CITY OF BELLAIRE TEXAS

BUILDING AND STANDARDS COMMISSION

MARCH 26, 2014

Council Chamber	Regular Session	7:00 PM

7008 S. RICE AVENUE
BELLAIRE, TX 77401

I. REGULAR SESSION

A. Call to Order

Chairman Schuster called the meeting to order at 7:02 PM.

B. Announcement of Quourm

Chairman Schuster announced that a quorum was present, consisting of the following members:

Attendee Name	Title	Status	Arrived
Kristin Schuster	Chairperson	Present	
Laura Thurmond	Vice Chairperson	Absent	
Paul Katz	Commissioner	Present	
Burt Martin	Commissioner	Present	
Mike Baker	Commissioner	Present	
Laolu Yemitan	Commissioner	Present	
Danny Spencer	Commissioner	Present	

C. Rules for Public Comment

i. Sign up forms will be available at all Regular and Special meetings for registering the names of members of the Public who wish to either: i) speak on an agenda item, provided such items have not been the subject of a prior public hearing; or ii) make a general comment related to the Commission business. These forms will be given to the Secretary prior to the start of the meeting so that the person's name can be called to address the Commission at the appropriate time.

ii. Public Comments on agenda items will be made at the time an agenda item appears in the Order of Business and before the Commission's consideration of that item.

iii. Public Comments of a general nature shall be made at the time designated by the Order of Business.

iv. All public comments shall be limited to six (6) minutes per speaker with extensions of two (2) minute increments as approved by a majority vote of Commission members present.

v. Public Comment at Workshop meetings will be allowed at the discretion of the Chair. Any comments will be limited as described in Article IV Sec 8.

Chairman Schuster reviewed the rules for public comment that are listed on the agenda.

D. Approval or Correction of the Minutes

1. Building and Standards Commission - Regular Session - Feb 26, 2014 6:00 PM

   Chairman Schuster explained that the workshop before the last meeting was cancelled due to lack of a quorum, and stated that the time that the regular meeting was called to order should read 7:05 instead of 6:05 PM.

RESULT:	**APPROVED AS CORRECTED [5 TO 0]**
MOVER:	Kristin Schuster, Chairperson
SECONDER:	Danny Spencer, Commissioner
AYES:	Schuster, Katz, Martin, Baker, Spencer
ABSTAIN:	Yemitan
ABSENT:	Thurmond

E. Public Comment

There were no public comments under this section of the agenda.

F. Report from Building Official

There was no report from the Building Official.

G. Reports of Committees and Communications

i. Communications to Commission members outside of posted meetings

There were no communications to report.

ii. Committee Reports

There were no committee reports.

iii. Reports from Staff other than the Building Official

There were no reports from staff.

H. Old Business

1. Discussion, consideration, and possible action on a Report and Recommendation to the City Council on water vapor control in residential crawlspace construction including proposed amendments to the City of Bellaire Code of Ordinances, Chapter 9, Buildings.

   Chairman Schuster introduced the item and explained that a draft of a report that the Chair and Vice Chair completed together was included in the packet. She added that the intent for this item was more for discussion, not action. She asked staff to speak to their agenda statement regarding the item.

   Mr. Cabello explained that staff is recommending that no action be taken at this time due to the fact that he did not have a chance to review the draft report prior to it being put in the packet. He also mentioned that he has not had any complaints, other than Commissioner Martin, regarding crawlspace in the City of Bellaire. Mr. Cabello informed the Commission that he had contacted several

builders to see how/if they were insulating under the floors of the houses that they are building, and some said that they do insulate under the floors, others said that they do not. He added that some builders place a thin layer of concrete on the ground after the joist, and one said that he uses tar prior to placing the wood and uses plastic on the ground itself. Mr. Cabello pointed out that they put vapor barriers on one side, not both. He asked the Commission if they were planning to recommend open cell or closed cell foam. Mr. Cabello added that the proposal needs to be discussed further.

Chairman Schuster explained that the Commission is asking Council to send the issue back to staff and the City Attorney to come up with a requirement that would mandate the use of a vapor retarder, not a vapor barrier on the warm side of the insulation in the crawlspace. She pointed out that doing that would avoid the entrapment issue. Secondly, the Commission is not requiring the use of a specific product or building system to accomplish this. She mentioned that the code already addresses air tightness, air barrier, and insulation, so the only thing that the Commission is requiring is the installation of a vapor retarder. Chairman Schuster stated that the bulk of the report is dealing with why this is necessary/important when constructing a home.

Commissioner Katz stated that the 2012 Building Codes require air sealing of the conditioned space, such that a blower door test would have to be passed with 5 or less air changes per hour. He added that it also requires a certain level of insulation in the walls and crawlspace. However, Commissioner Katz explained that the code is not clear as to where the air barrier should be located, and that some builders do the caulking and sealing on the cold side of the floor substrate, which creates a problem. He stated that you always want to put the air barrier, as well as the vapor retarder on the warm side of the insulation.

Chairman Schuster stated that Commissioner Katz made clear something that she had missed, this isn't just about the vapor retarder, it is also about the location of the air barrier. She clarified that while batt insulation in the crawlspace is neither a vapor retarder or air barrier, there are ways to use batt insulation and apply an air barrier and vapor retarder as well.

Commissioner Martin stated that it was mentioned that he had extenuating circumstances due to flashing, and he explained that he has never had any flashing issues. He stated that his issue was dealing with moisture under the ground. He added that he knows at least one other person on his block that has problems.

Chairman Schuster pointed out that the Commission disagrees with staff's opinion that residents are not experiencing problems, and is trying to avoid future problems that the codes could potentially create.

Mr. Cabello explained that he is not saying that residents are not having problems, he is just saying that none of them are being reported.

Commissioner Katz stated that he knows of at least one builder who had to pull out the fiberglass batt insulation from under the crawlspace and remediate the mold and mildew and then go back and use foam insulation to fix the problems that were caused by the batt insulation. He stated that the problems are not being brought to the city because the builders don't want to pay for another permit.

Public Comment

Menny Rosenbaum, Bentley Custom Homes-Mr. Rosenbaum asked the Commission if the city is going to make a new ordinance and be liable if the ordinance that they impose creates problems in the future. He stated that engineers and architects around the country are trying to avoid this issue because of liability. Mr. Rosenbaum added that they cannot get one engineer in Harris County to tell them how to put the vapor barrier in the crawlspace, or even how to do an outside wall. He also mentioned that the City of Bellaire does not currently do an inspection for this.

Chairman Schuster stated that Mr. Rosenbaum raises a good point, and it is something that the Commission has considered a lot. She added that the proposal is not telling builders what product they have to use, it strictly focuses on performance and how the assembly will deal with air sealing and vapor migration, which the code already requires. Chairman Schuster informed Mr. Rosenbaum that the Commission is not trying to tell builders how to do their job, they are just trying to make it clear that part of their job is to ensure that a vapor retarder is installed on the warm side of the assembly. Chairman Schuster did not feel that any liability would be put on the city.

Mr. Rosenbaum stated that the venting of the crawlspace is more important than anything. He added that in his opinion, another big issue with houses built recently is no vapor barrier is put on the ground.

Chairman Schuster explained that the issue the Commission is trying to address is that the building code is going to require a tight building, effectively so tight that the builders hand will be forced by ventilation, and errors will be compounded. She added that the issue is with the future of the 2012 suite of codes, and that people who aren't careful about moisture are going to have problems. Chairman Schuster pointed out that Mr. Rosenbaum seems very meticulous about sealing the dirt, but other builders may not be.

Mr. Rosenbaum explained that he has never left a house with just dirt, his basic standard is poly and a lot of gravel to keep the poly in place. He stated that he has never had a homeowner complain. Mr. Rosenbaum informed the Commission that he seals the inside of the house with a vapor barrier and underneath the house with a retarder. He added that he feels that the city is taking on a serious liability by telling builders how to construct homes.

Chairman Schuster asked him if he read the wording because the Commission is trying very hard not to do that.

Mr. Rosenbaum then asked how it would be enforced. He questioned if the city inspectors would be required to go underneath the house, and stated that no other municipality does this.

Chairman Schuster mentioned that it is something that the Commission is asking staff to consider.

Mr. Rosenbaum also pointed out that some houses have 4,000 square feet worth of crawlspace and it would not be possible to inspect the whole area.

Chairman Schuster stated that it is a legitimate question and is something that the Commission has started talking about with staff.

Commissioner Baker mentioned that it sounded as though Mr. Rosenbaum doesn't feel that the code requires enough ventilation in the crawlspace, and that he doesn't want to change the way that he is doing it because it is working. He asked Mr. Rosenbaum if he was interpreting what the Commission is talking about as requiring him to change the way that he is currently building houses.

Mr. Rosenbaum confirmed this, and explained that he is worried that the Commission is going to come up with an ordinance that is going to make him uncomfortable with the way that he currently builds houses.

Chairman Schuster informed Mr. Rosenbaum that he is already doing what the Commission is trying to recommend.

Mr. Rosenbaum stated that he is hesitant due to the fact that has not seen it in writing and does not understand what kind of inspection it would entail.

Commissioner Baker agreed that the way Mr. Rosenbaum is doing it is consistent with the Commission's recommendation, and the Commission is simply asking that everyone else follow the same principal.

Chairman Schuster stated that she recalls, from past conversations, that Mr. Rosenbaum prefers to use open cell foam with a vapor retarder sprayed on top, and that he thinks it is more important to have adequate ventilation and to seal the dirt.

Mr. Rosenbaum confirmed this.

Chairman Schuster pointed out that she heard two concerns from Mr. Rosenbaum, the first being that he is afraid that the Commission is going to be tying builders' hands by requiring specific installations or products that they are not comfortable with, and second, how the ordinance is going to be enforced.

Mr. Rosenbaum confirmed this, and added the issue of future liability for the city.

Commissioner Katz asked Mr. Rosenbaum to describe exactly how he insulates the first floor substrate facing the crawlspace.

Mr. Rosenbaum informed the Commission that he uses a vapor retardant on the warm side of the sub floor.

Commissioner Katz asked what kind of vapor retarder Mr. Rosenbaum uses.

Mr. Rosenbaum stated that he uses a special primer, and then uses open cell foam.

Commissioner Katz pointed out that doing this is creating an air barrier on the warm side of the insulation.

Mr. Rosenbaum mentioned that once he puts the vapor retarder on the warm side of the crawlspace he then puts a vapor barrier on the first floor.

Commissioner Katz explained that this is creating a potential problem, in that any moisture that manages to come up through the sub floor is going to condense.

Chairman Schuster pointed out that these are important issues, but are separate from the current issue being addressed. She stated that the Commission, in general, does not support the use of a vapor barrier on the cold side of the floor assembly, but that is not included in the current ordinance proposal.

Commissioner Baker asked Mr. Rosenbaum if he was concerned at all about the existing moisture in the plywood decking prior to construction.

Mr. Rosenbaum stated that he checks the moisture level on the sub floor before installing any flooring.

Philip Robbins, Bentley Custom Homes-Mr. Robbins informed the Commission that builders still learn new things every year, and that the way houses are constructed on crawlspaces has changed a lot within the past 8 years. He stated that he would love for the city to tell the builders how they want it done, and bring all builders in Bellaire up to the level that they should be building at. He added that they are simply wanting to ensure that what the Commission is trying to recommend is a complete and correct product. Mr. Robbins pointed out that the city is getting into an area that he compared to the EIFS stucco issue during the 1980's.

Commissioner Katz agreed with Mr. Robbins and explained that the Commission is simply trying to ensure that all builders are constructing quality homes for the residents in the City of Bellaire.

Chairman Schuster mentioned that a lot of research has been done by the Commission, but a legitimate question is whether or not the Commission has asked the experts. She added that this is a great opportunity for the Commission to ask themselves if there is more homework that can be done. Chairman Schuster addressed the comment regarding the efface stucco issue by stating that it was a problem caused by vapor barriers being installed in the wrong place, and by requirung a vapor retarder in the right place the Commission serves to mitigate that kind of problem.

Commissioner Baker asked Mr. Robbins if he felt as though the 2012 ventilation requirements within the crawlspace are sufficient.

Mr. Robbins explained that to his knowledge builders are required to have one inch per every square foot of crawlspace area, which he feels is the minimum that should be required. He added that he has been under the houses built by Bentley Custom Homes and feels like there is always adequate flow, so in his personal opinion is that's probably correct. Mr. Robbins pointed out that he gets confused by the fact that while Bentley uses 16 x 30 vents, he has seen numerous houses that have 8 x 16 vents, and not many more of them. He stated that he doesn't see know how this is possible.

Commissioner Katz pointed out that the 2012 IRC requires that the minimum of net area ventilation openings shall not be less than 1 square foot for each 150 square foot of under floor area. However, he added that there is an exception that the total area of ventilation openings shall be permitted to be reduced by 1/1500 of the under floor area where the ground surface is covered with an approved class 1 vapor retarder material and required openings are placed to provide cross ventilation of the space. Commissioner Katz added that by putting the vapor retarder on the ground the code allows for a drastic reduction in cross

ventilation requirements. He agreed with Mr. Robbins that more ventilation is better.

Mr. Cabello pointed out that the city requires 1 square inch of flood vent for every square foot of area, which is more than what the code calls for.

Chairman Schuster thanked Mr. Rosenbaum and Mr. Robbins for coming to speak to the Commission. She added that the Commission has not heard from the insulation manufacturers, and that she would like to arrange a time for that to happen.

Mr. Rosenbaum suggested that it could be part of the plan check process, rather than it requiring an additional inspection. He explained that the architects or engineers could provide the city with a wall section that shows a vapor retarder.

Commissioner Baker stated that water vapor control in residential crawlspace construction is a very important issue that the Commission and city need to address. He added that the Commission must convince Council and all of the stakeholders that something needs to be done.
(Requested by John McDonald, Community Development)

I. New Business

1. Discussion, consideration, and possible action on a report to City Council, as required by Chapter 2, Section 2-97, of the City of Bellaire Code of Ordinances, regarding Commissioner Laolu Yemitan's absence from three (3) consecutive regular meetings of the Building & Standards Commission.

   Chairman Schuster introduced the item and mentioned that she had prepared two letters to Council in the event that Commissioner Yemitan wished to complete his term.

   Commissioner Yemitan explained that he had previously submitted his letter of resignation after getting the impression that Council would have to take action on the report sent to them regarding his absences. After having a conversation with the Director of Community Development, John McDonald, he realized that Council just needed to be notified of the absences and does not have to take action on the issue. Commissioner Yemitan added that Mr. McDonald informed him that he is technically still on the Commission until someone else is sworn in for his position, and that his term is completed in June. Commissioner Yemitan apologized to the Commission for his absences and explained that in each instance he was out of town and that he notified the Chair prior to his absences. He indicated his desire to complete his term if the Commission would have him.

   Chairman Schuster made a motion to amend the letter and send it forward to City Council. With the amendment, the letter reads:

   " In accordance with Chapter 2, Administration, Article VII, Boards and Commissions, Division 1, Generally, Sections 2-97, the Building and Standards Commission submits this report notifying City Council that Commissioner Laolu Yemitan has exceeded the limit of allowable consecutive absences from regular meetings. Commissioner Yemitan gave notice to the chair prior to said absences, and has subsequently reported to the Building and Standards Commission explaining the causes for these absences. He has indicated his desire to complete his current term on the commission. The commission finds the causes given to be

reasonable, and furthermore desires that Commissioner Yemitan complete his term."

Commissioner Baker seconded Chairman Schuster's motion.
(Requested by John McDonald, Community Development)

RESULT:	**ADOPTED AS AMENDED [UNANIMOUS]**
MOVER:	Kristin Schuster, Chairperson
SECONDER:	Mike Baker, Commissioner
AYES:	Schuster, Katz, Martin, Baker, Yemitan, Spencer
ABSENT:	Thurmond

2. **The Chair shall recognize any Commissioner who wishes to bring New Business to the attention of the Commission. Consideration of New Business shall be for the limited purpose of determining whether the matter is appropriate for inclusion on a future agenda of the Commission or referral to Staff for investigation.**

Commissioner Spencer mentioned the other issues that had come up in the conversation regarding air barriers in the crawlspace and asked if those would be new business items for the Commission's future agendas.

Chairman Schuster explained that several of those issues have been on previous agendas, which would make them old business, but that the Commission would be looking into some of them again.

J. Public Hearings

There were no public hearings.

K. Announcements & Comments by Commissioners

Chairman Schuster stated that she was glad Commissioner Yemitan had decided to finish out his term, and introduced Commissioner Spencer for those Commissioners who were not at the last meeting.

L. Adjournment

Motion: a motion was made by Commissioner Baker and seconded by Commissioner Yemitan to adjourn the regular meeting.

Vote: the motion carried on a unanimous vote of 6-0.

The meeting adjourned at 8:08 PM.

CITY OF BELLAIRE TEXAS

BUILDING AND STANDARDS COMMISSION

FEBRUARY 26, 2014

Council Chamber and Council Conference Room **Regular Session**
6:00 PM

7008 S. RICE AVENUE
BELLAIRE, TX 77401

Minutes Acceptance: Minutes of Feb 26, 2014 6:00 PM (Approval or Correction of the Minutes)

I. WORKSHOP SESSION

A. Call to Order

The workshop session was cancelled due to lack of a quorum.

B. Announcement of Quorum

C. Discussion and preparation of the letter the Commission wished to send forward to City Council recommending proposed amendments to the City of Bellaire Code of Ordinances, Chapter 9, Buildings, with regards to crawlspace requirements.

D. Adjournment

II. REGULAR SESSION

A. Call to Order

Chairman Schuster called the meeting to order at 7:05 PM.

B. Announcement of Quourm

Chairman Schuster announced that a quorum was present consisting of the following members:

Chairman Kristin Schuster
Vice Chairman Laura Thurmond
Commissioner Paul Katz
Commissioner Danny Spencer

Commissioners Mike Baker and **Burt Martin** were absent from the proceedings.

The following staff members were also present:

Building Official, Lee Cabello
Planning & Zoning Secretary, Ashley Parcus

C. Rules for Public Comment

1. **Sign up forms will be available at all Regular and Special meetings for registering the names of members of the Public who wish to either: i) speak on an agenda item, provided such items have not been the subject of a prior public hearing; or ii) make a general comment related to the**

Commission business. These forms will be given to the Secretary prior to the start of the meeting so that the person's name can be called to address the Commission at the appropriate time.

2. **Public Comments on agenda items will be made at the time an agenda item appears in the Order of Business and before the Commission's consideration of that item.**

3. **Public Comments of a general nature shall be made at the time designated by the Order of Business.**

4. **All public comments shall be limited to six (6) minutes per speaker with extensions of two (2) minute increments as approved by a majority vote of Commission members present.**

5. **Public Comment at Workshop meetings will be allowed at the discretion of the Chair. Any comments will be limited as described in Article IV Sec 8.**

Seeing no public, Chairman Schuster skipped the rules for public comment.

D. Approval or Correction of the Minutes

1. Building and Standards Commission - Regular Session - Jan 22, 2014 7:00 PM

RESULT:	**APPROVED [UNANIMOUS]**
MOVER:	Laura Thurmond, Vice Chairperson
SECONDER:	Paul Katz, Commissioner
AYES:	Schuster, Thurmond, Katz, Spencer
ABSENT:	Martin, Baker

E. Public Comment

There was no public comment.

F. Report from Building Official

There was no report from the Building Official.

G. Reports of Committees and Communications

1. Communications to Commission members outside of posted meetings

There were no communications to report.

2. Committee Reports

There were no committee reports.

3. Reports from Staff other than the Building Official

There were no reports from staff.

Minutes Acceptance: Minutes of Feb 26, 2014 6:00 PM (Approval or Correction of the Minutes)

H. Old Business

1. Discussion, Consideration, and Possible action on the letter the Commission wishes to forward to City Council recommending proposed amendments to the City of Bellaire Code of Ordinances, Chapter 9, Buildings, with regards to crawlspace requirements.

   Chairman Schuster explained that this item was on the agenda in case the Commission was prepared to vote on the report to Council. She stated that the report was not yet complete and that she would like to schedule another workshop to finish it. Chairman Schuster asked the Commissioners present if Wednesdays around 4 would work ok for them. Commissioner Spencer explained that he currently has a standing meeting on Wednesdays from 2-4, but could probably make it to City Hall by around 4:30.

   Chairman Schuster stated that the Commission would be polled via email for available dates/times.
   (Requested by John McDonald, Community Development)

I. New Business

1. Swearing in of new Commission member

   Chairman Schuster stated that Commissioner Spencer had been sworn in prior to the workshop session so that he could participate as a Commission member. She added that he was replacing Commissioner John Rigby who resigned due to a job responsibility, and welcomed him aboard.
   (Requested by John McDonald, Community Development)

2. **The Chair shall recognize any Commissioner who wishes to bring New Business to the attention of the Commission. Consideration of New Business shall be for the limited purpose of determining whether the matter is appropriate for inclusion on a future agenda of the Commission or referral to Staff for investigation.**

There was no new business brought forward.

J. Public Hearings

There were no public hearings scheduled.

K. Announcements & Comments by Commissioners

Commissioner Katz welcomed Commissioner Spencer to the Commission.

Chairman Schuster mentioned that Commissioner Yemitan recently resigned from the Commission and she thanked him for his service. She stated that she had appreciated his insight and would miss his feedback. She added that a 7th Commissioner would be appointed soon.

Vice Chairman Thurmond also welcomed Commissioner Spencer.

Commissioner Spencer thanked them and stated that he was happy to be part of the Commission.

Minutes Acceptance: Minutes of Feb 26, 2014 6:00 PM (Approval or Correction of the Minutes)

L. Adjournment

Chairman Schuster adjourned the meeting at 7:11 PM.

Minutes Acceptance: Minutes of Feb 26, 2014 6:00 PM (Approval or Correction of the Minutes)

Building and Standards Commission
Council Chamber, First Floor of City Hall
Bellaire, TX 77401

Meeting: 03/26/14 07:00 PM
Department: Community Development
Category: Amendment
Department Head: John McDonald
DOC ID: 1186

SCHEDULED
ACTION ITEM (ID # 1186)

Item Title:

Discussion, consideration, and possible action on a Report and Recommendation to the City Council on water vapor control in residential crawlspace construction including proposed amendments to the City of Bellaire Code of Ordinances, Chapter 9, Buildings.

Background/Summary:

This item has been added to the agenda at the Chair's request.

The draft report was not received by the Community Development Department until late Thursday evening and therefore City Staff has not had adequate time to review the report and its conclusions prior to the deadline for agenda packets to be prepared.

The Building Official has previously questioned the necessity of this proposal. In his tenure with the City, the only incident of rotting wood in a residential crawlspace reported to the City has been by Mr. Burt Martin in regards to his house. The Building Official believes there were extenuating circumstances that contributed to the problem (issues with installation of flashing). Additionally, there have been no other requests for the issuance of building permits for the repair of rotting wood in residential crawlspaces.

The Community Development Department requests that no action be taken at the March 26 meeting so as to allow staff adequate time to properly review and respond to the Commission's draft report and recommendation.

ATTACHMENTS:

- Appendix I (PDF)
- Appendix II (PDF)
- Crawlspace report_Final Draft (PDF)

U.S. DEPARTMENT OF
ENERGY
Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

Air Leakage GUIDE



Building Energy Codes

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



Meeting the Air Leakage Requirements of the 2012 IECC

The U.S. Department of Energy (DOE) recognizes the enormous potential that exists for improving the energy efficiency, safety and comfort of homes. The newest edition of the International Energy Conservation Code® (IECC) (2012) sets the bar higher for energy efficiency, and new air sealing requirements are one of the key new provisions.

This guide is a resource for understanding the new air leakage requirements in the 2012 IECC and suggestions on how these new measures can be met. It also provides information from Building America's Air Sealing Guide, Best Practices and case studies on homes that are currently meeting the provisions. The 2012 IECC and a few International Residential Code (IRC) requirements are referenced throughout the guide.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Building Energy Code Resource Guide:

Air Leakage Guide

PREPARED BY

Building Energy Codes

DOE's Building Energy Codes Program (BECP) is an information resource on national energy codes. BECP works with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes.

September 2011

Prepared for the U.S. Department of Energy under Contract DE-AC05-76RLO 1830

PNNL-SA-82900

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Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

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Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



INTRODUCTION:
Basics of Air Leakage

Air leakage control is an important but commonly misunderstood component of the energy efficient house. Tightening the structure with caulking and sealants has several positive impacts.

A tight house will:

- Have lower heating bills due to less heat loss
- Have fewer drafts and be more comfortable
- Reduce the chance of mold and rot because moisture is less likely to enter and become trapped in cavities
- Have a better performing ventilation system
- Potentially require smaller heating and cooling equipment capacities.

Air leakage is sometimes called infiltration, which is the unintentional or accidental introduction of outside air into a building, typically through cracks in the building envelope and through use of doors for passage. In the summer, infiltration can bring humid outdoor air into the building. Whenever there is infiltration, there is corresponding exfiltration elsewhere in the building. In the winter, this can result in warm, moist indoor air moving into cold envelope cavities. In either case, condensation can occur in the structure, resulting in mold or rot. Infiltration is caused by wind, stack effect, and mechanical equipment in the building (see Figure 1).

Wind creates a positive pressure on the windward face and negative pressure on the non-windward (leeward) facing walls, which pulls the air out of the building. Wind causes infiltration on one side of a building and exfiltration on the other. Wind effects can vary by surrounding terrain, shrubs, and trees.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

The “stack effect” is when warm air moves upward in a building. This happens in summer and winter, but is most pronounced in the winter because indoor-outdoor temperature differences are the greatest. Warm air rises because it’s lighter than cold air. So when indoor air is warmer than the outdoor air, it escapes out of the upper levels of the building, through open windows, ventilation openings, or penetrations and cracks in the building envelope. The rising warm air reduces the pressure in the base of the building, forcing cold air to infiltrate through open doors, windows, or other openings. The stack effect basically causes air infiltration on the lower portion of a building and exfiltration on the upper part.

Mechanical equipment such as fans and blowers causes the movement of air within buildings and through enclosures, which can generate pressure differences. If more air is exhausted from a building than is supplied, a net negative pressure is generated, which can induce unwanted airflow through the building envelope.

Bathroom exhaust fans, clothes dryers, built-in vacuum cleaners, dust collection systems, and range hoods all exhaust air from a building. This creates a negative pressure inside the building. If the enclosure is airtight or the exhaust flow rate high, large negative pressures can be generated.

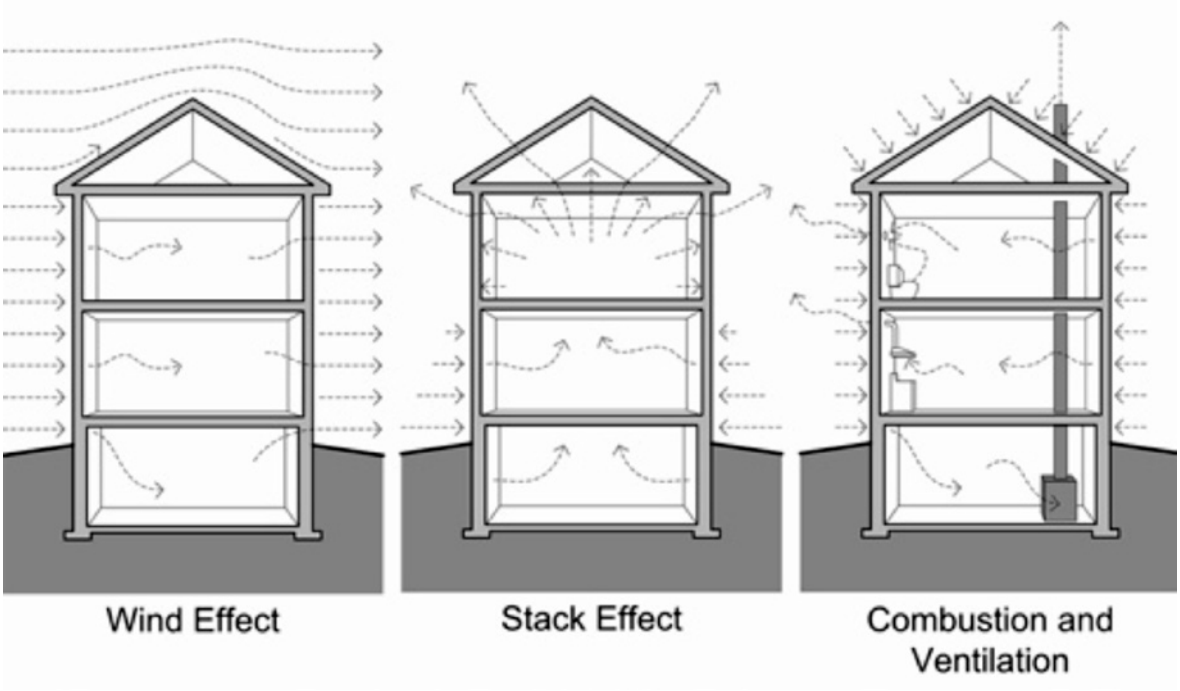


Figure 1: Examples of infiltration. Image courtesy: Building Science Corporation, www.buildingscience.com

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



CODES:
New Code Air Leakage Requirements

The 2012 IECC has several new requirements for verification of air sealing in new construction and additions. **These new requirements apply to new construction, additions, and alterations where adopted by states and local jurisdictions.** Furthermore, additional language was added to clarify that where there are conflicts or differences between provisions of the IECC and referenced codes, the IECC provisions must apply (Section R106, 2012 IECC).

For more information on the status of state code adoption, visit **http://www.energycodes.gov/states/**

R106.1.2 Provisions in Referenced Codes and Standards

Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

Sealing the building thermal envelope has been required by the energy code for many years (editions of the IECC). However, in years past the provisions were somewhat vague and only required that areas of potential air leakage such as joints, seams, and utility penetrations be sealed with a durable material such as caulking, gasketing, or weather stripping. The 2009 IECC required verification of air sealing by either a visual inspection against a detailed checklist or a whole-house pressure test. The 2012 IECC ***NOW*** requires all new construction and additions be both visually inspected and pressure tested as mandatory requirements. There have been some slight changes to the visual inspection checklist and ratcheting down of the testing parameters, requiring houses to be much tighter than the previous edition of the code (see Figure 2 and Table 1).

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

DEFINITIONS

As defined according to 2012 IECC:

BUILDING

Any structure used or intended for supporting or sheltering any use or occupancy, including any mechanical systems, service water heating systems and electric power and lighting systems located on the building site and supporting the building.

BUILDING THERMAL ENVELOPE

The basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

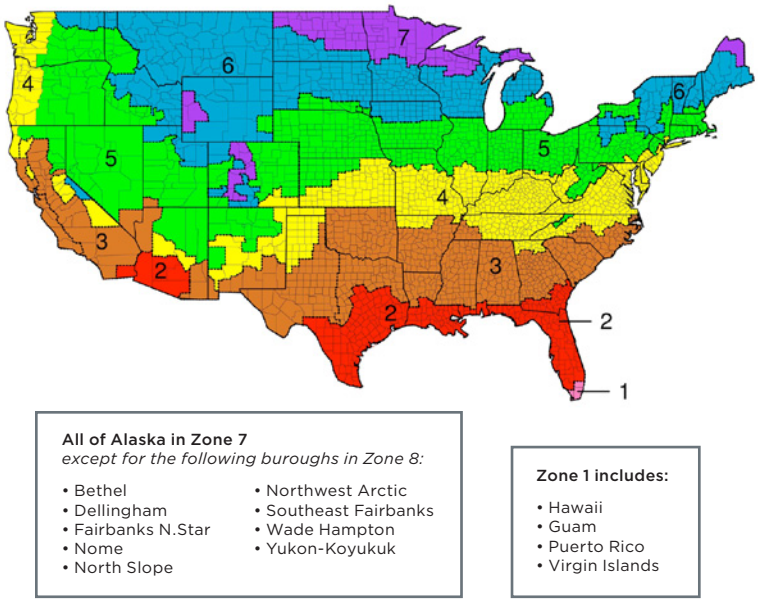


Figure 2: Climate zones (by county) for the 2012 IECC

Climate Zone	2009 IECC	2012 IECC
1 - 2	< 7 ACH	≤ 5 ACH @ 50 pascals
3 - 8	< 7 ACH @ 50 pascals	≤ 3 ACH @ 50 pascals

Table 1: 2009 vs. 2012 IECC Comparisons

R402.4 Air leakage (Mandatory)

The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

3 PLANNING: Air Sealing Measures and Checklists

The 2012 IECC provides a comprehensive list of components that must be sealed and inspected. However, unless the components are installed properly, passing the inspection and meeting the tested air leakage rate requirements may not be achievable without rebuilding some construction assemblies (such as gypsum board) that were previously installed. A good example is the air barrier between the ceiling (unconditioned attic) and conditioned space (living area). Since air leakage paths are driven by the fact that warm air rises, the attic is the largest area (square footage) of potential heat loss. Areas in the ceiling that might not have been sealed properly could include recessed cans, wires, pipes, attic access panels, drop down stair or knee wall doors and more. Figure 3 is a picture taken with an infrared camera illustrating where the temperature difference is and potential heat loss. The reds and purples indicate higher heat loss areas.

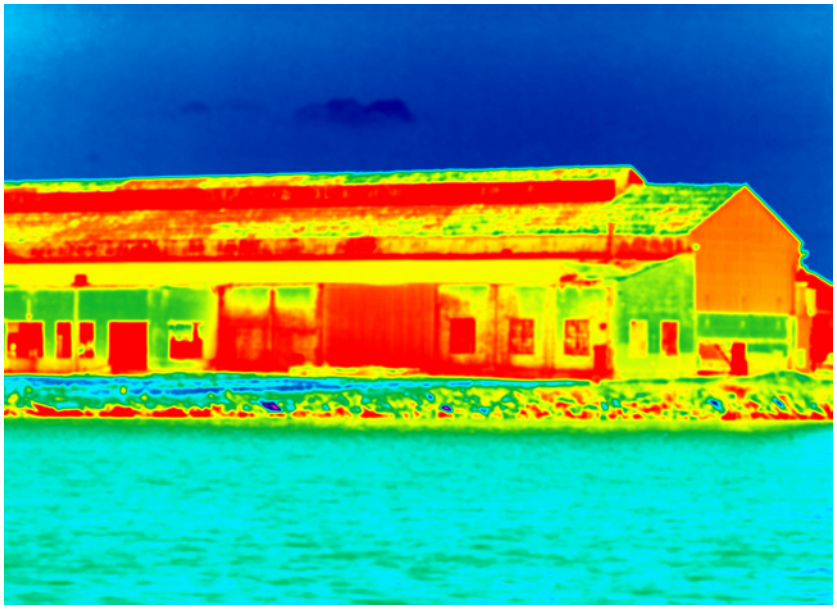
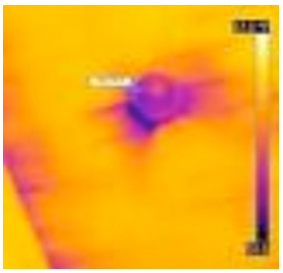
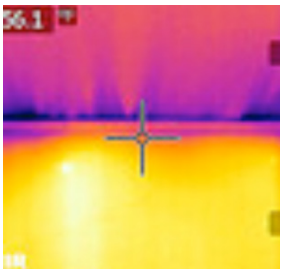


Figure 3: Air Leakage Test Results



Recessed Can



Ceiling Plane

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

DEFINITIONS

As defined according to 2012 IECC:

AIR BARRIER

Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or combination of materials.

CONTINUOUS AIR BARRIER

A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

R402.4.1.1 Installation

The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the code official an approved third party shall inspect all components and verify compliance.

The IECC's checklist covers not only air barriers but proper installation of insulation and other elements. **In Table 402.4.1.1, items that are directly related to air leakage and proper air barriers are highlighted in yellow.**

Even though the IECC checklist lists 14 specific components that are directly related to air barriers, more attention must be focused on all areas that have potential for air leakage. A good understanding of building science can facilitate proper air sealing. For example, Building America research identifies 19 key areas where air sealing can improve a home's energy efficiency, comfort, and building durability.

Common air sealing trouble spots are shown in Figure 4 on page 8 and listed in the following table. Several of these trouble spots are described in more detail as highlighted in the Building America Air Sealing Checklist.

Additional information on other trouble spots and other building science information can be found in the Building America Best Practices guides and Air Leakage guide available for free download at **www.buildingamerica.gov**.

Builders, contractors, and/or designers should develop an air sealing strategy beginning with reviewing the building plans and identifying potential areas of air leakage. These checklists can be used to help identify the areas. The strategy also needs to include the types of materials that will be used to create an air barrier and seal the building envelope. The IECC does not identify specific products that must be used to create air barriers and seal the building envelope, but does require that the materials allow for expansion and contraction.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Table R402.4.1.1 (2012 IECC). Air Barrier and Insulation Installation*

COMPONENT	CRITERIA*
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawl space walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
Shafts, penetration	Duct shafts, utility penetrations and flue shafts opening to exterior or unconditioned space shall be sealed.
Narrow cavities	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall.
Plumbing and wiring	Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.

*In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

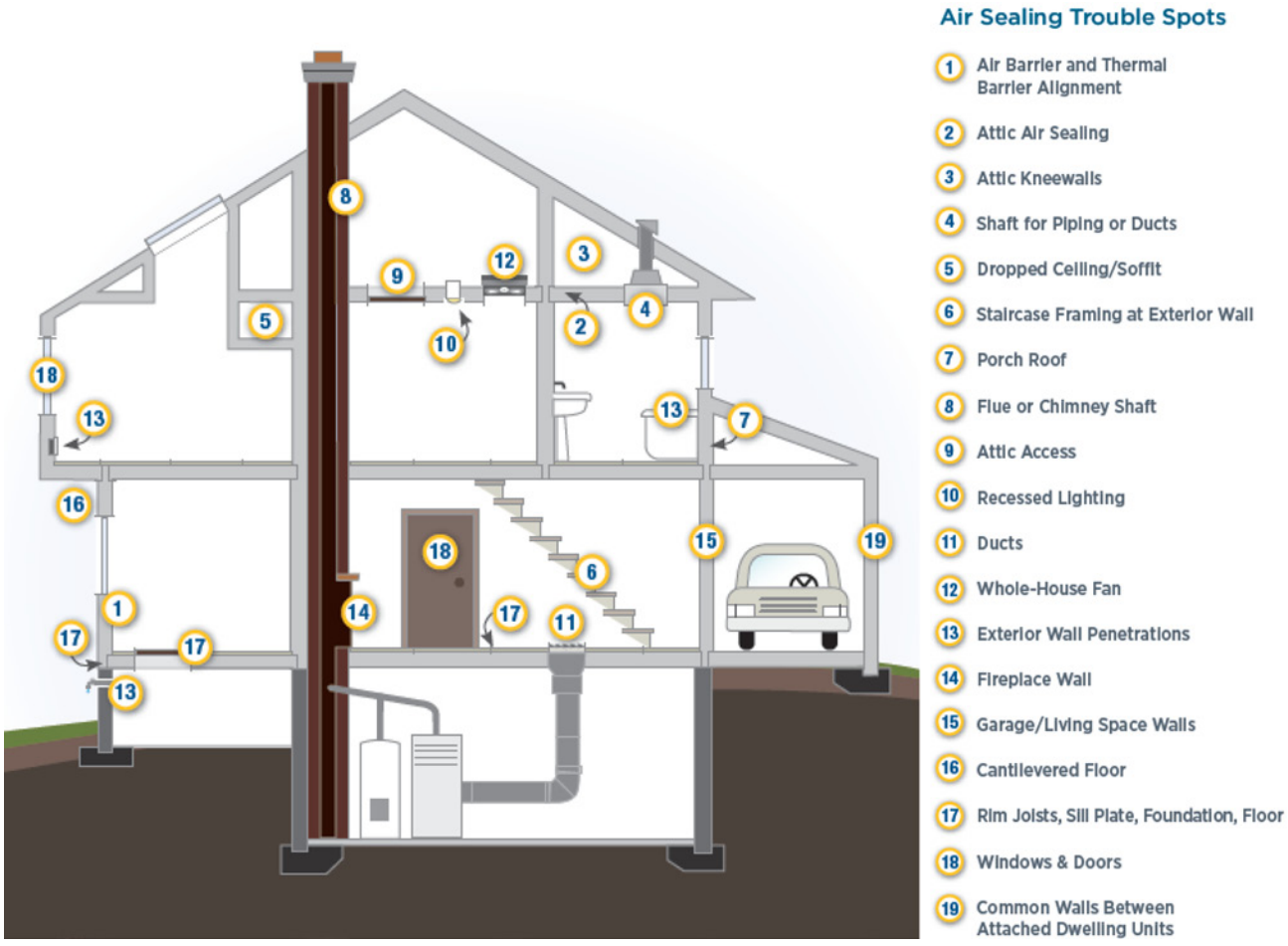


Figure 4: Building America—air sealing trouble spots

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Table 2. Building America Air Sealing Checklist

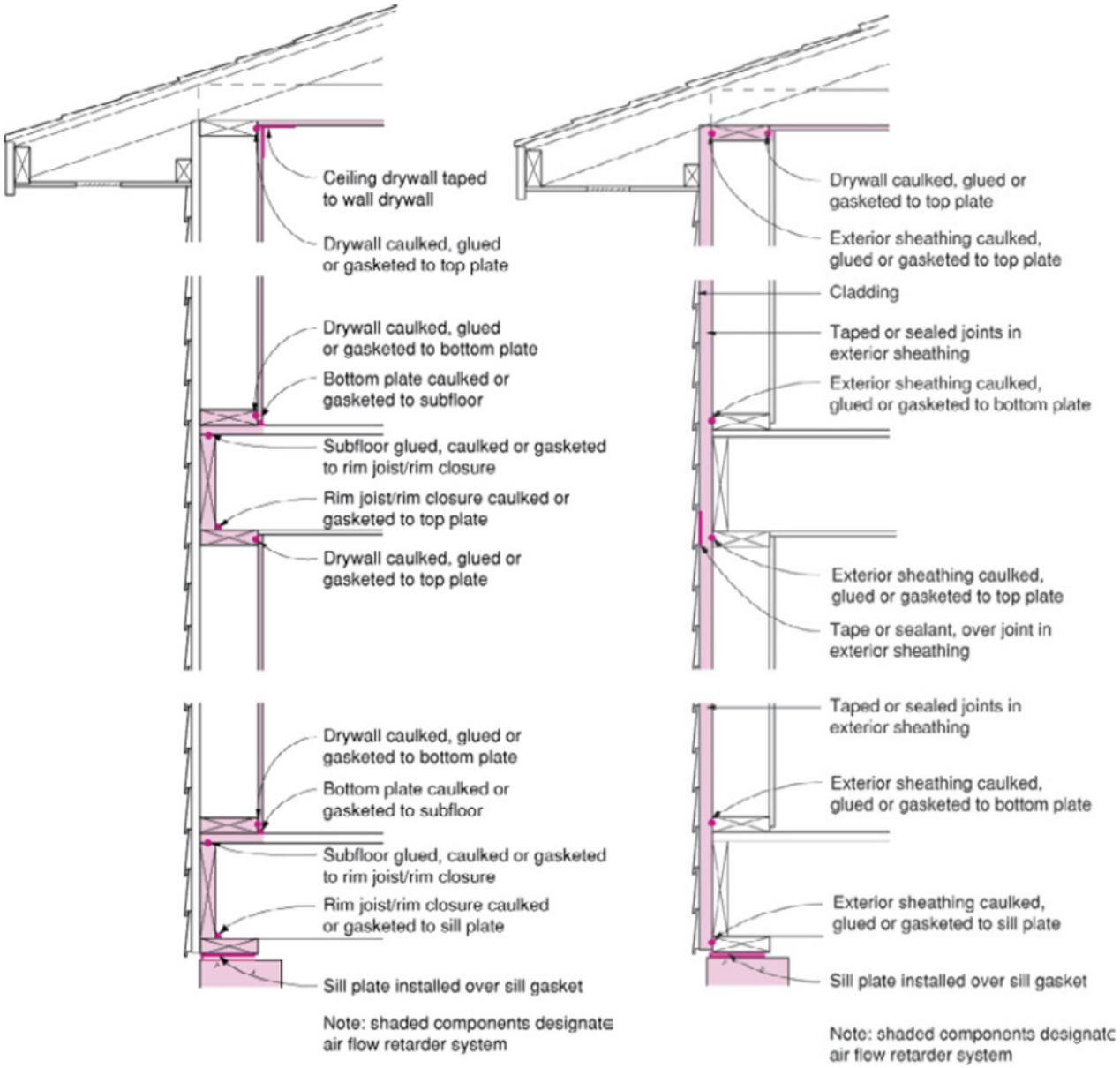
Air Barrier	Completion Guidelines
1. Air Barrier and Thermal Barrier Alignment	Air Barrier is in alignment with the thermal barrier (insulation).
2. Attic Air Sealing	Top plates and wall-to-ceiling connections are sealed.
3. Attic Kneewalls	Air barrier is installed at the insulated boundary (kneewall transition or roof, as appropriate).
4. Duct Shaft/Piping Shaft and Penetrations	Openings from attic to conditioned space are sealed.
5. Dropped Ceiling/Soffit	Air barrier is fully aligned with insulation; all gaps are fully sealed.
6. Staircase Framing at Exterior Wall/Attic	Air barrier is fully aligned with insulation; all gaps are fully sealed.
7. Porch Roof	Air barrier is installed at the intersection of the porch roof and exterior wall.
8. Flue or Chimney Shaft	Opening around flue is closed with flashing, and any remaining gaps are sealed with fire-rated caulk or sealant.
9. Attic Access/Pull-Down Stair	Attic access panel or drop-down stair is fully gasketed for an air-tight fit.
10. Recessed Lighting	Fixtures are provided with air-tight assembly or covering.
11. Ducts	All ducts should be sealed, especially in attics, vented crawlspaces, and rim areas.
12. Whole-House Fan Penetration at Attic	An insulated cover is provided that is gasketed or sealed to the opening from either the attic side or ceiling side of the fan.
13. Exterior Walls	Service penetrations are sealed and air sealing is in place behind or around shower/tub enclosures, electrical boxes, switches, and outlets on exterior walls.
14. Fireplace Wall	Air sealing is completed in framed shaft behind the fireplace or at fireplace surround.
15. Garage/Living Space Walls	Air sealing is completed between garage and living space. Pass-through door is weather stripped.
16. Cantilevered Floor	Cantilevered floors are air sealed and insulated at perimeter or joist transition.
17. Rim Joists, Seal Plate, Foundation, and Floor	Rim joists are insulated and include an air barrier. Junction of foundation and sill plate is sealed. Penetrations through the bottom plate are sealed. All leaks at foundations, floor joists, and floor penetrations are sealed. Exposed earth in crawlspace is covered with Class I vapor retarder overlapped and taped at seams.
18. Windows and Doors	Space between window/door jambs and framing is sealed.
19. Common Walls Between Attached Dwelling Units	The gap between a gypsum shaft wall (i.e., common wall) and the structural framing between units is sealed.

Items highlighted in yellow will be discussed in more detail.

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Air Barrier and Thermal Barrier Alignment

Envelope Air Sealing



Source: Building Science Corporation

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Attic Kneewalls

Air barrier is installed at the insulated boundary (kneewall transition or roof, as appropriate)

Kneewalls, the sidewalls of finished rooms in attics, are often leaky and uninsulated. A contractor can insulate and air seal these walls in one step by covering them from the attic side with sealed rigid foam insulation. A contractor can plug the open cavities between joists beneath the kneewall with plastic bags filled with insulation or with pieces of rigid foam. Another option is to apply rigid foam to the underside of the rafters along the sloped roof line and air seal at the top of the kneewall and the top of the sidewall, which provides the benefit of both insulating the kneewall and providing insulated attic storage space.

Doors cut into kneewalls should also be insulated and air sealed by attaching rigid foam to the attic side of the door, and using a latch that pulls the door tightly to a weather-stripped frame.

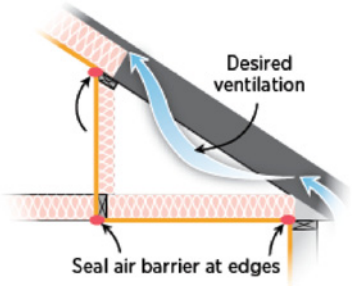


Figure 5. Insulate and air seal the kneewall itself, as shown, or along the roof line (Source: DOE 2000a).



Figure 6. Air seal floor joist cavities under kneewalls by filling cavities with fiberglass batts that are rolled and stuffed in plastic bags (as shown here) or use rigid foam, Oriented Strand Board (OSB), or other air barrier board cut to fit and sealed at the edges with caulk.

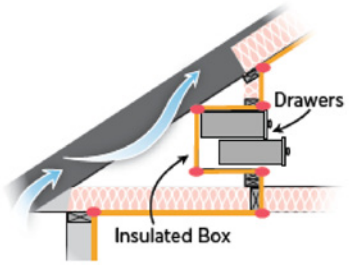


Figure 7. Build an airtight insulated box around any drawers or closets built into attic kneewalls that extend into uninsulated attic space. Insulate along air barrier (shown in yellow on drawing) or along roof line with rigid foam (Source: Iowa Energy Center 2008).

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Dropped Ceiling/Soffit

Air barrier is fully aligned with insulation; all gaps are fully sealed

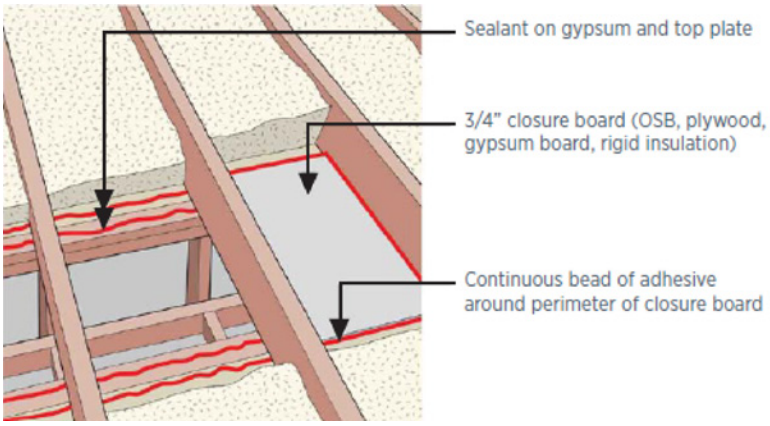
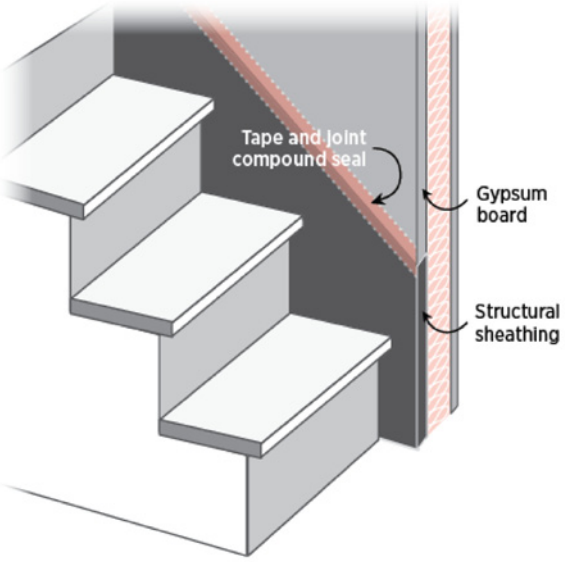


Figure 8. Place a solid air barrier over soffits as follows: pull back existing insulation; cover area with air barrier material (gypsum, plywood, OSB, rigid foam, etc.); seal edges with caulk; cover with insulation (Lstiburek 2010).

Soffits (dropped ceilings) found over kitchen cabinets or sometimes running along hallways or room ceilings as duct or piping chases are often culprits for air leakage. A contractor will push aside the attic insulation to see if an air barrier is in place over the dropped area. If none exists, the contractor will cover the area with a piece of rigid foam board, sheet goods, or reflective foil insulation that is glued in place and sealed along all edges with caulk or spray foam, then covered with attic insulation. If the soffit is on an exterior wall, sheet goods or rigid foam board should be sealed along the exterior wall as well. If the soffit contains recessed can lights, they should be rated for insulation contact and airtight or a dam should be built around them to prevent insulation contact.



Staircase Framing at Exterior Wall/Attic

Air barrier is fully aligned with insulation; all gaps are fully sealed

If the area under the stairs is accessible, look to see if the inside wall is finished. If not, have your contractor insulate it, if needed, and cover it with a solid sheet product like drywall, plywood, OSB, or rigid foam insulation. Then, your contractor can caulk the edges and tape the seams to form an air-tight barrier. Stairs should be caulked where they meet the wall.

Figure 9. Install an air barrier and air sealing on exterior walls behind stairs. If the area behind the stairs is inaccessible, caulk stairs where they meet the wall. Use caulk if the area is already painted; use tape and joint compound if area will be painted.

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Porch Roof

Air barrier is installed at the intersection of the porch roof and exterior wall

If a test-in inspection identifies air leakage at the wall separating the porch from the living space, the contractor will investigate to see if the wall board is missing or unsealed. If this is the case, the contractor will install some type of wall sheathing (oriented strand board, plywood, rigid foam board) cut to fit and sealed at the edges with spray foam. A contractor will also make sure this wall separating the attic from the porch is fully insulated.





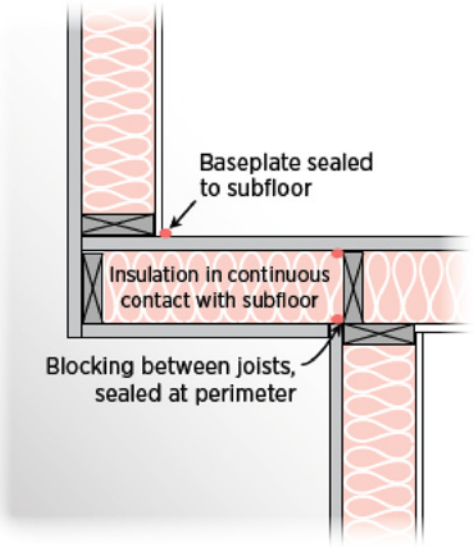
Figure 10. When researchers pulled back the porch ceiling, they found the wall board was missing so nothing was covering the insulation on this exterior wall. An air barrier of rigid foam board was put in place with spray foam (Image: Moriarta 2008).

Studies Show

Steven Winter Associates, a Building America research team lead, used a blower door test and infrared cameras to investigate high-energy bill complaints at a 360-unit affordable housing development and found nearly twice the expected air leakage. Infrared scanning revealed an air leakage path on an exterior second-story wall above a front porch. Steven Winter Associates found that, while the wall between the porch and the attic had been insulated with unfaced fiberglass batts, wall board had never been installed. The insulation was dirty from years of windwashing as wind carried dust up through the perforated porch ceiling, through the insulation, into the attic and into the wall above. Crews used rigid foam cut to fit and glued in place with expandable spray foam to seal each area. Blower door tests showed the change reduced overall envelope leakage by 200 CFM_{50}. At a cost of $267 per unit, this fix resulted in savings of $200 per year per unit, for a payback of less than two years.

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Cantilevered Floor



Cantilevered floors are air sealed and insulated at perimeter or joist transitions

Cantilevered floors, second-story bump-outs, and bay windows are another area in the home that often lacks proper air sealing. The floor cavity must be filled with insulation with good alignment (i.e., that is completely touching) the underside of the floor. The interior and exterior sheathing needs to be sealed at the framing edges. Blocking between floor joists should form a consistent air barrier between the cantilever and the rest of the house. Continuous sheathing, such as insulating foam sheathing, should cover the underside of the cantilever and be air sealed at the edges with caulk.

Figure 11. Block and air seal both the floor-to-upper wall junction and the floor-to-lower wall junction.

R402.4.1 Building thermal envelope

The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

The most common products for creating an airtight barrier are tapes, gaskets, caulks, and spray foam materials.

Tapes

To limit air leakage, builders use tapes to seal the seams of a variety of membranes and buildings products, including housewrap, polyethylene, OSB, and plywood. Tapes are also used to seal duct seams; seal leaks around penetrations through air barriers, for example, around plumbing vents, and sheet goods to a variety of materials, including concrete. No single tape works well in all of these applications, so builders, general contractors and trades need to familiarize themselves with the range of products and what will work best (time tested) and include these materials in the overall air barrier strategy.



Image: GreenBuildingAdvisor.com

Attachment: Appendix I (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Gaskets can be Better than Caulk

When builders first learn about air sealing, they often depend heavily on caulk. After inspecting a home for leaks during a blower-door test, however, they learn that caulk has a few downsides. That's when they usually graduate to gaskets.

Typical locations for gaskets include between the:

- Top of the foundation and the mudsill;
- Subfloor and the bottom plate;
- Window frame and the rough opening;
- Bottom plate and the drywall; and
- Top plate and the drywall.

Spray Foams

Spray foams are available in a variety of different forms, from small cans to larger industrial gallon sizes. Special care needs to be taken when using these products, as some expand more than others and some can exert significant pressure on the surrounding structure during expansion.

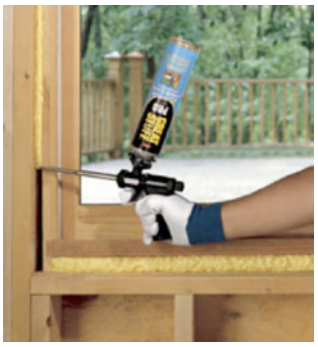


Image: Sprayfoam.com

Who is Responsible for Air Sealing?

The IECC does not specify who is responsible for air sealing; it states that the building envelope shall be sealed in accordance with manufacturers' instructions and the provisions (checklist) of the IECC. The construction documents for permitting to begin construction are typically submitted by the person in charge of the project and responsible for making sure all measures are installed properly and meet the provisions of the code. The inspector is responsible for making sure those measures meet code by verifying through on-site inspections.

Since so many different areas of the building envelope must be sealed, the responsibility will not always be on one person, installer, or trade. For example, the mechanical contractor who installs the heating and cooling equipment most likely will not be installing an air barrier between the attic and conditioned space, as that is usually the responsibility of the insulation contractor.

However, general contractors typically assume that the insulation and air sealing contractors seal and fill the holes, including filling any unintended holes that other subs leave behind. An air sealing strategy

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can include identifying who is responsible for sealing which building components, including unintended cracks or holes in the building thermal envelope.

The following table is an example of building components to be sealed and who might be responsible for sealing those components.

Table 3. Building components to be sealed and who might be responsible for sealing those components

Building Components	Contractor/Trade
Ceiling/attic, kneewalls, attic access, recessed lighting, walls, floors, garage separation, electrical and service penetrations in ceiling, floors, and walls	• Insulation/air sealing installers • Gypsum board contractors • Foundation contractors • Electricians • Roofers • Framers • General contractors
Service water piping, penetrations for water supply and demand	• Plumbers • Electricians
Rim joists, sill plates, windows, skylights, doors, porch roof, shower/tub on exterior wall, electrical box on exterior wall, fireplace	• Framers • Roofers • Plumbers • Electricians • Insulation/air sealing installers • Window and door installers • General contractors
Ducts, piping, shafts, penetrations, register boots	• HVAC installers
All of the above	• Inspectors • General contractors

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TESTING: Requirements

The specific test requirements are based on the flow rate of air produced by a blower door at a specified pressure (50 pascals or 0.2 inches of water) when exterior doors are closed, dampers are closed but not otherwise sealed, exterior openings for continuous ventilation systems and heat recovery ventilators are closed but not sealed, HVAC systems are turned off, and duct supply and return registers are not covered or sealed.

The infiltration rate is the volumetric flow rate of outside air into a building, typically in cubic feet per minute (CFM) or liters per second (LPS). The air exchange rate, (I), is the number of interior volume air changes that occur per hour, and has units of 1/h. The air exchange rate is also known as air changes per hour (ACH).

ACH can be calculated by multiplying the building's CFM by 60, then dividing by the building volume in cubic feet. (CFM x 60)/volume. The requirement is expressed in ACH, which takes account of the overall size (volume) of the home:

Total air leakage < 3-5 ACH (air changes per hour)

What is a blower door? It is a powerful fan that attaches and seals to a door (typically the entrance door to the home) and blows air into or out of the house to pressurize or depressurize the home. The inside-outside pressure difference will cause air to force its way through any cracks in the building thermal envelope. Measuring the flow rate at the specified test pressure indicates the leakiness of the envelope.

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Figure 12. Blower door

Who Performs the Test and is Certification Required?

The IECC does not specifically address who should perform the test. Builders, contractors, tradesmen, or code officials can perform the test. Code officials can also request the test be performed by an independent third party. The IECC does not require the person performing the test to be certified. However, it is recommended that the person be knowledgeable and have experience in using the equipment.

RESNET and BPI provide certifications for whole-house testing. For more information go to **www.resnet.org** or **www.bpi.org**.

R402.4.1.2 Testing

The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

During testing:

1. *Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;*
2. *Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;*
3. *Interior doors, if installed at the time of the test, shall be open;*
4. *Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;*
5. *Heating and cooling systems, if installed at the time of the test, shall be turned off; and*
6. *Supply and return registers, if installed at the time of the test, shall be fully open.*

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5 TESTING: Presenting Results

A permanently affixed certificate posted on or near the electrical panel is not a new requirement in the IECC. However, the information required on the certificate ***NOW*** includes results of duct and whole-house pressure tests in addition to the predominant R-values of insulation installed in or on ceiling/roof, walls, foundations, and ducts outside conditioned spaces; fenestration U-factors and solar heat gain coefficients (SHGCs); and efficiencies of heating, cooling, and service water heating equipment.

As a recommendation for verification of testing, whomever performs the testing should also submit the test results to the building official and/or general contractor, confirming the air leakage levels have been met.

R401.2 Certificate (Mandatory)

A permanent certificate shall be completed and posted on or in the electrical distribution panel by the builder or registered design professional. The certificate shall list the results from any required duct system and building envelope air leakage testing done on the building.

2012 IECC Energy Efficiency Certificate

Insulation Rating	R-Value	
Ceiling / Roof	_____	
Wall	_____	
Floor / Foundation	_____	
Ductwork (unconditioned spaces):	_____	
Glass & Door Rating	**U-Factor**	**SHGC**
Window	_____	_____
Door	_____	_____
Heating & Cooling Equipment	**Efficiency**	
Heating System:_____	_____	
Cooling System:_____	_____	
Water Heater:_____	_____	
Testing Results		
Ducts (unconditioned spaces):	____CFM/100 ft^2 of conditioned floor area	
Whole House	____ACH @ 50 Pascals	
Name:_____		Date:_____
Comments:		

The illustration is an Energy Efficiency Certificate that can be created and printed using DOE's Building Energy Codes Program software called RES*check*™.

www.energycodes.gov

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VENTILATION: Requirements

Many building scientists believed mechanical ventilation should have been part of the building design even prior to the 2012 IECC. However, there are disagreements as to the level of envelope tightness at which mechanical ventilation is necessary due to health and safety concerns. This is no longer a question given the new air leakage requirements of the 2012 IECC and other provisions in the International Residential Code (IRC) and International Mechanical Code (IMC). The 2012 IECC does not specifically address the requirements for whole-house mechanical ventilation, but it references the ventilation requirements of the IRC or IMC as a mandatory provision.

IECC, R403.5 Mechanical Ventilation (Mandatory)

The building shall be provided with ventilation that meets the requirements of the ***International Residential Code*** *or* ***International Mechanical Code****, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.*

Both the 2012 IRC and IMC require mechanical ventilation when the air infiltration rate of the dwelling unit is < 5 ACH when tested with a blower door in accordance with the 2012 IECC provisions.

IRC, Section R303.4 Mechanical Ventilation

Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c. (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house ventilation in accordance with Section M1507.3.

Section N1102.4.1.2 is the extraction of the air leakage requirements in the IECC, Section R402.4. ICC duplicated the language from the IECC residential provisions in the IRC, Chapter 11, Energy Efficiency.

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IMC, Section 401.2 Ventilation Required

Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with blower door at a pressure of 0.2-inch water column (to Pa) in accordance with Section 402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by mechanical means in according with Section 403.

IECC, Section R403.5.1 Whole-House Mechanical Ventilation System Fan Efficacy

Mechanical ventilation system fans shall meet the efficacy requirements of Table 403.5.1.

***Exception:** Where mechanical ventilation system fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.*

Table 4. 2012 IECC Table R403.5.1, Mechanical Ventilation System Fan Efficacy

Fan Location	Air Flow Rate Minimum (CFM)	Minimum Efficacy (CFM/watt)	Air Flow Rate Maximum (CFM)
Range Hoods	Any	2.8	Any
In-line Fan	Any	2.8	Any
Bathroom, Utility Room	10	1.4	< 90
Bathroom, Utility Room	90	2.8	Any

In addition, ASHRAE Standard 62.2 provides guidance on the appropriate ventilation for acceptable indoor air quality in low-rise residential buildings. The standard specifies that forced ventilation is required in houses with a natural infiltration rate less than 0.35 ACH. This is typically accomplished with heat recovery ventilation or exhaust fans running constantly or periodically. The standard offers guidance for incorporating whole-house systems into a home. This standard is not referenced in the IECC, though some jurisdictions and states adopt this standard as part of their requirements.

For more information on whole-house mechanical ventilation, refer to **Appendix B**.

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Ventilation Systems

There are several options for mechanical ventilation systems. Spot ventilation, using exhaust-only fans in the kitchen and bathroom, removes water vapor and pollutants from specific locations in the home, but does not distribute fresh air. Balanced ventilation systems, such as air-to-air exchangers, heat-recovery ventilators, and energy recovery ventilators, both supply and exhaust air.

Table 5: Pros and Cons of Various Mechanical Ventilation Systems

Ventilation Type	Pros	Cons
Exhaust Only Air is exhausted from the house with a fan	• Easy to install • Simple method for spot ventilation • Inexpensive	• Negative pressure may cause backdrafting • Makeup air is from random sources • Removes heated or cooled air
Supply Only Air is supplied into the house with a fan	• Does not interfere with combustion appliances • Positive pressures inhibit pollutants from entering • Delivers to important locations	• Does not remove indoor air pollutants at their source • Brings in hot or cold air or moisture from the outside • Air circulation can feel drafty • Furnace fan runs more often unless fan has an ECM (variable-speed motor)
Balanced Air Exchange System Heat and energy recovery ventilators supply and exhaust air	• No combustion impact • No induced infiltration/exfiltration • Can be regulated to optimize performance • Provides equal supply and exhaust air • Recovers up to 80% of the energy in air exchanged	• More complicated design considerations • Over ventilation unless the building is tight • Cost

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Heat and Energy Recovery Ventilation Systems

Heat recovery ventilators (HRVs) and energy recovery (or enthalpy recovery) ventilators (ERVs) both provide a controlled way of ventilating a home while minimizing energy loss by using conditioned exhaust air to warm or cool fresh incoming air. There are some small wall or window-mounted models, but the majority are central, whole-house ventilation systems that share the furnace duct system or have their own duct system. The main difference between an HRV and an ERV is the way the heat exchanger works. With an ERV, the heat exchanger transfers water vapor along with heat energy, while an HRV only transfers heat. The ERV helps keep indoor humidity more constant. However, in very humid conditions, the ERV should be turned off when the air conditioner is not running. Air-to-air heat exchangers or HRVs are recommended for cold climates and dry climates. ERVs are recommended for humid climates. Most ERV systems can recover about 70%–80% of the energy in the exiting air. They are most cost effective in climates with extreme winters or summers, and where fuel costs are high. ERV systems in cold climates must have devices to help prevent freezing and frost formation.

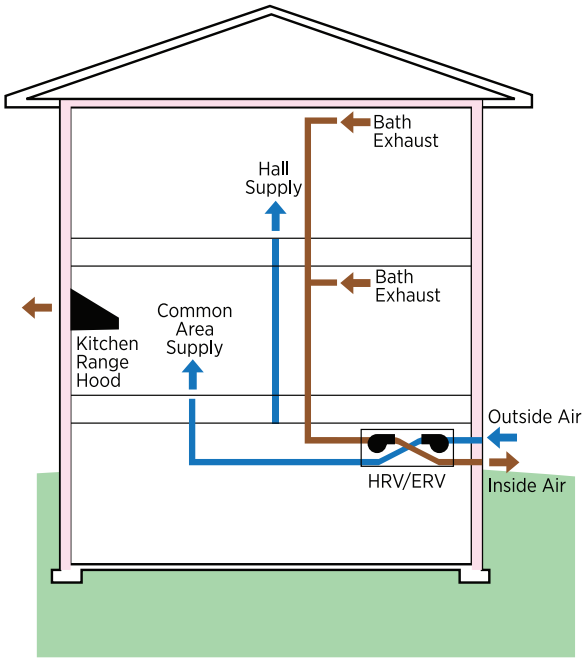


Figure 13. Heat and energy recovery ventilators bring in fresh air, exhaust stale air, and save energy by transferring heat into incoming air through a heat exchanger (Ruud 2011).

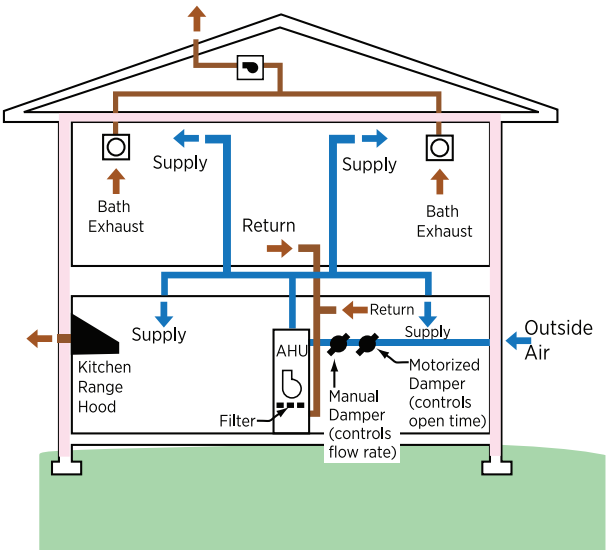


Figure 14. Semi-balanced ventilation systems provide fresh air and exhaust stale air but flow rates may not be balanced (Ruud 2011).

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HVAC SIZING: Requirements

Reducing infiltration can reduce the loads on the building, which in turn can reduce the required sizes of the heating and cooling equipment. The 2012 IECC contains a mandatory requirement that equipment be sized according to Air Conditioning Contractors of America (ACCA) Manual S, based on loads calculated in accordance with ACCA Manual J (or other approved means of calculating the loads and equipment sizing). Many jurisdictions allow the use of other heating system sizing calculators. Builders/contractors should check with the governing jurisdiction to see what they accept. The builder or contractor will also need to make an assumption when calculating the loads based upon the tested air leakage rate (changes per hour at 50 pascals) of the home. Since the IECC requires ≤ 3 ACH for climate zones 3-8 or ≤ 5 ACH for climate zones 1-2, at a 50 pascals pressure test, the infiltration rate assumption will need to be at the applicable ACH when running the load calculations.

R403.6 Equipment Sizing (Mandatory)

Heating and cooling equipment shall be sized in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

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CASE STUDIES:
Alternative Methods of Construction

Some builders are currently building energy efficient homes in the cold and very cold climates that achieve the low air leakage rates specified in the 2012 IECC ($\leq$ 3 ACH in climate zones 3-8). The following case studies showcase five cold climate builders who worked with Building America research teams. The builders used a variety of energy efficiency measures, including such things as insulated concrete forms (ICFs) and wood-framed walls with studs on 24-inch centers. The energy efficiency measures and testing results are summarized in Table 6 and the tested air leakage rates are highlighted in yellow.

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Table 6. Summary of Energy Efficiency Measures Incorporated in Case Study Homes in the Cold Climate

	Devoted Builders Kennewick, WA	Nelson Construction Farmington, CT
Project	Mediterranean Villas Pasco, WA 230 duplex and triplex units 1,140 - 2,100 ft^2 Market rate	Hamilton Way Farmington, CT 10 single family homes 2,960 - 3,540 ft^2 Market rate
Tested Air Leakage and Sealing	**Tested at 0.8 to 2.0 ACH at 50 Pa; Spray foam ceiling deck**	**Tested at < 3.0 ACH at 50 Pa; Foam critical seal of rim and floor joists**
Walls	R-25 ICF	2x6 24-in. o.c.
Wall Insulation	R-25 ICF	2-inch foil-faced polyisocyanurate R-13 sheathing, plus R-19 cellulose in stud cavities
Attic Insulation	R-49 blown-in cellulose on ceiling	R-50 blown-in fiberglass on ceiling
Foundation Insulation	R-25 ICF perimeter foundation insulation with floating slab	2-inch/R-10 XPS below slab; 2-inch/R-10 XPS in thermomass basement walls
Ducts	In conditioned space or in attic covered with spray foam and blown cellulose	In conditioned space in dropped ceiling or between joists
Air Handler	In conditioned space	In conditioned basement
HERS	54 - 68	53 - 54
HVAC	8.5 HSPF/14 SEER heat pumps	94% AFUE gas furnace; SEER 14 air conditioner
Windows	U-0.29	U-0.32, SHGC-0.27, double-pane, low-e, vinyl framed
Water Heating	84% EF tankless gas water heater	82% EF tankless gas water heater
Ventilation	Energy recovery ventilator	Temperature- and timer-controlled fresh air intake; exhaust fan ducted to draw from main living space; transfer grilles
Green	3-star BuiltGreen certified homes	2008 “Best Energy Efficient Green Community” by CT Home Builders Association; 2010 NAHB Energy Value Housing gold award
Lighting and Appliances	70% hardwired CFL lighting; ENERGY STAR refrigerators, dishwashers, and clothes washers	100% CFLs; optional appliances
Solar	No	Optional 7-kW PV systems
Verification	100% are third party tested and inspected, all homes met federal tax credit criteria since 2007	All Builders Challenge certified

AC = air conditioner; ACH = air changes per hour; AFUE = annual fuel utilization efficiency; CFL = compact fluorescent lights; Ef = energy factor; HERS = Home Energy Rating System; HSPF = Heating Seasonal Performance Factor; ICF = insulated concrete form;

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Table 6. Summary of Energy Efficiency Measures Incorporated in Case Study Homes in the Cold Climate (continued)

Rural Development, Inc. Turner Falls, MA	S&A Homes Pittsburgh, PA	Shaw Construction Grand Junction, CO
Wisdom Way Solar Village Greenfield, MA 20 duplex units 1,140 - 1,770 ft² Affordable housing	East Liberty Development, Inc. 6 single-family urban infill 3,100 ft² Above market rate	Burlingame Ranch Phase 1 Aspen, CO 84 units in 15 multi-family buildings 1,325 ft² Affordable
Tested at 1.1 to 1.5 ACH at 50 pa	**Tested at 3.0 ACH at 50 Pa; all penetrations and studs sealed**	**Tested at 2.5 in² leakage per 100 ft² of envelope**
Double walled (two 2x4 16-in. o.c. walls, 5 inches apart)	2x6 24-in. o.c.	2x6 24-in. o.c.
R-42 dense-pack, dry blown cellulose	R-24 blown fiberglass	R-24 of 3.5" high-density spray foam
R-50 blown-in cellulose on ceiling	R-49 blown-in fiberglass on ceiling	R-50 high-density foam at sloped roof, R-38 at flat roofs
Full uninsulated basement with R-40 blown cellulose under first floor	Precast concrete basement walls with steel-reinforced concrete studs at 2.5 in. XPS R-12.5	Slab with R-13 XPS edge; some basements with R-13 interior polyisocyanurate; R-28 of spray-foam insulation on ground under slab
No ducts	In conditioned space in open-web floor trusses	No ducts
None	In conditioned basement	None
8 - 18	51 - 55	54 - 62
Small sealed-combustion 83% AFUE gas-fired space heater on main floor; no AC	Two-stage 96%-AFUE gas furnace with multi-speed blower; SEER-14 AC	0.9 AFUE condensing gas boiler with baseboard hot water radiators
Triple-pane U-0.18 on north/east/west sides; double-pane U-0.26 on south side	U-0.33, SHGC-0.30, double-pane	U-0.37, SHGC-0.33 fiberglass-framed, double-pane
Solar thermal with tankless gas backup	82% EF tankless gas water heater	Solar thermal with gas boiler back-up
Continuous bathroom exhaust	Passive fresh air duct to return plenum; fan-cycler on 50% of time for fresh air circulation, bath exhausts	Heat-recovery ventilator
LEED Platinum	Meets LEED (not certified)	LEED Certified
100% CFLs; refrigerator, dishwasher	100% CFLs and ENERGY STAR refrigerator, dishwashers, and clothes washer	90% CFL; ENERGY STAR refrigerator, dishwashers, clothes washers, ceiling fans
2.8 to 3.4-kW PV; flat-plate collector solar thermal water heating	No	10-kW PV on one building; solar hot water heating on all buildings
All HERS rated	All Builders Challenge certified	All federal tax credit qualified

o.c. = on center wood framed walls; Pa = pascals; PV = photovoltaic; SEER = Seasonal Energy Efficiency Ratio; SHGC = solar heat gain coefficient; XPS = extruded polystryene

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CASE STUDIES/SUMMARY



Devoted Builders, LLC

http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_bp_devoted_cold.pdf



Nelson Construction

http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_bp_nelson_cold.pdf



Rural Development, Inc.

http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_bp_ruraldevelopment_cold.pdf



S&A Home

http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_bp_sahomes_cold.pdf



Shaw Construction

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APPENDIX A:
References and More Information on Air Sealing

2012 IECC. 2012 International Energy Conservation Code, Section 402.4 "Air Leakage," Section 403.5 "Mechanical Ventilation," International Code Council (ICC), Washington, DC. www.iccsafe.org/Store/Pages

2012 IRC. 2012 International Residential Code, Section M 1507.3, R303.4, R403.5

2010 ASHRAE, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA. ASHRAE Standard 62.2-2010

Air Sealing: A Guide for Contractors to Share with Homeonwners - Volume 10, Building America, Pacific Northwest National Laboratory, Oakridge National Laboratory, PNNL-19284

Builders Challenge Guide to 40% Whole-House Energy Savings in the Cold and Very Cold Climates, Volume 12, Building America Best Practices Series, February 2011, PNNL-20139

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Rudd, Armin. 2011. *Local Exhaust and Whole House Ventilation Strategies*, Prepared by Building Science Corporation for the U.S. Department of Energy, http://www.buildingamerica.gov

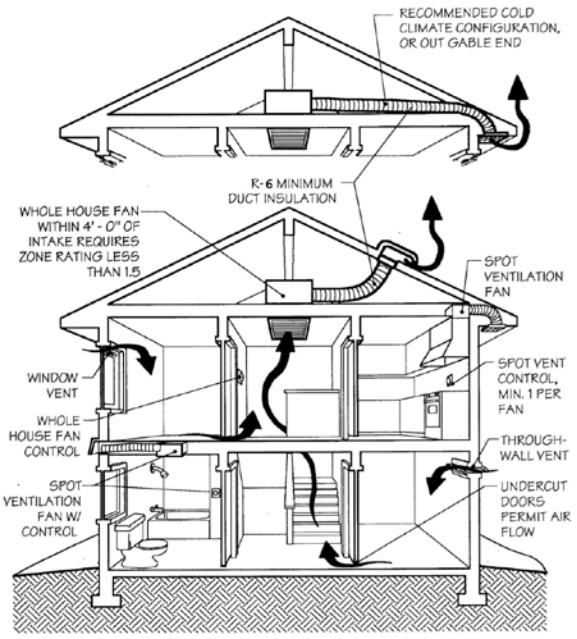
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APPENDIX B: Code Note

Whole-House Mechanical Ventilation

[ASHRAE 62.2-2010, 2012 IECC, 2012 IRC]
PNNL-SA-83104

ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, defines the roles of and minimum requirements for mechanical and natural ventilation systems to achieve acceptable indoor air quality. This material supplements requirements contained in the national model energy codes with respect to mechanical ventilation systems. At this time, the residential provisions of the IECC do not reference ASHRAE 62.2.



Ventilation
The process of supplying outdoor air to or removing indoor air from a dwelling by natural or mechanical means. Such air may or may not have been conditioned.

Mechanical Ventilation
The active process of supplying air to or removing air from an indoor space by powered equipment.

Natural Ventilation
Ventilation occurring as a result of only natural forces.

CFM
Cubic feet per minute, a standard measurement of airflow.

In the past, no specific requirements for ventilation were imposed for residential buildings because leakage in envelope components and natural ventilation were considered adequate to maintain indoor air quality. As envelope construction practices have improved, the need to provide fresh air to homes via mechanical means has increased.

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ASHRAE Standard 62.2 provides guidelines for ventilation requirements. In addition to addressing whole-house ventilation, the standard also addresses local exhaust (kitchens and bathrooms) and criteria for mechanical air-moving equipment. Ventilation requirements for safety (including combustion appliances, adjacent space concerns, and location of outdoor air inlets) are also addressed.

To comply with the ASHRAE standard, residential buildings (including manufactured homes) are required to install a mechanical ventilation system. An override control for the occupants is also required.

Plan Review

1. Confirm that a mechanical ventilation system that provides the appropriate ventilation rate (CFM) is called out. See ASHRAE 62.2-2010, Table 4.1a, for details.
2. Check that the planned ventilation rate does not exceed 7.5 CFM per 100 ft^2 if located in a very cold climate or a hot, humid climate. See Tables 8.1 and 8.2 for details.
3. Check that local exhaust systems for kitchens and bathrooms have been planned for appropriately.

Field Inspection

1. Confirm that a mechanical ventilation system that provides the appropriate ventilation rate (CFM) is installed.
2. Confirm that occupant override control has been installed as required by ASHRAE 62.2-2010 section 4.4, and 2012 IRC, section M1507.3.

Code Citations*

ASHRAE 62.2-2010, Table 4.1a (I-P) Ventilation Air Requirements, CFM
[2012 IRC Table M1507.3.3(1) Continuous Whole-House Ventilation System Airflow Rate Requirements]

Floor Area (ft^2)	0-1 Bedrooms	2-3 Bedrooms	4-5 Bedrooms	6-7 Bedrooms	7+ Bedrooms
< 1,500	30	45	60	75	90
1,500 - 3,000	45	60	75	90	105
3,001 - 4,500	60	75	90	105	120
4,501 - 6,000	75	90	105	120	135
6,001 - 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

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ASHRAE 62.2-2010, Table 8.1 Hot, Humid U.S. Climates

Mobile, AL	Savannah, GA	Wilmington, NC
Selma, AL	Valdosta, GA	Charleston, SC
Montgomery, AL	Hilo, HI	Myrtle Beach, SC
Texarkana, AR	Honolulu, HI	Austin, TX
Apalachicola, FL	Lihue, HI	Beaumont, TX
Daytona, FL	Kahului, HI	Brownsville, TX
Jacksonville, FL	Baton Rouge, LA	Corpus Christi, TX
Miami, FL	Lake Charles, LA	Dallas, TX
Orlando, FL	New Orleans, LA	Houston, TX
Pensacola, FL	Shreveport, LA	Galveston, TX
Tallahassee, FL	Biloxi, MS	San Antonio, TX
Tampa, FL	Gulfport, MS	Waco, TX
	Jackson, MS	

ASHRAE 62.2-2010, Table 8.2 Very Cold U.S. Climates

Anchorage, AK	Marquette, MI	Fargo, ND
Fairbanks, AK	Sault Ste. Marie, MI	Grand Forks, ND
Caribou, ME	Duluth, MN	Williston, ND
	International Falls, MN	

2012 IECC, Section R403.5 Mechanical ventilation (Mandatory)

The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

2012 IRC, Section R303.4 Mechanical ventilation

Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c. (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house ventilation in accordance with Section M1507.3.

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2012 IRC, Section M1507.3 Whole-house mechanical ventilation system
Whole-house mechanical ventilation systems shall be designed in accordance with Sections M1507.3.1 through M1507.3.3.

M1507.3.1 System design
The whole-house ventilation system shall consist of one or more supply or exhaust fans, or a combination of such, and associated ducts and controls. Local exhaust or supply fans are permitted to serve as such a system. Outdoor air ducts connected to the return side of an air handler shall be considered to provide supply ventilation.

M1507.3.2 System controls
The whole-house mechanical ventilation system shall be provided with controls that enable manual override.

M1507.3.3 Mechanical ventilation rate
The whole-house mechanical ventilation system shall provide outdoor air at a continuous exchange rate of not less than that determined in accordance with Table M1507.3.3(1).

Exception: The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25-percent of each 4-hour segment and the ventilation rate prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table M1507.3.3(2).2012.

Table 7.4. 2012 IRC Table M1507.3.3(2) Intermittent Whole-House Mechanical Ventilation Rate Factors

Run-Time Percentage in Each 4-Hour Segment	25%	33%	50%	66%	75%	100%
Factor	4.0	3.0	2.0	1.5	1.3	1.0

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Raised floor home in Baton Rouge

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Raised floor homes in New Orleans

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Introduction

This document summarizes key information based on a cooperative research project conducted by the U.S. Department of Agriculture's Forest Products Laboratory and the Louisiana State University Agricultural Center. The study was supported by the Forest Products Laboratory, APA–The Engineered Wood Association and the Southern Pine Council. This summary is intended for homeowners, builders, architects, insulation contractors, home inspectors, building officials and consultants. The study itself (Glass and others, 2010) and additional references for further reading are given at the end of this summary.

Why does moisture management matter?

We generally want our homes to be safe, durable and comfortable – all while requiring reasonable amounts of energy for heating or cooling. The last thing homeowners want is to find mold or decay in their homes. The key to preventing growth of mold and decay fungi is proper moisture management. It also is essential for preventing corrosion of nails and screws that hold the structure together and avoiding expansion/contraction damage such as cupping or buckling of wood flooring.

How much moisture is too much?

Wood has a strong affinity for water vapor. At a relative humidity of 50 percent at room temperature, wood holds about 10 percent of its dry weight as absorbed moisture. This percentage commonly is called moisture content. At 80 percent relative humidity, wood moisture content is about 16 percent. When moisture content increases, wood expands. When wood dries, it shrinks. Expansion/contraction damage depends on how much the moisture content changes and how sensitive the particular construction or wood product is to such changes.

The traditional guideline for protecting wood and wood products from rot or decay is to keep the moisture content below 20 percent. Studies have shown, however, that mold growth can occur on wood at moisture content levels above 15 to 18 percent, and corrosion of metal fasteners in treated wood can occur when moisture content exceeds 18 to 20 percent. Reaching these moisture content levels does not mean mold growth or corrosion will necessarily occur. For each of these moisture-related problems, a key factor is the amount of time the wood spends at an elevated moisture level.

How does insulation affect moisture levels?

The rates of wetting and drying of building assemblies, whether they are floors, walls or ceilings, can be affected by thermal insulation. The job of thermal insulation is to slow down heat flow – to help keep the inside of the house warm when it's cold outside and cool when it's hot outside. In addition to its thermal resistance, insulation provides some resistance to moisture migration, and this resistance can vary widely between different types of insulation. Insulation's effect on limiting heat flow will coincidentally make certain parts of the floor assembly warmer (or cooler) than other parts of the assembly. This is important because wood tends to dry when it is warm relative to its surroundings and is prone to moisture accumulation when it is cooler than its surroundings.



Figure 1. Example of an open crawl space.

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



Figure 2. Example of a wall-vented crawl space.

Three different crawl space types

For the purpose of discussing moisture management, **crawl spaces** can be classified into three different types.

1. We refer to open pier-and-beam foundations as **open crawl spaces**. (See Figure 1, page 3.) Open crawl spaces may have a continuous wall on just the front side and be open on the other sides.
2. We refer to crawl spaces with continuous perimeter walls that include vents to the outside as **wall-vented crawl spaces**. (See Figure 2.)
3. Finally, we refer to crawl spaces with continuous perimeter walls with no vents as **closed crawl spaces**. (See Figure 3.)

A closed crawl space, with regard to air and water vapor movement, is effectively part of the interior space and is intended to be isolated from the ground and the exterior. The ground and perimeter walls typically are covered with a vapor barrier, and the crawl space may be provided with conditioned air. A number of studies in various climates have shown this type of crawl space can remain safely dry, but this method of construction is not typical and is risky in flood hazard areas.

Building codes require that raised floor foundations in flood hazard areas permit floodwaters to move through the space underneath the building. That can be achieved in closed crawl spaces with breakaway panels or vents that normally stay closed but open when floodwaters exert pressure. The long-term ability of these devices to remain sufficiently airtight to provide an essentially closed crawl space has not been demonstrated. Furthermore, in the event of a flood, the crawl space will flood, and the perimeter walls will inhibit drainage and drying after the flood. In addition, potential floodwater contaminants and mold growth, which may occur subsequent to flooding in a closed crawl space, will be coupled with indoor air. Because of these hazards, the closed crawl space is not advisable in flood-prone areas.

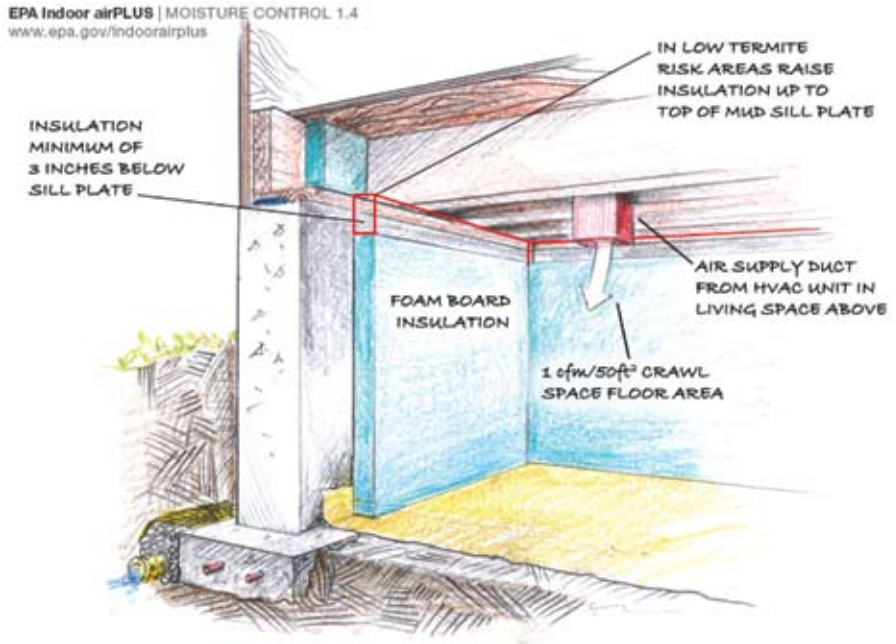


Figure 3. Sketch of a closed crawl space with conditioned air supply. [Illustration: Dennis Livingston, Community Resources. Reprinted with permission of the U.S. Environmental Protection Agency.]

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Managing rainwater and soil moisture

Site grading and management of roof runoff can largely determine how wet the soil becomes under a house. In general, the soil around the foundation should be graded so water drains away from the building. Wet soil under a raised house can supply a large amount of humidity to crawl spaces, especially in wall-vented crawl spaces.

An established method of limiting evaporation of moisture from wet soil into wall-vented crawl spaces is to cover the soil with a vapor retarder such as polyethylene, typically 0.15 millimeters (6 mil) or thicker. The use of soil covers in wall-vented crawl spaces is based on a large body of research. If site conditions allow rainwater to wind up on top of the soil cover, however, the soil cover may be counterproductive.

Results from this study showed humidity levels (on an absolute scale) in open crawl spaces were essentially the same as outdoors. This means evaporation from the soil under an open crawl space is overpowered by a high rate of air exchange between the crawl space and the outdoors. This finding suggests if a house is to be built on a site with poor grading and drainage, an open crawl space would be preferable to a wall-vented crawl space.

Water vapor movement

Water vapor generally diffuses from an area of higher concentration to one with lower concentration. This often corresponds with migration from higher temperature to lower temperature. For example, when a building is air-conditioned and the outdoor climate is hot and humid, water vapor migrates through the building shell from outdoors to indoors. This is referred to as inward vapor drive.

Inward vapor drive means water vapor will be absorbed by the subfloor from the outside. This absorbed moisture will migrate through the subfloor and will dry to the inside. When the rate of wetting is higher than the rate of drying, moisture will accumulate in the subfloor. If the moisture content gets too high for too long, problems like mold and rot can occur.

To protect the subfloor from moisture accumulation, the insulation under the subfloor should be selected to provide enough resistance to the inward vapor drive.

Experimental study

Conditions were monitored in a dozen Louisiana homes – eight in New Orleans and four in Baton Rouge. Eleven of the 12 homes were located in flood hazard areas and were constructed with open pier foundations. The sole home in the sample with a wall-vented crawl space incorporated a vapor-retarding soil cover, in accordance with conventional recommendations. The 11 other homes (with open crawl spaces) did not incorporate soil covers.

Air temperature and humidity were measured with data loggers placed indoors, outdoors and in crawl spaces. Moisture content and temperature of the wood or plywood subfloor was measured, typically twice each month. Monitoring started in October 2008 and concluded in October 2009.



Figure 4a. Example of rigid, foil-faced polyisocyanurate foam.

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



Figure 4b. Example of closed cell spray foam.

The sample of 12 houses included six different insulation systems:

A. 2-inch-thick, rigid, foil-faced polyisocyanurate foam insulation installed below the floor joists. All seams were sealed with foil tape, penetrations were sealed with spray foam and rim joist areas were insulated with spray foam type D below (Figure 4a, page 5).

B. 2 inch average thickness of approximately 2 pounds per cubic foot closed cell sprayed polyurethane foam below the subfloor (Figure 4b).

C. 2.6 inch average thickness of medium-density (1 pound per cubic foot) open cell sprayed polyurethane foam below the subfloor.

D. 3.4 inch average thickness of low-density (0.5 pounds per cubic foot) open cell sprayed polyurethane foam below the subfloor (Figure 4c).

E. Same as D, except with the addition of one coat of a spray-applied vapor retardant paint coating (nominal perm rating less than 0.5).

F. 6.25-inch, kraft-faced fiberglass batts installed between floor joists with the kraft facing up against the subfloor, supported by metal rods (Figure 4d, page 7).

All insulation systems were nominally R-13, except the batt insulation, which was nominally R-19.

Houses in New Orleans originally were insulated with fiberglass batt insulation. Contractors removed batt insulation from half of the floor and replaced it with rigid foam or spray foam insulation. Floors in the Baton Rouge houses were insulated entirely with rigid foam and/or spray foam.

Results

The main results are summarized here, followed by a discussion of the main factors affecting subfloor moisture levels and the implications.

- For all 12 houses the predominant vapor drive was inward from May through October (when air conditioning was running). During the other months, the difference between indoor and outdoor water vapor pressure (a way of expressing humidity on an absolute scale) was small.



Figure 4c. Example of open cell spray foam.

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)



Figure 4d. Example of typical fiberglass batt insulation.

- Air temperature in open crawl spaces was very close to outdoor air temperature. These crawl spaces were slightly warmer than outdoors in cold weather and slightly cooler than outdoors in warm weather.
- In contrast, the wall-vented crawl space was considerably warmer than outdoors in cold weather and considerably cooler than outdoors in warm weather.
- In all crawl spaces, water vapor pressure essentially was the same as outdoor vapor pressure.
- Moisture conditions within plywood or solid wood subfloors were found to depend on several variables:
  - Season of the year.
  - Indoor temperature during summer.
  - Type of interior floor finish.
  - Type of under-floor insulation.

Seasonal effect

In most cases, a seasonal trend was observed of higher subfloor moisture content during summer and lower subfloor moisture content during winter. This is a result of the subfloor being cooler than the crawl space during the months when air conditioning is running and warmer than the crawl space during the winter. The seasonally varying temperature differences between the subfloor and the crawl space are amplified by the thermal insulation, which is located between the subfloor and the crawl space.

Air conditioning and indoor temperature

For a given type of insulation and interior floor finish, subfloor moisture content generally increased with decreasing indoor temperature during summer. That is, the cooler the air conditioning was keeping the temperature indoors, the wetter the subfloor. The potential for low air conditioning set-point temperatures to cause problematic moisture accumulation in floors over crawl spaces in the southeastern United States has been recognized for decades (Verrall 1962).

A cautious designer should select floor insulation that can accommodate lower-than-average temperatures during the air conditioning season without resulting in moisture accumulation in the subfloor. On the other hand, homeowners in hot, humid climates can reduce the risk of seasonal moisture accumulation if they set the thermostats controlling their air conditioners as high as they feel is practical. Houses in the study with summertime indoor temperatures of 78 degrees F or higher did not show elevated subfloor moisture levels, regardless of the type of floor insulation. Higher air conditioner thermostat settings will, along with reducing the risk of moisture problems in subfloors, result in less energy consumption. Use of ceiling fans and stand-alone dehumidifiers can improve summertime comfort levels in homes with higher air conditioning set-point temperatures.

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Interior floor finish

For a given indoor temperature and type of insulation, summertime subfloor moisture content generally was higher under an impermeable floor finish such as vinyl than under carpet. Vinyl is very impermeable and prevents inward drying of the subfloor. Carpet, on the other hand, is much more permeable to water vapor. Hardwood flooring with polyurethane finish and ceramic tile are less permeable than carpet but considerably more permeable than vinyl. Impermeable floor finishes, by inhibiting inward drying of the subfloor, raise summertime subfloor moisture content.

Types of insulation and resistance to water vapor flow

For a given indoor temperature and type of interior floor finish, higher subfloor moisture content during summer was found with more permeable insulation. Greater permeability allows for water vapor to migrate through insulation and into subfloor materials.

Foam board faced with aluminum foil is essentially impermeable to water vapor. Closed cell spray foam insulation is somewhat impermeable. These types of insulation showed good performance, preventing summertime moisture accumulation in subfloors.

In contrast, open cell spray foam and batt insulation are much more permeable. Open cell foam gave subfloor moisture contents above 20 percent in some cases when vinyl flooring was present and the air-conditioned indoor temperature was relatively low during the summer. This type of insulation was not reliable for preventing summertime moisture accumulation in subfloors.

Batt insulation, although giving lower subfloor moisture contents on average than open cell foam, also gave some elevated moisture levels (above 20 percent moisture content). The glass fibers do not provide much resistance to water vapor diffusion, but the kraft paper facing, right below the subfloor, does provide some resistance. The kraft facing becomes more permeable as relative humidity increases, however, and in the southeastern United States, the outdoor relative humidity commonly is above 80 percent.

In a few instances, open cell foam was finished with a coat of vapor retardant paint. One reason for choosing this combination is that open cell foam plus paint is less expensive than closed cell foam. If the floor finish was carpet, the application of vapor retardant paint over open cell foam had no discernable effect on subfloor moisture content. It should be noted, however, that subfloor moisture contents under carpeted floors never became elevated, due to the moderately high vapor permeability of the carpet.

In contrast, if the floor finish was vinyl, the vapor retardant paint applied over open cell foam appeared to result in lower subfloor moisture contents on average (relative to an otherwise identical floor system with the vapor retardant paint omitted), but some individual moisture readings still exceeded 16 percent moisture content. The data regarding the effect of vapor retardant paint were not conclusive, and further research is needed to determine whether the combination of open cell foam and vapor retardant paint can be a reliable strategy for preventing summertime moisture accumulation in subfloors in this climate.



Raised floor home in Baton Rouge

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Summary

Twelve houses in New Orleans and Baton Rouge, La., were monitored over a one-year period. In all 12 houses the predominant vapor drive was inward from May through October (when air conditioning was running). During the other months, the difference between indoor and outdoor water vapor pressure was small.

The air temperature in open crawl spaces was very close to outdoor air temperature. These crawl spaces were slightly warmer than outdoors in cold weather and slightly cooler than outdoors in warm weather. In contrast, the wall-vented crawl space was considerably warmer than outdoors in cold weather and considerably cooler than outdoors in warm weather. In all crawl spaces, water vapor pressure was essentially the same as outdoor vapor pressure.

Moisture conditions within plywood or solid wood subfloors generally showed a seasonal trend of higher moisture content during the summer and lower moisture content during the winter. Subfloor moisture content during summer generally increased with decreasing indoor temperature (the lower the air conditioning kept the temperature, the wetter the subfloor), increased with decreasing permeability of the interior floor finish (wetter subfloor under vinyl than under carpet) and increased with increasing permeability of the under-floor insulation (wetter subfloor with open cell sprayed polyurethane foam than with closed cell sprayed polyurethane foam). **Foil-faced rigid foam and closed cell sprayed polyurethane foam exhibited good performance, keeping subfloor moisture content within acceptable levels.** In contrast, open cell sprayed polyurethane foam and fiberglass batt insulation were not reliable for preventing summertime moisture accumulation in subfloors.

Questions and answers

1. The study results indicate that open cell sprayed polyurethane foam and fiberglass batt insulation are not always reliable for raised floor systems in this climate. Is there a suitable retrofit for a raised floor system in which either open cell foam or fiberglass insulation is already installed?

Answer: The study did not address this issue directly. The study did find, however, that properly sealed foil-faced rigid foam insulation installed below the floor joists (without any insulation in the joist spaces) prevented summertime subfloor moisture accumulation. This performance is attributed to the vapor-impermeable aluminum foil facing and the air-sealing details at all edges and penetrations. We therefore expect this type of insulation to be a suitable retrofit for a raised floor system already equipped with fiberglass insulation. As long as the existing insulation and subfloor have not been exposed to elevated moisture levels, it would not be necessary to remove the insulation.

If it is not feasible to add foil-faced rigid foam (due to obstructions, affordability, etc.), the risk of subfloor wetting may be reduced in batt insulated floors by keeping the air conditioning thermostat setting at 78 degrees F or higher and replacing vinyl and other impermeable floorings with more permeable floorings. Although the study did not investigate the effect of drooping batt insulation, we would expect that drooping batts pose an additional risk due to humid air bypassing the kraft vapor retarder, leading to increased moisture accumulation in the cool subfloor of an air-conditioned home. We advise making sure all batts are held in full contact with the subflooring.

Likewise, risk of moisture problems in homes with open cell foam subfloor insulation may be reduced by the same strategies (higher thermostat settings and more permeable flooring). Although the study did not investigate the effect of multiple coats of vapor retardant paint over open cell foam, it is possible this strategy would result in lower summertime subfloor moisture levels.

2. The study results indicate closed cell spray foam is a suitable insulation for raised floor systems in southern Louisiana. Should the floor joists, as well as the subflooring, be covered with closed cell spray foam?

Answer: The study did not address this issue, and we therefore cannot make explicit recommendations. It could be argued from building science principles, however, that covering the joists in wall-vented crawl spaces with closed cell foam is likely to keep them drier

Attachment: Appendix II (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

during summer months. As the study indicated, in a wall-vented crawl space, crawl space temperature can be noticeably cooler than outside temperature during summer months while water vapor pressure in the crawl space is very close to that of the outdoor environment. This results in high relative humidity levels in the crawl space. Under these conditions, the joists are likely to reach higher than desirable moisture levels. Therefore, isolating the joists from crawl space conditions by covering them with closed cell foam could reasonably be expected to limit the peak moisture content they reach during summer months. In contrast, in open crawl spaces, both temperature and vapor pressure are very similar to outdoor conditions, and thus seasonal peak moisture content of the floor joists is expected to remain in a safe range. For this reason, covering the joists in open crawl spaces with closed cell foam is not expected to provide substantial benefits.

3. Will covering floor joists with spray foam increase the risk of termite infestation?

Answer: Covering the joists with spray foam can interfere with performing periodic inspections for termites. The degree of risk concerning termite infestation depends on location of the joists and whether they are preservative treated. Joists that are in contact with piers – or near perimeter walls in the case of wall-vented crawl spaces – have the potential to serve as infestation routes. If joists are not pressure treated, spraying them with borate preservative coating will substantially lower infestation risk. Homeowners who have contracts with pest control operators for termite inspection should follow the contract terms.

4. What is a suitable time of year to install closed cell spray foam insulation?

Answer: In a new home that is not yet occupied, the season for installation would not appear to matter, although it is important to ensure that the floor system is adequately dry before installing the insulation. A floor deck that was constructed with wet lumber or that was exposed to rain before the building was enclosed should be allowed to dry. In an existing occupied home that is air-conditioned during the summer, installation would be best done during late fall, winter or early spring. The floor system moisture content at time of installation will be less important if the interior floor covering is vapor-permeable.

Further reading

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Acknowledgments

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We also extend our gratitude to the owners of the houses in the study and the staff of New Orleans Area Habitat for Humanity for their gracious cooperation; Audrey Evans and Sydney Chaisson for assistance with house selection; Robert Munson and C.R. Boardman of FPL for preparing instrumentation and processing data; Kevin Ragon, Stuart Adams and Brett Borne of LSU AgCenter for assistance with field data collection; and Paul LaGrange of LaGrange Consulting, Cathy Kaake of the Southern Forest Products Association and Tom Kositzky of APA for facilitating the study.

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For more information on high performance, sustainable housing and landscaping,
visit the website **www.LSUAgCenter.com/LaHouse** and
LaHouse - Home and Landscape Resource Center on the LSU campus in Baton Rouge, La.

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City of Bellaire Building and Standards Commission

DRAFT - Report to City Council regarding a recommendation for water vapor control in crawlspace construction

Attachment: Crawlspace report_Final Draft (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Introduction

This report and recommendation have developed over the course of nine months of work by the Building and Standards Commission of the City of Bellaire. During this time period 12 meetings and workshops were held to discuss the topic, including a workshop with local builders to collect information and feedback.

The intent of this recommendation by the Building and Standards Commission is to prevent mold, mildew and wood rot caused by the trapping of excessive moisture that has condensed out of hot humid air onto wood within the crawlspaces of homes in Bellaire. After significant study, the Commission recognizes that such problems may be exacerbated as the energy efficiency measures mandated by the 2012 IECC/IRC are implemented in our community.

The International Energy Conservation Code (IECC) and International Residential Code (IRC) are model codes ratified by the City of Bellaire to govern construction within the City of Bellaire. In September of 2013 the city ratified the 2012 edition of these codes, moving from the 2009 version previously ratified.

Recommendation

The Building and Standards Commission of the City of Bellaire respectfully recommends that City Council direct City Staff to work with the Commission to develop a revision to the City of Bellaire Code of Ordinances, Chapter 9, Buildings, Article II, Building Codes, Division I, Generally, Section 9.17, Amendments to the Building Code for the purpose of mandating the installation of a vapor retarder over all surfaces of the insulation facing the crawlspace in all new residential construction, and to develop a process for verifying compliance with this requirement.

Refer to **Exhibit I** for suggested language, provided by the Commission for the consideration of City Staff and City Attorneys in drafting a revision to the City Code of Ordinances, for a future recommendation to City Council.

Water vapor control in crawlspace construction

The energy efficiency measures in the recently ratified 2012 IRC and IECC, which mandate Air Barrier and Insulation requirements, will result in new houses that are built to be significantly more air-tight than homes built in previous years. With minimal air leaks in the building envelope, the HVAC (Heating, Ventilation and Air Conditioning) system will be more effective at removing humidity from the air inside of the house. As a result, the moisture in the warm humid air in the crawl space will want to migrate to the dryer environment created inside the house, in an effort to equalize vapor pressure. This is known as vapor drive. While the 2012 codes address Air Barrier (air-tightness) and Insulation (heat transfer) requirements, vapor drive through the crawlspace is not addressed.

Vapor will move from an area of high vapor pressure to low vapor pressure along the path of least resistance. The codes mandate the installation of a vapor retarder in exterior wall assemblies, but not in the floor assembly above the crawlspace. As a result, vapor will migrate through this unprotected floor assembly. In summer conditions the floor assembly will be kept cool by the AC, and when moisture begins to migrate into the dry environment inside the house it will form condensation on the floor joists. The relatively limited air circulation in the crawl space area allows the condensation to linger, which can lead to mold, mildew and wood rot. Installing a vapor retarder in the appropriate place within the floor assembly (as is required within exterior wall assemblies) will slow the rate of vapor transfer and will reduce the amount of condensation being formed to an amount that can be drawn out through evaporation.

Increasingly stringent energy codes, the hot-humid climate and flood management practices particular to Bellaire come together to set Bellaire homes up for future moisture and mold issues. This is a problem that develops over time. The decision whether or not to install a vapor retarder in the floor assembly above the crawlspace should not be left up to the builder or even the first home owner because a problem may not be recognized for many years. The burden may only fall on future owners of the building.

It is the responsibility of local jurisdictions to modify Model Codes to local conditions.

Attachment: Crawlspace report_Final Draft (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

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Confluence of factors in Bellaire

Energy Code Requirements: The state of Texas mandates energy code requirements and sets minimum energy efficiency standards in construction. These requirements are becoming more stringent with each update of the code. Increasing energy efficiency standards are driving rapid changes in construction practices. Per the recently ratified 2012 IECC and IRC, houses must be visually inspected and tested for air-tightness. Air leakage now must not exceed 5 air changes per hour (ACH). This is a significant decrease from the 7 ACH allowed under the 2009 codes, and an increase in the verification requirements.

Refer to **Appendix I** "Building Technologies Program Air Leakage Guide" by the United States Department of Energy for information about the Air Leakage and Insulation requirements in the 2012 IECC and IRC, including a description of the blower door test.

Specific Climate Conditions: Humidity and heat are the primary climate specific factors affecting energy efficiency in buildings. Here in Bellaire, our hot/humid climate puts significant demand on building systems relative to other parts of the country. Publishers of models codes are challenged with developing standards that can address and be adapted to multiple climate zones across the country. Building and Standards Commission's recommendation is intended to tailor the code requirements to Bellaire's specific climate conditions by mandating certain additional measurements.

Refer to **Appendix II** "Insulating Raised Floors in Hot Humid Climates" by the Louisiana State University Agricultural Center for information and empirical data about crawlspace insulation and moisture management practicies in hot/humid climates.

Flood management: The Federal Emergency Management Agency (FEMA) requires the finished floor of a newly constructed or substantially remodeled structure located in the flood plain to be at or above base flood elevation (BFE). The City of Bellaire goes beyond this and requires the finished floor to be a minimum of 1' above BFE. This additional local requirement contributes to a flood insurance rate reduction all Bellaire homeowners receive through the NFIP's Community Rating System. The city of Bellaire has adopted a 'no net-fill' ordinance in order to prevent overall fill in floodplain, and to prevent conveyance of water in neighboring properties. Bellaire does not allow lots to be filled with dirt to raise the finished floor. As a result, most homes must be built with a crawl space in order to raise the floor to an adequate height.

Refer to **Appendix III** for sections of the City of Bellaire Code of Ordinances pertaining to flood hazard mitigation and residential drainage requirements.

Attachment: Crawlspace report_Final Draft (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Summary

Current building science indicates that inaction by the City of Bellaire on the matter of water vapor control in crawlspace construction has the potential to set Bellaire homeowners up for long term problems in the future due to the confluence of code factors, climate conditions and flood control requirements. While there are Bellaire homeowners who have encountered mold in the crawlspace and deteriorated framing, City Staff has heard few complaints. The Building and Standards Commission recognizes that such problems may be exacerbated as energy efficiency requirements continue to increase, and cautions that a lack of reporting does not mean problems are not occurring. Crawlspace moisture problems are hidden conditions. They may exist undiscovered until a homeowner uncovers them in the course of some other investigation or there is a building system failure.

The proposed requirement for a vapor retarder sets performance criteria only. It does not mandate the use of specific building products or systems. There are in multiple low-cost ways builders can comply with the requirement if they are not already doing so. Many of the established builders in Bellaire recognize the need for water vapor control in crawlspace construction and already use construction methods that would meet the requirements of an ordinance change in keeping with the Commission's recommendation. The Building and Standards Commission found this to be the case while conducting interviews with local builders during a Workshop Session held in Council Chambers in August of 2013. The intent of the Commission's recommendation is to protect residents of homes constructed by builders who are not currently meeting the proposed standard.

The requirement of a vapor retarder in the crawlspace will raise the minimum quality of construction in the City of Bellaire and in turn contribute to the reputation of our city as a premier community in which to build and live.

Exhibit I

Building and Standards Commission suggest the following language, for the consideration of City Staff and the City Attorney in developing a revision to the City of Bellaire Code of Ordinances, Chapter 9, Buildings, Article II, Building Codes, Division I, Generally, Section 9.17, Amendments to the Building Code.

Crawl Space Air Barrier, Insulation and Moisture Control

In addition to the requirements of Sections R402.1 and R402.2 of the 2012 IECC, a non-hygroscopic material air barrier and vapor retarder shall be applied over all surfaces of the insulation facing the crawlspace if the insulation does not effectively provide the same.

Attachment: Crawlspace report_Final Draft (1186 : Proposed Amendment to Chapter 9- Crawlspace Requirements)

Building and Standards Commission
Council Chamber, First Floor of City Hall
Bellaire, TX 77401

Meeting: 03/26/14 07:00 PM
Department: Community Development
Category: Report
Department Head: John McDonald
DOC ID: 1187

ADOPTED
ACTION ITEM (ID # 1187)

Item Title:

Discussion, consideration, and possible action on a report to City Council, as required by Chapter 2, Section 2-97, of the City of Bellaire Code of Ordinances, regarding Commissioner Laolu Yemitan's absence from three (3) consecutive regular meetings of the Building & Standards Commission.

Background/Summary:

In accordance with *Chapter 2 Administration, Article VII, Boards and Commissions, Division 1, Generally, Section 2-97*, *Attendance and Training Requirements*, *of the City of Bellaire Code of Ordinances*, the Commission is required to notify City Council of any commission member who is absent from three (3) consecutive regular meetings of the board.

The Chairman has submitted two draft letters for possible consideration and/or action.

ATTACHMENTS:

- Letters to City Council-Absences (PDF)

RESULT:	**ADOPTED AS AMENDED [UNANIMOUS]**
MOVER:	Kristin Schuster, Chairperson
SECONDER:	Mike Baker, Commissioner
AYES:	Schuster, Katz, Martin, Baker, Yemitan, Spencer
ABSENT:	Laura Thurmond

CITY OF
Bellaire
7008 South Rice Avenue • Bellaire, Texas 77401-4495 • (713) 662-8222 • Fax (713) 662-8212

March 21, 2014

Honorable Mayor and City Council

City of Bellaire

7008 South Rice Avenue

Bellaire, TX 77401

Mayor and Council Members,

In accordance with Chapter 2, Administration, Article VII, Boards and Commissions, Division 1. Generally, Section 2-97, The Building and Standards Commissions submits this report notifying City Council that Commissioner Laolu Yemitan has exceeded the limit of allowable consecutive absences from regular meetings. Commissioner Yemitan has submitted a letter to the Building and Standards Commission explaining the causes for these absences and indicating his desire to complete his current term on the commission. The commission finds the causes given to be reasonable, and furthermore desires Commissioner complete his term.

Respectfully submitted,

Kristin Schuster

Chair, Building and Standards Commission

Attachment: Letters to City Council-Absences (1187 : Report to Council regarding Commissioner

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Honorable Mayor and City Council

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Mayor and Council Members,

In accordance with Chapter 2, Administration, Article VII, Boards and Commissions, Division 1. Generally, Section 2-97, The Building and Standards Commissions submits this report notifying City Council that Commissioner Laolu Yemitan has exceeded the limit of allowable consecutive absences from regular meetings. Commissioner Yemitan has submitted his resignation to the chair via email, and indicated that he no longer wishes to complete his current term.

Respectfully submitted,

Kristin Schuster

Chair, Building and Standards Commission

Attachment: Letters to City Council-Absences (1187 : Report to Council regarding Commissioner