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Get ready for air leakage testing

■ *New state and city of Seattle codes have requirements for continuous air barriers.*

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Will your building pass a blower door test? The movement towards more efficient buildings has upped the bar in Washington state and Seattle. In the delayed issue of the 2009 Seattle and Washington state energy codes, chapters 5 and 13 include a requirement for continuous air barriers.

Buildings with inadequate air barriers tend to be drafty, resulting in variable interior temperatures and heat loss through gaps and holes. Air barriers reduce or eliminate inadvertent airflow into and out of a building enclosure — reducing the operating expenses for building owners, improving occupant comfort and reducing the risk of moisture damage.

The U.S. Department of Energy estimates that 40 percent of heat produced in an average building is lost to uncontrolled air leakage.

To compensate for projected heat loss, local mechanical engineers typically size the heating capacity of HVAC systems so that one-third is attributable to uncontrolled air infiltration through discontinuities in the air barrier. The new energy codes target these inefficiencies as areas for improvement.

Providing continuous air barriers is a highly cost-effective way to decrease long-term energy costs.

What's in the code

The state energy code requires single-family homes and all buildings over five stories be designed with air barrier systems. The Seattle amendments expand this requirement to all buildings, regardless of height. In addition to design requirements, both codes require pressure testing of the whole building.

Single-family homes must pass the air leakage test. Air-barrier testing has been conducted on single-family homes since the late 1970s; however, large building testing is in its infancy, which may be why projects complying with 2009 non-residential and multifamily code won't be required to pass tests. For now, municipalities will collect data on leakage rates in an effort to target appropriate requirements for future code versions.

Designing the air barrier

Since air barrier design was not required previously, architects may not have the knowledge or experience to design an effective air barrier system. However, building scientists and envelope consultants have been advocating for years on the merits of air barriers for reducing moisture issues and improving durability and energy performance.

Continuous air barriers are composed of many different building components and assemblies that, when linked together in a continuous airtight manner, control air movement across the building enclosure.

Initial considerations should be made when selecting which elements of each assembly will act as air barriers. Materials selection will vary based on exposure, loads that will act on the air barrier, and constructability.

After the airtight element for each assembly has been selected, penetrations through and transitions between materials must be closely scrutinized to ensure they are well sealed. Electrical junction boxes, hose bibs, plumbing vents and other penetrations must be appropriately sealed to the air barrier. Connections must be maintained around windows and where the wall transitions to the roof and other assemblies.

A good way to confirm that the air barrier is continuous is to trace a line in plans and sections without lifting your pencil, according to JRS Engineering principal Scott Croasdale.

Croasdale's advice is reflected in one of the Seattle code's requirements. Plan and section diagrams of the air barrier's location will need to be submitted as part of permit documents. Both codes will require all air barrier components to be detailed, including transitions at doors, windows, roofs, decks and other locations.

Installation is important

Contractors bring concepts to reality for buildings in general and air barriers specifically. Contractor quality control programs can go a long way towards carrying an air barrier design to its successful conclusion, but sequencing challenges can arise, and trades may be performing new tasks and will likely be interacting with other trades in ways they have not in the past.

The biggest learning curve for contractors is making sure the framers insert air barrier products at critical transition points, such as between walls and vented roofs or behind deck ledgers.

Depending on how the air barrier is achieved, there can be a range of cost impacts over what is currently being done. Factors that influence cost are materials selection, assemblies and the degree of complication of details. For example, a vented roof is generally considered less costly than a conventional roof, but it makes achieving air barrier continuity more difficult, as drywall on the ceiling becomes the air barrier component, rather than the underlay that performs this role in conventional roof assemblies.

Air barrier testing

To determine a building's leakage rate, a blower door test is conducted. This test involves closing all exterior windows and doors and opening all interior doors. Once the entire building volume is linked, calibrated door fans are used to produce differential interior-to-exterior pressure. The air flow and pressures are measured to arrive at an envelope leakage amount.

JRS Engineering has found that it typically requires one or two days in the building in order to set up and conduct the test. The bulk of this time is spent setting up, with the actual test time lasting about an hour.

Having a quantitative number that indicates how a building will perform can be daunting. Measuring construction quality is not often done this way. The payoff will be in the building's long-term operating costs.

Lessons learned from testing will be applied by designers and contractors to subsequent buildings, resulting in more efficient methods of creating tighter envelopes and smaller, more efficient heating and cooling systems.

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