#6477

CSA-A440: the Window Standard

Standards are always referred to in codes and other regulations. But who reads them? Who has actually looked at one? Manufacturers do. Inspectors might occasionally. But as builder or product specifier, do you really know what's in a given standard?

How often have you seen a product ad say it meets a given CSA or ULC standard? It may often cover something different than you think!

With recent changes in window technology, the CSA standard for windows has been modified. We thought it would be interesting to look at what it actually says.

Exciting entertainment it ain't! It makes good bedtime reading - if you have a hard time getting to sleep. But it does spell out in great detail what and how window tests are done.

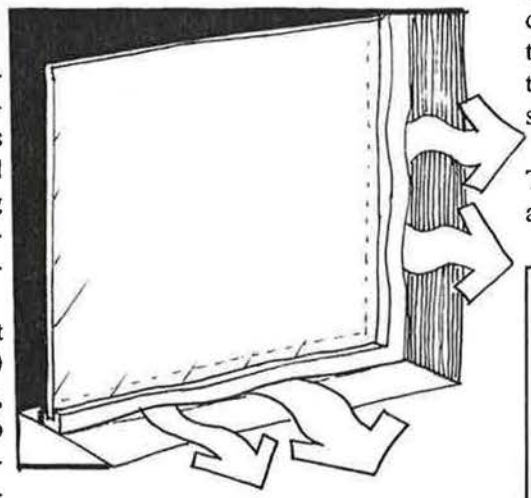
There are several sections to the standard, all under the main heading of CSA-A440. The document provides definitions and spells out how tests are to be carried out. It applies to both fixed and opening windows that are factory-assembled, intended for vertical installation in buildings

Manufacturers wishing to prove that their windows comply with CSA A440 submit a 1000 m wide, 1000 m high unit, complete with all hardware and screens to an accredited testing laboratory. The sample for testing is chosen by the manufacturer and must be a typical unit off the production line.

The window is installed in the test chamber following the manufacturer's instructions for installation with all operable lights in the closed and latched position.

Window Classification

Windows are classified for their Airtightness, Water Tightness and Wind Load Resistance.



Air Tightness

Air leakage is caused by wind, internal positive or negative pressure, and by stack effect. Excessive air leakage will lead to discomfort and drafts, low relative humidity due to too high an air change rate, noise transmission due to sound leakage, as well as dust and airborne pollutants that are carried in the air. Air leakage during both summer and winter may be a significant contributor to energy loss.

Tighter windows reduce the air changes and increase the relative humidity. Leaky windows also increase the potential for condensation on both window frames and glazing as the surface temperature is lowered.

The air tightness test rates a window based on the amount of air that can pass through a closed window from the outside to the inside at a given wind pressure. Air infiltration through a window is measured under ambient temperature conditions (20°C) at a pressure difference of 75 Pa. (this represents a wind speed of 25 mph.).

With operable windows, most of the air leakage occurs through the joists between the sash and the frame and between meeting rails of the sliding sash. The ratio of the length of this crack to the window area decreases with increasing window size so the leakage per unit area of window will tend to decrease with increasing window size.

Air tightness ratings are A1, A2, A3. The tests measure the maximum air leakage rate.

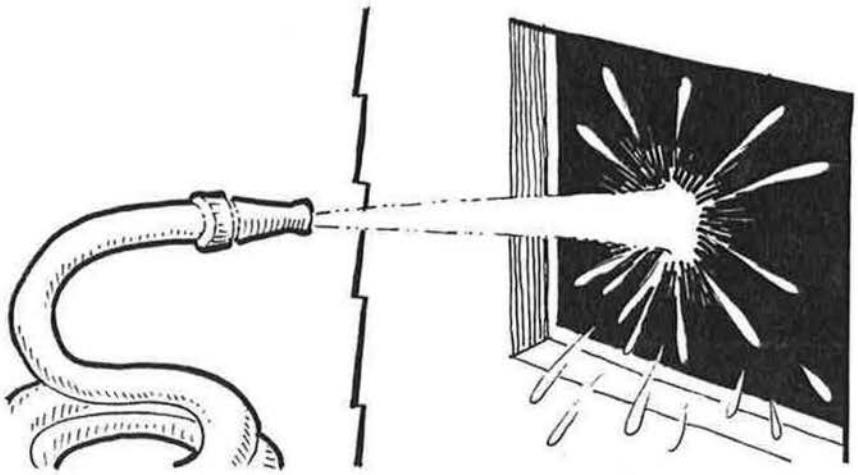
Maximum air leakage rate per lenght of crack

	$m^3/h/m$	cu.ft./hr/ft
A1	2.79	30.03
A2	1.65	17.76
A3	0.55	5.92

Water Tightness

For the water tightness test, the window is mounted in a chamber and an even film of water is sprayed onto the outside while the window is subjected to the appropriate positive pressure. During the test the pressure is cycled four times, each cycle of five minutes with the pressure applied and one minute with no pressure.

Water is not allowed to penetrate the window to cause wetting of the interior surfaces or through the window into the wall below the sill; and no water shall remain trapped in the window assembly



after the test pressure has been released.

Water tightness ratings are B1, B2, B3.

Test pressure difference (Pascals)	
B1	150
B2	200
B3	250

Wind Load Resistance

Wind loads are the main structural forces windows must resist. The objective of the wind load test is to determine how rigid the sash members are and to check the strength of a window assembly subjected to the extreme pressure differentials caused by the wind. The amount of deflection is used as an indication of this strength. Sash members can't deflect more than 1/125 of their length; and mullions shall not deflect more than 1/175 of their length.

The window is subjected to a load equal to half the test pressure for a minimum of 10 seconds. The full pressure is then applied both in an inward and outward direction.

For both loading directions, deflections are measured at the midpoints of all meeting stiles, mullions, muntins or at the most restrictive location after the pressure has been applied for 10 seconds and while it is still being applied.

Windows are also subject to operating forces which affect the hardware design, its attachment, and the members to which it is attached.

No failure or permanent deformation of any part of the window that may cause any operational malfunction is allowed. If the glass breaks, two re-tests must be done. Glass breakage during either of the two re-tests is a failure of this test.

Wind load resistance ratings are C1, C2, C3.

Material Specifications

In addition to performance, minimum material specifications for all component materials are given. These requirements are based on acceptable design principles, historic applications and good manufacturing practice as well as minimum requirements for: hardware and fasteners; weatherstripping; insect screens; and foam or sponge materials.

Materials specifications include items such as wood preservatives: the preservative must be certified by the preservative manufacturer, using independent laboratory tests, and must be registered under the Pest Control Act, have a registration number from Agriculture Canada, and can't have any detrimental effect on paint finishes.

For wood frames maximum moisture content is spelled out, minimum wall thickness for vinyl or metal frames. Specs also cover finishes: anodized coatings for aluminum, enamels for wood, and vinyl weathering characteristics.

A new item included in the latest revisions requires that except for storm windows, *all metal windows must incorporate a thermal break.* This is a new requirement that, if enforced, is going to have some impact on the West coast as non-thermally broken aluminum frames have a large market segment.

The material specifications also identify glazing, sealing compounds, and adhesives. Weatherstripping must be made of a material that is resistant to deterioration by weathering or aging and be compatible with the window frames. Open cell plastic foam can't be used nor can surface-applied, glued-on weatherstripping.

Minimum glass thickness is governed by the requirements of the NBCC or other appropriate regulatory authorities.

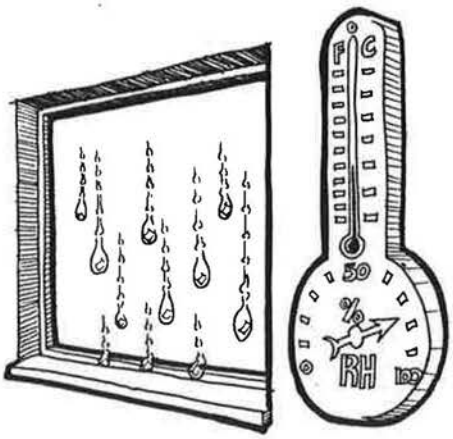
When the window is installed properly, following the manufacturer's instructions, exposed horizontal surfaces wider than 6mm must be sloped to shed water. Insulating glass units must be glazed in a manner that prevents accumulation of water in the glazing cavity. The drainage system must prevent contact between any accumulated water and the seal of the insulating glass unit.

Window design must allow on-site reglazing

Windows complying with all requirements of this standard should have the following information attached: the manufacturer's identity permanently marked on each window so that the mark is visible when the window is installed. A second label (it need not be permanent) must indicate what classifications the window meets for air tightness, water tightness, and wind load resistance (e.g. something like A1, B2, C1).

Condensation Test

A condensation resistance test is also done. This determines the Temperature Index (I) for glazing, sash, and frame. The Temperature Index, when used in conjunction with the winter (January) design



temperature for a given location, identifies the maximum relative humidity that the glazing and sash or frame can take before surface condensation happens. Knowing (I) allows a specifier to determine if a window will be suitable for the conditions to which it will be exposed, and thus avoid excessive condensation.

To determine the Temperature Index the window is subjected to temperature conditions of -30°C outdoors and 20°C indoors, and the inside surface temperatures of the glazing and sash of the frame are measured. If the temperature of the inside surface of the window glazing or frame drops below the dew point (a function of the interior relative humidity), condensation will appear on these surfaces.

Energy rating (ER value)

A new addition to the standard is the energy performance rating.

The energy rating provides a method for comparing different window products based on their effect on annual energy supplied by the house heating system.

The ER equation incorporates three elements: solar heat gain, heat transmission loss and heat loss associated with window air leakage.

In developing the energy rating, each of the weather factors in 13 major Canadian cities were averaged, including solar radiation incident on windows facing the four cardinal compass directions, to produce a single set of average weather conditions. Rating values based on these average conditions do not apply to any specific location. Ranking of the windows offers a comparison - along the lines of the gas consumption figures for trucks and cars.

An ER value can also be calculated for a specific location and orientation. This is known as the ERS. The method for obtaining ERS values for a specific location and orientation is also provided in the standard. The ERS values can be used to make a comparative estimate of the effect on annual heating energy requirements of alternate window installations.

A User Guide in the standard provides a method for making such estimates.

For further information: Canadian Standards Association, 178 Rexdale Blvd. Rexdale, Ont. M9W 1R3

B.C. R-2000 Agreement

The R-2000 Program gained a new lease on life in B.C. when program partners (BC Gas, Bank of Montreal, the Canadian Home Builders' Association of B.C., Energy, Mines and Resources Canada, the New Home Warranty Program of B.C. and Yukon, and West Kootenay Power) signed an agreement formalizing their commitment to the delivery of *R-2000 - The Energy Efficient New Home Program in B.C.*

Effective April 2, 1992 the R-2000 name will replace Quality Plus in all promotion and communication to industry and the general public, allowing builders and the provincial Program to take advantage of R-2000 national advertising and name recognition with consumers. Builders who were qualified to construct certified Quality Plus Homes automatically qualify to build R-2000 homes.

Purchasers of R-2000 homes qualify for mortgage rate discounts through the Bank of Montreal, and may qualify for additional cash rebates, grants and low cost loans depending on the utility by which they're serviced.

Why the change?

When the Quality Plus program was introduced the R-2000 label was dropped because it was perceived that R-2000 wasn't recognized by the public - it had a low profile and was too "techie". After a couple of years it seems the public doesn't recognize or understand "Quality Plus" while R-2000 (surprise, surprise!) has a high recognition.

Conspicuous by its absence from the list of sponsors is B.C. Hydro (a prime mover of the Quality Plus program). At the moment they are reassessing their position and how they will participate.

HRV Industry Merger

Conservation Energy Systems, Inc., North America's longest established manufacturer of residential heat recovery ventilation systems has been acquired (as of April 1, 1992) by **Venmar Ventilation Inc.** of Drummondville, Quebec. Rick Olmstead, President of CES Inc. will maintain a major position in CES.

The vanEE™ Heat Recovery Ventilators (HRV) have been marketed in North America since 1980.

Venmar Ventilation Inc is a major Canadian manufacturer and distributor of home ventilation equipment. The company has developed a full line of products utilizing leading edge manufacturing technology.

The distinct product lines that have made each firm successful will be maintained after the merger.