ANSI/ASHRAE/IES Addenda bf, bn, and bs, to
ANSI/ASHRAE/IESNA Standard 90.1-2007

ASHRAE ADDENDA

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on June 26, 2010; by the ASHRAE Board of Directors on June 30, 2010; by the IES Board of Directors on June 23, 2010; and by the American National Standards Institute on July1, 2010.

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
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In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This language places performance requirements for air leakage of the opaque envelope. Performance requirements have existed on fenestration and door products to date, but evidence suggests that the opaque envelope is the source of the majority of air leakage in buildings, and that the cause is the lack of attention in the design, construction and enforcement process due to the absence of performance criteria

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum bf to 90.1-2007

Revise the Standard as follows (I-P units).

Add to Section 3.2 Definitions:

continuous air barrier: The combination of interconnected materials, assemblies and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope.

Modify Section 4.2.4 as follows:

4.2.4 Inspections. All building construction, *additions*, or *alterations* subject to the provisions of this standard shall be subject to inspection by the *building official*, and all such work shall remain accessible and exposed for inspection purposes until approved in accordance with the procedures specified by the *building official*. Items for inspection include at least the following:

a. wall insulation after the insulation and vapor retarder are in place but before concealment
b. roof/ceiling insulation after roof/insulation is in place but before concealment
c. slab/foundation wall after slab/foundation insulation is in place but before concealment
d. fenestration after all glazing materials are in place
e. *continuous air barrier* after installation but before concealment
f. ~~e.~~ mechanical systems and equipment and insulation after installation but before concealment
g. ~~f.~~ electrical equipment and systems after installation but before concealment

Delete Section 5.4.3.1 as follows:

~~**5.4.3.1** ***Building Envelope*** **Sealing.** The following areas of the building envelope shall be sealed, caulked, gasketed, or weather stripped to minimize air leakage:~~

~~a. joints around fenestration and door frames~~
~~b. junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels~~
~~c. openings at penetrations of utility services through roofs, walls, and floors~~
~~d. site-built fenestration and doors~~
~~e. building assemblies used as ducts or plenums~~
~~f. joints, seams, and penetrations of vapor retarders~~
~~g. all other openings in the building envelope.~~

Add new Section 5.4.3.1 as follows:

5.4.3.1 ***Continuous Air Barrier.*** The entire *building envelope* shall be designed and constructed with a *continuous air barrier.*

Exceptions to 5.4.3.1:

a. Semiheated spaces in climate zones 1 thru 6.
b. Single wythe concrete masonry buildings in climate zone 2B

5.4.3.1.1 Air Barrier Design. The air barrier shall be designed and noted in the following manner:

a. All air barrier components of each building envelope assembly shall be clearly identified or otherwise noted on construction documents.
b. The joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be detailed or otherwise noted.
c. The continuous air barrier shall extend over all surfaces of the building envelope (at the lowest floor, exterior walls, and ceiling or roof).
d. The continuous air barrier shall be designed to resist positive and negative pressures from wind, stack effect, and mechanical ventilation.

5.4.3.1.2 Air Barrier Installation The following areas of the *continuous air barrier* in the *building envelope* shall be wrapped, sealed, caulked, gasketed, or taped in an approved manner to minimize air leakage:

a. Joints around *fenestration* and *door* frames (both manufactured and site-built).
b. Junctions between *walls* and *floors*, between *walls* at building corners, between *walls* and *roofs or ceilings*.
c. Penetrations through *the air barrier in building envelope roofs*, *walls*, and *floors*.
d. Building assemblies used as ducts or plenums.
e. Joints, seams, connections between planes, and other changes in air barrier materials.

5.4.3.1.3 Acceptable Materials and Assemblies. Continuous air barrier materials and assemblies for the

opaque *building envelope* shall comply with one of the following requirements:

a. Materials that have an air permeance not exceeding 0.004 cfm/ft^2 under a pressure differential of 0.3" w.g. (1.57psf) when tested in accordance with ASTM E 2178. The following materials meet the requirements of 5.4.3.1.3 a:

   1. Plywood—minimum 3/8 in.
   2. Oriented strand board—minimum 3/8 in.
   3. Extruded polystyrene insulation board—minimum 1/2 in.
   4. Foil-faced urethane insulation board—minimum 1/2 in.
   5. Exterior gypsum sheathing or interior gypsum board—minimum 1/2 in.
   6. Cement board—minimum 1/2 in.
   7. Built up roofing membrane
   8. Modified bituminous roof membrane
   9. Fully adhered single-ply roof membrane
   10. A Portland cement/sand parge, stucco, or gypsum plaster minimum 1/2 in. thick
   11. Cast-in-place and precast concrete.
   12. Sheet metal.
   13. Closed cell 2 lb/ft^3 nominal density spray polyurethane foam—minimum 1 in.

b. Assemblies of materials and components (sealants, tapes, etc.) that have an average air leakage not to exceed 0.04 cfm/ft^2 under a pressure differential of 0.3" w.g. (1.57psf) when tested in accordance with ASTM E 2357 ASTM E 1677, ASTM E 1680 or ASTM E283; The following assemblies meet the requirements of 5.4.3.1.3 b.

   1. Concrete masonry walls that are:

      i. Fully grouted, or
      ii. Painted to fill the pores.

Add to Section 12 - References, under "American Society for Testing and Materials"

E1677-2005	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
E 1680-95 (2003)	Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
E2178-03	Standard Test Method for Air Permeance of Building Materials
E2357-05	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
E283-04	Standard Test Method for Determining Rate of Air Leakage Thru Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.

Revise the Standard as follows (SI units)

Add to Section 3.2 Definitions:

continuous air barrier: The combination of interconnected materials, assemblies and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope.

Modify Section 4.2.4 as follows:

4.2.4 Inspections. All building construction, *additions*, or *alterations* subject to the provisions of this standard shall be subject to inspection by the *building official*, and all such work shall remain accessible and exposed for inspection purposes until approved in accordance with the procedures specified by the *building official*. Items for inspection include at least the following:

a. wall insulation after the insulation and vapor retarder are in place but before concealment
b. roof/ceiling insulation after roof/insulation is in place but before concealment
c. slab/foundation wall after slab/foundation insulation is in place but before concealment
d. fenestration after all glazing materials are in place
e. *continuous air barrier* after installation but before concealment
f. ~~e.~~ mechanical systems and equipment and insulation after installation but before concealment
g. ~~f.~~ electrical equipment and systems after installation but before concealment

Delete Section 5.4.3.1 as follows:

~~**5.4.3.1 *Building Envelope* Sealing.** The following areas of the building envelope shall be sealed, caulked, gasketed, or weather stripped to minimize air leakage:~~

~~a. joints around fenestration and door frames~~
~~b. junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels~~
~~c. openings at penetrations of utility services through roofs, walls, and floors~~
~~d. site-built fenestration and doors~~
~~e. building assemblies used as ducts or plenums~~
~~f. joints, seams, and penetrations of vapor retarders~~
~~g. all other openings in the building envelope.~~

Add new Section 5.4.3.1 as follows:

5.4.3.1 *Continuous Air Barrier.* The entire *building envelope* shall be designed and constructed with a *continuous air barrier.*

Exceptions to 5.4.3.1:

a. Semiheated spaces in climate zones 1 thru 6.
b. Single wythe concrete masonry buildings in climate zone 2B

5.4.3.1.1 Air Barrier Design. The air barrier shall be designed and noted in the following manner:

a. All air barrier components of each building envelope assembly shall be clearly identified or otherwise noted on construction documents.
b. The joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be detailed or otherwise noted.
c. The continuous air barrier shall extend over all surfaces of the building envelope (at the lowest floor, exterior walls, and ceiling or roof).
d. The continuous air barrier shall be designed to resist positive and negative pressures from wind, stack effect, and mechanical ventilation.

5.4.3.1.2 Air Barrier Installation. The following areas of the *continuous air barrier* in the *building envelope* shall be wrapped, sealed, caulked, gasketed, or taped in an approved manner to minimize air leakage:

a. Joints around *fenestration* and *door* frames (both manufactured and site-built).
b. Junctions between *walls* and *floors*, between *walls* at building corners, between *walls* and *roofs or ceilings*.
c. Penetrations through *the air barrier in building envelope roofs*, *walls*, and *floors*.
d. Building assemblies used as ducts or plenums.
e. Joints, seams, connections between planes, and other changes in air barrier materials.

5.4.3.1.3 Acceptable Materials and Assemblies. Continuous air barrier materials and assemblies for the opaque *building envelope* shall comply with one of the following requirements:

a. Materials that have an air permeance not exceeding 0.02 L/s×m^2 under a pressure differential of 0.02 L/s×m^2 at 75 Pa when tested in accordance with ASTM E 2178. The following materials meet the requirements of 5.4.3.1.3 a:

1. Plywood—minimum 10 mm
2. Oriented strand board —minimum 10 mm
3. Extruded polystyrene insulation board—minimum 12 mm
4. Foil-faced urethane insulation board—minimum 12 mm
5. Exterior gypsum sheathing or interior gypsum board —minimum 12 mm
6. Cement board—minimum 12 mm
7. Built up roofing membrane
8. Modified bituminous roof membrane
9. Fully adhered single-ply roof membrane
10. A Portland cement/sand parge, stucco, or gypsum plaster minimum 12 mm thick
11. Cast-in-place and precast concrete.
12. Sheet metal.
13. Closed cell 32 kg/m^3 nominal density spray polyurethane foam—minimum 25 mm

b. Assemblies of materials and components (sealants, tapes, etc.) that have an average air leakage not to exceed 0.02 L/s×ft^2 under a pressure differential of 0.2 L/s×m^2 at 75 Pa when tested in accordance with ASTM E 2357 ASTM E 1677, ASTM E 1680 or ASTM E283; The following assemblies meet the requirements of 5.4.3.1.3 b.

1. Concrete masonry walls that are:

   i. Fully grouted, or
   ii. Painted to fill the pores.

Add to Section 12 - References, under "American Society for Testing and Materials"

E1677-2005	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
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FOREWORD

This addendum limits poorly oriented fenestration. Compliance can be shown by having more south facing fenestration than west facing fenestration. For those buildings affected by this requirement, this reduces envelope loads, energy usage and thereby costs. This approach gives flexibility to building design teams to work with building siting and fenestration orientation as well as fenestration area to comply with the requirement. This addendum provides exceptions for retail glass and buildings potentially shaded from the south or west. Also, an exception is provided for certain additions and alterations.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum bn to 90.1-2007

Revise the Standard as follows (I-P units)

5.5.4.5 Fenestration Orientation. The *vertical fenestration area* shall meet the following requirement:

$$A_S \geq A_W \text{ and } A_S \geq A_E$$

where

A_s = south oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true south)

A_n = north oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true north)

A_w = west oriented *vertical fenestration area* (oriented less than 30 degrees of true west)

A_e = east oriented *vertical fenestration area* (oriented less than 30 degrees of true east)

In the southern hemisphere, replace A_s with A_n in the formulae above.

Exceptions to 5.5.4.5:

a. *Vertical fenestration* that complies with the exception to 5.5.4.4.1 (c).

b. Buildings that have an existing building or existing permanent infrastructure within 20 ft to the south (north in the southern hemisphere) which is at least half as tall as the proposed building.

c. Buildings with shade on 75% of the west and east oriented *vertical fenestration* areas from permanent projections, existing buildings, existing permanent infrastructure, or topography at 9 a.m. and 3 p.m. on the summer solstice (June 21 in the northern hemisphere).

d. *Alterations* and *additions* with no increase in *vertical fenestration area*.

Modify Section 11 as follows:

Table 11.3.1 Part 5 Building Envelope. Budget Building Design.

c. Fenestration – No shading projections are to be modeled; fenestration shall be assumed to be flush with the exterior wall or roof. If the fenestration area for new buildings or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.2 is met. If the fenestration area facing west or east of the proposed building exceeds the area limit set in Section 5.5.4.5, the area shall be reduced proportionally until the area is the same as the area limit set in Section 5.5.4.5. The area limit is the fenestration area facing south in the northern hemisphere or the fenestration area facing north in the southern hemisphere as defined in Section 5.5.4.5. Fenestration U-factor shall be the minimum required for the climate, and the SHGC shall be the maximum allowed for the climate and orientation. The fenestration model for envelope alterations shall reflect the limitations on area, U-factor, and SHGC as described in Section 5.1.3.

Revise the Standard as follows (SI units)

5.5.4.5 Fenestration Orientation. The *vertical fenestration area* shall meet the following requirement:

$$A_S \geq A_W \text{ and } A_S \geq A_E$$

where

A_s = south oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true south)

A_n = north oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true north)

A_w = west oriented *vertical fenestration area* (oriented less than 30 degrees of true west)

A_e = east oriented *vertical fenestration area* (oriented less than 30 degrees of true east)

In the southern hemisphere, replace A_s with A_n in the formulae above.

Exceptions to 5.5.4.5:

a. *Vertical fenestration* that complies with the exception to 5.5.4.4.1 (c).

b. Buildings that have an existing building or existing permanent infrastructure within 6 m to the south (north in the southern hemisphere) which is at least half as tall as the proposed building.

c. Buildings with shade on 75% of the west and east oriented *vertical fenestration* areas from permanent projections, existing buildings, existing permanent infrastructure, or topography at 9 a.m. and 3 p.m. on the summer solstice (June 21 in the northern hemisphere).

d. *Alterations* and *additions* with no increase in *vertical fenestration area*.

Modify Section 11 as follows:

Table 11.3.1 Part 5 Building Envelope. Budget Building Design.

c. Fenestration – No shading projections are to be modeled; fenestration shall be assumed to be flush with the exterior wall or roof. If the fenestration area for new buildings or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.2 is met. If the fenestration area facing west or east of the proposed building exceeds the area limit set in Section 5.5.4.5, the area shall be reduced proportionally until the area is the same as the area limit set in Section 5.5.4.5. The area limit is the fenestration area facing south in the northern hemisphere or the fenestration area facing north in the southern hemisphere as defined in Section 5.5.4.5. Fenestration U-factor shall be the minimum required for the climate, and the SHGC shall be the maximum allowed for the climate and orientation. The fenestration model for envelope alterations shall reflect the limitations on area, U-factor, and SHGC as described in Section 5.1.3.

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FOREWORD

This new requirement will provide the means for non-critical receptacle loads to be automatically controlled (turned off) based on occupancy or scheduling without additional individual desk top or similar controllers. The requirement allows for maximum flexibility by allowing one of each dual receptacle to be uncontrolled for critical loads and includes a major receptacle load area type – open office cubicles. It is considered most likely that option "a"(scheduled control) will be the compliance path most commonly applied for this requirement since it is simple and can be incorporated along with the same lighting Scheduled auto-off control that is already required therefore reducing the control cost to near zero in some cases. Additional wiring will likely be required to facilitate the application to less than 100% of the receptacles as is the expected application. Labeling and/or color code identification is commonly practiced and/or otherwise required by other building codes and is left to the discretion of the designer or builder.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum bs to 90.1-2007

Revise the Standard as follows (I-P units)

8.4.2 Automatic Receptacle Control . At least 50% of all 120 volt receptacles installed in an enclosed space, including those installed in modular partitions, shall be controlled by an *automatic control device* that shall function on:

a. a scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times—an independent program schedule shall be provided for areas of no more than 25,000 ft^2 but not more than one floor,

b. an *occupant sensor* that shall turn receptacles off within 30 minutes of all occupants leaving a space, or

c. a signal from another control or alarm system that indicates the area is unoccupied.

Exceptions: Receptacles for the following shall not require an *automatic control device:*

a. Receptacles specifically designated for equipment requiring 24 hour operation.

b. Spaces where patient care is rendered.

c. Spaces where an automatic shutoff would endanger the safety or security of the room or building occupant(s).

d. Corridors

e. Hotel and motel guest rooms

f. Restrooms

Revise the Standard as follows (SI units)

8.4.2 Automatic Receptacle Control. At least 50% of all 120 volt receptacles installed in an enclosed space, including those installed in modular partitions, shall be controlled by an *automatic control device* that shall function on:

a. a scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times—an independent program schedule shall be provided for areas of no more than 2,320 m^2 but not more than one floor,

b. an *occupant sensor* that shall turn receptacles off within 30 minutes of all occupants leaving a space, or

c. a signal from another control or alarm system that indicates the area is unoccupied.

Exceptions: Receptacles for the following shall not require an *automatic control device:*

a. Receptacles specifically designated for equipment requiring 24 hour operation.

b. Spaces where patient care is rendered.

c. Spaces where an automatic shutoff would endanger the safety or security of the room or building occupant(s).

d. Corridors

e. Hotel and motel guest rooms

f. Restrooms

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.