

Performance Evaluation of Windows

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This Presentation

We will discuss:

- **Window Standards**
- **Laboratory Testing**
- **Field Testing**

This Presentation

- **Window Standards**
- **Laboratory Testing**
- **Field Testing**

CSA A440 Family of Standards

- **A440-00 “Windows”**
 - A440.1 “Users Guide”
 - **A440.2 “Window Thermal Performance”**
 - A440.3 “Users Guide”
 - **A440.4 “Window Installation”**

A440-00
Windows

Special Publication
A440.1-00
**User Selection Guide to
CSA Standard A440-00,
Windows**



Special Publication
A440.1-00
**User Selection Guide to
CSA Standard A440-00,
Windows**

Published in December 2000
by
CSA International
178 Rexdale Boulevard
Toronto, Ontario
Canada
M9W 1R3
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A440.2-98
**Energy Performance of
Windows and Other
Fenestration Systems**

Special Publication
A440.3-98
**User Guide to CSA
Standard A440.2-98,
Energy Performance of
Windows and Other
Fenestration Systems**



Special Publication
A440.3-98
**User Guide to CSA
Standard A440.2-98,
Energy Performance of
Windows and Other
Fenestration Systems**

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Published in March 1998
by
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178 Rexdale Boulevard
Etobicoke, Ontario,
Canada
M9W 1R3



CSA A440-00

Main Sections are:

- **Material Specifications**
- **Preservatives & Coatings**
- **Component Specifications**
- **Design Specifications**

CSA A440-00 (Cont'd.)

- **Glazing Methods**
- **Performance Requirements**
- **Test Methods**
- **Test Specimens**

Performance Requirements

- **Ease of Operation**
- **Air Tightness**
- **Water Tightness**
- **Wind Load Resistance**
- **Forced Entry Resistance**
- **Condensation Resistance**
- **Mechanical Tests**

Ease of Operation

Measure of forces required to operate window sash or locks:

- **Initiate motion**
- **Maintain motion**

Air Tightness

*Rate of air infiltration and exfiltration in
 $m^3/hr.m$ at 75 Pa, ASTM E283*

- **A1: 2.79**
- **A2: 1.65**
- **A3: 0.55**
- **Fixed: 0.25**

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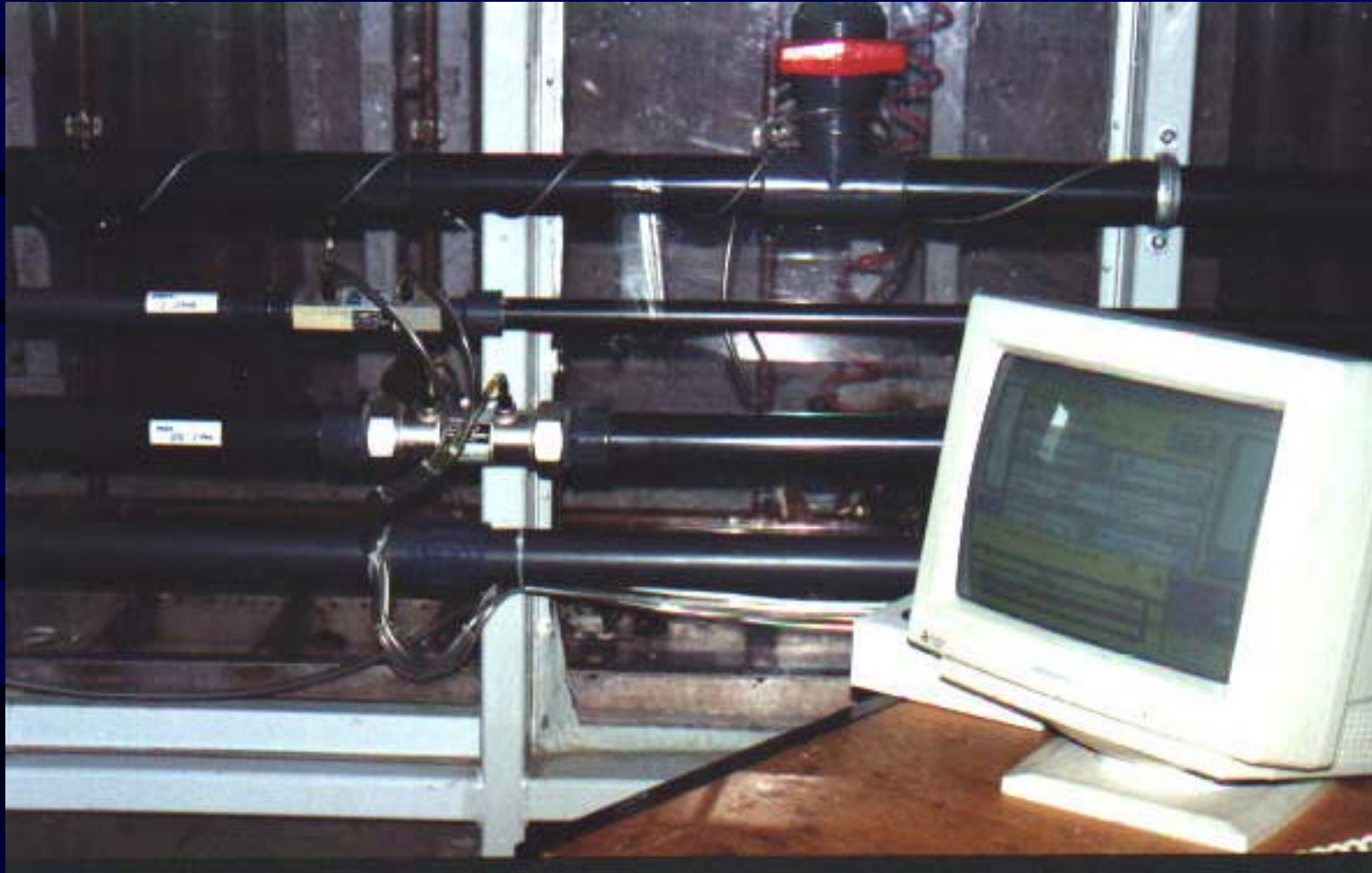


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Water Tightness

Visual inspection for leakage under cyclic pressure application, ASTM E547

- **Four cycles of 5 min ON, 1 min OFF**
- **B1 to B7 (150 to 700 Pa)**

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Wind Load Resistance (Deflection)

Uniformly distributed load, ASTM E330

- **Sash L/125, Mullion L/175**
- **C1 to C5 (± 500 to 2000 Pa)**

Wind Load Resistance (Blow Out)

Uniformly distributed load, ASTM E330

- **No permanent damage**
- **C1 to C5 (± 1500 to 5000 Pa)**

Forced Entry Resistance

Levels F10 & F20

Grade 10 & 20 ASTM F548

- **Dismantling from exterior**
- **Hand and tool manipulation**
- **Hardware load tests**
- **Repeat hand and tool manipulation**

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Condensation Resistance

Temperature Index (I), the lower of:

- *Coldest frame surface temperature*
- *Coldest average of three glass temperatures @ 50 mm from sightline*
- **90** - Temperature Index @ -30/+20 °C
- **98** - Temperature **Factor** @ -18/+21 °C
- **00** - Temperature Index @ -30/+20 °C

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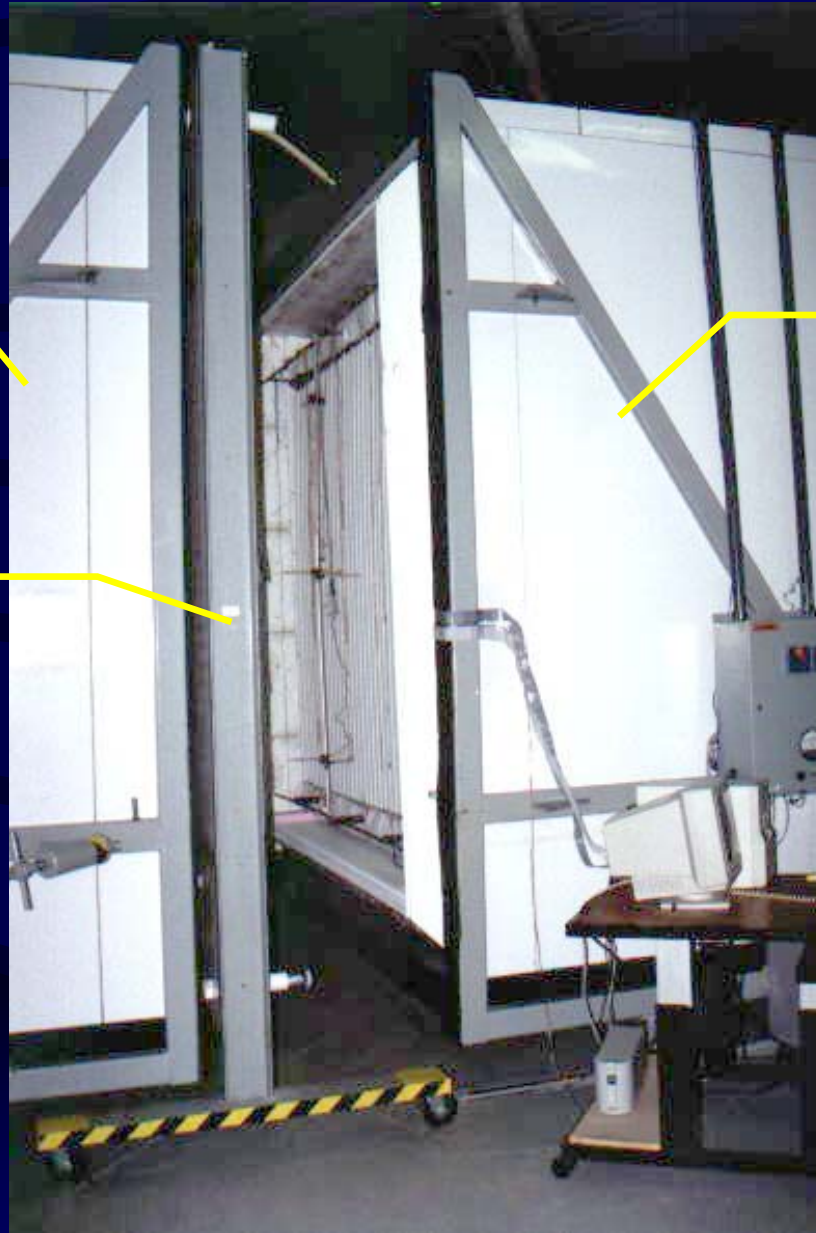
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**Weather
Side**

Test Wall

**Room
Side**



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Mechanical Tests

- **Screen Strength**
 - Standard Duty, 60 N (13.5 lb)
 - Heavy Duty, 330 N (75 lb)
- **Blocked Operation (Sliding)**
- **Sash Strength (Projecting)**
- **Sash Pull Off (PVC, FRP)**

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This Presentation

- Window Standards
- Laboratory Testing
- **Field Testing**

Common Field Tests:

- **Air Tightness**
- **Water Tightness**
- **Wind Load Resistance**



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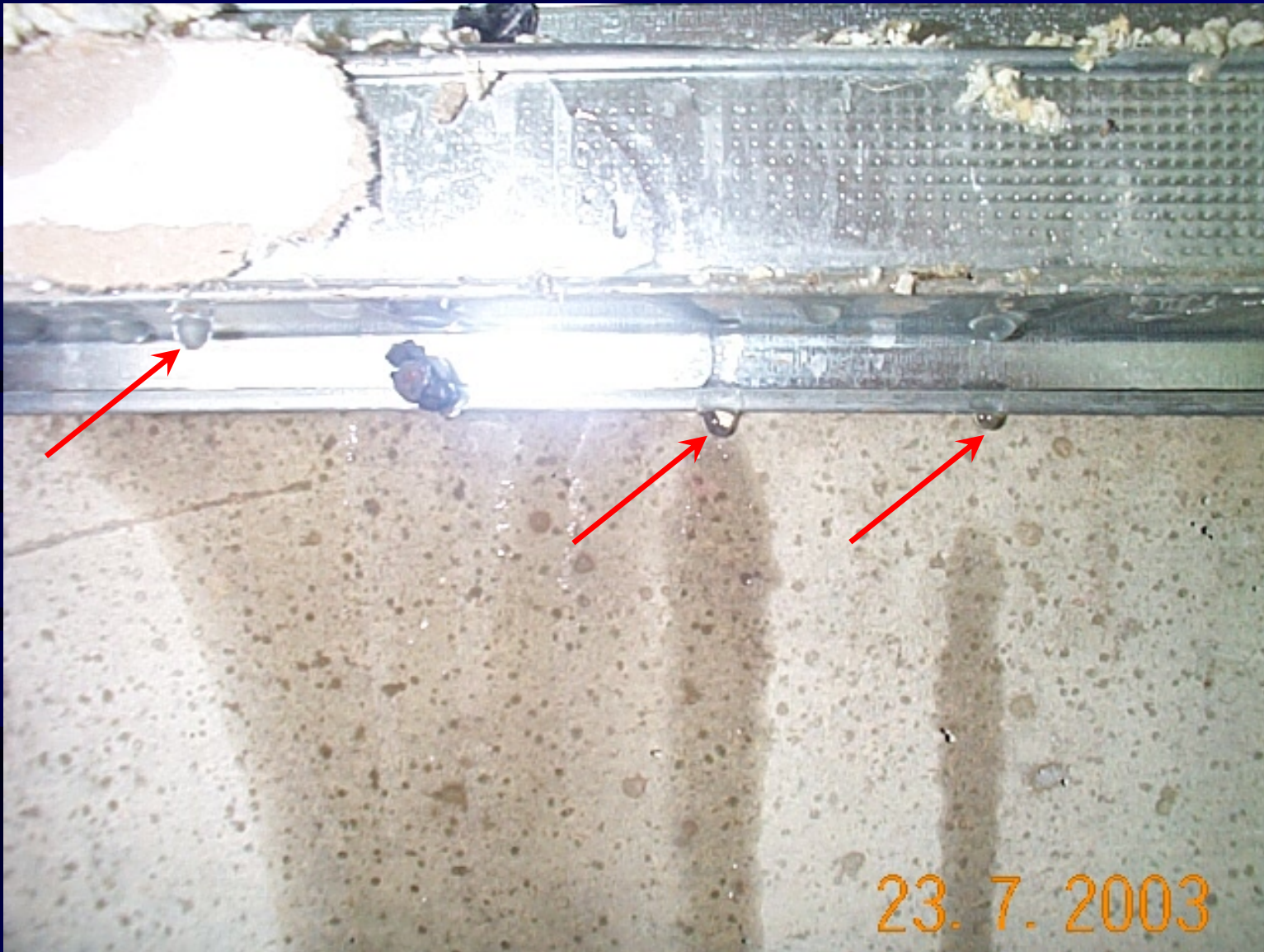


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Why Windows Continue to Leak?

- **Standards are for Standard Products**
- **Specifications need to be Job-Specific**
- **Inspectors need guidelines**

More Info

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Canadian 

Window & Door

Manufacturer

May 2000

Published Twice Yearly
For The Canadian Window,
Door & Fenestration Industry

**The Success of
Windows and
Doors Can...**

**Industry Canada Report
Window & Door Review 2000**

**Hinge on
Innovative
Hardware**

Salesmanship
The Life Blood of Every
Successful Company

Elie's Insight:
How Do You Choose A
Window Testing Lab?

**CSA Takes Over
Certification**

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Fenestration Feature!
Spring 2000
Buyer's Guide

**Regular
Contributing Writer
to the Industry**

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Elie Alkhoury,

How to IMPROVE Forced Entry Resistance of Windows & Sliding Doors

In Canada, windows and sliding doors are required to meet the specified level of forced entry resistance, as mandated in national and provincial building codes. Testing requirements are outlined in their respective standards. In this article, I would like to provide some insight to the evaluation process. Most importantly, I will provide some general design guidelines to meeting these levels in a practical manner. The CSA A440-98 window standard specifies one level of performance, which requires passing all the tests outlined in ASTM F 588 Grade 10 with some minor variation. The CAN/CGSB-82.1-M89 sliding door standard also specifies two levels of performance: F1 and F2, which both require testing to ASTM F 842, Grades 10 and 20 respectively. In all cases, the ASTM test methods involve the following steps in sequence:

- Remove from any exposed screws, glazing beads, and any other members or mechanical fasteners that can be removed from the exterior within a time limit of 5 minutes, using some prescribed common hand tools.

- Perform hand manipulation from the exterior for a period of 5 or 10 minutes for Grade 10 and 20 respectively.
- Carry out tool manipulation for the same period of time as hand manipulation.
- Perform sash and hardware load tests in a specified sequence involving various load directions and magnitude, in an attempt to disengage the locking mechanism.
- Repeat the hand and tool manipulation tests as above. It should be noted that all of the above tests are to be performed without damaging the window/door intentionally by cutting through components, or breaking glass. The methods are

intended to establish a measure of resistance to assemblies subjected to attacks by "unskilled or opportunistic burglars." For applications requiring higher levels of security, security glazing is usually employed which offer higher resistance to force generated by skilled burglary attacks. For these applications other evaluation methods, which could be the subject of a future article, should be employed.

Preventing Access Of Lock From The Exterior: Your First Step To Securing A Pass Rating.

We have seen, in many instances, that by simply reducing clearances, controlling tolerances between window components and/or relocating a lock, a typical residential window would pass the evaluation process with flying colors. If such control cannot be achieved on the shop floor, then you may need to resort to some active means of shielding the hardware, in order to prevent exterior access. First of all, improving FER does not necessarily imply increased product cost. There are simple and effective



In Canada, building codes mandate a specified level of FER

Canadian Window & Door Manufacturer

November 2000 55

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Do You Know Your Temperature Index?



Elie Alkhoury

Elie Alkhoury is founder & CEO of CAN-BEST, operating an independent, state-of-the-art testing and research laboratory, accredited by SCC and AAMA. He welcomes any comments or questions pertaining to window performance evaluation and testing.

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Well, that's not exactly what I meant! Since my usual column has something to do with windows, I'll try to restrict my talk to just that. By now, I presume some of you window suppliers have had your fair share of customers complaining about window condensation and frosting during this winter. While many of these complaints would be easily and readily dealt with, some unfortunately could escalate unnecessarily to the detriment of the window manufacturer.

Part of the blame I think rests on the window supplier's first reaction to their customer's complaint. The first response is usually "the window is fine, but the house is too humid"... too many plants... lots of cooking and showers... too cold of a spell, etc. All that may be perfectly true, but how do you expect to get paid if all the consumer wanted was to have a "better" window, a window that's not drafty and that doesn't condense itself to a puddle of water every morning. Here, the old adage "a better educated customer is a better consumer" comes to the rescue. Better customer education is needed, and most significantly at the time of sale and not at the time of complaint.

Having a higher Temperature Index for a window is perhaps the most significant of three main variables that, if maximized, it would contribute greatly towards reducing the potential for surface condensation. The

second variable would be to control window installation, while the third is to moderate the interior environmental conditions. Therefore, whenever you're faced with a complaint, just remember that two out of these three variables are actually under your own control, not your customer's. So, before we rush to blame the customer for jacking up that humidifier, let's have a deeper look at the real question, the one that you're expected to have answers for: What's the window's Temperature Index? i.e. under what conditions do you expect your window to operate satisfactorily and near-condensation-free?

The Temperature Index—Referred to as "I Value", the Temperature Index is the condensation resistance rating of the CSA A440 Window Standard. The purpose of this rating is to provide a comparative means of evaluating windows under the same set of environmental and installation conditions. It does not relate to actual field installations or to its environmental conditions.

The Temperature index (I) is derived by laboratory testing of an actual window under controlled exterior and interior environmental conditions. It is directly proportional to the window's interior surface temperature relative to the temperature difference between the interior and exterior. In other words, the higher I value is, the higher the window's potential resistance to condensation would be. It's a dimensionless number that could theoretically range from 0 to 100. While the minimum Temperature Index allowable by the A440 Standard is 140, it is quite possible to achieve up to 180 or more in a specially designed window for that demanding application where moisture condensation would not be tolerated,

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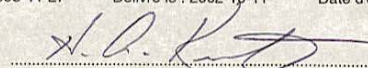
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