in the air

Only sealants and other components that have demonstrated that they are unaffected by long-term UV light exposure should be used as the structural sealant between the glass lites of IGUs that are exposed to UV light. Other sealants should be properly shielded from the UV light. Many silicones have shown excellent performance under UV light exposure. No sealants should be exposed to strong chemicals or other highly unusual conditions.

IGMA TM-3000 *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use* includes more detailed guidance on control of UV light and chemical exposure.

If the fenestration product contains solvents or other volatile elements, they will be dispersed much faster in a well-vented glazing system. Certain volatiles may, if long-term exposure takes place, affect the properties and the performance of the materials used for the edge-seal and the sealant-glass bond.Nevertheless, long-term exposure to certain volatiles, even at low concentrations, may affect the properties and the performance of the materials used for the edge-seal and the sealant-glass bond.

D.3 Miscellaneous

D.3.1 The IGU should “float” in the fenestration product glazing cavity. This means that there should be sufficient clearance around the perimeter of the IGU to prevent contact with the frame members during the expansion/contraction of the materials or if there is movement of building, and/or fenestration product components.

D.3.2 There should be no glass to metal (or other hard materials) contact. Only flexible glazing materials (exterior and interior pre-formed gaskets, tapes, etc.) should be in contact with glass edges in order to allow the rotation of glass edges during changes in air space temperature or barometric pressure.

D.3.3 When glazing, apply a known controlled pressure which should not exceed 17.9 Newtons per linear centimetre (10 pounds per linear inch). This is a difficult unit of force to measure in the field so ask for guidance from the fenestration product manufacturer.

D.3.4 For fixed windows and non-operating sashes, use two setting blocks (compatible materials) at 1/4 points with Shore “A” hardness of 85 + durometer. For large widths, where deflection of the horizontal member may be of concern, the setting blocks may be moved to a location not closer than 150 mm from the comers of the insulating glass unit. For side-hinged, operating sashes, setting blocks should be placed 50 mm from the lower hinge comer and 50 mm from the upper non-hinged comer on horizontal and vertical members. Other setting block locations may be appropriate for other fenestration product types.

Annex E
(informative)
Climate Resiliency

E.1 Introduction

The expectation is that in the coming decades, the climate of Canada will become warmer, with some locations experiencing higher wind speed, more intense and frequent rain events, and as a result heightened wind-driven rain loads. The ability of construction materials and built assemblies to continue to perform under changing environmental conditions is called “climate resiliency”.

Users of this standard should be aware that tests noted in the CAN/CGSB glass standards are made at specified conditions of temperature, relative humidity, etc. In-service conditions may be different and could affect the performance of some glass, safety glazing, and insulating glass unit products. Currently, the differences between test and in-service conditions are not considered significant but this could change in the future as the climate changes.

The user should refer to local building codes to ensure compliance with local jurisdiction in selecting the appropriate product for their application based on current climatic design data. Users should also consult with manufacturers of glass products (for example, the manufacturer of an interlayer for laminated glass, or perimeter sealants for insulating glass units) to determine if in-service conditions that are different from test conditions should be taken into account during product selection. Technology is rapidly evolving in the glass industry with constant introduction of new products. Design tools are now available that allow the user to estimate future climatic design data which can be used to discuss with manufacturers future possible service conditions in order to select the appropriate product for the intended application.

Users of the CGSB glass standards should note that each standard has a limited scope. The test methods are intended to address specific performance aspects. For example, CAN/CGSB-12.1 *Safety Glazing* addresses reducing injury to a person impacting a safety glazing product. It does not directly address other performance aspects such as strength, fire rating or appearance. Climate change may create new performance needs not previously considered such as wind-borne debris impact or higher wind loads which may be addressed in whole or in part by other standards. In some cases, a desired performance aspect may not be addressed by an available standard in which case, the assistance of a design professional should be obtained.

E.2 Guidance for Climate Resiliency

What guidance can be offered to building designers, glass and glazing product manufacturers, and builders now, when revised climate data that takes into account projections of climate change is not yet fully available and continues to evolve? Construction of new buildings and renovation of existing buildings cannot be stopped. Based on the available research on this topic as described in this Annex, some recommendations for the selection and installation of fenestration products are provided in Table E.1.

Table E.1
Climate Resiliency: Potential Impacts

Climate change effects	Effects on glass and glazing products	Recommendations for selection of products
Higher ambient annual and daily air temperatures and humidity	Higher temperatures, change in flexibility and stiffness	Select materials that are more dimensionally stable with temperature change (lower coefficient of thermal expansion) to control expansion and contraction, and flexibility or stiffness. Applies especially to glass and glazing products with plastic components — interlayers, vinyl, fibreglass, and composites spacers for insulating glass units — that are directly exposed to solar radiation.
		Select products with enhanced elasticity and resistance to repeated movement cycles, and which maintain flexibility or stiffness at anticipated in-service temperatures. Applies to organic jointing and sealing products such as butyl rubbers, polyurethanes, and polysulphides in glass, laminated glass, and insulating glass units.
	Accelerated aging due to more prolonged periods of higher temperature (especially when wet) and from exposure to higher levels of UV-B radiation	Select products of proven and heightened resistance to heat aging and UV radiation. Applies to insulating glass units with organic and polymer-based spacers and sealants and laminated glass with interlayers directly exposed to solar radiation.
	Increased risk of fire exposure, especially at the wildland urban interface (WUI)	Select fire-rated products. Applies to glass, safety glazing, and insulating glass units in fenestration products.
	Increased risk of thermal stress related breakage	Select heat treated glass, and where safety glazing is needed, tempered glass. Applies to glass and glazing exposed to solar radiation that simultaneously are affected by thermal bridging, such as in balcony guards, high thermal performance windows, doors, and skylights, and other fenestration assemblies.

Climate change effects	Effects on glass and glazing products	Recommendations for selection of products
Increase in freeze / thaw cycles	Increase in temperature fluctuations, including more frequent and extreme freeze-thaw cycles	Select products that are designed to allow drainage of water that penetrates into glazing cavities. Applies to exposed elements such as a balcony guards.
Increase in precipitation, including wind driven rain	Increase in wind driven rain loads. Higher average temperature and humidity within fenestration product frames and in installation openings, together with increased incidence of water in more prolonged contact with glass and glazing products	Select fenestration products that enhance drainage of water from surfaces and minimize the likelihood of the entry and retention of water in fenestration product frames. Applies to fenestration products of all types incorporating laminated glass with interlayers prone to delamination under moisture and fenestration products with insulating glass units.
		Select materials that are more dimensionally stable when wetted and that have enhanced resistance to degradation from contact with warm liquid water (hydrolysis). Applies to laminated glass with interlayers prone to delamination under moisture and insulating glass units with organic perimeter sealants.
		Select materials with enhanced resistance to corrosion, or take steps to reduce the likelihood of wetting of corrosion susceptible materials. Applies to insulating glass units with sputter-coated low-e coated glass.
Increased Wind Speed and Design Pressures	Increased magnitude and frequency of extreme wind events (windstorms, tornadoes, hurricanes, down drafts, derechos)	Select fenestration products that incorporate glass and glazing with greater resistance to higher design wind pressure and with resistance to wind borne debris where required. Refer to climatic data in latest building codes for changes in wind pressure that may require the use of safety glazing such as tempered and / or laminated glass.

The identification of broad classes of materials that are at risk from climate change effects is not meant to indicate that products made from them should not be used. Instead, building owners, designer professionals, specifiers, and builders should use the recommendations as guidance to discuss with glazing material and product manufacturers how to create resiliency to climate change.

Further guidance and literature to address the following potential future consequences of climate change on safety glazing products:

Reference Standards:

1. ASTM E997 *Standard Test Method for Evaluating Glass Breakage Probability Under the Influence of Uniform Static Loads by Proof Load Testing*
2. CSA A440.6 *High exposure fenestration installation*
3. CSA A440S1 *Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-17, North American Fenestration Standard/Specification for windows, doors, and skylights*
4. CSA A440.2 *Fenestration energy performance / User guide to CSA A440.2-14, Fenestration energy performance*
5. CSA A440.4 *Window, door, and skylight installation*
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