### **BUILDING ENERGY CODES PROGRAM**





ANSI/ASHRAE/IES Standard 90.1-2016: Overview Prepared by Pacific Northwest National Laboratory for the U.S. Department of Energy

# **Acknowledgements**

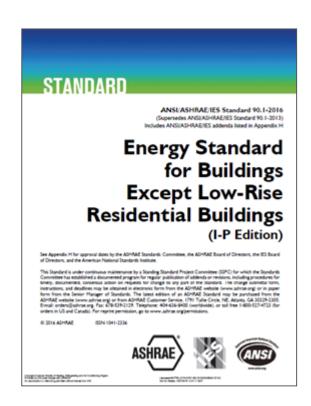


PNNL and DOE would like to thank ASHRAE Standing Standard Project Committee 90.1 for their contributions to the development of the 90.1-2016 presentations and their technical review of the content.

### Structure of Standard 90.1-2016



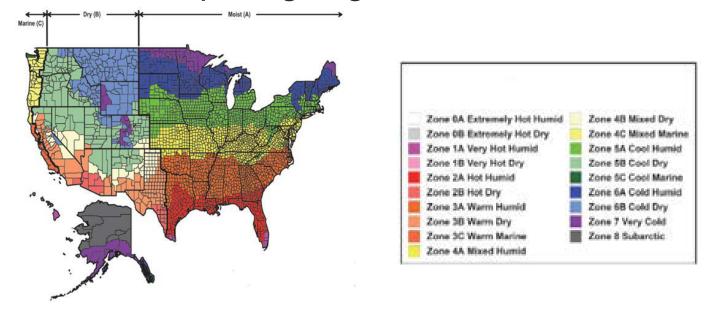
- 1 Purpose
- 2 Scope
- 3 Definitions, Abbreviations, and Acronyms
- 4 Administration and Enforcement
- 5 Building Envelope
- 6 Heating, Ventilating, and Air Conditioning
- 7 Service Water Heating
- 8 Power
- 9 Lighting
- 10 Other Equipment
- 11 Energy Cost Budget Method
- 12 Normative References
- Normative Appendices A-H



# **Summary of Changes**



- Total of 121 addenda
- Major format changes for ease of use
- New climate maps aligning with ASHRAE Standard 169



- New performance-based compliance path
- Significant whole building energy savings

### **New Format**



### <u>2013</u>

278 total pages
Two-column format
No shading for table rows
Defined terms normal font

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TABLE 6.4.3.4.3	Maximum Damper Leakage, cfm per ft2 at 1.0 in, wc	

Climate Zone	Ventilation A	ir Intake	Exhaust/Relief			
Cimate Zone	Nonmotorized <sup>a</sup>	Motorized	Nonmotorized <sup>a</sup>	Motortzed		
1, 2	_		_	_		
Any height	20	4	20	4		
3	_	_	_	_		
Any height	20	10	20	10		
4, 5b, 5c	_	_	_	_		
Fewer than three stories	NA	10	20	10		
Three or more stories	NA	10	NA	10		
5a, 6, 7, 8	_	_	_	_		
Fewer than three stories	NA	4	20	4		
Three or more stories	NA	4	NA	4		

Dumpers smaller than 24 in. in either dimension may have leakage of 40 chrift

equipped with controls configured to automatically restart and temporarily operate the mechanical cooling system as required to maintain zone temperatures below an adjustable cooling setpoint at least SF above the occupied cooling setpoint or to prevent high space humidity levels.

Exception: Radiant heating systems configured with a setback heating setpoint at least 4°F below the occupied heating setpoint

6.4.3.3 Optimum Start Controls. Individual health and cooling systems with seabox control and DIOC fall most optimum start controls. The control algorithm shall, as a missimum, be a finaction of the difference between space tensor and cocupied septonic, the outdoor temperature, and the amount of time prior to scheduled occupacy. Must sufficient shall incorporate floor temperature into the optimum start algorithm.

6.4.3.4 Zens Inshino, IIVAC systems serving zones that are intended to operate or be occupied nonsimultaneously shall be divided into isolation areas. Zenes may be grouped in a single isolation area provided it does not exceed 200. the of conditioned floor area nor include more than one floor. Be a conditioned floor area nor include more than one floor Each isolation area shall be equipped with isolation described include and the control of the service cipable of automatically shutting off the supply of conditioned air and outdoor air to and exhaust air from the area. Each isolation area shall be controlled independently by a device meeting the requirements of Section 6.4.3.3 for central systems and plants, controls and devices shall be provided to allow statelle system and equipment operation for yearing length of time while serving only the smallest isolation area served by the system or plant.

Exceptions: Isolation devices and controls are not required for

 exhaust air and outdoor air connections to isolation zones when the fan system to which they connect is 5000 cfm and smaller:

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- exhaust airflow from a single isolation zone of less than 10% of the design airflow of the exhaust system to which it connects; or
- zones intended to operate continuously or intended to be inoperative only when all other zones are inoperative.

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 being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems.

6.4.3.4.2 Shuteff Damper Controls. All outdoor air intake and ethansat systems thal be equipped with motorized dampers that will automatically shat when the systems or spaces served are not in use. Vertilitation outdoor air an exhaustrelief dampers shall be capable of automatically shating off during perocoupney building warm-up, cooldown, and sethack, except when vertiliation reduces energy costs or when verifitation must be supplied to meet code requirements.

Exceptions

- Back draft gravity (nonmotorized) dampers are acceptable for exhaust and relief in buildings less than there stories in height and for verification air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2, and 3. Back draft dampers for vertilation air intakes must be protected from direct exonount to wind.
- Back draft gravity (nonmotorized) dampers are acceptable in systems with a design outdoor air
- 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.

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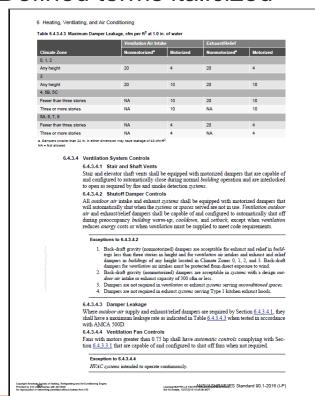
### 2016

388 total pages

Single-column format

Alternate shading for table rows

Defined terms italicized



# Section 2 – Scope

2.1 - 2.4



### Applies to:

- New buildings and their systems
- New portions of buildings and their systems
- New systems and equipment in existing buildings, and
- New equipment or building systems specifically identified in the standard that are part of industrial or manufacturing processes
- Criteria for determining compliance with requirements
- Does not apply to:
  - Single-family houses, low-rise multi-family ≤ 3 stories above grade, manufactured houses (mobile or modular)
  - Buildings that use neither electricity nor fossil fuel
- Certain other buildings or elements may be exempt
- Does not circumvent any safety, health, or environmental requirements

# **Section 4**Administration and Enforcement



### General (Section 4.1)

- Scope
  - New Buildings
  - Additions to Existing Buildings
  - Alterations to Existing Buildings
  - Replacement of Portions of Existing Buildings
  - · Changes in Space Conditioning
- Administrative Requirements
- Alternative Materials, Methods of Construction, or Design
- Validity
- Other Laws
- Reference Standards
- Normative Appendices
- Informative Appendices
- Reference Standard Reproduction Annexes

Compliance Paths and Documentation (Section 4.2)

# **Compliance Paths**



### **Building System**

### **Compliance Options**

**Envelope** 

Prescriptive Option

**HVAC** 

**Mandatory Provisions** 

(required for all compliance options)

Trade Off
Option

Energy Cost Budget

Performance Rating Method

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**SWH** 

Power

Lighting

Other

**Energy Code Compliance** 

# **Compliance Path**



### Compliance Paths for 2016

- 1. Prescriptive
- 2. Energy Cost Budget
- 3. Appendix G (New)
- 4.2 Compliance
- 4.2.1 Compliance Paths
- 4.2.1.1 New Buildings

New buildings shall comply with either the provisions of a. Section 5, "Building Envelope"; Section 6,

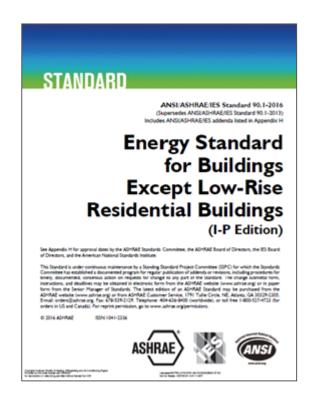
Heating, Ventilating, and Air Conditioning"; Section

7, "Service Water Heating"; Section 8,

"Power"; Section 9, "Lighting"; and Section 10,

"Other Equipment," or

- b. Section 11, "Energy Cost Budget Method," or
- c. Appendix G, "Performance Rating Method."



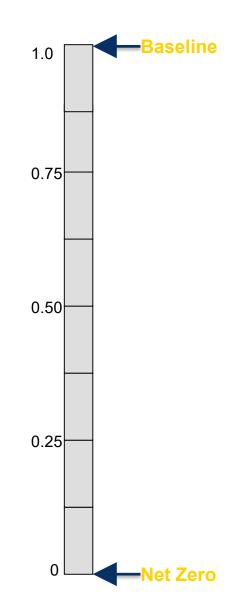
# **Compliance Path**



 Requires a Performance Cost Index (PCI) specific to building type and climate zone

$$PCI = \frac{Proposed\ Building\ Performance}{Baseline\ Building\ Performance}$$

- PCI of 1.0 = baseline building
- PCI of 0.0 = zero net energy
- For compliance, PCI < PCI<sub>t</sub>
- PCI<sub>t</sub> specified in Standard, and varies by building type, climate zone, and proportion of regulated to unregulated load



# **Compliance Path**



 Building type and climate zone adjustment by Building Performance Factor

Table 4.2.1.1 Building Performance Factor (BPF)

	Climate Zone																
Building Area Type <sup>a</sup>	0A and 1A	0B and 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	0.73	0.73	0.71	0.69	0.74	0.73	0.68	0.78	0.81	0.81	0.76	0.80	0.81	0.76	0.79	0.74	0.80
Healthcare/ hospital	0.64	0.56	0.60	0.56	0.60	0.56	0.54	0.57	0.53	0.55	0.59	0.52	0.55	0.57	0.52	0.56	0.56
Hotel/motel	0.64	0.65	0.62	0.60	0.63	0.65	0.64	0.62	0.64	0.62	0.60	0.61	0.60	0.59	0.61	0.57	0.58
Office	0.58	0.62	0.57	0.62	0.60	0.64	0.54	0.58	0.60	0.58	0.60	0.61	0.58	0.61	0.61	0.57	0.61
Restaurant	0.62	0.62	0.58	0.61	0.60	0.60	0.61	0.58	0.55	0.60	0.62	0.58	0.60	0.63	0.60	0.65	0.68
Retail	0.52	0.58	0.53	0.58	0.54	0.62	0.60	0.55	0.60	0.60	0.55	0.59	0.61	0.55	0.58	0.53	0.53
School	0.46	0.53	0.47	0.53	0.49	0.52	0.50	0.49	0.50	0.49	0.50	0.50	0.50	0.49	0.50	0.47	0.51
Warehouse	0.51	0.52	0.56	0.58	0.57	0.59	0.63	0.58	0.60	0.63	0.60	0.61	0.65	0.66	0.66	0.67	0.67
All others	0.62	0.61	0.55	0.57	0.56	0.61	0.59	0.58	0.57	0.61	0.57	0.57	0.61	0.56	0.56	0.53	0.52

# **Additional Training Materials**



Slide decks are also available detailing the Envelope, HVAC, and Power and Lighting requirements of Standard 90.1-2016, accessible at

https://www.energycodes.gov/training