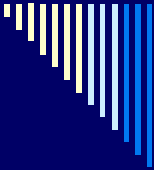


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**ANSI/ASHRAE/IESNA**  
**Standard 90.1-**  
**1999/2001/2004**  
**Energy Standard for Buildings**  
**Except Low-Rise Residential**  
**Buildings**

Larry Spielvogel, PE  
Past Chair

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
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**Standard 90.1-1999/2001/2004**

- Developed jointly by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and the Illuminating Engineering Society of North America (IESNA)
  
- Developed under American National Standards Institute (ANSI) consensus guidelines

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
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**Standard 90.1-1999/2001/2004**

- Team Effort – All of the Major Players in the Design and Construction Industry Were Involved:
  - American Institute of Architects (AIA)
  - Building Owners and Managers Association (BOMA)
  - North American Insulation Manufacturer's Association (NAIMA)
  - Air-Conditioning and Refrigeration Institute (ARI)
  - Gas Appliance Manufacturers Association (GAMA)

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### Key Features of Standard 90.1-1999/2001/2004

- Mandatory, enforceable language
- Based on economic analysis
- True prescriptive paths
- Extensive treatment of retrofits and renovations
- Explicit treatment of minimally conditioned buildings
- Simplified climate zones

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
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### Mandatory, Enforceable Language

- Standard 90.1-1999 is a code-intended standard. As such, it is written in unambiguous language intended to allow a code official to say “that complies” or “that doesn’t”
- There are no “shoulds”, “coulds” or “shall consider” phrases – just lots of “shalls”

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
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### Based on Consistent Economic Criteria

- While previous ASHRAE standards were based on professional judgment combined with analysis of energy and cost impacts, Standard 90.1-1999 is the first to attempt to use consistent economic criteria as the basis for requirements.

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## Renovations and Retrofits

- ❑ Previous ASHRAE Standards were more or less silent on the concept. All standards were designed for “new construction” but what does that mean?
- ❑ ASHRAE worked with BOMA on Chapter 4 to develop detailed rules for how Standard 90.1-1999 should be applied to renovations and retrofits.

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## Minimally Conditioned Buildings

- ❑ Buildings that are minimally conditioned or minimally used should not need as stringent energy requirements as buildings that are fully conditioned or fully used.
- ❑ Standard 90.1-1999 took a first step in dealing with minimally conditioned buildings in its’ semi-heated space envelope requirements.

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## Climate Zones

- ❑ Use of ASHRAE Standard 90.1-1999 requires the specification of only 2 parameters (HDD65 and CDD50) for envelope requirements and only 4 more parameters for mechanical system requirements. (3 design temps plus one more)
- ❑ Standard 90.1-2004 reduces climate tables from 26 to 8.
- ❑ All these parameters are listed for numerous locations in Appendix D.

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## Interpretations for Standard 90.1

- Users Manual
  - Provides much of the background
- Formal Interpretations
  - Formal written interpretations take time
- Informal Interpretations
  - Quick, informal answers to questions
- ASHRAE Manager of Standards  
(404)636-8400

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## Now A Look at Standard 90.1

- Organization of Standard
- Administration and Enforcement
- Envelope
- Mechanical
- Lighting and Power
- Trade-offs

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## Organization of Standard 90.1

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

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## Appendices

<u>NORMATIVE</u>	<u>INFORMATIVE</u>
A Assembly U-, C-, and F-Factor Determination	E Informative References
B Building Envelope Criteria	F Addenda Description Information
C Envelope Trade-Off Methodology	G Performance Rating Method
D Climate Data	

Items in red apply to Standard 90.1-2001 and 2004 only

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## Title and Purpose

- Title: Energy Standard for Buildings **Except** Low-Rise Residential Buildings
- Purpose: The purpose of this standard is to provide **minimum** requirements for the energy- efficient design of buildings **except** low-rise residential buildings.

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## Scope

- Chapter 2 lists what types of construction and building systems fall within the standard and what types of construction and systems fall outside the standard.
- The point of this in codes is “what is exempt?”

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## Scope Exemptions

- Single-family houses, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular)
- Buildings that do not use either electricity or fossil fuel

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
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## More Scope Exemptions

- Equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial purposes.
- Envelope may be exempt if building has small enough heating and cooling systems

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
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## Definitions

- Chapter 3 provides over 11 pages of specifically defined terms, abbreviations, and acronyms
- These are definitions that are “above and beyond” ordinarily accepted meanings.
- Defined terms are noted in *italics* in the text of the standard.

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## Administration and Enforcement Requirements I

- Chapter 4 covers compliance for new buildings, existing buildings, additions to existing buildings, alterations to existing buildings, and changes in space conditioning in existing buildings
- **ALL** of these events are meant to trigger the requirements of Standard 90.1

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
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## Administration and Enforcement Requirements II

- To ensure that Standard 90.1 is not applied too zealously to situations where it is not appropriate, numerous cases are examined in this chapter and exceptions are granted where appropriate
- Example – changing the refrigerant in existing equipment does not qualify as an alteration

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
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## Overview – Standard 90.1 Envelope Requirements

- Chapter 5 (Building Envelope) regulates the construction and performance of the exterior building envelope
- Chapter 5 explicitly does not address moisture control or provide guidance on moisture migration that may lead to condensation, mold, mildew, or insulation or equipment deterioration

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## Envelope Appendices

- Chapter 5 (Building Envelope) is accompanied by 4 normative appendices
  - A – default assemblies and U-, C-, and F-factor calculations
  - B – the climate zone prescriptive tables
  - C – the envelope trade-off mechanism
  - D – the climate data

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## Envelope Key Concepts

- Conditioned versus semi-heated versus unconditioned space
- Residential versus Nonresidential versus Semi-Heated space-conditioning category
- Assembly
- Climate

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## Overview – Standard 90.1 Mechanical Requirements

- Chapter 6 (Heating, Ventilating, and Air Conditioning) regulates all mechanical equipment serving building HVAC needs and sets Federal minimum standards.
- Chapter 7 (Service Water Heating) regulates all SWH systems and equipment
- Chapter 10 (Other Equipment) regulates electric motors

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### Chapter 6 (Heating, Ventilating and Air Conditioning)

- Offers a simplified approach for small (less than 25,000 ft<sup>2</sup>), short (less than two stories) buildings with single zone HVAC
- This section parallels the development of “small” or “simple” building sections in each chapter of Standard 90.1

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### Chapter 6 (HVAC for Not-So-Simple Buildings) I

- Requires load calculations
- Regulates equipment efficiency
- Requires controls
  - Zone thermostatic, off-hour, ventilation system, heat pump auxiliary heat, humidifier preheat, humidification and dehumidification, freeze protection and snow/ice melting systems, ventilation controls for high-occupancy areas

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### Chapter 6 (HVAC for Not-So-Simple Buildings) II

- Regulates HVAC system construction and insulation
  - Duct and plenum insulation, piping insulation
  - Duct and plenum leakage
- Requires that construction documents and manuals be provided to the owner
- Requires system balancing in all buildings and commissioning in large buildings

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### Chapter 6 (HVAC for Not-So-Simple Buildings) III

- ❑ Requires economizers (with lots of exceptions)
- ❑ Regulates simultaneous heating and cooling
- ❑ Regulates air system design and control
- ❑ Regulates hydronic system design and control
- ❑ Regulates heat rejection equipment
- ❑ Requires energy recovery (with exceptions)
- ❑ Regulates exhaust hoods
- ❑ Regulates radiant heating systems

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### Chapter 7 (Service Water Heating)

- ❑ Requires load calculations
- ❑ Regulates equipment efficiency
- ❑ Requires SWH piping insulation
- ❑ Requires SWH temperature controls
- ❑ Requires pool heater shut-off controls, pool covers, and pool heater/pump shut-off controls
- ❑ Requires heat traps

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### Chapter 10 (Other Equipment)

- ❑ Sole requirement is to require the use of motors that meet the requirements of the Energy Policy Act of 1992. Since this Act sets manufacturing standards for motors, all motors in the US meet this requirement.
- ❑ Requirements function is primarily to provide a motor baseline for the ECB trade-off

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## Overview – Std 90.1 Lighting and Power Requirements

- Chapter 8 (Power) regulates voltage drop in feeders and branch circuits and requires that construction documents and manuals be provided to the owner
- Chapter 9 (Lighting) regulates the wattage of lighting installed inside or outside a building, how that lighting should be installed, and how it should be controlled.

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## Chapter 8 (Power)

- Regulates voltage drop in feeders and branch circuits
- Requires construction drawing and manuals be supplied to owner
- Chapter was carefully constructed to regulate only aspects of building power systems that are NOT covered in electrical codes

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## Chapter 9 (Lighting) I

- Requires interior lighting controls
- Requires tandem wiring of ballasts
- Regulates exit signs
- Defines installed interior lighting power
- Defines luminaire wattage
- Regulates exterior lighting efficacy

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## Chapter 9 (Lighting) II

- Provides two options for regulating interior lighting power
  - Building Area Method
  - Space-By-Space Method
- Provides additional interior lighting power allowances for specific situations

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## Standard 90.1 Tradeoffs – ENVSTD and ECB

- These are the only two formal tradeoffs within Standard 90.1
  - **ENV**elope **ST**andard for tradeoffs among envelope components
  - **E**nery **C**ost **B**udget for whole building tradeoffs
- Less formally, lighting power may be traded off within spaces in a building

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
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## Training Resources

- ASHRAE Chapters
- ASHRAE Learning Institute Courses
- ASHRAE's website – [www.ashrae.org](http://www.ashrae.org)
  - Interpretations, addenda, errata, mailing lists, videos, free viewing
- DOE's code website – [www.energycodes.gov](http://www.energycodes.gov)
  - Presentations, status of states, code comparisons, simplified compliance materials (maps, guides, software), videos

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**Federal Energy Policy Act**

- **Certify Compliance**
- **Deadline – July 15, 2004**
- **Comparisons with IECC**
- **Use of COMCheck EZ**



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
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**Questions?**

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