



Article #1705 -

## Meeting the Commercial Continuous Air Barrier Requirements for ASHRAE 90.1-2010 and the 2012 IECC- Code Notes

[2012 IECC, ASHRAE 90.1-2010]

ASHRAE/IES Standard 90.1-2010 (90.1-2010) and the commercial provisions of the 2012 International Energy Conservation Code (2012 IECC) require that the building envelope be carefully designed to limit uncontrolled air leakage into and out of the building. Uncontrolled air leakage will lead to increased energy usage in the building as it introduces hot air into the building during the cooling months and cold air into the building during the heating months. Uncontrolled air leakage in humid regions of the country can also increase the latent load inside the building requiring the additional use of the building's cooling system to bring the level of humidity into acceptable levels.

The building envelope includes the roof, wall, and floor systems that surround the space being heated and cooled. The provisions require that either building materials or assemblies be selected that do not exceed the maximum air leakage requirements (CFM/ft<sup>2</sup>). The 2012 IECC also allows the building envelope to be tested to not exceed a maximum air leakage rate as a method for demonstrating compliance with the code. Both 90.1-2010 and the 2012 IECC require that all seams, penetrations, and transitions between approved materials or assemblies are sealed. The 2012 IECC requires:

The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

The 2012 IECC exempts buildings in Climate Zones 1 through 3 and 90.1-2010 exempts semi-heated spaces in Climate Zones 1 through 6 in addition to single wythe concrete buildings in Climate Zone 2B.

### Requirements

The 2012 IECC and 90.1-2010 allow the designer to use either building materials or assemblies that meet a maximum air leakage requirement, to demonstrate compliance with the code or standard.

#### Materials

Materials must be tested to ensure that the maximum air permeability is no greater than 0.004 cfm/ft<sup>2</sup>. Several typical materials will meet this requirement and both 90.1-2010 and the 2012 IECC provide a list of pre-approved materials that are "deemed to comply" with the maximum air leakage requirement and therefore can be included in the design of the building with no additional documentation. The list of pre-approved materials includes:

1. Plywood with a thickness of not less than 3/8 inch (10 mm).
2. Oriented strand board having a thickness of not less than 3/8 inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12 mm).

5. Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m<sup>3</sup>) having a thickness of not less than 1 1/2 inches (36 mm).
6. Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m<sup>3</sup>) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12 mm).
8. Cement board having a thickness of not less than 1/2 inch (12 mm).
9. Built up roofing membrane.
10. Modified bituminous roof membrane.
11. Fully adhered single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch (16 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.

### Assemblies

Building assemblies are comprised of several building components that overall must meet a maximum air leakage rate of 0.04 cfm/ft<sup>2</sup>. Roof, wall and floor assemblies that do not use an approved material from the preceding list must document that the proposed assembly meets the maximum leakage requirements. The assembly must be tested in accordance with ASTM E 2357, ASTM E 1677, ASTM E 283 or E 1680 (90.1-2010 only). Both the 2012 IECC and 90.1-2010 provide a list of preapproved assemblies that are "deemed to comply" and include:

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating (2012 IECC);
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness (2012 IECC);
3. Concrete masonry walls that are fully grouted or painted to fill the pores (90.1-2010).

The 2012 IECC allows the option of testing to show that the building envelope does not exceed a maximum air leakage rate of 0.40 cfm/ft<sup>2</sup>. The process for air leakage testing to demonstrate compliance with the 2012 IECC is similar to that used for residential construction. Small commercial projects typically are able to use blower door systems for providing air leakage testing for the building. Large buildings can use blower door systems but if the pressure differential cannot be met by the fan power available, multipoint tests may need to be used to demonstrate compliance with the IECC. Both horizontal and vertical glazing and doors also have maximum air leakage requirements. The IECC allows fenestration products installed in buildings that demonstrate compliance by testing, to be exempt from the air leakage requirements.

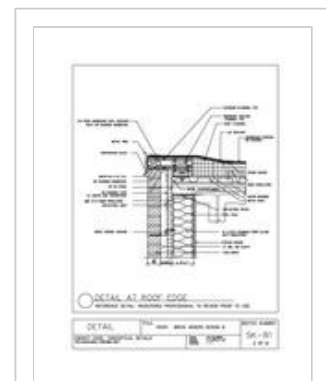
### Building Test

## Plan Review

### Compliance by Materials or Assemblies

Because both 90.1-2010 and the 2012 IECC allow options for complying with the continuous air barrier requirements it will be important for the designer to designate the option that they have selected for the roof, wall and floor systems. In some cases portions of the envelope may comply with the materials requirement and others may comply with assembly requirements. At a minimum the plan reviewer must:

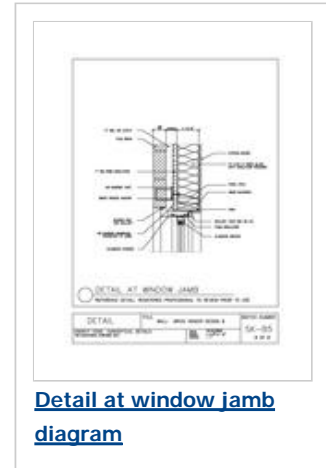
1. Verify that the construction details in the building plans designate either the materials or assemblies that are considered part of the air barrier.  
Construction details should be provided for roof, wall and floor assemblies



and the transitions from one assembly to the next for example from a wall to a roof (see Figure 1). Details should also be provided where penetrations are planned for the continuous air barrier for example for a window or door (see Figure 2).

2. Verify that the sealants have been called out on the plans and/or specifications to ensure that the air barrier seams are sealed including sealing the transitions in places and changes in materials. Also, sealing must be designated for all penetrations in the continuous air barrier to ensure its integrity.
3. Verify that the materials or assemblies that are proposed for the design are listed as meeting the requirements without further documentation as specified in 2012 IECC (Section C402.4.1.2.1 1-15 and C402.4.1.2.2 1 and 2) or 90.1-2010 (Section 5.4.3.1.3.a 1-13 and b.1) For materials or assemblies that are not approved verify that documentation is submitted showing that either the materials or assemblies proposed meet the maximum air leakage requirements as tested in accordance with:
  - Materials: ASTM E 2178
  - Assemblies: ASTM E 2357, E 1677, E 1680 (90.1-2010 only) or E 283

[Detail at roof edge diagram](#)



[Detail at window jamb diagram](#)

### Compliance by Building Test

Only the 2012 IECC allows for testing to meet the continuous air barrier requirements. If the Building Test option is selected verify that this is specified in the plans or specifications. Also, verify that the phase of construction is designated as to when testing will occur (e.g. after final but before issuance of certificate of occupancy, phased based on completion of each floor of a building, etc). Documentation will need to be submitted to demonstrate that the building envelope meets the maximum air leakage requirement of 0.40 cfm/ft<sup>2</sup>.

### Field Inspection

Verification for compliance with the continuous air barrier requirement will be dependent on the compliance option selected above. If the material and assembly options are selected:

1. Verify that the materials and or assemblies that are installed in the field are consistent with the construction plans, air barrier plan details and specifications. Materials or assemblies installed that are not consistent with the construction plans must be approved by the enforcement agency.
2. Verify that the air barrier seams are sealed including sealing the transitions in places and changes in materials. Also, verify that all penetrations in the continuous air barrier are sealed to ensure its integrity.

If the Building Test option is designated on the plans ensure that the air leakage test is conducted per the approved plans and specifications and that the maximum air leakage rate is no greater than 0.40 cfm/ft<sup>2</sup>. Documentation will need to be submitted demonstrating compliance with the Building Test option.

### References

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Copyright, 2011, [American Society of Heating, Refrigerating and Air-Conditioning Engineers](#), Atlanta, GA. ASHRAE Standard 90.1-2010.

Copyright, 2011, Executive Office of Public Safety and Security, Commonwealth of Massachusetts. Sample construction details in support of the commercial energy code. See: <http://www.mass.gov/?pageID=eopsterminal&L=4&L0=Home&L1=Consumer+Protection+%26+Business+Licensing&L2=License+Type+by+Business+Area&L3=Construction+Supervisor+License&sid=Eeops&b=t>

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