THE CHANGING REQUIREMENTS OF AIRTIGHTNESS IN THE US

Wagdy Anis, FAIA, LEED AP
Wiss, Janney, Elstner Associates, Inc. - USA.

ABSTRACT

Building problems such as condensation, frost, efflorescence, mold, icicle and ice dam formation, wood decay, metal corrosion, premature failure of assemblies, draftiness and discomfort, and energy loss have all been associated with the phenomenon of air leakage of building enclosures.

In 1965, at the Institute for Research in Construction, at the National Research Council of Canada, (IRC-NRC) Kirby Garden authored the Canadian Building Digest No. 72 entitled "Controlling Air Leakage is Important". In 1977, also at IRC-NRC, Gustav Handegord, in a paper entitled "The Need For Airtightness in Buildings" concluded that air leakage through construction is the principal means by which water vapor moves to cold surfaces and is the major cause of condensation in buildings.

The Canadian Model National Building Code incorporated air barrier requirements in 1985 in Chapter 5, Environmental Separation, (without quantified maximum air permeance requirements). In 1995 the Model Code adopted 0.2 L/s*m^2 @ 75 Pa (0.004 cfm/ft^2 @ 0.3" w.g.), the air leakage rate of a sheet of 1/2" thick drywall, as the maximum air leakage rate for materials used to construct the air barrier.

In 2001 a major overhaul of the Massachusetts' energy code was promulgated. The energy code until then had been based on ASHRAE 90.1 1989. Guided by the International Energy Conservation Code (IECC) 2000 and ASHRAE 90.1 1999, MA put in place the first advanced proprietary energy code that combined the best of both codes. It also included extensive air barrier requirements for the first time in the US, based on the Canadian example with additional requirements for compartmentalization and leakage control of stationary mechanical systems and open louvers. Massachusetts undertook a massive educational campaign introducing the new code requirements and held hundreds of public educational sessions and in-house consultations to design firms regarding the new requirements. Funding for this effort was provided by the Department of Energy Resources and the utility companies. Publications on the impact of airtightness ensued (Anis, 2001)

As a result of the Massachusetts air barrier requirements, the Air Barrier Association of America was formed in 2001 based on ISO 9000, with a mission of industry regulation, education and knowledge dissemination.

Attempts to introduce airtightness requirements using air barrier technology into ASHRAE 90.1 were triggered by a Change Proposal to amend ASHRAE 90.1-2001 to include air barrier requirements submitted by the author in 2002. A cost effectiveness study based on energy savings was performed by NIST for SSPC 90.1 committee and published as NISTIR 7238 , (Emmerich, McDowell, Anis, 2005). SSPC 90.1 included air barrier requirements in ASHRAE 90.1 2010, although a whole building airtightness compliance option is missing. The New Buildings Institute (NBI), published its Advanced Buildings Guide as "EBenchmark" in 2003 (subsequently became "Core Performance"), ASHRAE Advanced Energy Design Guides and ANSI/ASHRAE/ IES/USGBC 189.1 all included air barrier requirements. The IECC in 2012 adopted air barrier requirements that include a whole building airtightness option. The US Army Corps of Engineers in 2009 published its air barrier and whole building testing protocol and requirements with a maximum whole building air permeability of the enclosure (six-sided box) of 0.25 cfm/ft2 @ 0.3" w.g (1.25 L/s•m2 @75 Pa). Following suit, the General Services Administration (GSA), the biggest property owner in the world, published its P-100 Design Guide with whole building air testing requirements and a maximum air permeability of 0.4 cfm/ft2 @ 1.57 psf (2.0 L/s•m2 @ 75 Pa). In 2010, the tri-forces published UFC-3-101-01 Architecture , with air tightness requirements for the army, navy and air force buildings with whole building testing requirements to different criteria for the different branches of the Department of Defense (USACE and NAVFAC at 0.25 cfm/ft2 @ 1.57 psf (1.25 L/s•m2 @75 Pa) and Air Force at 0.4 cfm/ft2@1.57 psf (2.0 L/s•m2 @ 75 Pa). The International Green Construction Code (IgCC-2012) has recently been published and requires mandatory air leakage testing of whole buildings.

The requirements for whole building air tightness testing are becoming increasingly attractive to many jurisdictions. The State of Washington was the first to institute air barrier requirements with both a maximum material air leakage requirement and a whole building maximum air permeability rate with testing requirements for buildings six stories and higher. Requirements for enclosure commissioning as an option for buildings that are too difficult to test are also being considered.