

- 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

A photograph of a row of modern, two-story townhouses with light beige horizontal siding and teal-colored trim around the windows and doors. Each unit has a small front porch with a dark roof and teal columns. Young trees are planted in front of the units. The image is framed by a white curved border at the top and bottom.

Passing the Air Tightness Test

A real-world example from a local development

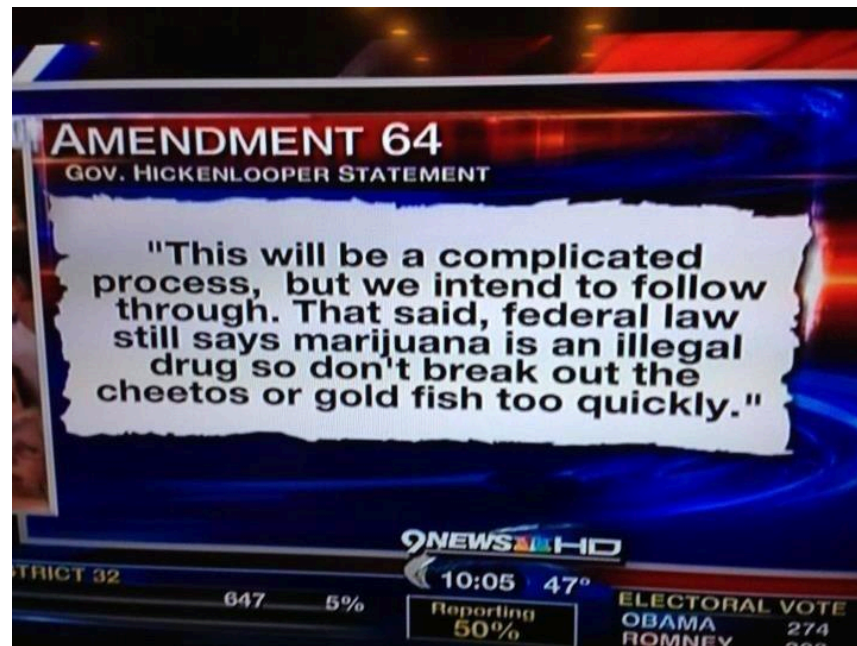
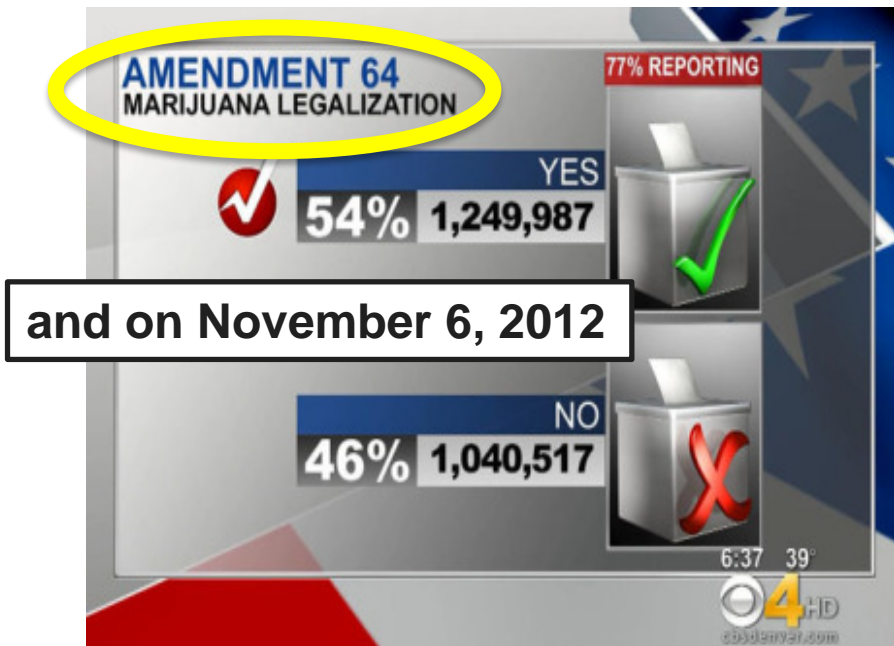
6/19/2018

Kim DeVoe & Brad Smith

“Houses do NOT need to breathe. People do.” *Allison Bailes – Energy Vanguard*

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*

Colorado votes...



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.

Why this all matters



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.







Why this all matters

A meta-study health report from '*Global Environmental Health and Sustainability*' showed in years of research from 17 different sources on green buildings (tighter envelopes and proper ventilation) that, in almost all cases:

- **Air quality increased**
- **Cleanliness increased**
- **Thermal comfort increased**
- **Occupant satisfaction increased**
- **Self reported well being increased**
- **Asthma & Allergy symptoms decreased**
- **Absenteeism from work & school decreased**
- **Respiratory symptoms decreased**







Defining building types

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

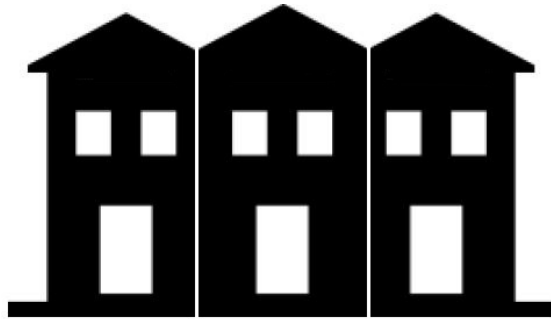
New Construction Building Types	Single Family Detached 	Single Family Attached 	Multi-family – stacked units (low-rise and high-rise) 	Small Commercial (≤5,000 sf) 	Large Commercial (>5,000 sf) 	Commercial / Residential Mixed Use 
Examples	Houses that are free of any shared walls and stand alone	Duplex, triplex, townhomes, row-houses. Each unit has its own foundation and roof (including IBC R2, R3)	Stacked apartments or condos (to include high-rise projects built under the IBC)	Small office buildings, offices adjacent to unconditioned space	Large multi-story office buildings, large multi-use buildings	Retail on street level, MF stacked units above
Test Required	Residential Air Tightness Test	Residential Air Tightness Test	Multifamily Unit Air Tightness Test	Small Commercial Building Air Barrier Test	Large Commercial Building Air Leakage Test	Large or Small Commercial Building Air Leakage Test & MF Unit Air Tightness Test
Compliance Metric (Leakage not to exceed)	3 ACH50	3 ACH50	0.30 CFM50/SF unit enclosure surface area (SA)	0.25 CFM50/SF unit enclosure surface area (SA)	0.25 CFM75/SF building envelope surface area (SA)	0.25 CFM50/SF SA for small commercial. 0.25 CFM75/SF for large commercial. 0.30 CFM50/sf for MF units above

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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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- Locally, approximately 25% of residential projects opted for Simulated Performance Path (SPA) or HERS rating
- Most modeling software(s) currently only accepting ACH50
- Liability on reporting that shows house does *not* meet requirements of the 2015 IECC

2012 IECC ANNUAL ENERGY COST COMPLIANCE			
Date:	January 28, 2015	Rating No.:	34548
Building Name:	Ryland Homes	Rating Org.:	EnergyLogic, Inc
Owner's Name:	Ryland Homes Homeowner	Phone No.:	(970) 556-0839
Property:	3927 Oak Shadow Wy	Rater's Name:	Brad Smith
Address:	FT Collins, CO 80528	Rater's No.:	8809000
Builder's Name:	Ryland Homes	Rating Type:	Confirmed
Weather Site:	FT Collins, CO	Rating Date:	1/28/15
File Name:	3927 Oak Shadow Wy Ryland Homes REM.big		
Annual Energy Cost (\$)			
	2012 IECC	As Designed	
Heating:	588	516	
Cooling:	125	75	
Water Heating:	123	123	
SubTotal - Used to Determine Compliance:	837	715	
Lights & Appliances:	798	782	
Photovoltaics:	-0	-0	
Service Charge:	240	240	
Total:	1875	1736 *	
Mandatory Requirements:			
Duct Insulation R-Value Check (per Section 405.2)	6.0	10.0	
Minimum Duct Insulation (Design must be equal or higher)			
Window U-Factor Check (Section 402.5)	0.480	0.340	
Window U-Factor (Design must be equal or lower):			
<u>Home Infiltration (Section 402.4.1.2):</u>		PASSES	
Duct Leakage (Section 403.2.2):		PASSES	
Mechanical Ventilation (Section 403.5):		PASSES	
<p>This home MEETS the annual energy cost requirements of Section 405 of the 2012 International Energy Conservation Code based on a climate zone of 5B. In fact, this home surpasses the requirements by 14.6%.</p> <p>Name: Brad Smith Signature: <i>Brad Smith</i> Date: 2015.01.28</p> <p>Organization: EnergyLogic, Inc Date: January 28, 2015</p>			

How it started, the lessons and improvements



Air sealing challenges: Sequencing



Air sealing challenges: Sequencing 2



Air sealing challenges: Leapfrogging of trades



Air sealing challenges: Architectural / design details



Air sealing challenges: Defects & Quality in construction



Phase I- Blower Door Testing



Party wall

**Often an indicator things
aren't going to go well**

Building 40

- *Unit 1 = 3.70 ACH50*
 - *Unit 2 = 4.93 ACH50*
 - *Unit 3 = 4.88 ACH50*
 - *Unit 4 = 6.93 ACH50*
 - *Unit 5 = 4.40 ACH50*
 - *Unit 6 = 5.07 ACH50*
 - *Unit 7 = 4.91 ACH50*
- } Avg 1418 CFM

Building 40

- ***Unit 1 = 3.70 ACH50***
- ***Unit 2 = 4.93 ACH50***
- ***Unit 3 = 4.88 ACH50***
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- ***Unit 6 = 5.07 ACH50***
- ***Unit 7 = 4.91 ACH50***

Avg 1418 CFM



Indication of bigger problem?

**There is no such thing as failure, only
learning experiences.**

- Anonymous

Steps toward improvement

1. Learn from mistakes
2. Identify failures from diagnostics
3. Develop protocol
4. Meeting with all trades intimately involved – *“You make a hole, you own the hole”*
5. Implement QA/QC policies
6. Review change order w/ mgmt – *yes, there was an increase in cost (refer to #3)*
7. Keep photo log of inspections

STEPS TO TAKE DURING CONSTRUCTION OF PARTY WALLS & EXTERIOR WALLS IN MITIGATION OF AIR INFILTRATION

- ✓ ALL PENETRATIONS IN BOTH EXTERIOR AND PARTY WALLS MUST BE SEALED WITH AN APPROVED PRODUCT. IN ADDITION, ALL PENETRATIONS MUST BE PHOTOGRAPHED AND AS-BUILT
- ✓ FLASH BOTTOM PLATE AT EXTERIOR SHEATING AND RETURNS ON EXTERIOR WALLS *make a hole on the hole*
- ✓ FLASH INSIDE FRAMED CORNERS AT EXTERIOR WALLS *connection of studs*
- ✓ FLASH BOTTOM C-CHANNEL AT PARTY WALLS *connection of studs*
- ✓ COMPARTMENTALIZE THE MID-LANDING *Treat with cellulose*
- ✓ SEAL BETWEEN FLOORS OF ANY STACKED ROOM TO REMOVE THE CONVECTIVE LOOP
- ✓ PAY CLOSE ATTENTION TO PENETRATIONS IN MECHANICAL CLOSETS AND HOT WATER HEATER ROOMS
- ✓ ENSURE TEST T's ARE PROPERLY SEALED IN WALLS
- ✓ NET AND SPRAY A CLOSE CELL CELLULOSE ON ONE SIDE OF DEMISING WALL
- ✓ QC/QA PLUMBING, HVAC, ELECTRICAL, LOW VOLTAGE, INSULATION & VAPOR BARRIER PRIOR TO COMMENCING WITH DRYWALL
- ✓ SEAL PLUMBING PENETRATIONS AT DRYWALL PRIOR TO SETTING CABINETS
- ✓ PAY CLOSER ATTENTION OF HOW THE ATTIC ACCESS IS CONSTRUCTED (i.e., attic access trim properly secured to framing, caulked to drywall, proper gasket installed, and the use of a plywood door in lieu of drywall, etc.)
- ✓ ELIMINATE SEAL AT TOP PLATES AT ATTICS, AND SUBSTITUTE WITH FLASHING ALL TOP OF PLATE CONNECTIONS
- ✓ SEAL TOP OF PLATE CONNECTIONS, AND SPRINKLER HEADS UNDER PLATFORMS PRIOR TO CONSTRUCTION *- acoustic sealant*
- @ top plates prior to drywall*
- locate tile room*
- add studs*
- with evans*

Phase II plan – post meeting

- ✓ SEAL AT TRUSS AND SHAFTLINER TO PREVENT AIR INFILTRATION INTO THE 2" AIR SPACE
- ✓ IMPLEMENT A QA/QC POLICY THAT "ALL SUBCONTRACTORS" INVOLVED ARE INTIMATELY, THE POLICY SHOULD CONSIST OF PRE AND POST INSPECTIONS AS FOLLOWS (PRE-INSULATION, POST-INSULATION/VAPOR BARRIER, PRE-SHEAR PANELS, POST-SHEAR PANELS, PRE-DRYWALL & POST-DRYWALL) KEEP A PHOTO LOG OF THESE INSPECTIONS

Delete Poly for Exterior Walls

Attendees:

- Site Superintendent(s)
- Air sealing & Insulation contractor
- Air leakage test firm
- Mechanical Project mgmt
- Drywall Project mgmt.
- Plumber
- City representative

Phase II implementation

Architectural/design details – shed roof, soffit vents & water line



Phase II implementation

Architectural/design details – shed roof, soffit vents & water line



Sealing all penetrations – exterior and party walls



Phase II implementation

Flash bottom plate at exterior sheathing & returns on exterior walls



Phase II implementation

Flash inside framed corners at exterior walls and at transitions



Phase II implementation

Flash top plate & bottom of C-channel at party walls



Phase II implementation

Spray foam rim joist – make sure to seal top plate from interstitial space



Phase II implementation

Flash where demising wall meets roof deck



Phase II - lessons learned

Compartmentalize the mid landing under the stairs



Phase II implementation

Eliminate sill seal of top plates in attics & flash with spray foam



Sill seal of top plates in attics often ends up like this



Note:

Pre and post blower door tests done on some units prior to sealing top plate.

The difference - between 50-247 CFM of air leakage

Seal plumbing penetrations prior to setting cabinets



Phase II lessons learned



Phase II - lessons learned

Bead of foam just as good if done well



Phase II - lessons learned

Seal rim joist *and* bottom of top plate – sealing either/or is as effective



Phase II - lessons learned

Seal between floors (tub drain) – focus on air entering interstitial space instead



Phase II - lessons learned

Attempt to seal sprinkler head – largely not effective



Phase II - lessons learned

Dense pack one side of demising wall – unable to verify effectiveness




Building 30

- *Unit 1 = 2.41 ACH50*
- **Unit 2 = 2.48 ACH50**
- **Unit 3 = 2.89 ACH50**
- **Unit 4 = 2.56 ACH50**
- **Unit 5 = 2.87 ACH50**
- **Unit 6 = 2.83 ACH50**
- *Unit 7 = 2.80 ACH50*

Avg 738 CFM

**** A drop of 680 CFM!***

Building 30

- ***Unit 1 = 2.41 ACH50***
 - *Unit 2 = 2.48 ACH50*
 - *Unit 3 = 2.89 ACH50*
 - *Unit 4 = 2.56 ACH50*
 - *Unit 5 = 2.87 ACH50*
 - *Unit 6 = 2.83 ACH50*
 - ***Unit 7 = 2.80 ACH50***
- 
- Avg 706 CFM

Steps to success

- Involve all trades and make sure they know goal.
- Get third party air leakage test firm on board early.
- Identify problems early in the process. Easier & less costly to repair.
- Focus, focus, focus on party walls.
- Maintain continuity of air barrier when it jogs outside to inside to outside.
- Define air sealing scope of work for all subcontractors (if applicable to them).
- Pre blower door tests are very informative. *best done on 1st building.

Questions?

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