ANSI/ASHRAE/IES Addenda am, aq, and ax 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 July 1, 2010.

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FOREWORD

The intent of this addendum is to revise air leakage criteria so they more closely reflect current practice.

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 am to 90.1-2007

Modify the standard as follows (I-P units).

Modify Section 3.2 (definitions) as follows:

Doors…..

Nonswinging*:* roll-up, metal coiling, sliding and all other doors that are not swinging doors.

metal coiling door: an upward acting *nonswinging* door assembly consisting of interlocking horizontal slats or sheets that, upon opening the door, roll up around a horizontal barrel above the door opening.

swinging……

Modify section 5.4.3.2 as follows:

5.4.3.2 Fenestration and Doors. Air leakage for *fenestration* and *doors* shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, NFRC 400, or ASTM E283 as specified below. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be *labeled* and certified by the *manufacturer.* Air leakage shall not exceed: ~~1.0 cfm/ft^2 for glazed swinging entrance doors and for revolving doors and 0.4 cfm/ft^2 for all other products.~~

a. 1.0 cfm/ft^2 for glazed swinging entrance doors and revolving doors, tested at a pressure of at least 1.57 pounds per square foot (psf) in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, NFRC 400, or ASTM E283.

b. 0.06 cfm/ft^2 for curtainwall and storefront glazing, tested at a pressure of at least 1.57 pounds per square foot (psf) or higher in accordance with NFRC 400 or ASTM E283.

c. 0.3 cfm/ft^2 for unit *skylights* having condensation weepage openings, when tested at a pressure of at least 1.57 pounds per square foot (psf) in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400, or 0.5 cfm/ft^2 when tested at a pressure of at least 6.24 pounds per square foot (psf) in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

d. 0.4 cfm/ft^2 for *nonswinging opaque doors*, tested at a pressure of at least 1.57 pounds per square foot (psf) or higher in accordance with ANSI/DASMA 105, NFRC 400, or ASTM E283.

e. 0.2 cfm/ft^2 for all other products when tested at a pressure of at least 1.57 pounds per square foot (psf) in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400, or 0.3 cfm/ft^2 when tested at a pressure of at least 6.24 pounds per square foot (psf) in accordance with AAMA/WDMA/CSA 101/I.S/A440.

Exceptions to 5.4.3.2:

a. Field-fabricated fenestration and doors.

b. ~~For *garage doors*, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternative for compliance with air leakage requirements.~~ *Metal coiling doors* in *semiheated spaces* in climate zones 1 through 6.

Modify Chapter 12 Normative References as follows:

Reference	Title
American Architectural Manufacturers Association, 1827 Walden Office Square, Suite 550, Schaumburg, IL 60173-4268	
AAMA/WDMA/CSA 101/I.S.2/A440-05	Standard / Specification for Windows, Doors, and Unit Skylights
American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959	
ASTM E283-04	*Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*
Canadian Standards Association, 5060 Spectrum Way, Mississauga, Ontario, Canada L4W 5N6	
AAMA/WDMA/CSA 101/I.S.2/A440-05	Standard / Specification for Windows, Doors, and Unit Skylights
Window and Door Manufacturers Association, 2025 M Street, NW, Washington, DC 20036	
AAMA/WDMA/CSA 101/I.S.2/A440-08	North American Fenestration Standard / Specification for windows, doors, and skylights

Modify the standard as follows (SI units).

Modify Section 3.2 (definitions) as follows:

Doors…..

Nonswinging*:* roll-up, metal coiling, sliding and all other doors that are not swinging doors.

metal coiling door: an upward acting *nonswinging* door assembly consisting of interlocking horizontal slats or sheets that, upon opening the door, roll up around a horizontal barrel above the door opening.

swinging……

Modify section 5.4.3.2 as follows:

5.4.3.2 Fenestration and Doors. Air leakage for *fenestration* and *doors* shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, NFRC 400, or ASTM E283 as specified below. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be *labeled* and certified by the *manufacturer.* Air leakage shall not exceed: ~~1.0 cfm/ft2 for glazed swinging entrance doors and for revolving doors, 0.06 cfm/ft2 for curtainwall/storefront, and 0.3 cfm/ft2 for all other products.~~

a. (18.3 $m^3/h \times m^2$) for glazed swinging entrance doors and revolving doors, tested at a pressure of at least 75 Pa in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, NFRC 400, or ASTM E283.

b. 1.1 $m^3/h \times m^2$ for curtainwall and storefront glazing, tested at a pressure of at least 75 Pa or higher in accordance with NFRC 400 or ASTM E283.

c. 5.5 $m^3/h \times m^2$) for unit *skylights* having condensation weepage openings, when tested at a pressure of at least 75 Pa in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400, or 9.14 $m^3/h \times m^2$ when tested at a pressure of at least 300 Pa in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

d. 7.32 $m^3/h \times m^2$) for *nonswinging opaque doors*, tested at a pressure of at least 75 Pa or higher in accordance with ANSI/DASMA 105, NFRC 400, or ASTM E283.

e. 3.66 $m^3/h \times m^2$ for all other products when tested at a pressure of at least 75 Pa in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400, or 5.5 $m^3/h \times m^2$ when tested at a pressure of at least 300 Pa in accordance with AAMA/WDMA/CSA 101/I.S/A440.

Exceptions to 5.4.3.2:

a. Field-fabricated fenestration and doors.

b. ~~For *garage doors*, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternative for compliance with air leakage requirements.~~ *Metal coiling doors* in *semi-heated spaces* in climate zones 1 through 6.

Modify Chapter 12 Normative References as follows:

Reference	Title
American Architectural Manufacturers Association, 1827 Walden Office Square, Suite 550, Schaumburg, IL 60173-4268	
AAMA/WDMA/CSA 101/I.S.2/A440-05	Standard/Specification for Windows, Doors, and Unit Skylights
American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959	
ASTM E283-04	*Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*
Canadian Standards Association, 5060 Spectrum Way, Mississauga, Ontario, Canada L4W 5N6	
AAMA/WDMA/CSA 101/I.S.2/A440-05	Standard / Specification for Windows, Doors, and Unit Skylights
Window and Door Manufacturers Association, 2025 M Street, NW, Washington, DC 20036	
AAMA/WDMA/CSA 101/I.S.2/A440-08	North American Fenestration Standard / Specification for windows, doors, and skylights

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FOREWORD

This is a proposed modification to the Purpose and Scope of Standard 90.1

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 aq to 90.1-2007

Modify the standard as follows (I-P and SI units).

1. PURPOSE

~~The purpose of this standard is to provide minimum requirements for the energy efficient design of buildings except low rise residential buildings.~~

To establish the minimum energy efficiency requirements of buildings, other than low rise residential buildings, for:

1. design, construction, and a plan for operation and maintenance, and
2. utilization of on-site, renewable energy resources

2. SCOPE

2.1 This standard provides:

a. minimum energy-efficient requirements for the design, ~~and~~ construction, and a plan for operation and maintenance of:

1. new buildings and their systems
2. new portions of buildings and their systems
3. new systems and equipment in existing buildings
4. new equipment or building systems specifically identified in the standard that are part of industrial or manufacturing processes

b. criteria for determining compliance with these requirements.

~~**2.2** The provisions of this standard apply to:~~

~~a. the envelope of buildings, provided that the enclosed spaces are~~

~~1. heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h·ft^2 or~~
~~2. cooled by a cooling system whose sensible output capacity is greater than or equal to 5 Btu/h·ft^2, and~~

~~b. the following systems and equipment used in conjunction with buildings:~~

~~1. heating, ventilating, and air conditioning,~~
~~2. service water heating,~~
~~3. electric power distribution and metering provisions,~~
~~4. electric motors and belt drives, and lighting.~~

2.~~3~~2 The provisions of this standard do not apply to

a. single-family houses, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular), or
b. buildings that ~~do not~~ use neither~~either~~ electricity nor fossil fuel, ~~or~~
~~c. equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes.~~

2.4~~3~~ Where specifically noted in this standard, certain other buildings or elements of buildings shall be exempt.

2.5~~4~~ This standard shall not be used to circumvent any safety, health, or environmental requirements.

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FOREWORD

Rationale for deleting current 6.5.7.1:

This section is deleted because it is largely superseded by the proposed requirements. One of the key reasons for replacing this section is that it often produces inhumane working conditions for kitchen workers.

Rationale for 6.5.7.1.1:

This basically outlaws "short-circuit" hoods. Research by the American Gas Association Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Rationale for 6.5.7.1.2:

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air.

Rationale for 6.5.7.1.3:

This requirement is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table 6.5.7.1.3 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003. ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent of this section is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods It should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold was maintained to exempt small restaurants but include larger restaurants and commercial/institutional kitchens. The "Individual kitchen exhaust hoods larger than 5000 cfm" statement was changed to "a facility has a total kitchen hood exhaust airflow rate greater than 5,000 cfm" to prevent the use of multiple hoods or hood sections in an effort to keep individual hood exhaust beneath 5,000 cfm thus avoiding the energy saving methods required in 6.5.7.1.4.

Rationale for 6.5.7.1.4:

With the deletion of the current 6.5.7.1 makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices. The use of available transfer air per the proposed 6.5.7.1.4.a is the same as exception (a) to the current 6.5.7.1.

Rationale for 6.5.7.1.5:

This section is fundamental to the kitchen exhaust system commissioning and performance verification which protects public health and safety. Hood systems are a field assembly of various components including hoods, fans, replacement air systems, duct and distribution systems and require testing once installed to assure specified system performance is met. This section requires verification of hood system performance and operation, and supports ASHRAE 90.1 purpose and scope

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 ax to 90.1-2007

Revise the Standard as follows (I-P units)

Add the following definitions to Section 3:

transfer air: air transferred from one room to another through openings in the room envelope, whether it is transferred intentionally or not. The driving force for transfer air is generally a small pressure differential between the rooms, although one or more fans may be used.

replacement air: outdoor air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: makeup air, supply air, transfer air, and infiltration. However, the ultimate source of all replacement air is outdoor air. When replacement air exceeds exhaust, the result is exfiltration.

makeup air (dedicated replacement air)***:*** outdoor air deliberately brought into the building from the outside and supplied to the vicinity of an exhaust hood to replace air, vapor, and contaminants being exhausted. Makeup air is generally filtered and fan-forced, and it may be heated or cooled depending on the requirements of the application. Makeup air may be delivered through outlets integral to the exhaust hood or through outlets in the same room.

Modify Section 6 as follows

~~**6.5.7.1 Kitchen Hoods.** Individual kitchen exhaust hoods larger than 5000 cfm shall be provided with makeup air sized for at least 50% of exhaust air volume that is~~

~~a. unheated or heated to no more than 60°F and~~

~~b. uncooled or cooled without the use of mechanical cooling.~~

~~**Exceptions:**~~

~~a. Where hoods are used to exhaust ventilation air that would otherwise exfiltrate or be exhausted by other fan systems.~~

~~b. Certified grease extractor hoods that require a face velocity no greater than 60 fpm.~~

6.5.7.1 Kitchen Exhaust Systems

6.5.7.1.1 Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10% of the hood exhaust airflow rate.

6.5.7.1.2 Conditioned supply air delivered to any space with a kitchen hood shall not exceed the greater of:

a. the supply flow required to meet the space heating or cooling load

b. the hood exhaust flow minus the available transfer air from adjacent spaces. Available transfer air is that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces

6.5.7.1.3 If a kitchen/dining facility has a total kitchen hood exhaust airflow rate greater than 5,000 cfm then each hood shall have an exhaust rate that complies with Table 6.5.7.1.3. If a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall not exceed the Table 6.5.7.1.3 values for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154 for definitions of hood type, appliance duty, and net exhaust flow rate.

TABLE 6.5.7.1.3 (I-P) Maximum Net Exhaust Flow Rate, CFM per Linear Foot of Hood Length

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment.
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Pass-over	210	210	280	Not allowed

Exception:

At least 75% of all the replacement air is transfer air that would otherwise be exhausted.

6.5.7.1.4 If a kitchen/dining facility has a total kitchen hood exhaust airflow rate greater than 5,000 cfm then it shall have one of the following:

a. At least 50% of all replacement air is transfer air that would otherwise be exhausted.

b. Demand ventilation system(s) on at least 75% of the exhaust air. Such systems shall be capable of at least 50% reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.

c. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40% on at least 50% of the total exhaust airflow.

6.5.7.1.5 Performance Testing: An approved field test method shall be used to evaluate design air flow rates and demonstrate proper capture and containment performance of installed commercial kitchen exhaust systems. Where demand ventilation systems are utilized to meet 6.5.7.1.4, additional performance testing shall be required to demonstrate proper capture and containment at minimum airflow.

Modify section 12 as follows:

American Society of Heating, Refrigerating and Air-Conditioning Engineers,
1791 Tullie Circle, NE, Atlanta, GA 30329

ANSI/ASHRAE Standard 154-2003 **Ventilation for Commercial Cooking Operations**

Revise the Standard as follows (SI units)

Add the following definitions to Section 3:

transfer air: air transferred from one room to another through openings in the room envelope, whether it is transferred intentionally or not. The driving force for transfer air is generally a small pressure differential between the rooms, although one or more fans may be used.

replacement air: outdoor air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: makeup air, supply air, transfer air, and infiltration. However, the ultimate source of all replacement air is outdoor air. When replacement air exceeds exhaust, the result is exfiltration.

makeup air (dedicated replacement air)***:*** outdoor air deliberately brought into the building from the outside and supplied to the vicinity of an exhaust hood to replace air, vapor, and contaminants being exhausted. Makeup air is generally filtered and fan-forced, and it may be heated or cooled depending on the requirements of the application. Makeup air may be delivered through outlets integral to the exhaust hood or through outlets in the same room.

Modify Section 6 as follows

~~**6.5.7.1 Kitchen Hoods.** Individual kitchen exhaust hoods larger than 5000 cfm shall be provided with makeup air sized for at least 50% of exhaust air volume that is~~

~~a. unheated or heated to no more than 60°F and~~
~~b. uncooled or cooled without the use of mechanical cooling.~~

~~**Exceptions:**~~

~~a. Where hoods are used to exhaust ventilation air that would otherwise exfiltrate or be exhausted by other fan systems.~~
~~b. Certified grease extractor hoods that require a face velocity no greater than 60 fpm.~~

6.5.7.1 Kitchen Exhaust Systems

6.5.7.1.1 Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10% of the hood exhaust airflow rate.

6.5.7.1.2 Conditioned supply air delivered to any space with a kitchen hood shall not exceed the greater of:

a. the supply flow required to meet the space heating or cooling load
b. the hood exhaust flow minus the available transfer air from adjacent spaces. Available transfer air is that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces

6.5.7.1.3 If a kitchen/dining facility has a total kitchen hood exhaust airflow rate greater than 2,358 L/s then each hood shall have an exhaust rate that complies with Table 6.5.7.1.3. If a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall not exceed the Table 6.5.7.1.3 values for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154 for definitions of hood type, appliance duty, and net exhaust flow rate.

Exception:

At least 75% of all the replacement air is transfer air that would otherwise be exhausted.

6.5.7.1.4 If a kitchen/dining facility has a total kitchen hood exhaust airflow rate greater than 2,358 L/s then it shall have one of the following:

TABLE 6.5.7.1.3 (SI) Maximum Net Exhaust Flow Rate, L/s per Linear Meter of Hood Length

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment.
Wall-mounted canopy	217	325	433	596
Single island	433	541	650	758
Double island (per side)	271	325	433	596
Eyebrow	271	271	Not allowed	Not allowed
Backshelf/Pass-over	325	325	433	Not allowed

a. At least 50% of all replacement air is transfer air that would otherwise be exhausted.

b. Demand ventilation system(s) on at least 75% of the exhaust air. Such systems shall be capable of at least 50% reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.

c. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40% on at least 50% of the total exhaust airflow.

6.5.7.1.5 Performance Testing: An approved field test method shall be used to evaluate design air flow rates and demonstrate proper capture and containment performance of installed commercial kitchen exhaust systems. Where demand ventilation systems are utilized to meet 6.5.7.1.4, additional performance testing shall be required to demonstrate proper capture and containment at minimum airflow.

Modify section 12 as follows:

American Society of Heating, Refrigerating and Air-Conditioning Engineers,
1791 Tullie Circle, NE, Atlanta, GA 30329

ANSI/ASHRAE Standard 154-2003 **Ventilation for Commercial Cooking Operations**

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.