Energy Code Compliance

Montana Best Practices Newsletter

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The walls between art and engineering exist only in our minds.

—Theo Jansen

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Common Walls and Air Tightness in Townhouses

The 2012 International Energy Conservation Code (IECC) requires that all residential buildings, which includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2 (apartment dwellings), R-3, and R-4 buildings three stories or less in height above-grade plane comply with a specific building tightness limit. In Montana that limit is four air changes per hour at 50 Pascals of pressure difference (ACH50). This air leakage rate requirement is important to achieving an efficient building thermal envelope but, currently the IECC does not address differences between single-family and multifamily buildings. Due to unique characteristics, a multifamily building poses significant challenges to measuring air leakage to the outside from individual dwelling units.

There are two primary parts to this discussion. One part involves the testing procedures used to measure unit tightness. The second part is how to seal *common walls* between the units to minimize air leakage while maintaining fire rating compliance. A common wall is also called *a party wall*, *fire wall*, *area separation wall*, or *townhouse separation wall*. Such a wall is a fire-resistance rated wall that extends continuously from the foundation to the underside of fire protected roof sheathing or through the roof to a parapet. The purpose of a common wall is to prevent the spread of fire between units.

This brief article will touch on the key challenges of constructing common walls that comply with the code provisions for fire rating and the building tightness provisions of the IECC. A more comprehensive treatment of these issues can be found in the references included at the end of this article. Of special note regarding code related provisions is the USDOE Code Compliance Brief titled, *Air Sealing and Insulating Common Walls (Party Walls) in Multi-Family Buildings.*

Tightness Testing

The standard method for testing new building envelope air leakage is based on single-family homes. This method includes a blower door placed in an exterior door. The blower door depressurizes the dwelling unit to a specified pressure differential and the rate at which air is being exhausted from the dwelling unit is recorded. A ±50 Pascal pressure differential is standard for testing residential buildings. The dwelling unit acts as a single pressure zone and all leakage measured is to the outside.

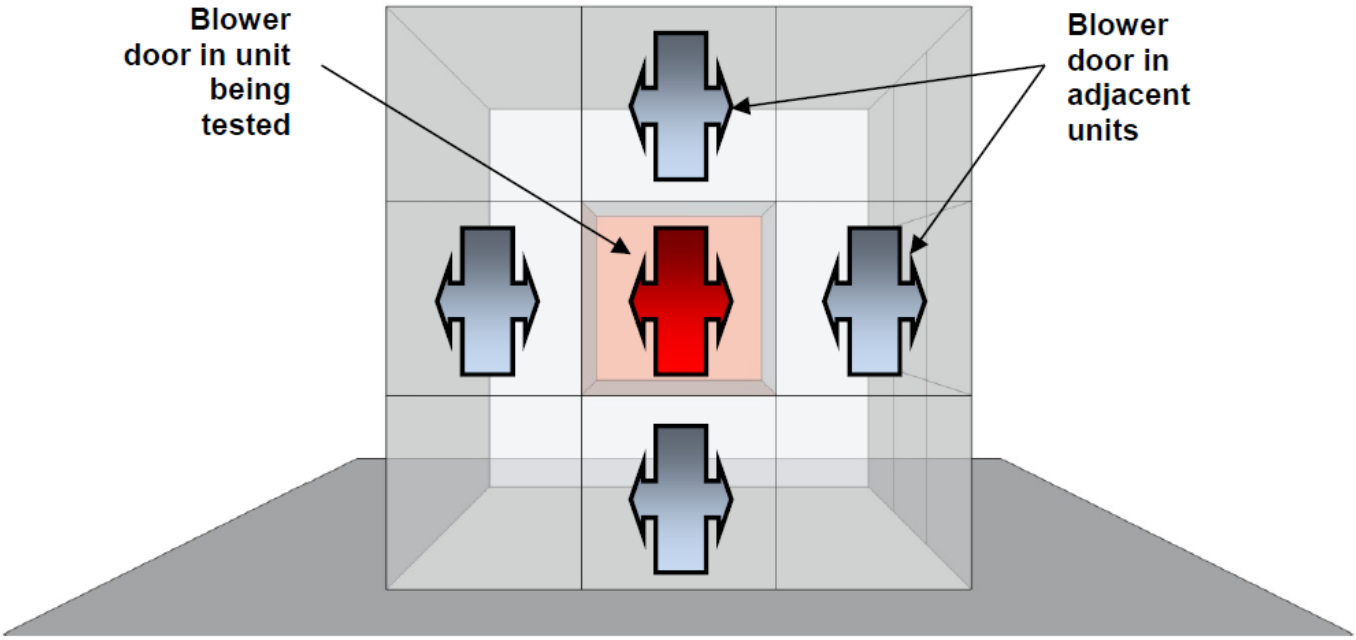
In attached dwellings, testing a single unit by the standard method captures air leakage to the outside as well as to the adjacent spaces. An alternative testing method for multifamily buildings is a “guarded” test. A guarded test requires additional blower doors being set up in the adjacent conditioned spaces. The additional blower doors depressurize those

spaces to the same pressure as the unit being tested. This eliminates a pressure difference between the units being tested and the adjacent spaces thus, eliminating air movement between the spaces. With the adjacent spaces at the equal pressure as the tested unit, the only leakage measured will be to the outside.

The Consortium for Advanced Residential Buildings used blower door test data available from numerous multifamily projects to compare guarded and unguarded test results. Their analysis suggests an average air leakage reduction of about 30percent with guarded blower door testing.

For some builders the question becomes whether to spend money on air sealing, especially at the common walls, or pay for guarded tightness testing. There are added benefits with increased air leakage control which include:

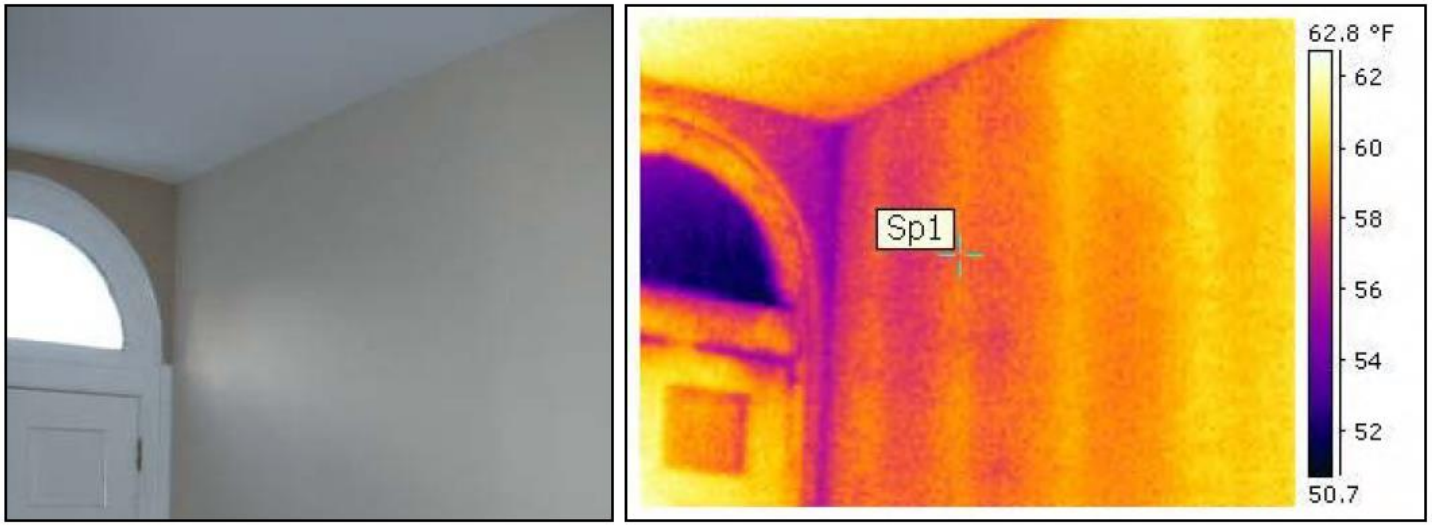
- Increased energy efficiency by reducing air leakage
- Improved smoke and fire control
- Improved occupant comfort, including reduced odors, drafts, and sound transmission
- Greater control and effectiveness of heating, ventilation, and air conditioning systems



Guarded Blower Door Test Setup

Source: Challenges of Achieving 2012 IECC Air Sealing Requirements in Multifamily Dwellings. Refer to references

A focus on sealing exterior wall air leakage without reducing air leakage between dwelling units may exacerbate indoor air quality problems. The movement of pollutants, smoke/fire, and odors between apartments may have health and safety consequences, so there is an added benefit of reducing air leakage between dwelling units.



Infrared image on right shows gap consequences of poorly sealed common wall.

Source: ENERGY STAR Thermal Bypass Checklist Guide and Energy Services Group

Example of properly air sealed common wall with fire-rated sealant (in orange). Source: ENERGY STAR Thermal Bypass Checklist Guide and MaGrann Associates

Air Sealing at Common Walls

There are several code and standards provisions related to common walls in low-rise multifamily buildings. There are also some barriers to understanding the code intent relative to building tightening. There are no clear definitions in the International Energy Conservation Code (IECC) and International Residential Code (IRC) for the terms used to describe a common wall. The air leakage requirements in the IECC may be difficult to achieve if code officials do not allow air sealing of smaller gaps and seams in the common wall because these practices are not specifically detailed by UL and the codes.

The International Building Code [IBC] defines a fire wall as, "A fire-resistance rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall."

Issues with air sealing of common walls can be a barrier to greater energy efficiency in multifamily housing and to achieving air leakage limits mandated by the IECC. The relevant Underwriters Laboratories (UL) fire resistance testing is conducted on a laboratory test wall that has no intentional air sealing in place and no materials or methods for air sealing (beyond draft stopping measures) are shown in the "U" Design drawings or material listings. "U" Designs have been interpreted by some code officials as having no approved air sealing methods or materials for smaller gaps and seams. Fire-stopping is not necessarily air sealing. Fire-stopping materials like rock wool or fiberglass does virtually nothing to stop air infiltration. Fire-rated caulk or foam should be used to air seal common walls for air tightness.

The USDOE Building Energy Code Program Code Compliance Brief titled *Air Sealing and Insulating Common Walls (Party Walls) in Multi-Family Buildings* summarizes some of the issues:

> Air sealing has proven to be challenging for multi-family dwellings because it is difficult to identify all the locations that need to be sealed and the appropriate materials needed to seal the areas. Gap-sealing materials used in the perimeter of these walls must meet applicable testing and fire rating standards. In frame construction, gypsum common walls are most normally used. Gypsum common walls may be load-bearing walls, but cannot attach structurally to adjacent units. They are most generally constructed of two layers of 1-inch thick gypsum liner panels, held together by a network of metal "C" and "H" channels, and are held in place vertically by aluminum breakaway clips screwed to the metal channels and to the frame wall. The breakaway clips are designed to allow the frame wall to fall away without disturbing the common wall. Common walls are fire tested according to ANSI/UL 263 (ASTM E119) without any frame wall on the fire side because that wall is assumed to have already fallen away. The referenced test method, UL 263, has no provisions in the test to assess air leakage.
>
> According to the IRC, dwelling units in two-family dwellings should be separated from each other by wall and floor assemblies having not less than 1-hour fire-resistance rating were tested in accordance with UL 263 or ASTM E119. Fire-resistance-rated floor/ceiling and wall assemblies should extend to and be tight against the exterior wall, and the wall assemblies should extend from the foundation to the underside of the roof sheathing. A common interpretation of "tight" would be "no gap through which air could flow"; however, in practice, that would be essentially impossible to achieve without a sealant material to span inevitable gaps between rigid framing materials installed by even the most skilled practitioners. Yet the UL 263 tested assemblies make no explicit provision for the application of specific sealant materials to achieve this "tight" status between the rated and exterior walls. The problem to be addressed is that code officials typically interpret the "U" Designs as having no approved method or material to seal them at the ¾-inch air space perimeter of the common wall. Common walls not sealed at the perimeter location makes these walls porous to air flow coming from the exterior or an attached garage. However, some of the "U" Designs do allow for different types of sealant as optional methods for air sealing.

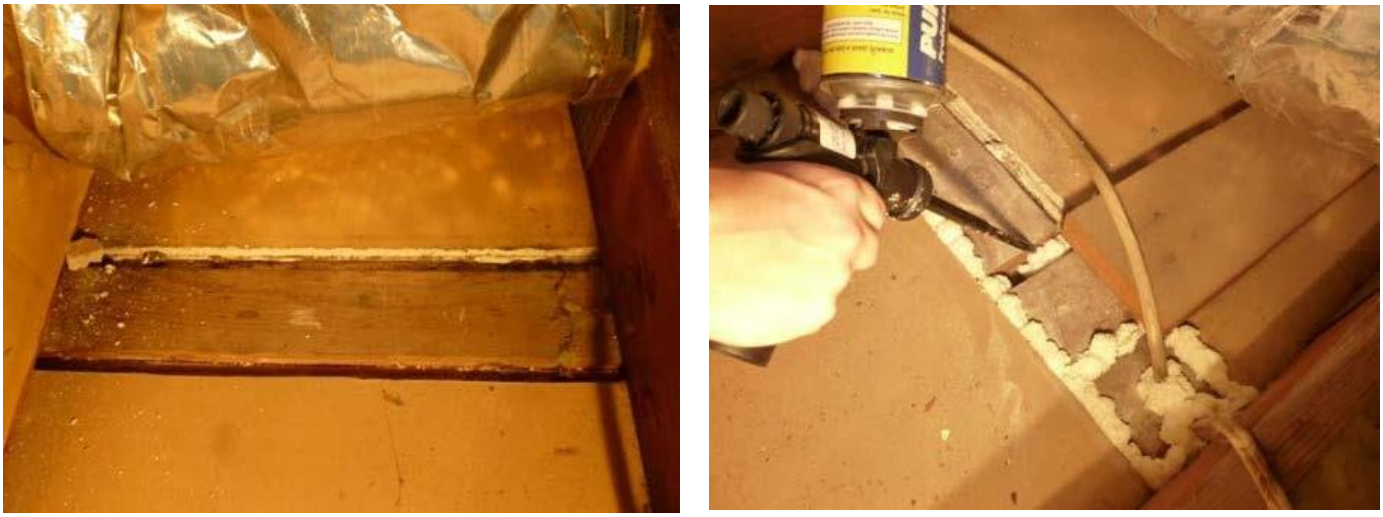
Important Montana Amendments to the IRC (ARM 24.301.154)

Montana amended the IRC as it relates to townhouse fire resistant construction. Following is the relevant language of the Montana amendment to R302.2:

> A common two-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts, or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with the adopted electrical code. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

The deleted language would allow one-hour fire-resistance-rated wall assemblies to separate townhouse units since fire sprinklers are a part of the 2012 IRC. Since Montana does not require fire sprinklers in residential buildings governed by the IRC, the fire-resistance of townhouse common walls was increased to two-hours.

The typical townhouse common wall design in Montana appears to be a 2x6 wall with two layers of 5/8-inch sheetrock on both sides, which complies with ASTM E 119. The key to air sealing these walls is use of fire rated sealant or foam at penetrations.



In the photo on the left, gaps on each side of a common wall are left unsealed. On the right, fire rated spray foam is used to seal those gaps at the top plates.

Source: USDOE Building America Solution Center.

Plan Review:

Review the construction documents for details describing common wall construction, insulation, air sealing, materials and installation, and construction techniques. The 2018 IECC is more explicit about what is to be included on the submitted construction documents but it makes commons sense that the following be included: fire blocking sealants and installation details; air sealing materials and installation details; and Insulation materials and their R-values and installation details. Following are some of the key provisions of the International Residential Code (IRC) that apply to common walls:

2012 IRC, R302.2 Townhouses. Fire Resistance of townhouse common walls as amended by Montana.

R302.2.1 Continuity. Continuity of the fire-resistance-rated wall.

R302.2.4 Structural Independence. Each individual townhouse should be structurally independent with several exceptions.

R302.3 Two-family Dwellings. Fire Resistance of two-family dwelling common walls.

R302.4 Dwelling Unit Rated Penetrations. The fire resistance of dwelling wall and floor assemblies.

R302.11 Fireblocking. Fireblocking requirements in combustible construction.

2012 IECC, R402.4. Air Leakage. The *building thermal envelope* must be constructed to limit air leakage. The sealing methods between dissimilar materials should allow for differential expansion and contraction. The components listed in the Air Barrier and Insulation Table must be installed in accordance with the manufacturer's instructions and the criteria listed as the applicable method of construction.

Field Inspection:

1. Verify energy code compliance for sealing common walls would typically be at the framing and rough-in work inspection and include the building tightness testing results. It is especially appropriate in the case of multifamily dwelling units to require the testing technician record the details about how the tests were conducted as well as the results.
2. Verify that the provisions of *Table 402.4.1.1 Air Barrier and Insulation Installation* are met for the thermal envelope. Some code officials could interpret this to apply to common walls at least in terms of air leakage from the common walls to the attic or crawlspace.
3. Confirm fire blocking sealant and other sealing materials meet installation details per manufacturer specifications and approved construction documents.

Final Thoughts

The IECC air leakage provisions are seen by some as geared toward single-family construction that do not address the issues confronted in multifamily buildings. Some observers have suggested that the quantifying air leakage provisions should be based on the area of exterior envelope instead of dwelling volume. Such an approach is used for commercial buildings in the energy code. However, it is likely that interior building cavities, such as common walls, are connected through indirect air pathways to the outside which suggests that interior air leakage should be addressed regardless of the tightness metric.

Some jurisdictions might not allow air sealing of smaller gaps and seams in a common wall because these practices are not specifically detailed by UL and the I-Codes. It is important to check with the code official about acceptable sealing materials to be used in common walls.

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