Building America Case Study

Apartment Compartmentalization with an Aerosol-Based Sealing Process

Queens, New York

PROJECT INFORMATION

Construction: New

Type: Multifamily

Partners:

Builder: Bluestone Organization, *bluestoneorg.com*

Consortium for Advanced Residential Buildings, *carb-swa.com*

Research Topic: Air sealing building enclosures

Date Completed: 2014

Climate Zones: All

PERFORMANCE DATA

The aerosol process resulted in an average reduction of 71% in air leakage and an average apartment airtightness of 0.08 CFM50/ft^2 of the enclosure area.

Once this aerosol compartmentalization process is commercialized, it could allow an experienced team of two people to tightly seal three to four apartments per day. Materials for setup and sealing are expected to total $100–$200 per apartment.

Air sealing building enclosures is a difficult and time-consuming process. Current methods in new construction require laborers to physically locate small and large holes in multiple assemblies and manually seal each of them. In this study, the U.S. Department of Energy team Consortium for Advanced Residential Buildings (CARB) demonstrated a method for automated air sealing and compartmentalization of buildings. CARB accomplished this through the use of an aerosolized sealant developed by the Western Cooling Efficiency Center at the University of California, Davis.

CARB presented the effectiveness of this new technology application in a newly constructed multifamily building in Queens, New York. Three methods were used to evaluate the success of the aerosolized sealant: blower door testing of overall apartment leakage before and after sealing, point-source testing of individual leaks, and pressure measurements in the walls of the target apartment during sealing.

The aerosolized sealant proved successful by effectively sealing individual leaks that are labor intensive to address individually and diffuse leaks that are typically difficult to identify and treat. The technique proved most effective in sealing leaks from small penetrations, such as electrical outlets in the unit walls. These leaks are often easy to identify during a preliminary air leakage test, but they can be difficult to address because of their complicated geometry. The aerosol process also sealed difficult-to-reach cracks, such as those at the bottom edge of drywall at wall/floor joints.

A powered-flow hood device is used to measure point-source leakage from an electrical outlet.

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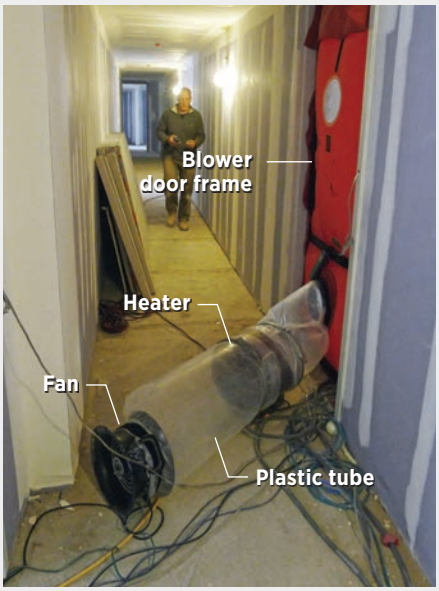
The Sealing Process

1. The dwelling is pressurized to 100 pascals or as close as possible.
2. The air compressor is started, sending pressurized air to the spray nozzles.
3. The pump delivers sealant to the spray nozzles. Small droplets of sealant are injected into the air of the target apartment, where they remain suspended for some time.
4. As air exits the leaks in the apartment envelope, air currents carry the sealant to the leaks where it sticks to their edges. This process continues, and sealant builds up to the point that it virtually blocks any air movement into the leaks.



For more information, see the Building America report *Apartment Compartmentalization With an Aerosol-Based Sealing Process* at *buildingamerica.gov*.

Image credit: All images were created by the CARB team.

Air Leakage Test Results from Three Sealed Apartments
(All values in CFM50)

Apartment	Presealing	Postsealing	Construction Completion	Leakage Reduction
202	659	182	183	72%
303	514	85	159	69%
402	511	166	145	72%

The apartments were tested before and after sealing, then again after construction was completed. Tests showed that sealing during this early stage of construction dramatically reduced leakage (see table above). The aerosol process was very effective at achieving compartmentalization and easily surpassed the thresholds set by ASHRAE 62.2-2013 for compartmentalization of 0.2 CFM50/ft^2 of the enclosure area. The aerosol process yielded an average reduction of 71% in air leakage across three apartments and an average apartment airtightness of 0.08 CFM50/ft^2 of the enclosure area. On average, the sealing process took less than 2 hours for each apartment. At construction completion, apartment 303 was noticeably leakier than it was immediately following sealing, because a seal around a pipe penetration was disrupted and effectively removed by workers installing sprinkler pipes. This type of disruption is expected as a part of normal construction.

Overall, the aerosol sealing process has the potential to shortcut other very labor-intensive methods for sealing apartments, including the airtight drywall approach.

Lessons Learned

- Generally, smaller leaks (¼ in. and less) were easily sealed by the aerosol, whereas larger leaks (greater than ½ in.) took too much time to effectively seal. This has certain advantages. Larger leaks are generally more accessible and addressable by conventional means, whereas smaller leaks are less cost-effective to address in the same way. It is unlikely that the process can be adjusted to address the significantly larger leaks more effectively.
- The aerosol particles generally create an air barrier on the closest plane of leakage they encounter. This means that in a wall cavity that is shared with other apartments the near surface of that wall cavity is sealed. Successive sealing tests show that wall cavities between apartments are complex structures and exhibit multiple leakage pathways. Aerosol sealing will deal only with the surfaces of those cavities shared with the apartment being treated. In other words, this aerosol process currently cannot be used to address interwall leakage pathways.

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