ADDENDA

ANSI/ASHRAE/IES Addenda a, g, h, l, n, p, r to ANSI/ASHRAE/IES Standard 90.1-2016

Energy Standard for Buildings Except Low-Rise Residential Buildings

See Informative Appendix H for ASHRAE, IES, and ANSI approval dates.

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The track changes in this document show the changes made in addenda a, g, h, l, n, p and r.

3.2 Definitions

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building envelope trade-off schedules and loads: the schedules and internal loads[1], by *building* area type, to be used in the *building envelope* trade-off option simulations described in Appendix C.

~~***building exit:*** any doorway, set of *doors*, or other form of portal that is ordinarily used only for emergency egress or convenience exit.~~

~~***building grounds lighting:*** lighting provided through a *building*'s electrical *service* for parking lot, site, roadway, pedestrian pathway, loading dock, or security applications.~~

building material: any element of the *building envelope*, other than air films and insulation, through which heat flows and that is included in the component *U-factor* calculations.

…

conditioned space: see *space*.

~~***conductance:*** see *thermal conductance*.~~

construction: the fabrication and erection of a new *building* or any addition to or *alteration* of an *existing building*.

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cooling design temperature: the outdoor dry-bulb temperature equal to the temperature that is exceeded by 1% of the number of hours during a typical weather year.

~~***cooling design wet-bulb temperature:*** the mean coincident outdoor wet-bulb temperature utilized in conjunction with the cooling design dry-bulb temperature, often used for the sizing of cooling *systems*.~~

critical circuit: the hydronic circuit that determines the minimum differential pressure that the pump must produce to satisfy the zone loads (e.g., the circuit with the most-open valve). The *critical circuit* is the one with the highest pressure drop required to satisfy its load. At part-load conditions, the *critical circuit* can change based on zone loads.

…

floor area, gross: the sum of the *floor* areas of the *spaces* within the *building*, including basements, mezzanine and intermediate-floored tiers, and penthouses with a headroom height of 7.5 ft or greater. It is measured from the exterior faces of *walls* or from the centerline of *walls* separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar *spaces*, pipe trenches, exterior terraces or steps, chimneys, *roof* overhangs, and similar features.

gross building envelope floor area: the *gross floor area* of the *building envelope*, but excluding *slab-on-grade floors.*

gross conditioned floor area: the *gross floor area* of *conditioned spaces.*

gross lighted floor area: the *gross floor area* of lighted *spaces*.

gross semiheated floor area: the *gross floor area* of *semiheated spaces.*

(See *building envelope*, *floor*, *slab-on-grade floor*, *and space*.)

motor power, rated: the rated output power from the motor.

multilevel occupancy sensor: an occupancy sensor having an *automatic* OFF function that turns off all the lights, and either an *automatic* or a manually controlled ON function capable of activating between 30% and 70% of the lighting power. After that event occurs, the device shall be capable of all of the following actions when manually called to do so by the occupant:

a. Activating alternate sets of lights

b. Activating 100% of the lighting power

c. Deactivating all lights

multiscene control: a lighting *control device* or *system* that allows for two or more predefined lighting settings, in addition to all off, for two or more groups of *luminaires* to suit multiple activities in the *space*, and allows the *automatic* recall of those settings.

N

nameplate horsepower (hp): the nominal motor output power rating stamped on the motor nameplate.

…

nonrecirculating system: a domestic or *service* hot-water *distribution system* that is not a *recirculating system.*

nonrenewable energy: *energy* derived from a *fossil fuel* source.

nonresidential: all occupancies other than *residential*. (See *residential.*)

…

occupant sensor: a device that detects the presence or absence of people within an area and causes lighting, *equipment*, or appliances to be regulated accordingly.

occupied--standby mode: when a zone is scheduled to be occupied and an occupant sensor indicates zero population within the zone.

on-site renewable energy: *energy* generated from renewable sources produced at the *building* site.

…

semiheated space: see *space*.

sensible cooling panel: a panel designed for sensible cooling of an indoor *space* through heat transfer to the *thermally effective panel surfaces* from the occupants and/or indoor *space* by thermal radiation and natural convection.

sensible energy recovery ratio: change in the dry-bulb temperature of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air dry-bulb temperatures, expressed as a percentage.

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transformer: a piece of electrical *equipment* used to convert electric power from one voltage to another voltage.

dry-type transformer: a *transformer* in which the core and coils are in a gaseous or dry compound.

~~***liquid-immersed transformer:*** a *transformer* in which the core and coils are immersed in an insulating liquid.~~

toplighting: lighting *building* interiors with daylight admitted through *fenestration*, such as *skylights* and *roof monitors*, located on the *roof*.

U

U-factor: see *thermal transmittance*.

unconditioned space: see *space*.

unenclosed space: a *space* that is not an *enclosed space*.

unitary air conditioners~~cooling equipment~~: one or more factory-made assemblies that normally include an evaporator or cooling coil and a compressor and condenser combination. Units that perform a heating function are also included.

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Exception to 6.3.2(h)

Heat pumps that comply with the following:

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r. The *system* shall comply with the *demand control ventilation* requirements in Section 6.4.3.8, the ~~O~~occupied-~~S~~standby ~~C~~controls in Section 6.4.3.9, and the *ventilation* design requirements in Section 6.5.3.7.

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6.4 Mandatory Provisions

6.4.1 Equipment Efficiencies, Verification, and Labeling Requirements

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Table 6.4.3.4.3 Maximum Damper Leakage[a, b], cfm per ft² at 1.0 in. wc

Climate Zone	Building Height	~~*Ventilation Air*~~*Outdoor Air* Intake		Exhaust/Relief	
		~~Nonmotorized[a]~~Nonmotorized[c]	Motorized	~~Nonmotorized[a]~~Nonmotorized[c]	Motorized
~~0, 1, 2~~					
~~Any height~~0, 1, 2	Any height	20	4	20	4
~~3~~					
~~Any height~~ 3	Any height	20	10	20	10
~~4, 5B, 5C~~					
~~Fewer than three stories~~ 4, 5b, 5c~~Three or more stories~~	Fewer than three stories	~~NA~~20[d]	10	20	10
	Three or more stories	~~NA~~20[d]	10	~~NA~~20[d]	10
~~5A, 6, 7, 8~~					
~~Fewer than three stories~~ 5a, 6, 7, 8~~Three or~~	Fewer than three stories	~~NA~~20[d]	4	20	4
	Three or more stories	~~NA~~20[d]	4	~~NA~~20[d]	4

more stories					

a. When tested in accordance with AMCA Standard 500-D.
b. Dampers smaller than 12 in. in either height, width, or diameter need not be tested but shall be of the same design and construction as the smallest tested damper meeting the listed leakage rate requirement.
c. Non-motorized dampers smaller than 24 in. in either dimension height, width, or diameter may have a leakage rate of 40 cfm/ft^2.
d. Where allowed by Section 6.4.3.4.2, Exception 2.
NA = Not allowed

Table 6.4.3.4.3 Maximum Damper Leakage[a, b], L/s per m^2 at 250 Pa wc (SI)

Climate Zone	Building Height	Ventilation Air Outdoor Air Intake		Exhaust/Relief	
		Nonmotorized[a] Nonmotorized[c]	Motorized	Nonmotorized[a] Non motorized[c]	Motorized
0, 1, 2					
Any height 0, 1, 2	Any height	100	20	100	20
3					
Any height 3	Any height	100	50	100	50
4, 5B, 5C					
Fewer than three stories	Fewer than three stories	NA 100[d]	50	100	50
Three or more stories 4, 5b, 5c	Three or more stories	NA 100[d]	50	NA 100[d]	50
5A, 6, 7, 8					
Fewer than three stories	Fewer than three stories	NA 100[d]	20	100	20
Three or more stories 5a, 6, 7, 8	Three or more stories	NA 100[d]	20	NA 100[d]	20

a. When tested in accordance with AMCA Standard 500-D.
b. Dampers smaller than 300 mm in either height, width, or diameter need not be tested but shall be of the same design and construction as the smallest tested damper meeting the listed leakage rate requirement.
c. Non-motorized dampers smaller than 600 mm in either dimension height, width, or diameter may have a leakage rate of 200 L/s per m^2.
a. d. Where allowed by Section 6.4.3.4.2, Exception 2.
NA = Not allowed

6.4.3.4 Ventilation System Controls

6.4.3.4.1 Stair and Shaft Vents

Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of and configured to automatically close during normal *building* operation and are interlocked to open as required by fire and smoke detection *systems*.

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 oOutdoor air* and exhaust/relief dampers shall be capable of and configured to automatically shut off during preoccupancy *building warm-up, cooldown*, and *setback*, except when *ventilation* the supply of *outdoor air* reduces *energy* costs or when *ventilation* *outdoor air* must be supplied to meet code requirements.

Exceptions to 6.4.3.4.2

1. Back-draft gravity (nNon-motorized (gravity back draft) dampers are acceptable for exhaust and relief in *buildings* less fewer than three stories in height and for

~~*ventilation*~~ *outdoor air* intakes and exhaust and relief dampers in *buildings* of any height located in Climate Zones 0, 1, 2, and 3. ~~Back-draft~~Non-motorized dampers for ~~*ventilation*~~ *outdoor air* intakes must be protected from direct exposure to wind.

2. ~~Back-draft gravity (n~~Non-motorized~~)~~ dampers are acceptable in *systems* with a design *outdoor air* intake or exhaust capacity of 300 cfm 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.
5. Dampers are not required in systems intended to operate continuously.

6.4.3.4.3 Damper Leakage

Where *outdoor air* supply and exhaust/relief dampers are required by Section 6.4.3.4, they shall have a maximum leakage rate as indicated in Table 6.4.3.4.3 ~~when tested in accordance with AMCA 500D~~.

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6.4.3.8 Ventilation Controls for High-Occupancy Areas

Demand control ventilation (*DCV*) is required for *spaces* larger than 500 ft^2 and with a design occupancy for *ventilation* of ≥25 people per 1000 ft^2 of *floor* area and served by *systems* with one or more of the following:

a. *Air economizer.*
b. *Automatic* modulating *control* of *outdoor air* damper.
c. Design outdoor airflow greater than 3000 cfm.

Exceptions to 6.4.3.8

1. *Systems* with exhaust air *energy* recovery complying with, and where required by, Section 6.5.6.1.
2. Multiple-zone *systems* without *DDC* of individual zones communicating with a central *control* panel.
3. *Systems* with a design outdoor airflow less than 750 cfm.
4. *Spaces* where >75% of the *space* design outdoor airflow is required for *makeup air* that is exhausted from the *space* or *transfer air* that is required for *makeup air* that is exhausted from other *spaces*.
5. *Spaces* with one of the following occupancy categories as defined in ASHRAE Standard 62.1: correctional cells, daycare sickrooms, science labs, barbers, beauty and nail salons, and bowling alley seating.

6.4.3.9 Occupied-Standby Controls

Zones serving only room~~(s)~~ that are required to have ~~A~~automatic ~~P~~partial OFF or ~~A~~automatic ~~F~~full OFF lighting controls per ~~s~~Section 9.4.1.1, and where the ANSI/ASHRAE Standard 62.1 occupancy category permits ventilation air to be reduced to zero when the space is in *occupied-standby mode*, shall meet the following within 5 minutes of all room~~(s)~~ in that zone entering *occupied-standby mode*~~.~~:

a. Active heating set point shall be set back at least 1°F~~,~~ ~~and~~.
b. Active cooling set point shall be set up at least 1°F~~,~~ ~~and~~.

c. All airflow supplied to the zone shall be shut- off whenever the space temperature is between the active heating and cooling set points.

Exception to 6.4.3.9:

1. Multiple--zone systems without automatic zone flow control dampers.

~~6.4.3.9~~ 6.4.3.10 Heated or Cooled Vestibules

Heating for vestibules and for air curtains with integral heating shall include *automatic controls* capable of and configured to shut off the heating *system* when *outdoor air* temperatures are above 45°F. Vestibule heating and cooling *systems* shall be controlled by a *thermostat* in the vestibule capable of and configured to limit heating to a maximum of 60°F and cooling to a minimum of 85°F.

Exception to 6.4.3.~~10~~9

Heating or cooling provided by *site-recovered energy* or by *transfer air* that would otherwise be exhausted.

~~6.4.3.10~~ 6.4.3.11 Direct Digital Control (DDC) Requirements

Direct digital control shall be required as follows.

~~6.4.3.10.1~~ 6.4.3.11.1 DDC Applications

DDC shall be provided in the applications and qualifications listed in Table 6.4.3.~~10~~11.1.

Exception to 6.4.3.~~10~~11.1

DDC is not required for *systems* using the simplified approach to compliance in accordance with Section 6.3.

~~6.4.3.10.2~~ 6.4.3.11.2 DDC Controls

Where *DDC* is required by Section 6.4.3.~~10~~11.1, the *DDC system* shall be capable of and configured with all of the following, as required, to provide the *control* logic required in Section 6.5:

a. Monitoring zone and *system demand* for fan pressure, pump pressure, heating, and cooling.

b. Transferring zone and *system demand* information from zones to air *distribution system* controllers and from air *distribution systems* to heating and cooling plant controllers.

c. Automatically detecting those zones and *systems* that may be excessively driving the *reset* logic and generate an alarm or other indication to the *system* operator

~~Table 6.4.3.10.1~~ Table 6.4.3.11.1 *DDC* Applications and Qualifications

***Building* Status**	**Application**	**Qualifications**
New *building*	Air-handling *system* and all zones served by the *system*	Individual *systems* supplying more than three zones and with fan *system* bhp of 10 hp and larger
	Chilled-water plant and all coils and *terminal* units served by the *system*	Individual plants supplying more than three zones and with design cooling capacity of 300,000 Btu/h and larger
	Hot-water plant and all coils and *terminal* units served by the *system*	Individual plants supplying more than three zones and with design heating capacity of 300,000 Btu/h and larger

Alteration or addition	Zone *terminal* unit such as *VAV* box	Where existing zones served by the same air-handling, chilled-water, or hot-water *system* have *DDC*
	Air-handling *system* or fan coil	Where existing air-handling *system*s and fan coils served by the same chilled- or hot-water plant have *DDC*
	New air-handling *system* and all new zones served by the *system*	Individual *systems* with fan *system* bhp of 10 hp and larger and supplying more than three zones and more than 75% of zones are new
	New or upgraded chilled-water plant	Where all chillers are new and plant design cooling capacity is 300,000 Btu/h and larger
	New or upgraded hot-water plant	Where all *boilers* are new and plant design heating capacity is 300,000 Btu/h and larger

d. Readily allowing operator removal of zones from the *reset* algorithm.

~~6.4.3.10.3~~ **6.4.3.11.3 DDC Display**

Where *DDC* is required by Section 6.4.3.~~10~~11.1 for new *buildings*, the *DDC system* shall be capable of trending and graphically displaying input and output points.

~~6.4.3.11~~ **6.4.3.12 Chilled-Water Plant Monitoring**

~~6.4.3.11.1~~ **6.4.3.12.1 Monitoring**

For electric-motor-driven chilled-water plants in new *buildings*, or for new plants in *existing buildings*, measurement devices shall be installed and shall measure the electric *energy* use and *efficiency* of the chilled-water plant for

a. water-cooled chilled-water plants larger than 1500 tons peak cooling capacity for Climate Zones 5 through 8, 3C, and 4C, and larger than 1000 tons peak cooling capacity for all other zones; and

b. air-cooled chilled-water plants larger than 860 tons peak cooling capacity for Climate Zones 5 through 8, 3C, and 4C, and larger than 570 tons peak cooling capacity for all other zones.

The *efficiency* shall be calculated in kW/ton (see Appendix E).

~~6.4.3.11.2~~ **6.4.3.12.2 Electric-Motor-Driven Chiller System Recording and Reporting**

The electrical *energy* use *efficiency* shall be trended every 15 minutes and graphically displayed and include hourly, daily, monthly, and annual data. The *system* shall maintain all data collected for a minimum of 36 months.

~~6.4.3.12~~ **6.4.3.13 Economizer Fault Detection and Diagnostics (FDD)**

Air-cooled direct-expansion cooling units listed in Tables 6.8.1-1 and 6.8.1-2, where an *air economizer* is installed in accordance with Section 6.5.1, shall include a fault detection and diagnostics (FDD) *system* complying with the following:

a. The following temperature sensors shall be *permanently installed* to monitor *system* operation:

1. *Outdoor air*
2. Supply air
3. Return air, where required for economizer *control*

b. The *system* shall have the capability of displaying the value of each sensor.

c. The FDD *system* or unit *controls* shall be capable of and configured to provide *system* status by indicating the following:

1. Free cooling available
2. Economizer enabled
3. Compressor enabled
4. Heating enabled
5. Mixed-air low-limit cycle active

d. The FDD *system* or unit *controls* shall have provisions to manually initiate each operating mode so that the operation of compressors, economizers, fans, and the heating *system* can be independently tested and verified.

e. The FDD *system* shall be capable of and configured to detect the following faults:

1. Air temperature sensor failure/fault
2. Not economizing when the unit should be economizing
3. Economizing when the unit should not be economizing
4. Damper not modulating
5. Excess *outdoor air*

f. The FDD *system* shall be capable of and configured to report faults to a fault management application or *DDC system* accessible by operating or *service* personnel, or annunciated locally on zone *thermostats*.

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6.5 Prescriptive Path

6.5.1 Economizers

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6.5.1.1.3 High-Limit Shutoff

All *air economizers* shall be capable of and configured to automatically reduce *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling *energy* use. High-limit shutoff *control* types and associated *set points* for specific climate zones shall be chosen from Table 6.5.1.1.3.

6.5.1.1.4 Dampers

~~Return, e~~Exhaust/relief, and *outdoor air* dampers shall meet the requirements of ~~Section~~ Table 6.4.3.4.3. Return dampers shall meet the requirements of motorized exhaust/relief dampers in Table 6.4.3.4.3.

Exceptions to 6.5.1.1.4

1. Exhaust/relief and outdoor air intake dampers on systems intended to operate continuously.

6.5.1.1.5 Relief of Excess Outdoor Air

Systems shall provide a means to relieve excess *outdoor air* during *air economizer* operation to prevent overpressurizing the *building*. The relief air outlet shall be located so as to avoid recirculation into the *building*.

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6.5.6 Energy Recovery

6.5.6.1 Exhaust Air Energy Recovery

Each fan *system* shall have an *energy* recovery *system* when the design supply fan airflow rate exceeds the value listed in Tables 6.5.6.1-1 and 6.5.6.1-2, based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table 6.5.6.1-1 shall be used for all *ventilation systems* that operate less than 8000 hours per year, and Table 6.5.6.1-2 shall be used for all *ventilation systems* that operate 8000 or more hours per year.

Energy recovery *systems* required by this section shall result in an *enthalpy recovery ratio* of at least 50%. A 50% *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and entering exhaust air enthalpies at *design conditions*. The *energy* recovery *system* shall provide the required *enthalpy recovery ratio* at both heating and cooling *design conditions*, unless one mode is not required for the climate zone by the exceptions below. Provision shall be made to bypass or *control* the *energy* recovery *system* to permit *air economizer* operation as required by Section 6.5.1.1

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Table 6.8.1-14 Vapor Compression Based *Indoor Pool Dehumidifiers*—Minimum *Efficiency* Requirements

***Equipment* Type**	**Subcategory or Rating Condition**	**Minimum *Efficiency***	**Test Procedure**
Single package indoor[a] (with or without economizer)	Rating Conditions: A, B, or C	3.5 *MRE*	AHRI 910
Single package indoor water-cooled (with or without economizer)	Rating Conditions: A, B, or C	3.5 *MRE*	
Single package indoor air-cooled (with or without economizer)	Rating Conditions: A, B, or C	3.5 *MRE*	
Split *system* indoor air-cooled (with or without economizer)	Rating Conditions: A, B, or C	3.5 *MRE*	

a. Units without air-cooled condenser.

G3.1.2.6 Economizers

Air economizers shall not be included in baseline *HVAC Systems* 1, 2, 9, and 10. Integrated ~~A~~a*ir economizer*~~s~~ *control* shall be included in baseline *HVAC Systems* 3 through 8, and 11, 12, and 13 based on climate as specified in Table G3.1.2.6.

Table G3.1.2.9 Baseline *Fan Brake Horsepower*

Baseline Fan Motor Brake Horsepower		
Constant-Volume *Systems* 3~~ to~~ 4, 12, and 13	**Variable-Volume *Systems* 5 to 8**	**Variable-Volume *System* 11**
$CFM_s \times 0.00094 + A$	$CFM_s \times 0.0013 + A$	$CFM_s \times 0.00062 + A$

Notes:

1. Where *A* is calculated according to Section 6.5.3.1.1 using the pressure-drop adjustment from the *proposed design* and the design flow rate of the baseline *building system*.
2. Do not include pressure-drop adjustments for evaporative coolers or heat recovery devices that are not required in the baseline *building system* by Section G3.1.2.10.

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This appendix 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.

Informative Appendix H

ANSI/ASHRAE/IES Standard 90.1-2019 incorporates all addenda to ANSI/ASHRAE/IES Standard 90.1-2016. Table H-1 lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE, IES, and ANSI approval dates for each addendum.

Table H-1 Addenda to ANSI/ASHRAE/IES Standard 90.1-2016

Addendum	Sections	Description of Changes[a]	ASHRAE Standard Committee Approval	ASHRAE BOD/Tech Council Approval	IES BOD Approval	ANSI Approval
bg (formerly addendum bg to 90.1-2013)	9.2, 9.3, Table 9.3	Adds a simplified building method for interior lighting in offices, schools, and retail buildings, and exterior lighting. This includes the addition of table 9.3.	1/12/2019	10/3/2019	12/14/2018	2/13/2019
dn (formerly addendum dn to 90.1-2013)	A9.4	Allows the use of the R-value of an airspace in enclosed cavities with or without insulation (Appendix A). Expands the R-value table in Appendix A (based on 2009 *ASHRAE Handbook—Fundamentals*, Chapter 26).	1/12/2019	1/16/2019	12/14/2018	1/17/2019
a	6.4.3.3.3, 6.3.3.4.2, 6.5.1.1.4	Changes term "ventilation air" to "outdoor air" in multiple locations. Revises tables and footnotes. Clarifies requirements for economizer return dampers.	1/20/2018	1/24/2018	1/8/2018	1/25/2018
b	5.5.3.1.1, 12	Updates reference to ANSI/CRRC S100 "Standard Test Methods for Determining Radiative Properties of Materials".	6/24/2017	6/24/2017	6/13/2017	6/29/2017
c	3.2	Adds rooftop monitors to definition of fixed and operable vertical fenestration.	6/24/2017	6/24/2017	6/13/2017	6/29/2017
d	Tables G3.1.1 \	Modifies text to make it consistent with other portions of Appendix G for projects undergoing phased permitting.	6/24/2017	6/24/2017	6/13/2017	6/29/2017
e	Table G3.1.11	Adds direction that SWH piping losses shall not be modeled.	6/24/2017	6/24/2017	6/13/2017	6/29/2017

f	G3.1.2.1	Modifies text to require that the capacity used for selecting the system efficiency represents that for the size of the actual zone instead of the size of the zones as combined into a single thermal block.	6/24/2017	6/24/2017	6/13/2017	6/29/2017
g	3.2, 6.3.2, 6.5.3.8	Provides definition of "occupied-standby mode" and adds new ventilation air requirements for zones served rooms in occupied-standby mode.	1/20/2018	1/24/2018	1/8/2018	1/25/2018
h	6.5.6.1	Clarifies that exhaust air energy recovery systems should be sized to meet both heating and cooling design conditions unless one mode is not exempted by existing exceptions.	1/20/2018	1/24/2018	1/8/2018	1/25/2018
j	6.4.3.8	Changes an exception related to demand control ventilation.	6/24/2017	6/24/2017	6/13/2017	6/29/2017
k	3.2, 6.4.3.3.5	Revises definition of "networked guest room control system" and aligns HVAC and lighting time-out periods for guest rooms.	6/23/2018	6/27/2018	5/30/2018	7/25/2018
l	Table G3.1.2.9	Adds requirements for fan break horsepower for two systems.	1/20/2018	1/24/2018	1/8/2018	1/25/2018
m	Table G3.1.5	Lowers baseline building performance air leakage and sets an air leakage value to be used in conjunction with the air-barrier verification path.	1/12/2019	1/16/19	12/14/2018	2/13/2019
n	3.2	Removes ten unused definitions and changes definition of "unitary cooling equipment" to "unitary air conditioners".	1/20/2018	1/24/2018	1/8/2018	1/25/2018
o	3.2, 4.2.2.3, 5.5, 5.7 through 11.7, G 1.3	Revises the submittals section of the envelope and power chapters for consistency across the standard.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
p	Table 6.1.8 -14	Revises the rating conditions for indoor pool dehumidifiers.	1/20/2018	1/24/2018	1/8/2018	1/25/2018
q	5.4.3, 5.5, 5.8.3, 5.9.1	Clarifies and restructures air leakage requirements for the building envelope.	9/14/2018	10/10/2018	10/23/2018	12/7/2018
r	G3.1.2.6	Specifies air economizer control types for Appendix G.	1/20/2018	1/24/2018	1/8/2018	1/25/2018

s	4.2.1.1, 11.4.3.1, G2.4	Modifies the Performance Cost Index (PCI) equation to implement a 5% limitation on renewable energy usage and clarifies what types of renewable energy systems are eligible.	9/14/2018	10/10/2018	10/23/2018	12/7/2018
t	9.4.2, Table 9.4.2-2	Expands the exterior LPD application table to cover additional exterior spaces that are not currently in the exterior LPD table	6/22/2019	6/26/2019	6/10/2019	7/24/2019
v	6.5.6.3	Adds section 6.5.6.3 containing heat recovery requirements for space conditioning in acute inpatient hospitals.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
x	4.1.1.2, 4.2.1.1, 4.2.1.2, 4.2.1.3	Clarifies compliance paths for new construction, additions, and alterations.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
y	G3.1.2.2	Fixes duct sizing run parameters within the Appendix G.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
z	G3.1.2.1, Table G3.5.1, Table G3.5.2	Modifies the formulas in Section 11 and G3.1.2.1 for removing fan energy from baseline packaged heating and cooling efficiency ratings to cap the system capacity equations in Section 11 to levels allowed in Section 6 and provide a fixed baseline efficiency rating for Appendix G.	9/14/2018	9/28/2018	10/23/2018	10/1/2018
ab	3.2	Modifies definition of "door", "entrance door", "fenestration", and "sectional garage door".	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ac	3.1, 3.2	Clarifies use of defined terms to include the term with different tense or plurality.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ad	5.2 through 11.2	This addendum clarifies the requirements for showing compliance using the methods in Sections 5-10, or Section 11, or Appendix G.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ae	3.2, 6.4.3.6, G3.1.3.18	Clarify humidification and dehumidification control requirements.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ag	Table G3.1.12	Provides accounts for the inclusion of automatic receptacle controls in a proposed building design for spaces that are not required to have them.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ah	9.1.4	Updates the language and terminology of the lighting wattage section. Also adds a section specifically to address using DC power over Cat6 structured cable for connection of LED lighting to a remote power supply.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
ai	3.2., 4.2.5, 5.2.9, 6.7.2.4, 9.4.3, 5.9 through 10.9, 11.2	Restructures commissioning and functional testing requirements in all sections of Standard 90.1 to require verification for smaller and simpler buildings and commissioning for larger and more complex buildings.	1/12/2019	1/16/2019	12/14/2018	2/13/2019

aj	3.2, 6.5.1, 6.5.2.3, 6.5.4.4	Adds a new definition "process application" and uses it throughout Standard in place of "process load".	1/12/2019	1/16/2019	12/14/2018	2/13/2019
ak	Table G3.1.5, Tables G3.4-1 through G3.4-8	Defines SHGC baseline for buildings in zones where there is no prescriptive maximum SHGC.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
al	Table G3.1.3, Table G3.1.7	Clarifies the modeling rules within section G3.1.	6/22/2019	6/26/2019	6/10/19	7/1/2019
am	6.5.6.4	Adds an indoor pool dehumidifier energy recovery requirement in new section 6.5.6.4.	6/23/2018	6/27/2018	5/30/2018	6/28/2018
an	3.2; 10.4.7; Table 10.8-6; 12; Appendix E	Provides a new table (Table 10.8.6) of information about the new efficiency requirements for commercial and industrial clean water pumps to users of ASHRAE 90.1. It also provides new definitions that are needed to accompany the table. New section 10.4.7 was also added.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
ao	3.2; 6.5.3.1.3; 12	Introduces the revised fan product efficiency requirement FEI and complements the fan power limitation in section 6.5.3.1.1.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
ap	6.5.3.5	Revises supply air temperature reset controls.	9/14/2018	9/28/19	10/23/2018	10/1/2018
aq	9.1.1, 9.2.2.3, 9.4.1.1, 9.4.1.3, 9.4.4, 9.6.2	Clarifies lighting control requirements for applications not covered in Section 9.6.2.	9/14/2018	9/28/19	10/23/2018	10/1/2018
ar	Table G3.1.12, G3.1.2.9, Table G 3.5.5, Table G.3.5.6, Table G3.6, Table G3.9.1	Cleanup of motor requirements in Appendix G related to Addend di in Standard 90.1-2016.	9/14/2018	9/28/19	10/23/2018	10/1/2018
as	Appendix I	Adds an informative appendix specific to commissioning.	NA	NA	NA	NA
at	11.5.1; G1.2.2	Revises language for energy accounting at buildings that provide fuel or electricity to vehicles.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
au	6.5.2.1	Eliminates the requirement that zones with DDC have air flow rates that are no more than 20% of the zone design peak flow rate.	1/12/2019	1/16/2019	12/14/2018	1/17/2019
aw	3.2; Tables 5.5-0 through 5.5-8, 5.8.2.5, 12	Revises the fenestration prescriptive criteria in Tables 5.5-0 through 5.5-8.	6/22/2019	6/26/2019	6/10/2019	7/24/2019

ay	3.2, 6.5.6	Provides separate requirements for nontransient dwelling unit exhaust air energy recovery.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
az	Table G3.1.17	Revises the modeling methodology language to clarify the baseline and proposed designs for refrigeration equipment.	1/12/2019	1/16/2019	12/14/2018	1/17/2019
ba	Table G3.1.1 Table G3.1.11	Establishes a methodology for determining the baseline flow rates on projects where service water-heating is demonstrated to be reduced by water conservation measures that reduce the physical volume of service water required.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bb	Table 9.6.1	Revises the lighting power densities for the Space-by-Space method	6/22/2019	6/26/2019	6/10/2019	7/24/2019
bd	Table 6.8.1-16	Adds the minimum efficiency requirements of Heat Pump and Heat Reclaim Chiller Packages. ~~and~~	6/22/2019	6/26/2019	6/10/2019	7/1/2019
be	6.4.1.1; Table 6.8.1-10 & 6.8.1-17	Revises the efficiency requirements for Computer Room air conditioners.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bf	5.4.3.4; 10.4.5	Establishes an alternative to the requirement for vestibules by use of an air curtain that meets specific requirements prescribed in the proposed language. Adds new section 10.4.5.	6/22/2019	6/26/2019	6/10/2019	7/24/2019
bh	Table 5.8.3.2	Corrects an omission related to nonswinging doors in Table 5.8.3.2	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bi	11.4.2; 12; Appendix C; Appendix G	Updates the reference year for Standard 140 in Sections 11 and 12 as well as Appendix C and G.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bj	6.5.5.1	Adds tables to the list of products that are exempt from meeting the requirements of section 6.5.6 - Heat Rejection Equipment.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bk	3.2, 11.4.3.2, G2.4.2	Clarifies that such projects must model the same electricity generation system in the baseline and proposed design and is aligned with the interpretation IC 90.1- 2013-16 OF ANSI/ASHRAE/IES STANDARD 90.1-2013 form January 21, 2018.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bl	Table 6.8.1-1	Revises Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bm	Table 6.8.1-2, 6.8.1-15	Revises Table 6.8.1-2 Electrically Operated Air Cooled Unitary Heat Pumps—Minimum Efficiency Requirements. Adds Table 6.8.1-15.	7/22/2019	8/15/2019	7/19/2019	8/19/2019

bn	3.2, Table 6.8.1-4, Table F3	Revises Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements. Adds Table F-3.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bo	3; Table 6.8.1-5; Table F-4	Revises Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements and adds Table F-4 Residential Warm Air Furnaces – Minimum Efficiency Requirements for sale in the US (see 10 CFR Part 430).	6/26/2019	8/1/2019	7/19/2019	8/26/2019
bp	Table 6.8.1-6; Table F-5	Revises Table 6.8.1.6 – Gas and Oil-Fired Boilers – Minimum Efficiency Requirements and adds table F-5 - Residential Boiler Minimum Efficiency Requirements for applications in the US (Refer to 10 CFR 430).	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bq	Table 6.8.1-7; 12	Revises Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
br	Table 6.8.1-11	Revises the previous Tables 6.8.1-12 & 13 and combines them into one table - Table 6.8.1-131 Commercial Refrigerators, Commercial Freezers and Refrigeration—Minimum Efficiency Requirements.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bs	Table 7.8; F2; Table F-2	Revises Table 7.8 Performance Requirements for Water-Heating Equipment—Minimum Efficiency Requirements and Table F-2 Minimum Energy Efficiency Requirements for Water Heaters.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bt	Table 4.2.1.1	Revises Table 4.2.1.1 Building Performance Factor (BPF).	6/22/2019	6/26/2019	6/10/2019	7/1/2019
bu	Table G3.1.1-1, G3.1.1, G3.1.3, Table G3.4-1 through Table G3.4-8	Clarifies requirements in the Appendix G as they related to HVAC zones and baseline heating.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bv	6.2.1, 6.6.2, 8.2.1, 8.6.1	Clarifies that designers have the option to use ASHRAE Standard 90.4 requirements instead of ASHRAE 90.1 requirements in computer rooms that have an IT equipment load larger than 10 kW. Adds section 8.6.1.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
bx	3.2, A6.1, A6.3	Adds heated slab F-factors for multiple combinations of under-slab and perimeter insulation in Appendix A. Adds Table A6.3.1-1&2.	6/22/2019	6/26/2019	6/10/2019	6/27/2019
bz	3.2; Appendix C1.4, C2, C3.1.2, C3.3,	Clarifies requirements of Appendix C as they pertain to informative outputs, the schedule of shades, energy costs, and updated references to Section 6.	6/22/2019	6/26/2019	6/10/2019	7/1/2019

	C3.5.5.1, C3.5.8					
ca	Table A3.2.3	Adds U-factors to Table A3.2.3 for use of continuous insulation on metal building walls with double layer cavity insulation.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
cc	A9.4.6	Clarifies the limitations of the calculation procedures in A9.4.6.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
ce	6.5.3.1.2	Makes revisions to provide energy savings potential by removing one of three criteria for fan motor selections, increasing the design options for load-matching variable-speed fan applications, accommodating new motor and drive technologies, and simplifying the motor selection criteria for fans.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
cf	6.4.5	Adds vacuum insulating glazing to the list of options for reach-in doors in walk-in coolers and freezers.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
cg	Table 9.5.1	Revises Table 9.5.1 Lighting Power Density Allowances Using the Building Area Method.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
ch	3.2; 9.4.1.1 (e)	Clarifies daylighted area requirements as they relate to skylights and clarifies primary sidelighting requirements.	6/22/2019	6/26/2019	6/10/2019	6/27/2019
ci	Table 4.2.1.1	Further revises Table 4.2.1.1 Building Performance Factor (BPF).	6/22/2019	6/26/2019	6/10/2019	7/1/2019
cj	Table 11.5.1.6; Table G3.1.6; Table G3.7	Revises the energy cost budget method in reference to lighting.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
cl	3.2; 11; Appendix G	Clarifies requirements throughout Section 11 to better align with Appendix G providing greater consistency between the two sections.	6/26/2019	8/1/2019	7/19/2019	8/26/2019
cm	6.5.2.1	Revises exceptions related to DDC enabled zones.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
cn	6.4, 6.4.1.1, 6.4.5m; Tables 6.8.1-18,19, & 20.	Cleans up outdated language regarding walk-in cooler and walk-in freezer requirements, and make the requirements consistent with current federal regulations that either already came into effect June 5, 2017 or will come into effect July 10, 2020. Adds new section 6.4.5m and Tables 6.8.1-18, 19, & 20.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
co	12	Revises the normative references in Standard 90.1.	6/22/2019	6/26/2019	6/10/2019	7/1/2019
cq	3.2; 6.4.1.2, 6.5.3.1.3	Makes clarifications ensure that the maximum fan power input is properly reported for installations both inside and outside the United States. Adds sections 6.4.1.3 and 6.5.3.1.3.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
cs	Appendix E	Revises the informative references of the Informative Appendix E.	NA	NA	NA	NA
ct	12	Updates the CTI normative reference in Standard 90.1.	7/22/2019	8/15/2019	7/19/2019	8/19/2019

cu	6.4.1.1, 6.4.1.5, Table 6.8.1-8	Revises requirements for liquid-to-liquid heat exchangers.	7/22/2019	8/15/2019	7/19/2019	8/19/2019
cv	9.4.1.2	Updates lighting control requirements for parking garages in section 9.4.1.2.	6/26/2019	8/1/2019	7/19/2019	8/26/2019
cw	9.4.1.1(e), 9.4.1.1(f)	Revises the daylight responsiveness requirements to continuous dimming.	6/26/2019	8/1/2019	7/19/2019	8/26/2019
cy	9.4.1(e)	Revises the sidelighting requirement exceptions.	7/22/2019	8/15/2019	7/19/2019	8/19/2019

NOTE

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a. *These descriptions may not be complete and are provided for information only.

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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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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