ADDENDA

ANSI/ASHRAE/IES Addendum br to
ANSI/ASHRAE/IES Standard 90.1-2013

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on January 23, 2016; by the ASHRAE Board of Directors on January 27, 2016; by the IES Board of Directors on December 31, 2015; and by the American National Standards Institute on January 28, 2016.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards.

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FOREWORD

This addendum to Standard 90.1 was developed in response to the update of ASHRAE Standard 169-2013, Climatic Data for Building Design Standards*. Standard 169-2013 includes more-recent weather data (resulting in changes in climate zone assignments for some locations, including approximately 10% of the 3000 counties in the United States) and the creation of a new Climate Zone 0. Standard 169 is now referenced for climatic data (though a new Reference Standard Reproduction Annex placed at the end of Standard 90.1 includes extracts from Standard 169). Criteria are now specified for Climate Zone 0 in most sections of Standard 90.1. This addendum covers criteria for Climate Zone 0 of Section 6 and for the mechanical systems portions Appendices C and G.*

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 br to 90.1-2013

Modify the standard as follows (IP and SI Units).

Revise section 6.4.3.4.2 as follows:

6.4.3.4.2 Shutoff Damper Controls. All outdoor air intake and exhaust systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use. Ventilation outdoor air and exhaust/relief dampers shall be capable of automatically shutting off during preoccupancy building warm-up, cooldown, and setback, except when ventilation reduces energy costs or when ventilation must be supplied to meet code requirements.

Exceptions:

1. Back draft gravity (nonmotorized) dampers are acceptable for exhaust and relief in buildings less than three stories in height and for ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 0, 1, 2, and 3. Back draft dampers for ventilation air intakes must be protected from direct exposure to wind.
2. Back draft gravity (nonmotorized) dampers are acceptable in systems with a design outdoor air intake or exhaust capacity of 300 cfm (140 L/s) or less.
3. Dampers are not required in ventilation or exhaust systems serving unconditioned spaces.
4. Dampers are not required in exhaust systems serving Type 1 kitchen exhaust hoods.

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Revise Table 6.4.3.4.3 as follows:

TABLE 6.4.3.4.3 Maximum Damper Leakage, cfm per ft^2 at 1.0 in. wc (L/s per m^2 at at 250 Pa wc)

Climate Zone	Ventilation Air Intake		Exhaust/Relief	
	Nonmotorized[a]	Motorized	Nonmotorized[a]	Motorized
0, 1, 2	—	—	—	—
Any height	20 (100)	4 (20)	20 (100)	4 (20)
3	—	—	—	—
Any height	20 (100)	10 (50)	20 (100)	10 (50)
4, 5b, 5c	—	—	—	—
Fewer than three stories	NA	10 (50)	20 (100)	10 (50)
Three or more stories	NA	10 (50)	NA	10 (50)
5a, 6, 7, 8	—	—	—	—
Fewer than three stories	NA	4 (20)	20 (100)	4 (20)
Three or more stories	NA	4 (20)	NA	4 (20)

a. Dampers smaller than 24 in.(600 mm) in either dimension may have leakage of 40 cfm/ft^2 (200 L/s per m^2).
NA = Not allowed

Revise Table 6.5.1-1 as follows:

TABLE 6.5.1-1 Minimum Fan-Cooling Unit Size for which an Economizer is Required for Comfort Cooling

Climate Zones	Cooling Capacity for Which an Economizer is Required
0a, 0b, 1a, 1b	No economizer requirement
2a, 2b, 3a, 4a, 5a, 6a 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	≥54,000 Btu/h (16 kW)

Revise Table 6.5.1-2 as follows:

TABLE 6.5.1-2 Minimum Fan-Cooling Unit Size for which an Economizer is Required for Computer Rooms

Climate Zones	Cooling Capacity for Which an Economizer is Required
0a, 0b, 1a, 1b, 2a, 3a, 4a	No economizer requirement
2b, 5a, 6a, 7, 8	≥135,000 Btu/h (40 kW)
3b, 3c, 4b, 4c, 5b, 5c, 6b	≥65,000 Btu/h (19 kW)

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Revise Table 6.5.1.1.3 as follows:

TABLE 6.5.1.1.3 High-Limit Shutoff Control Settings for Air Economizers[b]

Control Type	Allowed Only in Climate Zone at Listed Setpoint	Required High-Limit Setpoints (Economizer Off When):	
		Equation	Description
Fixed dry-bulb temperature	0b, 1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	T_{OA} > 75°F (24°C)	Outdoor air temperature exceeds 75°F (24°C)
	5a, 6a	T_{OA} > 70°F (21°C)	Outdoor air temperature exceeds 70°F (21°C)
	0a, 1a, 2a, 3a, 4a,	T_{OA} > 65°F (18°C)	Outdoor air temperature exceeds 65°F (18°C)
Differential dry-bulb temperature	0b, 1b, 2b, 3b, 3c, 4b, 4c, 5a, 5b, 5c, 6a, 6b, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy with fixed dry-bulb temperature	All	h_{OA} > 28 Btu/lb (47 kJ/kg)[a] or T_{OA} > 75°F (24°C)	Outdoor air enthalpy exceeds 28 Btu/lb (47 kJ/kg)[a] of dry air[a] or outdoor air temperature exceeds 75°F (24°C)
Differential enthalpy with fixed dry-bulb temperature	All	$h_{OA} > h_{RA}$ or T_{OA} > 75°F (24°C)	Outdoor air enthalpy exceeds return air enthalpy or outdoor air temperature exceeds 75°F (24°C)

a. At altitudes substantially different than sea level, the fixed enthalpy limit shall be set to the enthalpy value at 75°F (24°C) and 50% RH. As an example, at approximately 6000 ft (1830 m) elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb (53.5 kJ/kg).

b. Devices with selectable rather than adjustable setpoints shall be capable of being set to within 2°F (1.1°C) and 2 Btu/lb (3.4 kJ/kg) of the setpoint listed.

Revise Table 6.5.1.2.1 as follows:

TABLE 6.5.1.2.1 Water Economizer Sizing Dry-Bulb and Wet-Bulb Requirements for Computer Rooms

Zone		Evaporative Water Economizer		Dry Cooler Water Economizer
		Dry Bulb, °F	Wet Bulb, °F	Dry Bulb, °F
0	A	NR		NR
0	B	NR		NR
1	A	NR		NR
1	B	NR		NR
…				

NR—Not required

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Revise section 6.5.3.4 as follows:

6.5.3.4 Supply Air Temperature Reset Controls. Multiple zone HVAC systems must include controls that automatically reset the supply air temperature in response to representative building loads, or to outdoor air temperature. The controls shall reset the supply air temperature at least 25% of the difference between the design supply air temperature and the design room air temperature. Controls that adjust the reset based on zone humidity are allowed. Zones that are expected to experience relatively constant loads, such as electronic equipment rooms, shall be designed for the fully reset supply temperature.

Exceptions:

1. Climate Zones 0a, 1a, 2a, and 3a
2. Systems that prevent reheating, recooling, or mixing of heated and cooled supply air.
3. Systems in which at least 75% of the energy for reheating (on an annual basis) is from site recovered or site solar energy sources

Revise section 6.5.5.2.1 as follows:

6.5.5.2.1 Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate at two-thirds full speed or less and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exceptions:

1. Condenser fans serving multiple refrigerant circuits
2. Condenser fans serving flooded condensers
3. Installations located in Climate Zones 0, 1 and 2
4. Commercial kitchen hoods used for collecting and removing grease vapors and smoke
5. Where more than 60% of the outdoor air heating energy is provided from site-recovered or site solar energy

Revise section 6.5.6.1 as follows:

6.5.6.1 Exhaust Air Energy Recovery.

…

Exceptions:

…

6. Heating energy recovery in Climate Zones 0, 1 and 2.

…

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Revise Table 6.5.6.1-1 as follows:

TABLE 6.5.6.1-1 (IP) Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Less than 8000 Hours per Year

Zone	% Outdoor Air at Full Design Airflow Rate							
	≥10% and <20%	**≥20% and <30%**	**≥30% and < 40%**	**≥40% and < 50%**	**≥50% and < 60%**	**≥60% and < 70%**	**≥70% and < 80%**	**≥80%**
	Design Supply Fan Airflow Rate, cfm (L/s)							
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	NR	NR	NR	NR
0B, 1B, 2B,5C	NR	NR	NR	NR	≥26000 (12271)	≥12000 (5663)	≥5000 (2360)	≥4000 (1888)
6B	≥28000 (13215)	≥26500 (12507)	≥11000 (5191)	≥5500 (2596)	≥4500 (2124)	≥3500 (1652)	≥2500 (1180)	≥1500 (708)
0A, 1A, 2A, 3A, 4A, 5A, 6A	≥26,000 (12271)	≥16,000 (7551)	≥5500 (2596)	≥4500 (2124)	≥3500 (1652)	≥2000 (944)	≥1000 (472)	>0
7,8	≥4500 (2124)	≥4000 (1888)	≥2500 (1180)	≥1000 (472)	>0	>0	>0	>0

NR—Not required

Revise Table 6.5.6.1-2 as follows:

TABLE 6.5.6.1-2 (IP) Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Greater than or Equal to 8000 Hours per Year

Zone	% Outdoor Air at Full Design Airflow Rate							
	≥10% and <20%	**≥20% and <30%**	**≥30% and <40%**	**≥40% and <50%**	**≥50% and <60%**	**≥60% and <70%**	**≥70% and < 80%**	**≥80%**
	Design Supply Fan Airflow Rate, cfm (L/s)							
3C	NR	NR	NR	NR	NR	NR	NR	NR
0B, 1B, 2B, 3B, 4C, 5C	NR	≥19,500 (9203)	≥9000 (4248)	≥5000 (2360)	≥4000 (1888)	≥3000 (1416)	≥1500 (708)	>0
0A, 1A, 2A, 3A, 4B, 5B	≥2500 (1180)	≥2000 (944)	≥1000 (472)	≥500 (236)	>0	>0	>0	>0
4A, 5A, 6A, 6B, 7, 8	>0	>0	>0	>0	>0	>0	>0	>0

NR—Not required

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Revise Table 6.6.1 as follows:

TABLE 6.6.1 Power Usage Effectiveness (PUE) Maximum

Climate Zone	PUE[a]
0A	1.64
1A	1.61
2A	1.49
3A	1.41
4A	1.36
5A	1.36
6A	1.34
0B	1.62
1B	1.53
2B	1.45
3B	1.42
4B	1.38
5B	1.33
6B	1.33
3C	1.39
4C	1.38
5C	1.36
7	1.32
8	1.30

a. PUE_0 and PUE_1 shall not include energy for battery charging.

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Revise Table 6.8.2-1 as follows:

TABLE 6.8.2-1 Minimum Duct Insulation R-Value,[a] Cooling- and Heating-Only Supply Ducts and Return Ducts

Climate Zone	Duct Location						
	Exterior	Ventilated Attic	Unvented Attic Above Insulated Ceiling	Unvented Attic with Roof Insulation[a]	Unconditioned Space[b]	Indirectly Conditioned Space[c]	Buried
	Heating-Only Ducts						
0, 1, 2	None	None	None	None	None	None	None
…							
	Cooling-Only Ducts						
0	R-6 (1.06)	R-6 (1.06)	R-8 (1.41)	R-3.5 (0.62)	R-3.5 (0.62)	None	R-3.5 (0.62)
…							
	Return Ducts						
~~1~~0 to 8	R-3.5 (0.62)	R-3.5 (0.62)	R-3.5 (0.62)	None	None	None	None

a. Insulation R-values, measured in (h·ft²·°F)/Btu (m²·K)/W), are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of Section 6.4.4.2 or Section 5. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F (23.9°C) at the installed thickness.

b. Includes crawlspaces, both ventilated and nonventilated.

c. Includes return air plenums with or without exposed roofs above.

Revise Table 6.8.2-2 as follows:

TABLE 6.8.2-2 Minimum Duct Insulation R-Value,[a] Combined Heating and Cooling Supply Ducts and Return Ducts

Climate Zone	Duct Location						
	Exterior	Ventilated Attic	Unvented Attic Above Insulated Ceiling	Unvented Attic with Roof Insulation[a]	Unconditioned Space[b]	Indirectly Conditioned Space[c]	Buried
	Supply Ducts						
0	R-6 (1.06)	R-6 (1.06)	R-8 (1.41)	R-3.5 (0.62)	R-3.5 (0.62)	None	R-3.5 (0.62)
…							
	Return Ducts						
~~1~~0 to 8	R-3.5 (0.62)	R-3.5 (0.62)	R-3.5 (0.62)	None	None	None	None

a. Insulation R-values, measured in (h·ft²·°F)/Btu (m²·K)/W), are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of Section 6.4.4.2 or Section 5. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F (23.9°C) at the installed thickness.

b. Includes crawlspaces, both ventilated and nonventilated.

c. Includes return air plenums with or without exposed roofs above.

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Revise section C3.5.8 as follows:

C3.5.8 HVAC Systems. One HVAC system shall be provided for each thermal zone and shall have the following characteristics:

...

e. Outdoor air economizers, except in Climate Zone 0, and 1. The high-limit shutoff shall be "Fixed Dry Bulb" type as described in Table 6.5.1.1.3.

…

Revise Table G3.1.1-3 as follows:

TABLE G3.1.1-3 Baseline HVAC System Types

Building Type	Climate Zones 3b, 3c, and 4-8	Climate Zones 0~~1~~-3a
Residential	System 1—PTAC	System 2—PTHP
Public assembly <120,000 ft^2 (11,148 m^2)	System 3—PSZ-AC	System 4—PSZ-HP
Public assembly 120,000 ft^2 (11,148 m^2)	System 12—SZ-CV-HW	System 13—SZ-CV-ER
Nonresidential and 3 floors or fewer and <25,000 ft^2 (2300 m^2)	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft^2 (2300 m^2) or 5 floors or fewer and 25,000 ft^2 (2300 m^2) to 150,000 ft^2 (14,000 m^2)	System 5—Packaged VAV with reheat	System 6—Packaged VAV with PFP boxes
Nonresidential and more than 5 floors or >150,000 ft^2 (14,000 m^2)	System 7—VAV with reheat	System 8—VAV with PFP boxes
Heated-only storage	System 9—Heating and ventilation	System 10—Heating and ventilation
Retail and 2 floors or fewer	System 3—PSZ-AC	System 4—PSZ-HP

Notes:
1. Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.
2. Where attributes make a building eligible for more than one baseline system type, use the predominant condition to determine the system type for the entire building except as noted in Exception (1) to Section G3.1.1.
3. For laboratory spaces in a building having a total laboratory exhaust rate greater than 5000 cfm (2400 L/s), use a single system of type 5 or 7 serving only those spaces.
4. For hospitals, depending on building type, use System 5 or 7 in all climate zones.
5. Public assembly building types include houses of worship, auditoriums, movie theaters, performance theaters, concert halls, arenas, enclosed stadiums, ice rinks, gymnasiums, convention centers, exhibition centers, and natatoriums.

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Revise table G3.1.2.7 as follows:

TABLE G3.1.2.7 Climate Conditions under which Economizers are Included for Comfort Cooling for Baseline Systems 3 through 8 and 11, 12, and 13

Climate Zone	Conditions
0a, 0b, 1a, 1b, 2a, 3a, 4a	NR
Others	Economizer Included

Note: NR means that there is no conditioned building floor area for which economizers are included for the type of zone and climate.

Revise section C3.1.2.11 as follows:

G3.1.2.11 Exhaust Air Energy Recovery. Individual fan systems that have both a design supply air capacity of 5000 cfm (2400 L/s), or greater and have a minimum design outdoor air supply of 70% or greater shall have an energy recovery system with at least 50% recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the outdoor air supply equal to 50% of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the heat- recovery system to permit air economizer operation, where applicable.
Exceptions to G3.1.2.11: If any of these exceptions apply, exhaust;

(a) Systems serving spaces that are not cooled and that are exhaust air energy recovery shall not be included in the baseline building design heated to less than 60°F (16°C).
(b) Systems exhausting toxic, flammable, or corrosive fumes or paint or dust. This exception shall only be used if exhaust air energy recovery is not used in the proposed design.
(c) Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96. This exception shall only be used if exhaust air energy recovery is not used in the proposed design.
(d) Heating systems in climate zones ~~1~~ 0 through 3.
(e) Cooling systems in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.

Revise Table G3.4-1 as follows:

TABLE G3.4-1 Performance Rating Method Building Envelope Requirements For Climate Zone 0 and 1 (A,B)

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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.

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