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National Standard of Canada

Insulating glass units

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NATIONAL STANDARD OF CANADA **CAN/CGSB-12.8-2017**

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Insulating glass units

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE.

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Insulating glass units

1 Scope

This standard applies to sealed insulating glass (IG) units used in windows, doors and curtain walls 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 contained herein are applicable to glass units consisting of two or three sheets of glass and glazed in recessed openings so that the edge seals are shielded from direct weathering. The requirements also apply to glass units that may be coated, have muntin bars within the cavities and contain air or argon gas within the cavities.

The testing of permanently vented or capillary tube units are not included in this standard.

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

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, though referenced in this text, constitute provisions of this National Standard of Canada. The referenced documents may be obtained from the sources noted below.

NOTE The addresses provided below were 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-12.3 — *Flat, clear float glass*

CAN/CGSB-12.4 — *Heat absorbing glass*

CAN/CGSB-12.10 — *Glass, light and heat reflecting (Withdrawn in November 2016)*

CAN/CGSB-12.20 — *Structural design of glass for buildings (Withdrawn in November 2016).*

2.1.1 Source

The above may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone 819-956-0425 or 1-800-665-2472. Fax 819-956-5740. E-mail ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html.

2.2 National Research Council of Canada (NRC)

National Building Code of Canada

Research Paper No. 168 — Performance of Sealed Double-Glazing Units.

2.2.1 Source

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 Detailed requirements

3.1 Size[1]

3.1.1 Maximum size

The insulating glass units shall have size limitations as specified in the National Building Code of Canada (see Section 4), CAN/CGSB-12.20 and by provincial, municipal or other authorities having jurisdiction (see 5.1).

3.1.2 Tolerance

The tolerance on length and width dimensions shall be as specified in Table 1 and applies only to rectangular shapes.

Table 1 — Tolerances on dimensions

Length or width mm	Size tolerance of assembled unit mm
<1200 ≥1200	+3, -2 +5, -2

The difference in the lengths of the diagonals of a unit shall be a maximum of 5 mm.

3.1.3 Cavity[2] thickness

The cavity between the glass surfaces of sealed double or triple glazing shall be at least 6 mm wide, unless otherwise specified (see 5.1). The cavity thickness for test samples is as stated in 4.1.

3.2 Glass

The glass used in the units shall be in accordance with CAN/CGSB-12.1, CAN/CGSB-12.3, CAN/CGSB-12.4 and CAN/CGSB-12.10, or of a patterned or obscure glass as specified (see 5.1). 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[3].

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[1] These sizes apply to units that are sold commercially and not to the test samples detailed in 4.1.

[2] “Cavity” shall mean “hermetically sealed cavity.”

[3] A “separator” may also be known as a “spacer.”

3.3 Separators

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

3.4 Marking

Each unit 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, with the manufacturer's name or tradename and the year of manufacture.

3.5 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.

3.6 Performance requirements of test specimens

3.6.1 **Initial seal of units** (optional test as specified in 5.1)

Determine the integrity of the initial seal in accordance with Annex A. After 30 min of 5 kPa vacuum, a maximum of one specimen may show a final deflection of zero ± 0.1 mm. All other specimens shall have a deflection of at least 80% of that of the unit with the greatest deflection. Only one specimen with glass breakage is permitted[4].

3.6.2 Initial dew point

Determine the initial dew point for 18 specimens in accordance with 4.3.1[4].

3.6.3 Initial argon gas concentration (if applicable)

Argon-filled units shall be filled by standard manufacturing procedures to an average minimum volume of 90% of argon gas when tested in accordance with the test method described in Annex B. Use the two specimens that will be used for the volatile fogging test, the four that will be used for the weather cycling test and four (of the eight) that will be used for the high humidity test. New test specimens shall be submitted[4] when the average volume of argon gas for the ten units does not meet the minimum concentration of 90%. Report the percentage of argon gas.

3.6.4 Failure analysis (Water immersion technique)

If any units fail the initial argon gas concentration, the integrity of the Santoprene™ plug (see Annex B) of those units shall be determined using the method described in Annex C. If the Santoprene™ plug is faulty, then the failed tests shall not be included in the results.

NOTE Santoprene™ is a thermoplastic vulcanizate (TPV) and a registered trademark of ExxonMobil.

3.6.5 Volatile fogging

Two specimen units shall show no evidence of fogging or residue when tested and viewed in accordance with 4.3.2.

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[4] The manufacturer shall be informed of the results of the initial seal (if applicable), initial dew point and argon gas concentration tests. At this time, the manufacturer or authorized representative may elect to continue, halt and/or arrange to submit a new set of samples for testing.

3.6.6 Dew point, after weather cycling (Flexible edge sealed units only)[5]

The four specimen units shall not show a dew point temperature warmer than -40°C when tested in accordance with 4.3.3.

3.6.7 High-humidity cycling test

Eight specimen units shall not show a dew-point temperature warmer than -40°C when tested in accordance with 4.3.4.

3.6.8 Final argon gas concentration (if applicable)

Repeat this test as specified in 3.6.3 using the same specimens as used in the volatile fogging test, weather cycling test and the four (of eight) from the high humidity test. Record any differences in results[6].

3.6.9 Failure analysis (Water immersion technique)

If any units fail the final argon gas concentration, volatile fogging, dew point after weather cycling, and/or the dew point after high humidity tests, the integrity of the Santoprene™ plug of those units shall be determined using the method described in Annex C. If the Santoprene™ plug is faulty, then the failed tests shall not be included in the results.

4 Inspection

4.1 Sampling

The extent of sampling for routine acceptance inspection and testing shall be left to the discretion of the inspection authority, unless otherwise specified (see 5.1). The test samples for complete inspection and testing shall consist of the following:

One set of specimens consisting of at least 20 insulating glass units, with outside dimensions of 350 x 500 mm (±5 mm) and hermetically sealed cavities of at least 12 mm for double-glazed units and 6 mm each for triple-glazed units. 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 and shall incorporate a Santoprene™ plug (as specified in Annex B) or other resealable system (as specified in 5.1). If a resealable system other than Santoprene™ is used, then resealing shall be carried out by the manufacturer or an authorized representative.

One lite of a double-glazed unit and one outer lite of triple-glazed units shall be optically transparent sheet or float glass with or without a coating to facilitate dew point measurements. Although the specimens are as detailed above, the results of the tests are considered to be valid for units with muntin bars and/or with a larger number of coated lites than allowed above.

Each lite of glass shall have a 4 mm nominal thickness. 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 manufacturers standard production units with regard to design and construction[7].

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[5] It is not technically practicable to apply this weather cycling test to the rigid edge sealed units.

[6] The data recorded here will enable researchers to analyze and modify criteria if necessary.

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

4.2 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 20 ± 3°C and to an ambient atmospheric pressure and humidity, if desired by the manufacturer (see 5.1). 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. The units shall then be conditioned for 72 h (see 4.3) before testing.

4.3 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. A minimum set of 18 units shall be randomly selected and numbered for testing. The units shall be conditioned for at least 72 h at 22 ± 3°C before testing. The units with temporary edge channels or caps intended for handling purposes, shall have these removed for the weather cycling, high humidity 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 Data Summary Sheet is found in Table 2 as an aid in tracking of specimens during testing.

4.3.1 Dew point determination

Apply a thin film of alcohol to one face of the specimen, then place the chilled brass section of the dew point apparatus (see Figure 1-A or 1-B) in contact with the specimen for 3 min ± 15 s. Remove and observe (using light transmitted through the unit from beneath it, (see Figure 1-C)). If no frost or condensation has formed or a substantial amount of frost or condensation has formed, then the procedure shall be repeated using different temperatures for the chilled brass section. The dew point, ±1°C is the temperature which is slightly warmer than the point at which a faint deposit of frost or condensation occurs. The dew point shall be determined for both cavities of the triple-glazed units[8].

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

Table 2 — Data summary sheet

Unit	Initial seal test (optional)	Initial dew point	Initial gas% (if applicable)	Water immersion (if applicable)	Fog test — Weather cycling process — High humidity test	Final dew point	Final gas % (if applicable)	Water immersion (if applicable)
1		X	X	X	fog		X	X
2		X	X	X	fog		X	X
3		X	X	X	wc	X	X	X
4		X	X	X	wc	X	X	X
5		X	X	X	wc	X	X	X
6		X	X	X	wc	X	X	X
7		X	X	X	hh	X	X	X
8		X	X	X	hh	X	X	X
9		X	X	X	hh	X	X	X
10		X	X	X	hh	X	X	X
11		X			hh	X		
12		X			hh	X		
13		X			hh	X		
14		X			hh	X		
15		X						
16		X						
17		X						
18		X						
19	—	—	—	—	—	—	—	—
20	—	—	—	—	—	—	—	—

4.3.2 Volatile fogging test

Mount two of the selected specimens within a volatile fog test apparatus similar to that shown in Figure 2. For units with low-e coatings, the cold plate shall be located on the low-e coated side. Maintain the sealed unit top edge temperature (the edge location shown in Figure 2) at 58 ± 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 ± 3°C. Maintain the temperature of the cooling water at 22 ± 3°C. Determine the temperature of the cooling water immediately where it leaves the test apparatus.

Apply a voltage of approximately 115 V to the ultraviolet lamp[9]. Expose the units for 7 d, 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. Mount the units in a viewing box similar to that shown in Figure 3, 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. Darken the room, if necessary, to eliminate any glare on the unit. Stand about 2 m directly in front of the test unit with the box lamps on, and with the mid-height of the unit at eye level, and observe the unit for any evidence of fogging, or any other residue, on the interior (cavity) glass surface. 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. The glass breakage of the unit under test shall not constitute a failure and such unit shall be freely replaced and the test restarted for the replacement unit.

4.3.3 Weather cycling test

Place four of the selected specimen units in a laboratory weathering apparatus as described in Research Paper No. 168 of the Division of Building Research, National Research Council of Canada, and as shown in Figure 4, 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.

The 320 test cycles shall consist of the following:

60 ± 1 min cooling to -32 ± 3°C

90 ± 2 min heating to 50 ± 3°C

25 ± 2 min air circulating

5 ± 1 min water spray (water temperature 24 ± 3°C)

60 ± 1 min air circulation alone

240 ± 7 min total cycling time

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 72 h at 22 ± 3°C before measuring the final dew point as described in 4.3.1.

[9] The ultraviolet lamp shall be an Osram Ultra Vitalux 300 W lamp. The UV output shall be 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 shall be checked at the beginning of each test. The Osram lamp can be purchased from Nedco Ltd., 5600 Keaton Cres., Mississauga, Ontario L5R 3A3. Telephone 905-568-5021.

4.3.4 High-humidity cycling test

From the set of the selected units, place 8 units that have not been exposed to the weather cycling test, in a humidity cabinet and expose them to humid air flow induced by water sprayed between the cabinet wall and a baffle (see Figure 5).

The 224 test cycles shall consist of the following:

90 ± 2 min heating to 55 ± 3°C

50 ± 1 min hold at 55 ± 3°C

40 ± 1 min cooling to 22 ± 3°C

180 ± 4 min total cycling time

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. Condition the units for 72 h at 22 ± 3°C before measuring the final dew-point temperatures as described in 4.3.1.

4.3.5 A maximum total of two specimens with glass breakage (not including any breakages occurring during the initial seal test or volatile fog test) is permitted in the weather cycling and high-humidity cycling tests described in 4.3.3 and 4.3.4.

5 Options

The following options shall be specified in the application of this standard:

a) Maximum size of unit (see 3.1.1)

b) Cavity thickness, if other than as specified (see 3.1.3)

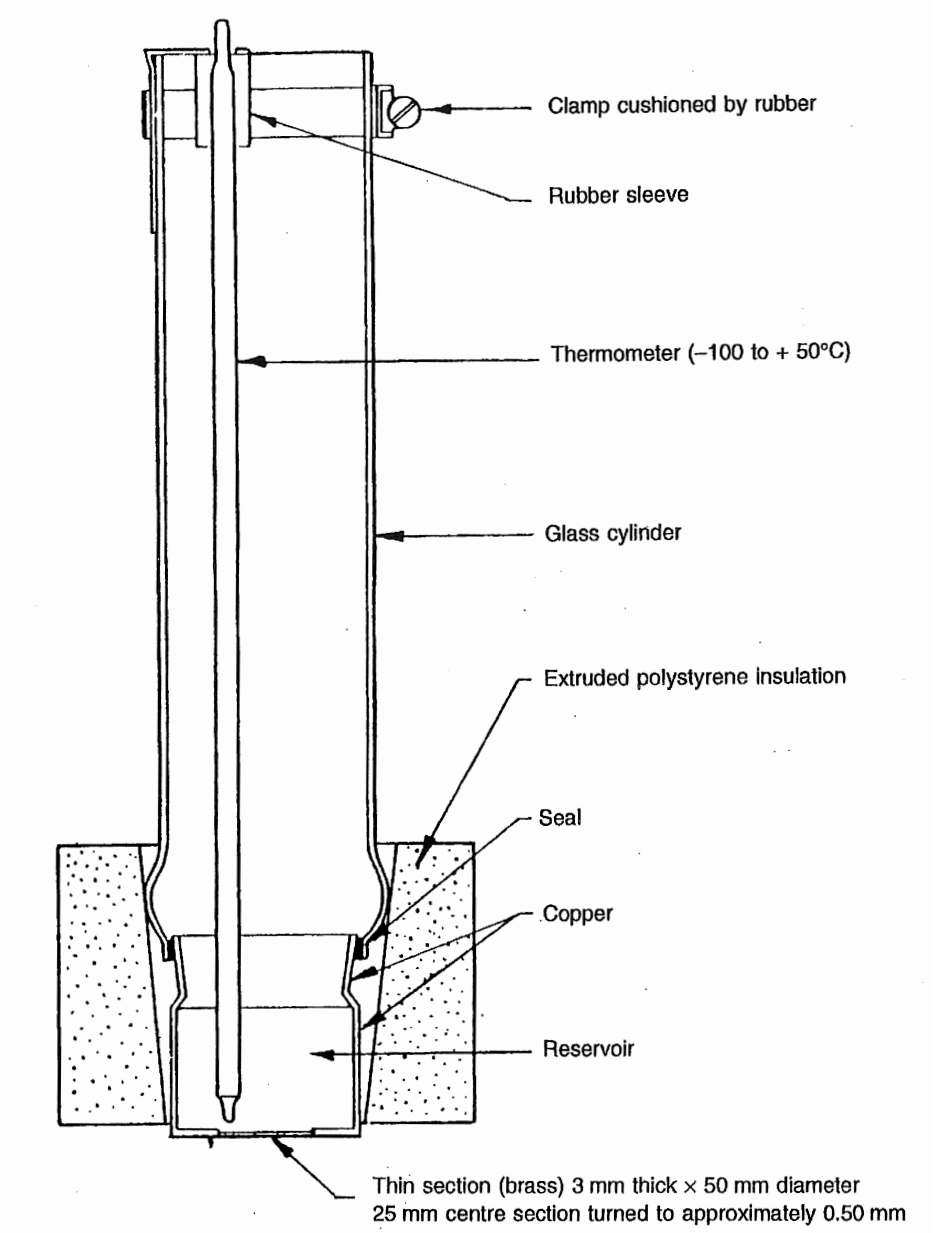
c) Type of glass (see 3.2.1)

d) Whether or not the initial seal test is required (see 3.6.1)

e) Sampling, if other than as specified (see 4.1)

f) Whether or not the cavity pressure balancing is required (see 4.2)

g) Method of resealing units (see 4.1).



Alcohol is contained in the reservoir of the apparatus to a depth of approximately 25 mm and is cooled by the introduction of dry ice or equivalent e.g. an immersion cooler, as required, to obtain and maintain the low temperature specified.

Figure 1-A – Apparatus for dew point measurement

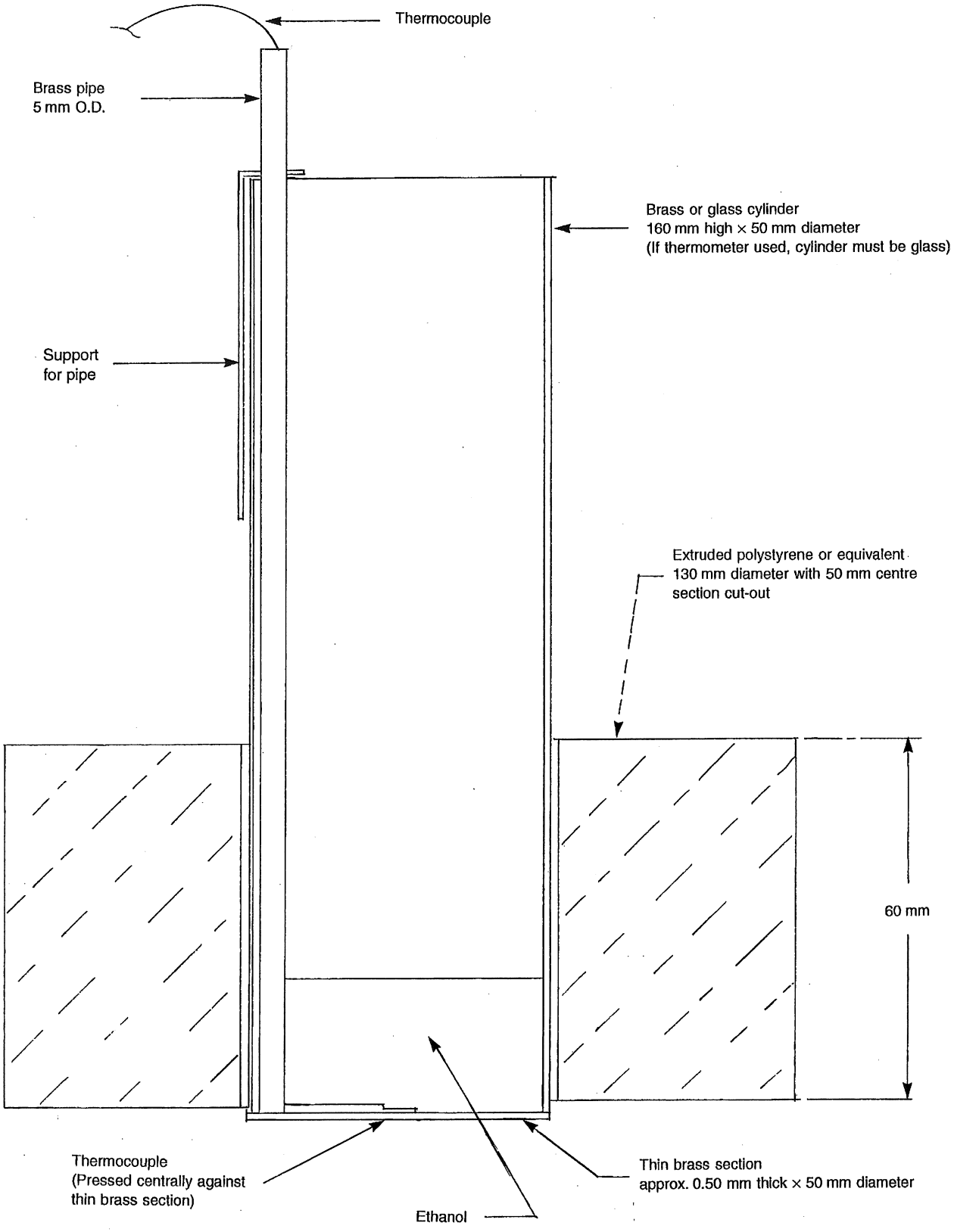
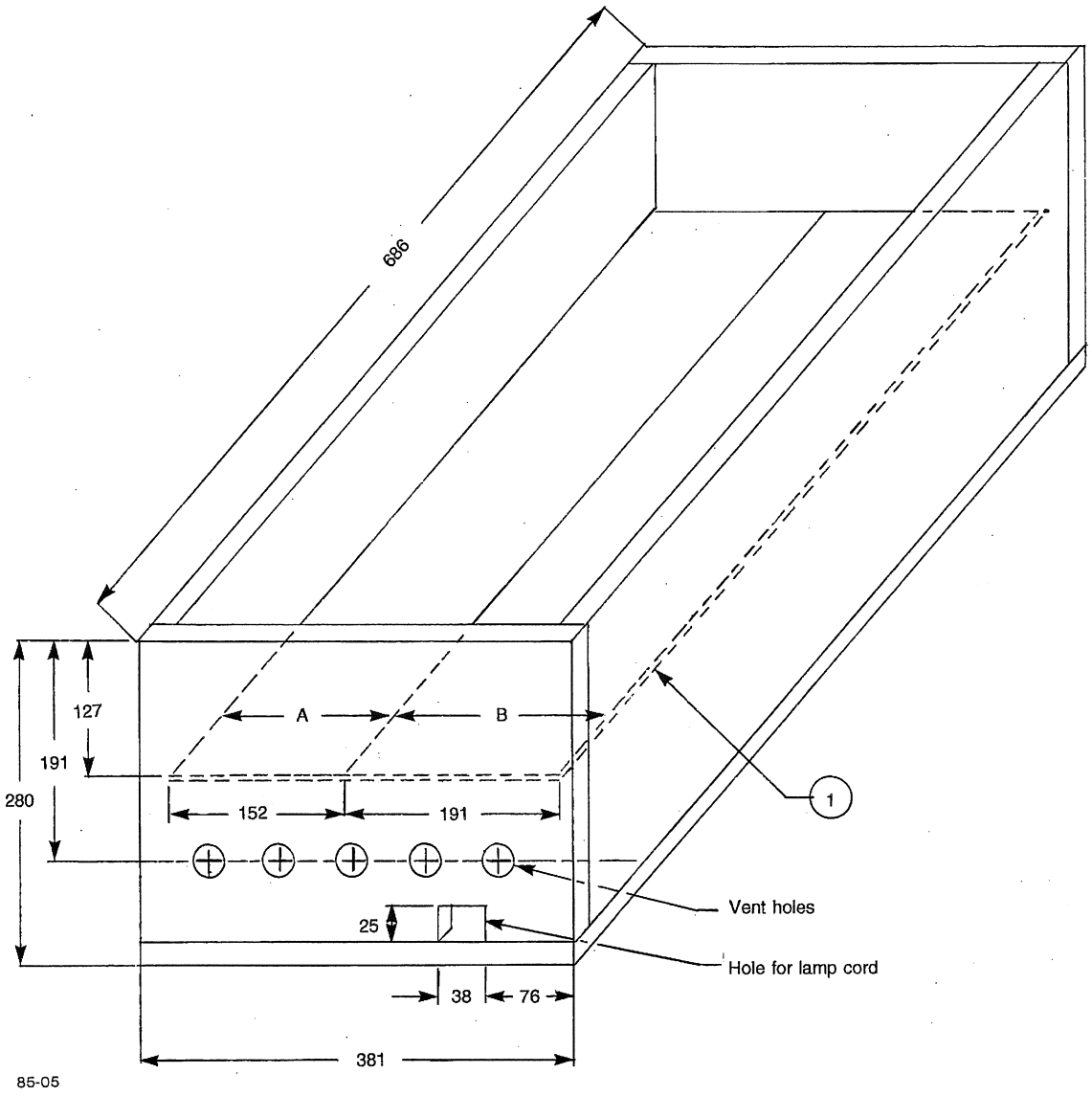


Figure 1-B — Dew point apparatus



NOTES:

1. Paint all of the exterior of the box and the top portion (above plexiglass) of the box's interior with a flat black paint. Paint the lower interior portion with a glossy white paint.
2. Item 1 is a sheet of 1/8 in translucent white plexiglass. Section A is covered with a piece of black cardboard. Section B is exposed white plexiglass.
3. A 24 in fluorescent fixture with one F20T 12/WW lamp (not shown) is centrally located under section B of item 1.

All dimensions are in millimetres.

Figure 1-C — Light box for dew point test

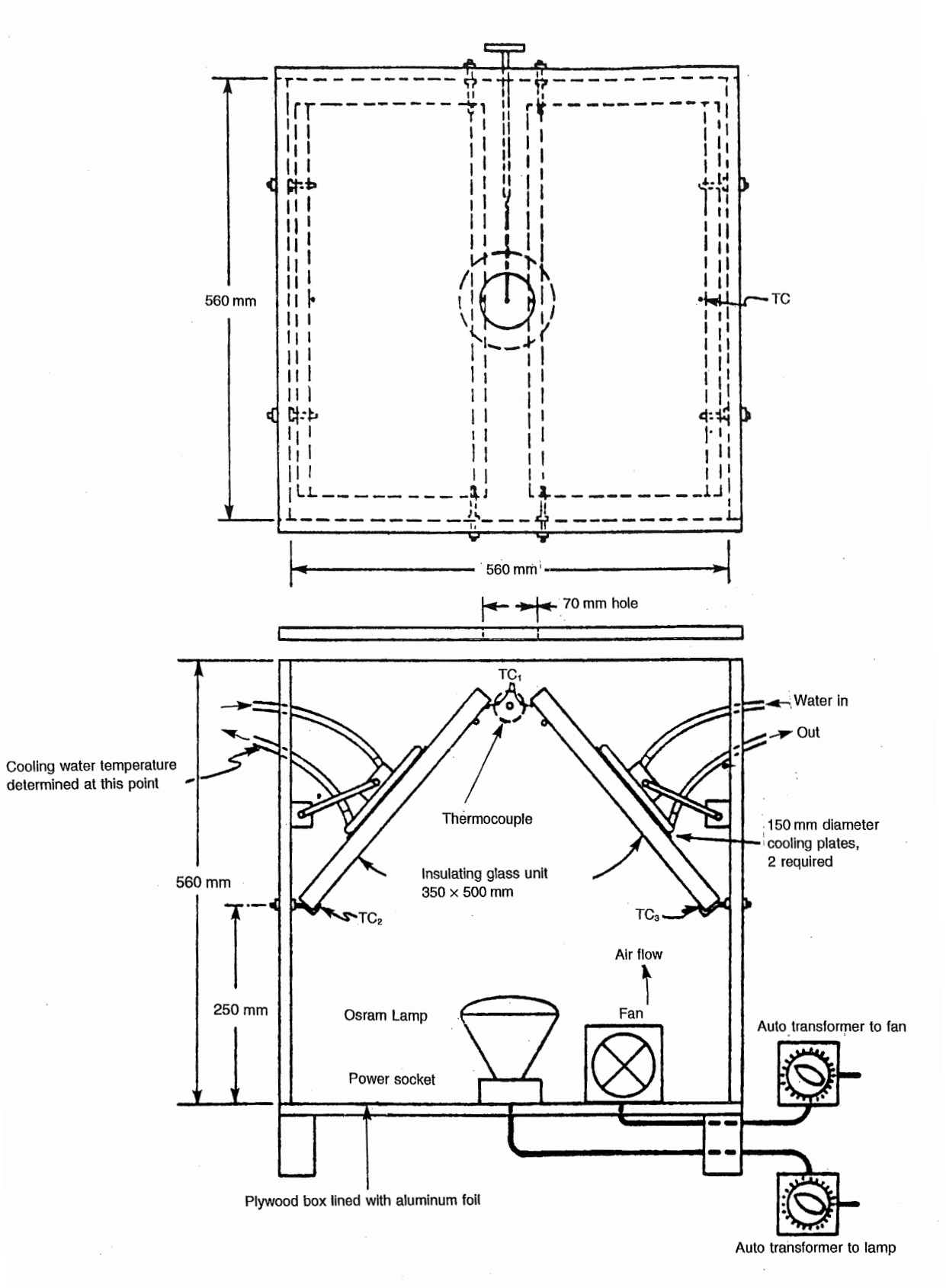


Figure 2 – Volatile fogging exposure box

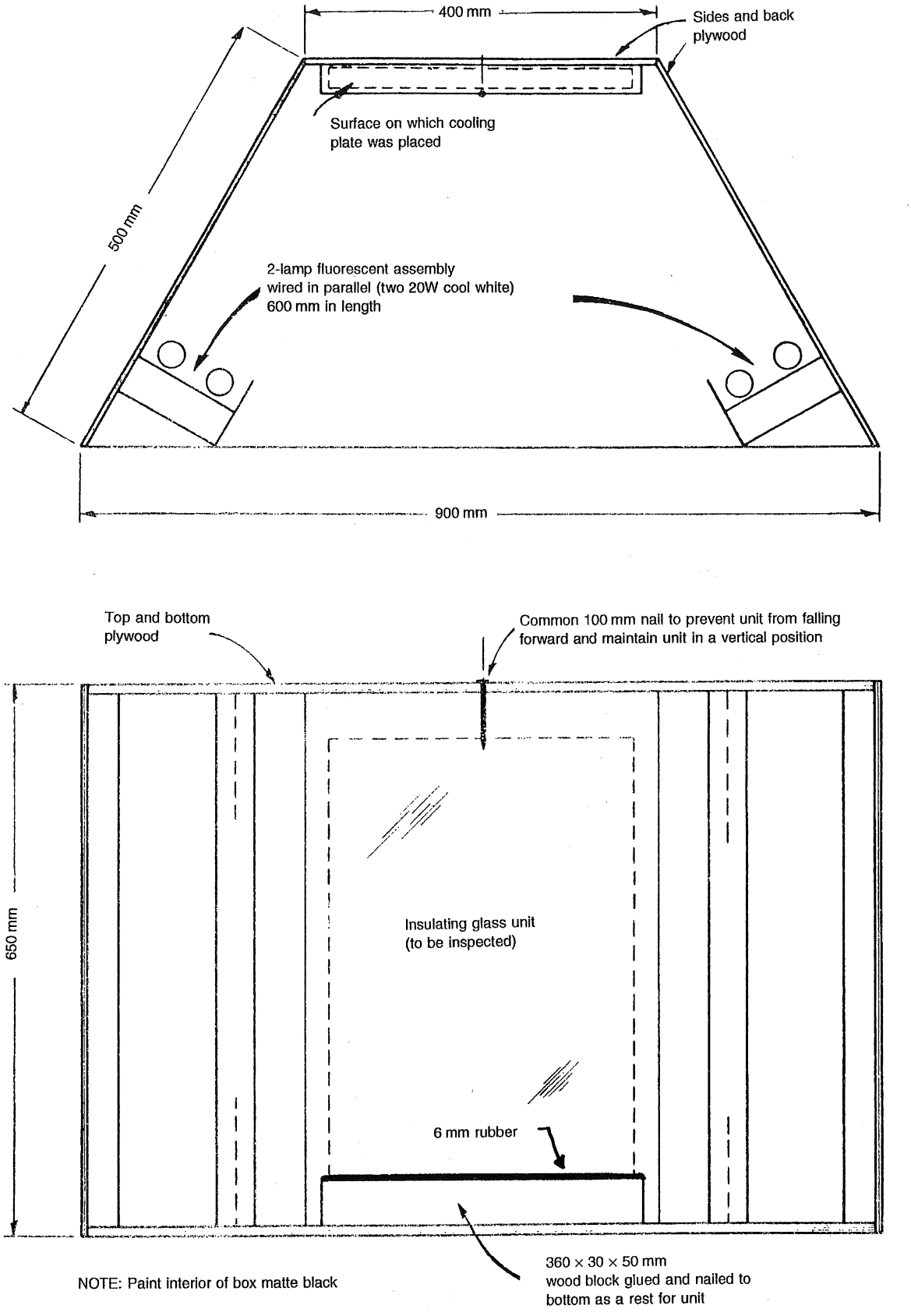


Figure 3 – Viewing box for volatile fogging exposure test

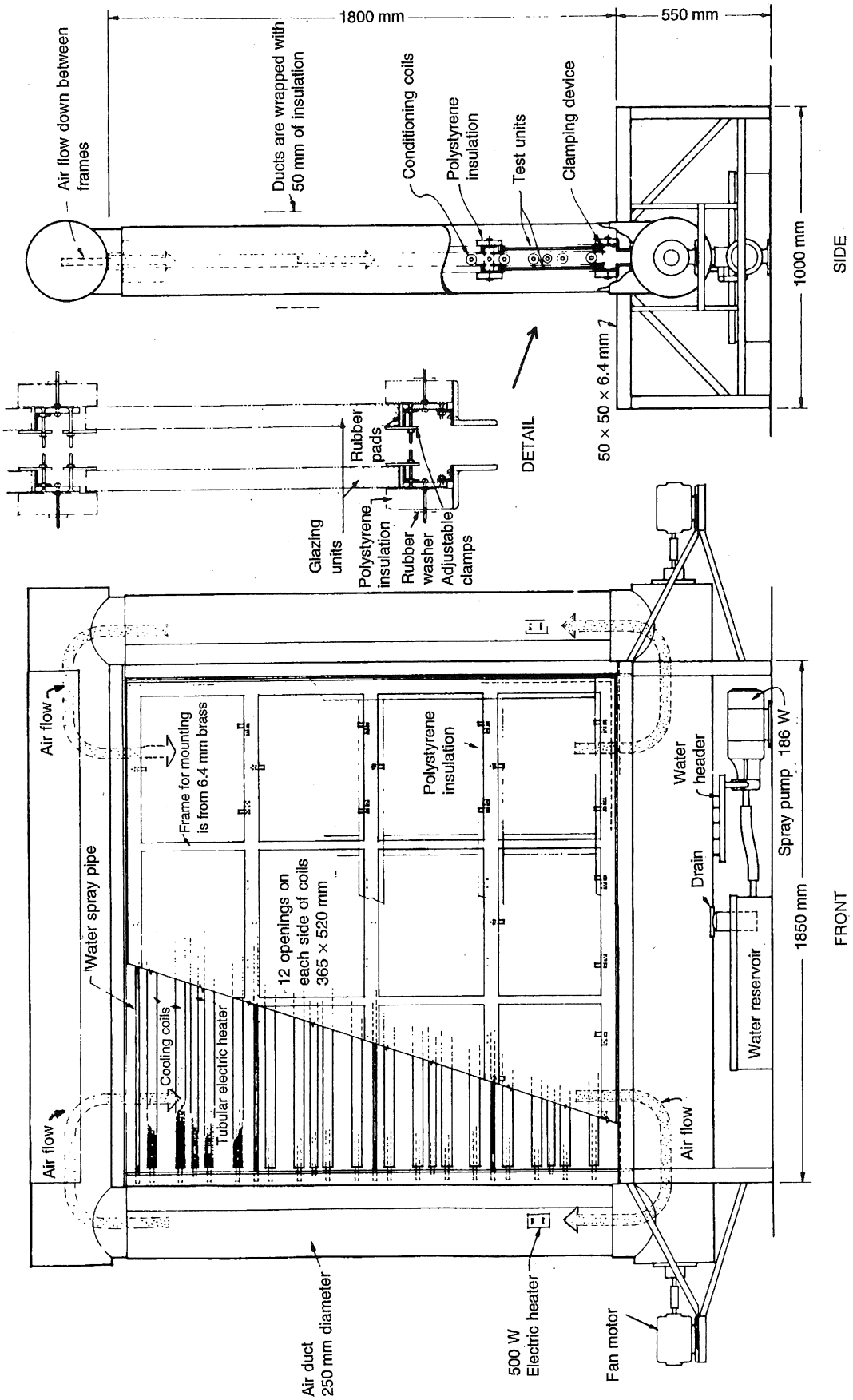


Figure 4 — Weathering apparatus for insulating glass units

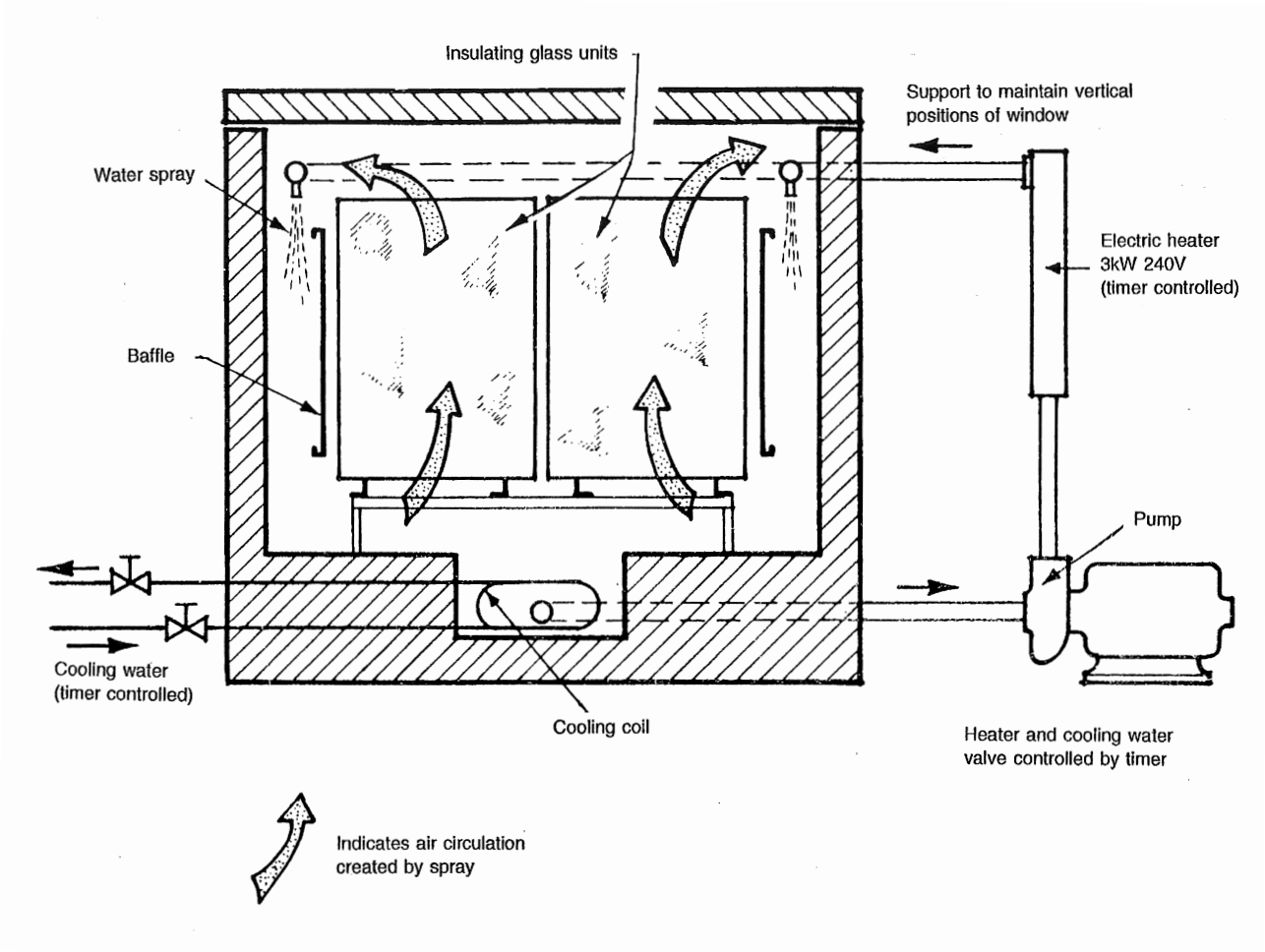


Figure 5 — High-humidity cycling cabinet

Annex A
(normative)

Optional initial seal test

A.1 Test procedure

A.1.1 Condition the units for at least 72 h to the same temperature as the vacuum chamber prior to the test and maintain this temperature within ±3°C during the test. Mount all the selected specimen units in a rack in the vacuum chamber with a dial indicator in contact with the centre of the glass on each side of the unit so that the deflection can be measured to ±0.03 mm. Set the dial indicators to a predetermined setting (preferably zero). Seal the chamber and record the dial readings. Lower the chamber pressure to 5 kPa. Maintain this vacuum for 30 min then record the dial readings again. Slowly release vacuum and allow the units to stabilize (usually dial readings will return to the original reading within 5 min); then, calculate the deflections.

Annex B
(normative)

Test method for the determination of argon concentration[10]

B.1 Introduction

B.1.1 Argon, 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 is 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.

B.2 Apparatus

B.2.1 Gas chromatograph: consists of a gas sampling valve[11] (100 to 250 uL capacity), and an adsorption column (Haysep® DB[12] or equivalent), a thermal conductivity detector (TCD) and an integrator. The apparatus shall separate argon, 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%.

B.3 Reagents and materials

B.3.1 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.

B.3.2 Reference standard mixtures: are gas mixtures that contain known percentages of argon, 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.

[10] This test method was developed by the National Research Council (NRC)-Institute for Research in Construction (IRC) in cooperation with the Insulating Glass Manufacturers of Canada (IGMAC).

[11] The gas sampling valves offer a precise way of introducing the gas samples into the gas chromatograph.

[12] The Haysep® DB adsorption column can be purchased from Hayes Separations Inc., Highway 173 Five Miles S, Badera, TX 78003, U.S.A. Telephone (830) 796-4512.

B.4 Calibration and standardization

B.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.

Carrier gas	Helium, 30 mL/min.
Column	Haysep® DB,
	100 - 120 mesh
Column size	30 ft by 1/8 in (nominal), stainless steel
Column (oven), temperature	-30°C
Sampling loop temperature	100°C
Detector temperature	105°C
Sample volume	250 uL

B.4.2 Reference standard introduction and separation[13]: Fill the 10 mL gas-tight syringe[14] 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 samples(s) into the gas chromatograph sampling port, as outlined in section B.5.

B.5 Test procedure

B.5.1 Introduction and separation: Using the gas-tight syringe, insert the needle in the in-situ sampling (Santoprene™ [15]) 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[16]. 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.

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

[14] Although the volume of the gas sampling loop may be a few hundred microlitres or less, a sufficient volume of the reference sample gas is passed 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.

[15] Details of the availability, installation and use of the Santoprene™ plug may be obtained from the Insulating Glass Manufacturers Alliance (IGMA), 1500 Bank Street, Suite 300, Ottawa, ON K1H 1B8. Telephone (613) 233-1510. Fax (613) 482-9436.

[16] 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 C
(normative)

Failure analysis for gas-filled IG units (Water immersion technique)

C.1 Apparatus

C.1.1 The test set-up consists of a see-through tank with minimum dimensions of 900 mm long x 500 mm wide x 300 mm high. It shall be capable of accommodating the standard IG unit size when it is placed horizontally in the tank. The tank shall be equipped with an electric immersion heater and a mixer to maintain a uniform temperature throughout the test.

C.2 Test procedures

C.2.1 Heat the water in the water tank to 55 ± 3°C and maintain that condition during the test. Place the IG unit on two setting blocks at the bottom of the tank in such a manner that the glass sheets are fully immersed and in a horizontal position at least 50 mm above the bottom. After a minimum of 5 min and a maximum of 10 min, observe any bubbles originating from any point around the perimeter of the IG unit and Santoprene™ plug, and record the position of leakage.

Annex D
(informative)

User's guide

D.1 Durability of IG unit seal

D.1.1 The standard CAN/CGSB-12.8 deals with the integrity and durability of the IG unit 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 A window or a curtain wall is a system consisting of many different components. For this system 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. Below are mentioned the most common reasons for seal failure of well-made insulating glass units.

D.2 Common causes for seal failure of IG units

D.2.1 Water and high humidity

All glazing systems 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 defense against water is the use of systems that use the rain-screen principle with a well-drained glazing cavity (to the outside). On the room side there should be an effective vapour barrier to prevent warm moist room air from reaching the cool surfaces in the glazing cavity and prevent water that has condensed on the interior glass surface during cold winter conditions from reaching the glazing cavity.

A well-vented glazing cavity will also keep the relative humidity around the perimeter of the IG unit much lower. If water is absorbed, it takes a long time for the materials to dry out. The moisture vapour transfer rate is much higher at high temperatures and high relative humidities and may thus shorten the life of insulating glass units.

If the glazing system 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.

IGMAC glazing manual gives good guidelines on how to glaze insulating glass units. If in doubt, contact your IG unit supplier.

D.2.2 Compatibility of materials

The common material 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, ASTM C794 and ASTM C1087.

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 sheets of glass of insulating glass units 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. The manuals mentioned in D.2.1 also have detailed information on UV light and chemicals in the air.

D.3 Miscellaneous

D.3.1 The glass should “float” in the window opening. This means that there should be sufficient clearance around the perimeter of the IG unit to prevent contact with the frame members during the expansion/contraction of the materials or if there is movement of building, window or curtain wall components.

D.3.2 There should be no glass to metal (or other hard materials) contact. Only flexible glazing materials 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 glazing pressure with inner and outer stops aligned with the spacer fulcrum point.

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 corners of the insulating glass unit. For side-hinged, operating sashes, setting blocks should be placed 50 mm from the lower hinge corner and 50 mm from the upper non-hinged corner on horizontal and vertical members.

Bibliography

[1] Insulating Glass Manufacturers Alliance (IGMA). TM-3000-90(16) *IGMA North American Glazing Guidelines for Sealed Insulating Glass for Commercial and Residential Use*. Available from the Insulating Glass Manufacturers of Canada, 27 Goulburn Avenue, Ottawa, Ontario K1N 8C7. Telephone 613-233-1510.

[2] National Research Council of Canada (NRC). CBD 4 *Condensation on Inside Window Surfaces*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[3] National Research Council of Canada (NRC). CBD 5 *Condensation between Panes of Double Windows*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[4] National Research Council of Canada (NRC). CBD 46 *Factory-Sealed Double-Glazing Units*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[5] National Research Council of Canada (NRC). CBD 55 *Glazing Design*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[6] National Research Council of Canada (NRC). CBD 101 *Reflective Glazing Units*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[7] National Research Council of Canada (NRC). CBD 129 *Potential for Thermal Breakage of Sealed Double-Glazing Units*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.

[8] National Research Council of Canada (NRC). CBD 132 *Glass Thickness for Windows*. Available from the National Research Council Canada, Publication sales and Distribution, Building M-19, Ottawa, Canada K1A 0R6. This NRC publication is part of a discontinued series and is archived by NRC as an historical reference.