Impact of air leakage on hygrothermal and energy performance of buildings in North America. Part II: CCMC evaluation of air barriers

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PART II: CCMC Evaluation of Air Barriers

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National Research Council Canada
Conseil national de recherches Canada

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CCMC Evaluation

- Air barrier “systems”
- Air barrier “materials”

CCMC Technical Guide

for evaluation of

Air Barrier Systems for Exterior Walls of Low-Rise Buildings

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Funding:

- Consortium of 17 manufacturers lead by CHBA
- Additional funding from IRAP and Canadian Codes Center / IRC

Technical Support:

- heat and mass transfer experts, computer modeling
- structural wind loading
- polymer chemists

Heat, Air and Moisture Control

- Controlling heat flow, airflow, moisture flow and others will control interactions among the physical elemts of the bldg, its occupant and the environment.
- Airflow "*merits major consideration mainly of its influence on heat and moisture flow*"

(Hutcheon, 1953)

- One of the key strategies in the control of airflow is the use of air barriers.
- Many performance and deterioration problems due to condensation of BEs can be attributed to inadequate or failed Air Barrier Systems (ABS)

Air Barriers

- ABs are systems of materials designed and constructed to provide a continuous barrier to the movement of air.

- ABs are intended to resist the air pressure differences that act on them.

Requirements for Air Barrier Systems

As well as being continuous, the effectiveness of the ABS depends on its:

- Air permeance (*Air leakage rate (acceptance criteria and assessment)*)
- Structural strength and rigidity *(continuity and resistance to wind loads over time and deflection)*
- Durability *(Durable over the expected lifetime of the building)* and,
- Buildability *(representative specimens).*

Present Air Leakage Rate Table

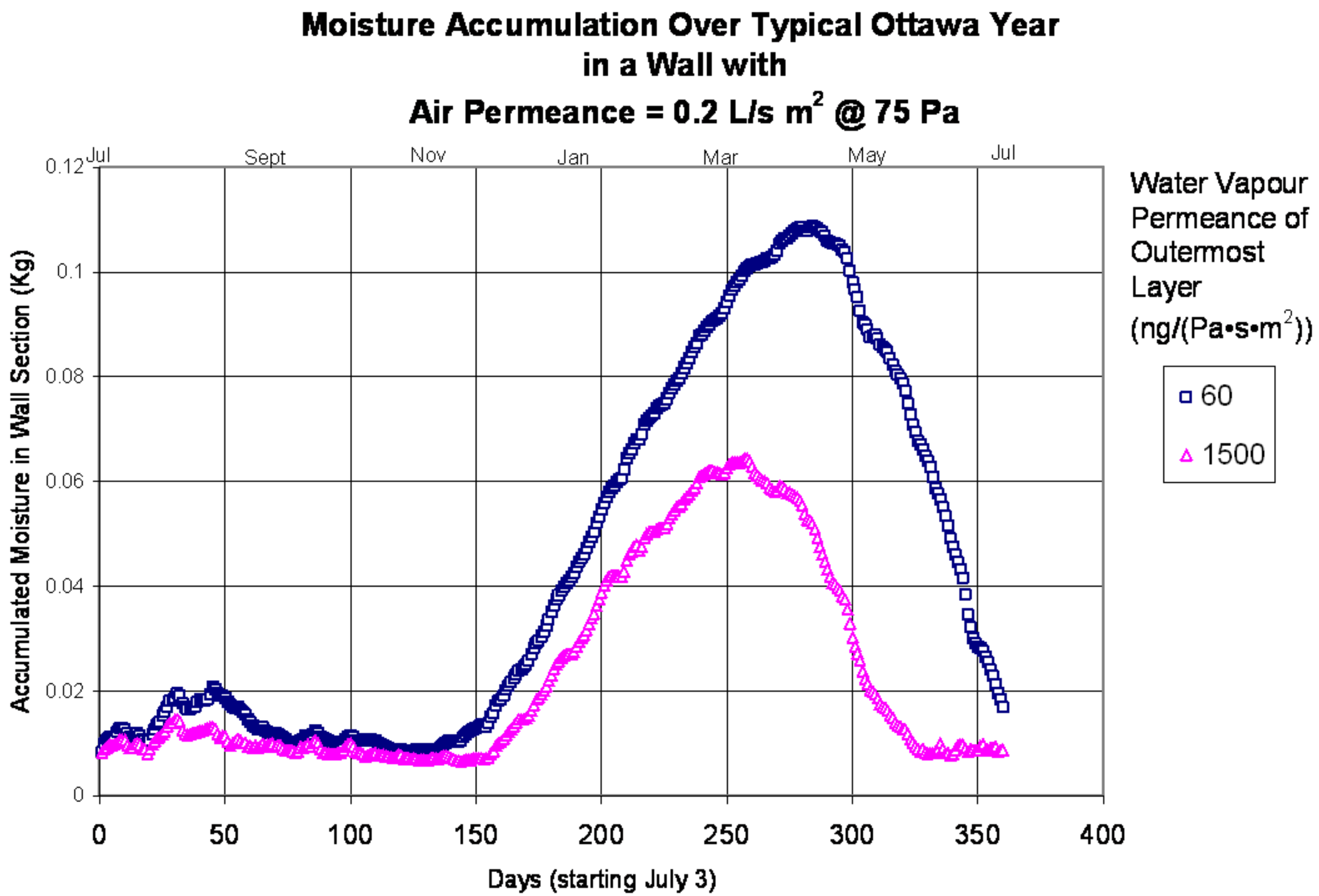
Table A-5.4.1.2.
Recommended Maximum Air Leakage Rates

Warm Side relative humidity at 21°C	Recommended maximum system air leakage rate, L / (s•m^2) at 75 Pa
<27%	0.15
27 to 55%	0.10
>55%	0.05

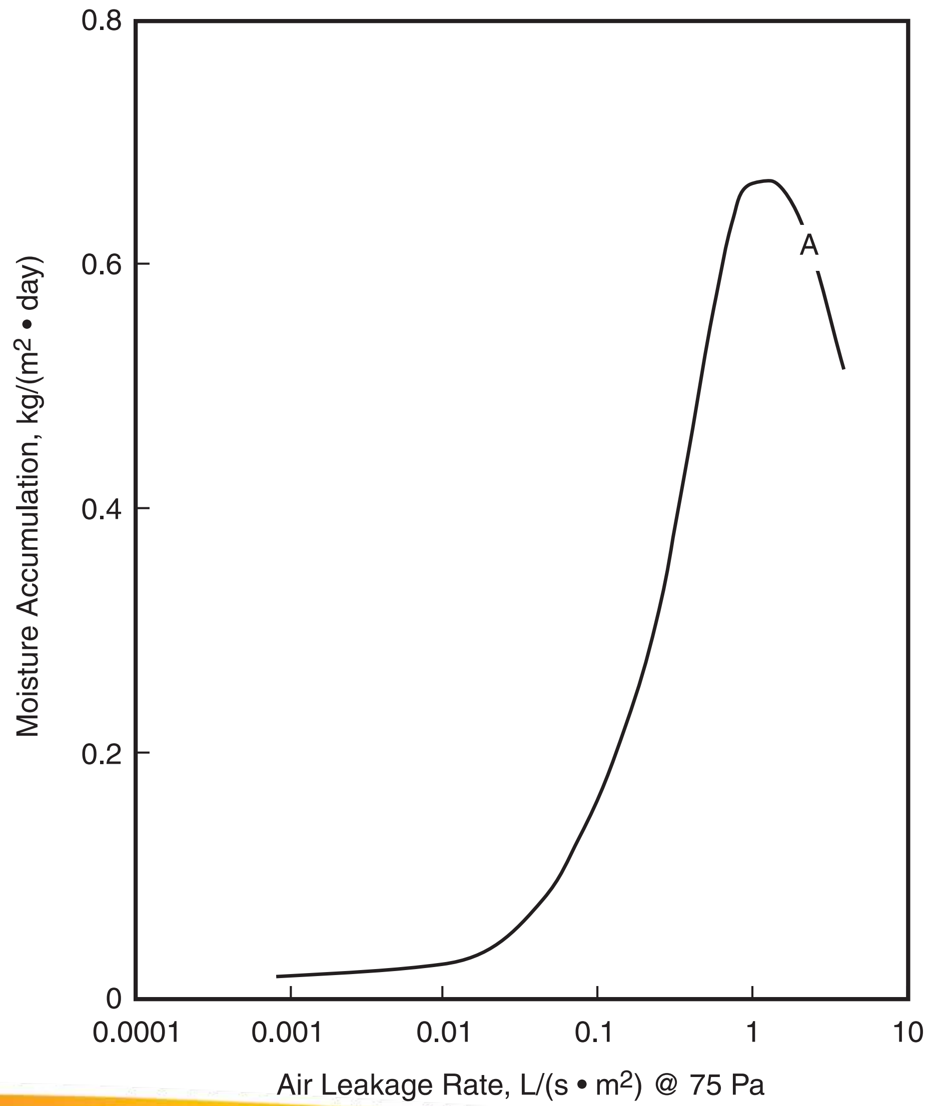
Permissible Air Leakage Rates

Water vapour permeance of outermost layer of wall assembly (ng / Pa•s•m^2)	Maximum permissible air leakage rates (l / s•m^2) @ 75 Pa
$15 < WVP \leq 60$	0.05
$60 < WVP \leq 170$	0.10
$170 < WVP \leq 800$	0.15
> 800	0.20

Drying Potential Effects on Moisture Accumulation

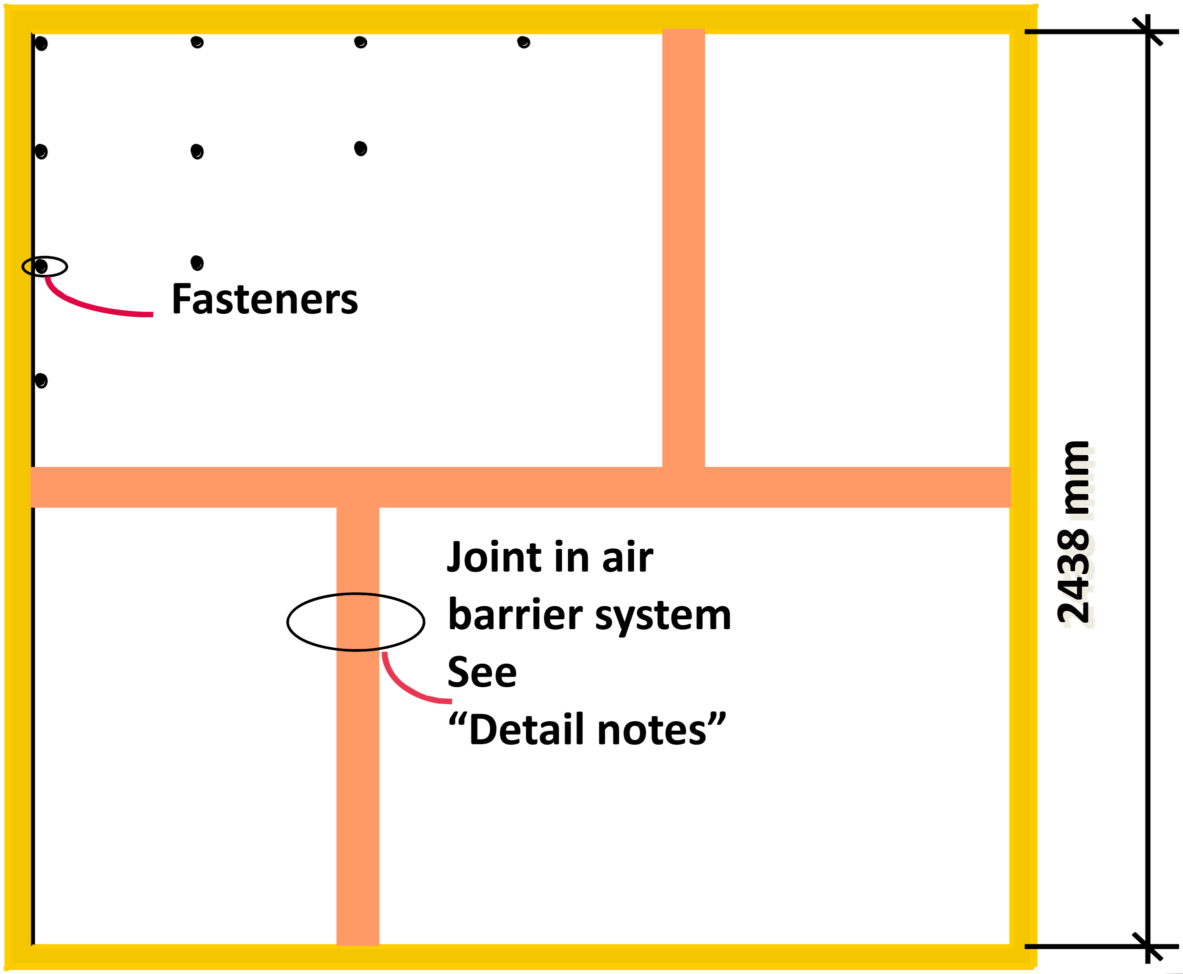


Moisture Acc. vs Air Leakage



If you have a product this is the way to go through for the evaluation of the proprietary ABS

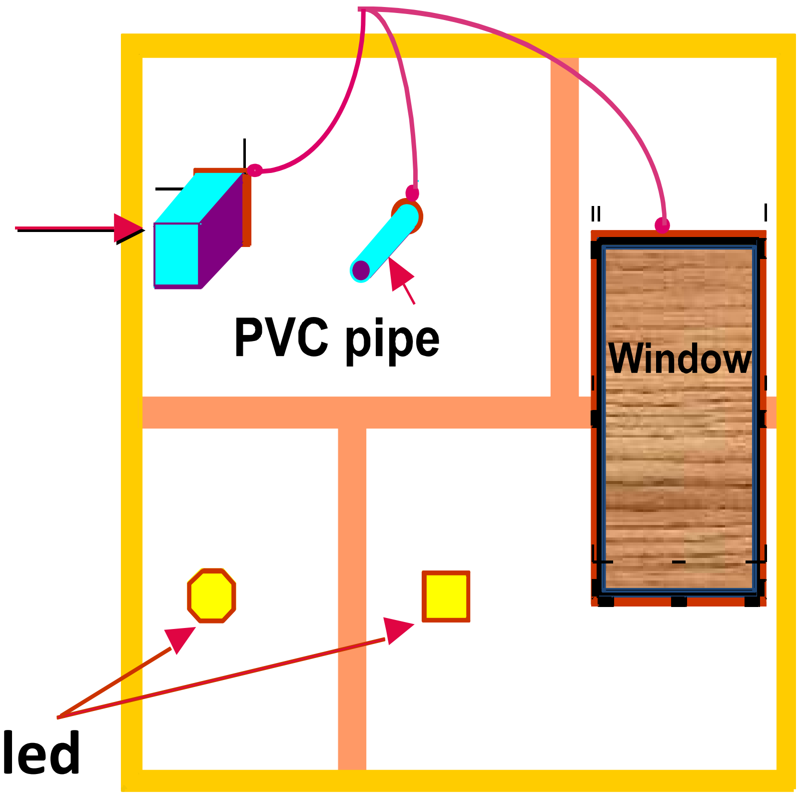
Specimen 1 - Opaque Wall



Specimen 2 - Continuity at Penetrations

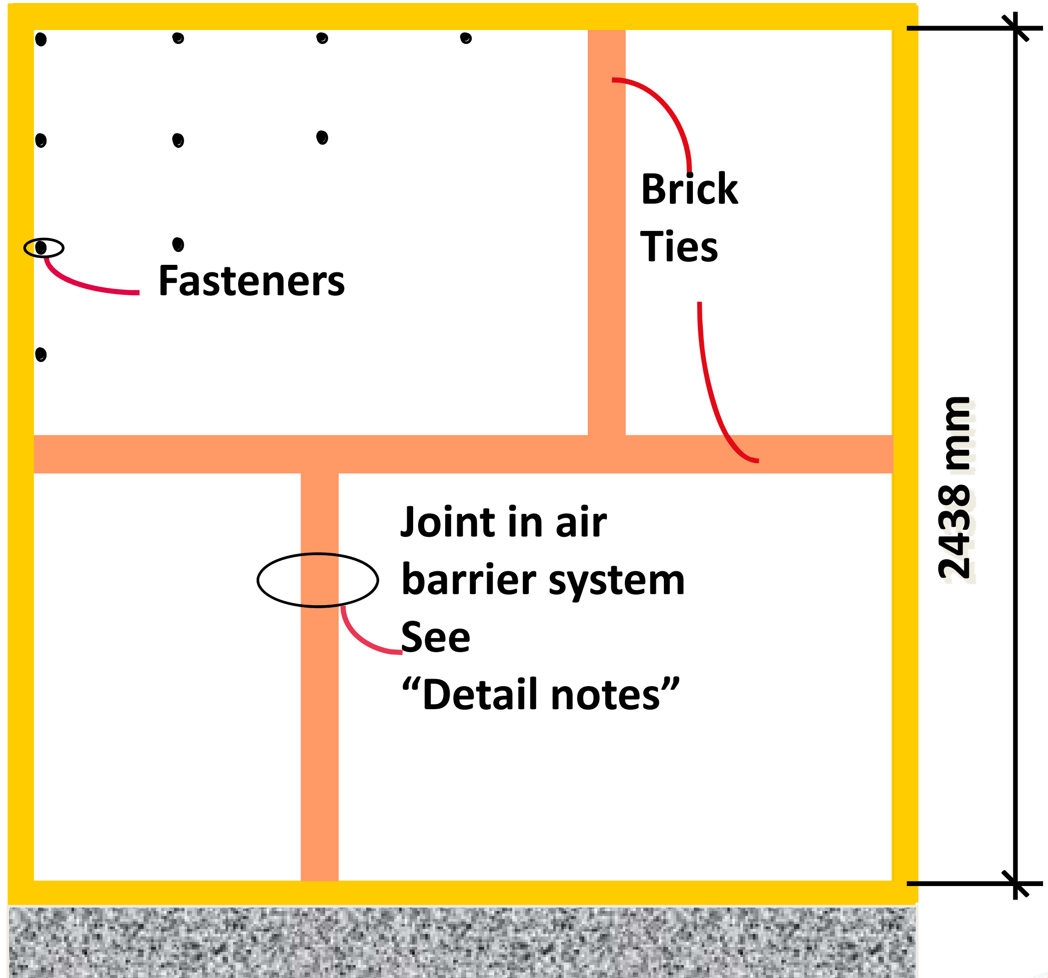
Junction To be Sealed

Galvanized Duct

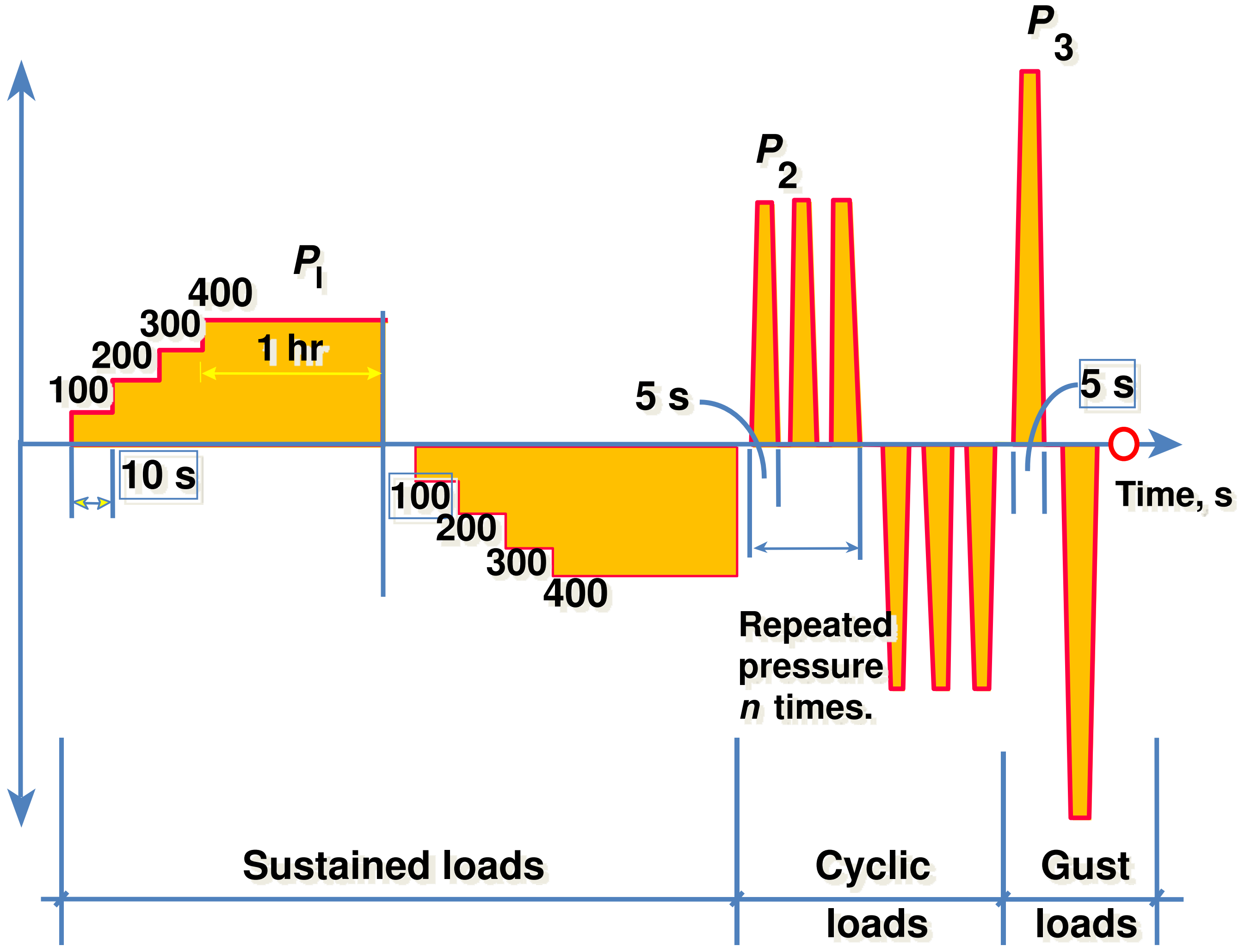


Hexagonal and Rectangular External Junction Boxes (or Interior Outlet Boxes) Installed in Accordance With Practice

Specimen 3 - Foundation Interface & Modified Opaque Wall



Structural Performance Test



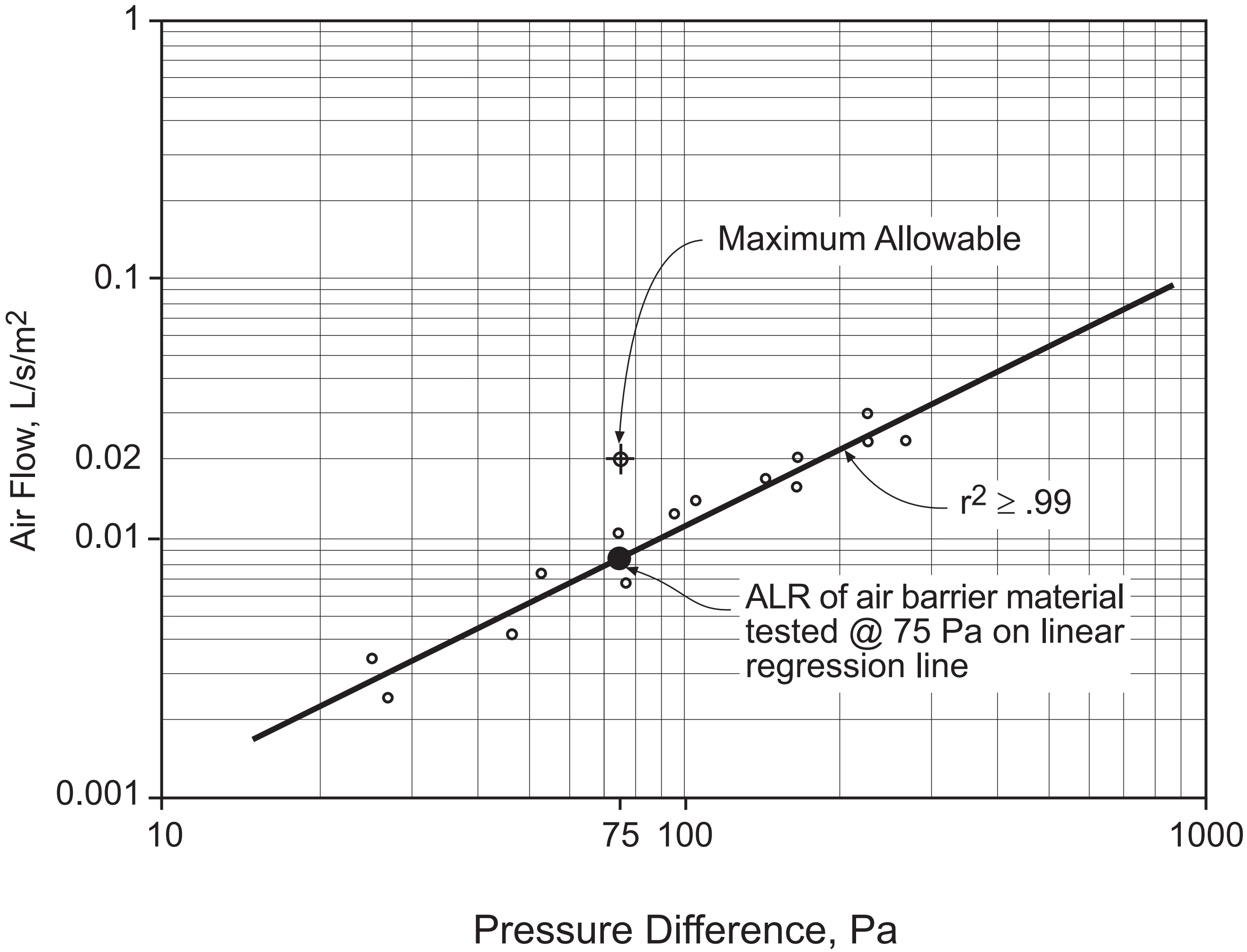
Wind Pressure Loadings

For geographical areas where wind design value is	P_1, P_1' sustained for 1 hr. (Pa)	P_2, P_2' 2000 cycles (1) (Pa)	P_3, P_3' gust wind (Pa)
$Q_{10} < 0.40$ kPa	400	530	800
$Q_{10} < 0.60$ kPa	600	800	1200

Air Leakage Rating of System:

- Air leakage rate of opaque wall specimen #1
- Specimen 2 and 3 must be within 10% of opaque wall specimen

Reference Pressure @75 Pa Δ P



Deflections at 1.5 x Design Wind Load:

For geographical areas where wind design value is	Record maximum deflection(s) after completion of wind pressure loading at following load
$Q_{10} < 0.40$ kPa	$D_{0.40}$ @ 640 Pa
$Q_{10} < 0.60$ kPa	$D_{0.60}$ @ 960 Pa

Durability of Air Barrier System:

- Criteria for 12 materials and accessories
- Physical and mechanical properties
- "Accelerated" aging and durability levels (accessible and non-accessible systems)

CCMC Technical Guide for Evaluation of Air Barrier Materials

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Air Barrier Materials

- No less than five specimens, 1 m^2 specimens tested
- Tested through range from 0 to 250 Pa
- Air leakage rate @ 75 Pa from linear regression must be ≤ 0.02 L / (s•m^2)

CCMC Evaluation Report

- air barrier material qualification
- appendix with proprietary air barrier system defined - for acceptance by building officials

Discussion

Thank you

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