• Please be sure to sign in at back of room

• Restrooms located in the lobby west of the floating wall

• Emergency exits located at the northwest exit and west entrance
Upcoming Events

Rawhide Energy Station and Wind Farm Tour
June 20, 8:30 a.m.-2:30 p.m.
Meet at Platte River Power Authority's north parking lot, 2001 Danfield Court (map)
Free parking, bus charter and lunch included. MUST RSVP 7 days in advance; max 50 participants.

Learn how electricity is generated with a tour of Platte River Power Authority’s Rawhide Energy Station and the Silver Sage Windpower Project. Platte River is the local wholesale electric provider owned by Estes Park, Fort Collins, Longmont and Loveland. Silver Sage is located 12 miles west of Cheyenne, Wyoming, and provides 12 megawatts of wind energy to Platte River’s generation portfolio.

Selling Energy Efficiency
July 18, 8:30-10 a.m.
222 Laporte Ave.
Colorado River Community Room
Discover new tips and tricks for selling energy efficient upgrades on retrofits and new construction. Sales tools and techniques gathered across several utility energy efficiency programs will help you gain an edge and better serve your customers.
Lessons from the field: Multifamily Building Air Tightness

5/16/2017

Gary Schroeder, Kim DeVoe & Brad Smith
“Houses do NOT need to breathe. People do.” Allison Bailes – Energy Vangaurd

Many people still have the mistaken impression that air leakage is good for health. But when they say that "Yeah, sealing is good, but you don't want to make it too tight," what they are really saying is, “Don’t forget about air quality.” Sean Maxwell – Contributor - Green Building Advisor
Previous Multifamily Testing
2009 I-Codes

- **Commercial Multifamily** - 4 stories and above
  - Whole building was treated as a single zone
  - 0.25 CFM75/Sq Ft of exterior envelope area

- **Residential Multifamily** - buildings less than 4 stories
  - Non-electric heat: 4.0 ACH50
  - Electric heat: 3.0 ACH50
How did we get to this new test metric

Previously testing whole building envelope.

- How to test the building envelope with adjoining units that have entry doors on exterior.
Then Colorado votes…

and on November 6, 2012

"This will be a complicated process, but we intend to follow through. That said, federal law still says marijuana is an illegal drug so don't break out the cheetos or gold fish too quickly."
City Council takes action to address pollutants.

*Directs Chief Building Official to*… minimize uncontrolled pathways for smoke and other indoor pollutants to transfer between units. **Walls, ceilings and floors that separate each apartment from neighboring apartments, corridors, common spaces, trash chutes, utility chases, floors above and below, stairwells and elevator shafts must be air sealed by sealing all penetrations in walls, ceilings, floors and chases. Weather-strip all doors that lead to common hallways.*
Dirty insulation is an indication of air leakage. In this case the insulation is acting like an air filter.

The primary goal of air sealing party walls is not so much energy reduction as much as it is improving indoor air quality by limiting the transfer of smoke or pollutants from one unit to another.
• Compartmentalization is the best way to limit transfer of smoke or pollutants.
• Test by unit instead of the entire building
• Amendment to code to define air barrier around each unit on plans.
• New air leakage metric created for MF stacked units:
  .30 CFM50/ sq ft surface area adopted
Why choose a different metric for stacked MF

- Senior Plan Reviewers, Testers and Builders mention difficulty hitting 3 ACH50.
- Typical Stacked MF units have less area thus much less volume than attached MF.
- Volume based tightness metrics can be hard to meet in small units.
- Stacked metric uses unit enclosure surface area including wall to exterior.
Sampling protocol

• LEED sampling considered
• Not used due to complexity, number of units to be tested & cost

We developed our own

*Unit Sampling*
• Min 20% of units in each building to test, including at least one of each type & approximately an equal number on each floor level.
• Each must pass without failure. If failure occurs, diagnose, correct & re-test until passing. Test two additional units of this type to passing.
Define MF Stacked

Multifamily - Stacked units (low-rise and high-rise)

Stacked apartments or condos (to include high-rise projects built under the International Building Code – IBC R2 & R3).

Also included are multifamily units above street level retail.
### Defining building types

#### Airtightness Testing Required for Different Building Types: City of Fort Collins Building Code

<table>
<thead>
<tr>
<th>New Construction Building Types</th>
<th>Single Family Detached</th>
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<th>Small Commercial (≤5,000 sf)</th>
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What metric is used to test these buildings?

Townhome

Row House

Often permitted as multifamily but are tested as single family attached.
## Defining building type

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*Note: The table indicates that Multifamily Building Air Tightness Test is not required for Single Family Attached buildings.*
How stacked multifamily units are connected

How do we limit these connections?
Air barrier assemblies

5/16/2017
Water (liquid & vapor), Air, Thermal

- Liquid water: drainage plane, water-resistive barrier (WRB)
- Vapor: vapor barrier, vapor retarder
- Air: air barrier
- Thermal: insulation
Air Barriers

Materials
  • $\leq 0.004\ \text{cfm/ft}^2\ \text{at}\ 75\ \text{Pa}$

Assemblies
  • $\leq 0.04\ \text{cfm/ft}^2\ \text{at}\ 75\ \text{Pa}$
### What kind of layer is it?

<table>
<thead>
<tr>
<th>Material</th>
<th>WRB</th>
<th>Vapor Barrier</th>
<th>Air Barrier</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Wrap</td>
<td>√</td>
<td>×</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>Building Paper</td>
<td>√</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Drywall (painted)</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>OSB</td>
<td>×</td>
<td>×</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>Polyethylene Sheet</td>
<td>?</td>
<td>√</td>
<td>?</td>
<td>×</td>
</tr>
<tr>
<td>Fluid Applied Membrane</td>
<td>√</td>
<td>?</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>Fiberglass Ins., Mineral Wool</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>√</td>
</tr>
<tr>
<td>Open Cell Foam</td>
<td>×</td>
<td>×</td>
<td>?</td>
<td>√</td>
</tr>
<tr>
<td>Closed Cell Foam</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
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Key questions

• What is the intended AB?
  ▪ Material(s)
  ▪ Identify plane of air tightness
  ▪ Connection of materials
• How is AB detailed on plans?
  ▪ Third party review recommended
• How/where does AB fit into construction sequence?
• Who is responsible for the primary AB? Scope of work.
Continuity of air barrier

- Clear understanding of plane of air tightness.

Images courtesy Brian Christensen - NORESCO
Walls pulling triple duty

UL Fire resistance rating

STC sound transmission class rating

Air tightness
Define air barrier on plans
Define air barrier on plans
Well developed plans
Two hour wall assembly - Shaftliner

- Roof truss
- Two ⅛" densglass ultra shaftliner panels
- ⅜" air space
- Insulation per builder's specs
- ⅛" gypsum board fire blocking both sides
- Continuous bead of sealant
- 2 ½" framing per plan
- Refer to UL design this sheet for attachment details
- ⅜" air space
- Sound insulation per builders specs
- ⅝" gypsum board - attach per structural engineer’s drawings

D

Upper level
Two hour wall assembly

Large gap is left to air seal.

Ripper installed in gap. Smaller gap to seal.
Looking up at top plate

Top plate from above – 6” ripper filling the gap is visible
Mind the transitions

Interior looking out to front porch.

Exterior front porch looking at porch roof.

Gap between sheathing & shaft-liner allowing air behind rim.
Mind the transitions

Interior looking out to front porch.

Exterior front porch looking at a porch roof.

Gap between sheathing & shaft-liner allowing air behind rim.
Are plan details being followed?

- CONT 6/8”-3/4” TH ADHERED FOAM WEATHERSTRIPPING ALONG STUD PLATE
- PROVIDE HORIZONTAL BRACING AT MID HEIGHT
- NOTE: FURNISH FIREGLASS OR MINERAL WOOL FIREBLOCKING IN ACCORDANCE WITHIBC 7.17.2
- NOTE: ELECT PENETRATIONS SHALL BE IN INDIVIDUAL STUD SPACES BETWEEN OPPOSING UNITS AND FITTED WITH PUTTY PACKS
- NOTE: PROVIDE 1 LAYER OF OSB @ SHEAR WALL LOCATIONS
- (2) LAYERS 5/8” TYPE X GYP BD
- 2 LAYERS 5/8” TYPE X GYP BD
- CONTINUOUS 5-1/2” ACOUSTICAL BATT
- 1/2” RESILIENT CHANNEL
- 2X6 STUD FRAMING, RE: STRUCTURAL
- CONT DEAD OF CAULK CONT FIRE CAULK JOINT, EACH END OF WALL
- TRIM AIR BARRIER MATERIAL WITH CONT SEAL AT TOP AND BOTTOM
- PROVIDE EXTRA LENGTH FOR POSSIBLE EXPANSION
Floating wall – challenging detail

2 LAYERS 5/8" TYPE X GYPSUM
CONTINUOUS 5-1/2" ACOUSTIC BATT
1/2" RESILIENT CHANNEL
2X6 STUD FRAMING, RE: STRUCTURAL
CONT BEAD OF CAULK
CONT FIRE CAULK JOINT, IF SIDE OF WALL
TRIM BEYOND INTERIOR
AIR BARRIER MEMBRANE
CONT SEAL AT TOP AND BOTTOM
- PROVIDE EXTRA LENGTH POSSIBLE EXPANSION

GA WP-3825 FOR 2-HOUR
One hour wall assembly - attic

DEMISING WALL @ ROOF BEARING - TYP.
One hour wall assembly - attic

All components similar to other side of wall.

Pre-engineered roof trusses @ 24" O.C.
With R-38 blown in insulation - re-struct.

1/2" resilient channel @ 12" O.C.

5/8" type-X gyp. board - pnt.

Continuous sealant at inside face of top plate - typ. at upper roof bearing conditions.

Typical 30 minute rated unit demising wall - double 2x4 wood stud framing @ 16" O.C.
With 1" airspace - re-construction notes.

5/8" gyp. board on both sides of demising wall - pnt.

Demising wall @ roof bearing - typ.
One hour wall assembly - attic

CONTINUOUS SILL SEALER AT INSIDE FACE OF TOP PLATE - TYP. AT UPPER ROOF BEARING CONDITIONS

DEMISING WALL @ ROOF BEARING - TYP.
One hour wall assembly - attic

DEMISING WALL @ ROOF BEARING - TYP.
One hour wall assembly - attic

DEMISING WALL @ ROOF BEARING - TYP.
One hour wall assembly - attic
Looking up at top plate – gap chinked with mineral wool for draft stop.

Looking down from above. Chinking removed shows direct connection with attic.
One hour wall assembly - attic

Foam seal or blocking above chinking will minimize pathway for air into wall.
Define early in the project whose scope of work entails caulking penetrations to drywall & sealing fixtures.
QC checks are critical. Pictured right, a pathway through wall from unit to unit during construction has damaged the putty compromising fire & air seal.
Challenges & lessons learned

5/16/2017
Not all construction is the same
Can you spot the area of concern in pic at right?
Hole in top plate at transfer grill allowed air from interstitial space above into unit(s).
Expensive and time intensive to correct
Known holes – Fire Suppression Lines

spray foam or caulking
Additional challenges

Solutions – side wall install or top hat
Summary

• **Steps to success**
  - Clearly define plane of air tightness/air barrier on plans.
  - Recommend hiring 3rd party air leakage tester *early*.
    - Plan review
    - Pre-drywall air barrier inspections
    - Air leakage test
  - Work with the insulation & air sealing contractor & define scope.
  - Identify problems early in the process. Easier & less costly to repair.
  - Pre blower door tests are very informative. *best done on 1st building.*
Building America Solution Center

Air Sealing Multifamily Party Walls

Scope

Air seal the common wall between units in a multi-family structure to minimize air leakage and provide a control layer for sound, smoke, fire, and air quality.

- In multifamily buildings, air seal the oao between the wall and all exterior and interior spaces.
- Confirm air sealing is a safety requirement.
- Possible air seal with closed-cell spray foam for sealing the bottom plate to subfloor and bottom and top plates to sheathing. In wood-framed walls, fire-rated caulking around plumbing and wiring, and two-part urethane foam for masonry block walls.

https://basc.pnnl.gov/resource-guides/air-sealing-multifamily-party-walls
Questions?

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