WCEC
WESTERN COOLING EFFICIENCY CENTER

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Achieving and Certifying Building Envelope Air Tightness with an Aerosol-Based Automated Sealing Process

April 19, 2013

3rd AIVC TightVent Workshop on Building and Ductwork Airtightness

Mark Modera, WCEC-UC Davis

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Presentation

- Background
  - Sealing more than 25% of envelope leakage in existing buildings has historically been very difficult
  - Leakage certification is key in both new construction and existing buildings
- Presentation
  - Technology background/description
  - Lab test results
  - Field test results

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AEROSOL SEALING OF BUILDING SHELLS

Basic Concept

- Seal New-Construction Building Shells at Rough-In
- Seal Existing Construction at Occupancy Change
- Reduce Sealing Cost, Produce Tighter Envelope and Automated Certification

Background

- Similar to commercialized aerosol-based duct sealing technology
- Tested in the laboratory under **funding from Building America**
- Currently testing in single-family residences under **support from California Energy Commission**

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Background – Aerosol Duct Sealing

- Block all grilles
- Pressurize duct system with a fog of atomized sealant particles
- Particles seal the leaks as they try to exit the duct system
- Track leakage throughout the sealing process
  - Computer uses measured pressurization flow and duct pressure to calculate leakage area

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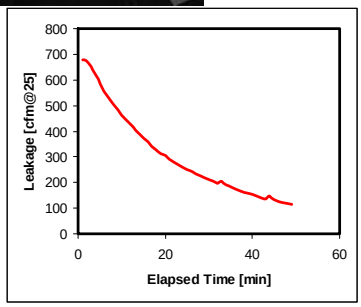
Aeroseal Sealing Process



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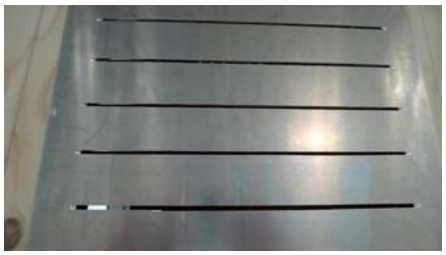
Test "House" Sealing Process



Test "House"

- 8' by 4' by 8' Tall
- Six removable leakage plates
- 1/10" slots in 1/8" aluminum
- Top, high on wall, far on wall
- 14" round inlet near top of box

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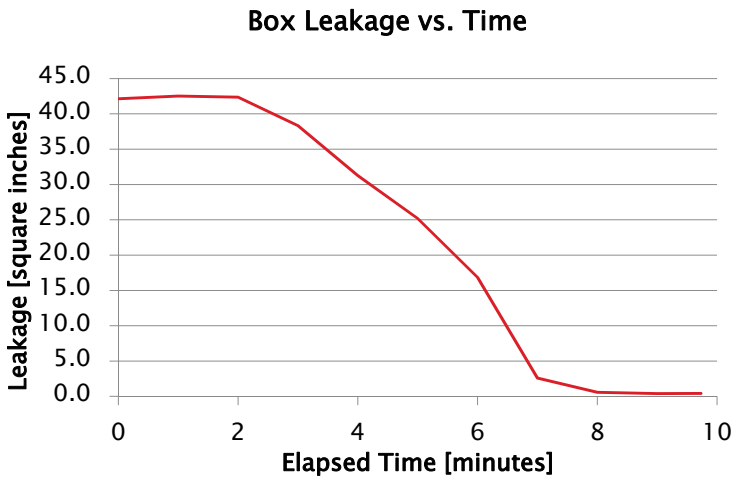

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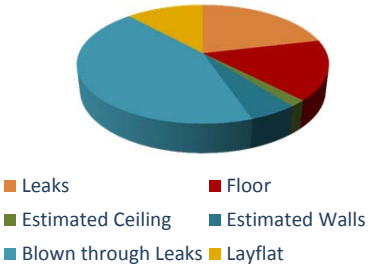
Measured Sealant Deposition Pattern



- **Leaks:** sealant removed from leaks and weighed after experiment
- **Tubing:** weighed before and after experiment
- **Floor:** plastic sheet weighed before and after experiment
- **Ceiling:** plastic sheet weighed before and after experiment
- **Walls:** wall patches weighed before and after experiment
- **Blown Through Leaks:** calculated by subtraction

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Laboratory Test Summary

- Aerosol sealing of enclosures looks quite encouraging
  - Sealing rates in small (nominally quiescent) enclosure as good or **better than that experienced in ducts**
  - Deposition on floor is comparable to deposition in leaks
  - Negligible deposition on ceiling and walls
- Sensitivity tests performed
  - Lower **Operating Pressure** reduced overall sealing time, sealant use, and sealant deposition in/around leaks
  - Smaller **Particle Size** did not impact the sealant required for sealing but decreased deposition on floor

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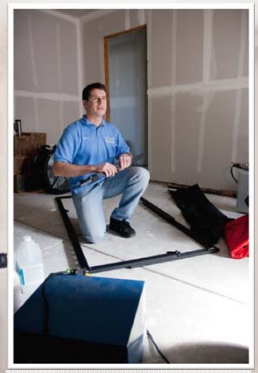
AEROSOL ENVELOPE SEALING: New Home



Assembling and installing the blower door

Connecting blower door, compressor and monitoring software

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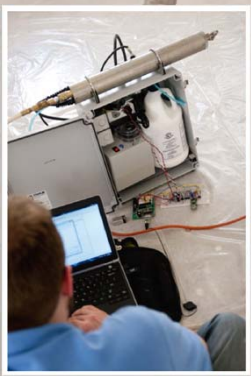
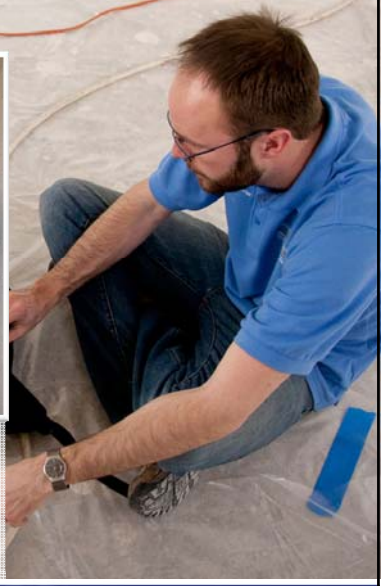


Testing custom injection and data acquisition box

Moving aerosol injector to other rooms in the house



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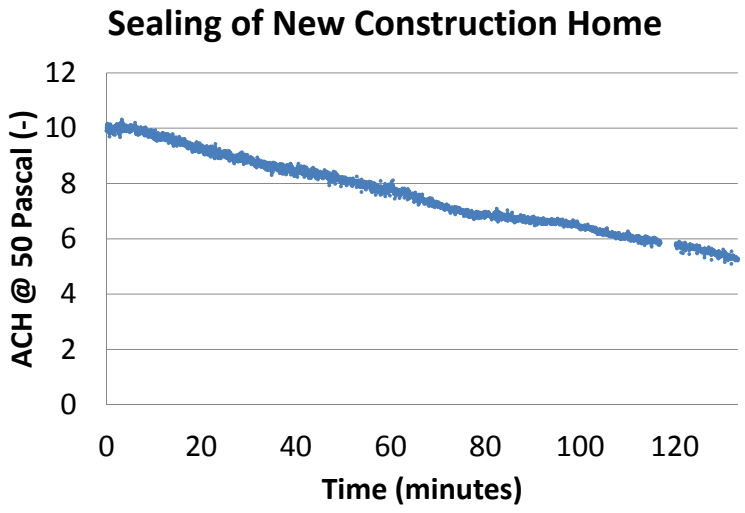

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AEROSOL ENVELOPE SEALING: New Home

Aerosol-sealed leak between can light and drywall

Aerosol-sealed leak between electrical outlet and wall

TAKEAWAYS

- Sealed 50% of leaks
- Test stopped pre-maturely
- No residual sealant build-up on floors, wiring or walls

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AEROSOL ENVELOPE SEALING: Existing Home

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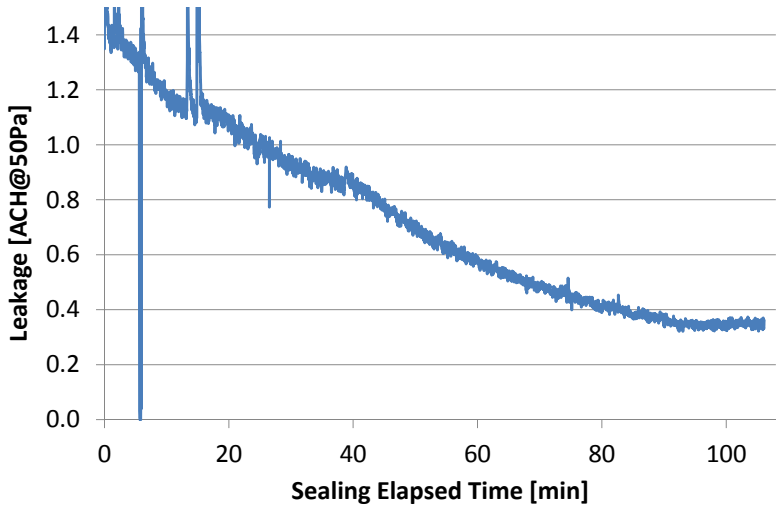

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Multi-Point Injection of New Sealant



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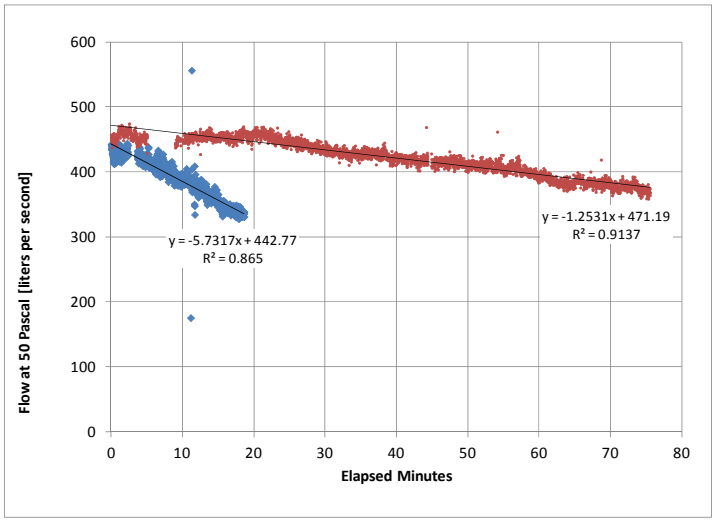
Multi-Point Injection of New Sealant



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AEROSOL ENVELOPE SEALING

- Current Status
  - Demonstrated in laboratory
  - Tested in single family residences
    - Sheetrock stage of new construction
    - Occupancy change in existing home
  - Developing and testing alternative sealants and atomization systems
  - Testing at different stages of construction process
  - Investigating non-residential applications