IECC 2012 Commercial Energy code update

Commercial Envelope

Statewide Code Compliance June 1st 2014

Introduction

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Iowa State Fire Marshal's Office

Building Code Bureau

- Commercial Energy Code Summary

  - Energy Codes 101
  - Paths of compliance
  - ASHRAE 90.1 2010 & IECC 2012 Comparison
  - Increased prescriptive insulation requirements – Table C402.2
  - Manual daylighting controls for buildings seeking 30% < WWR ≤ 40%;
  - Skylights/daylighting for large (>10,000 ft^2) spaces w/ tall (15') ceilings;
  - Continuous air barrier requirement for most buildings – Mandatory
  - Interesting HVAC & Lighting Provisions
  - 2015 IECC Preview

CHAPTER 303
STATE BUILDING CODE—REQUIREMENTS FOR ENERGY CONSERVATION IN CONSTRUCTION

[Prior to 12/21/05, see rules 661—16.800(103A) to 661—16.802(103A)]

661—303.1(103A) Scope and applicability of energy conservation requirements.

303.1(1) *Scope.* Rules 661—303.1(103A) through 303.3(103A) establish thermal energy efficiency standards for the design of new buildings and structures or portions thereof, additions to existing buildings, and renovation and remodeling of existing buildings, except for residential buildings of one or two dwelling units, which are intended for human occupancy and which are heated or cooled by regulating their exterior envelopes and selection of their heating, ventilation, and air-conditioning systems, service water heating systems and equipment for the efficient use of energy, and lighting efficiency standards for buildings intended for human occupancy which are lighted.

303.1(2) *Applicability.* Rules 661—303.1(103A) through 661—303.3(103A) apply to design and construction of buildings which are intended for human occupancy throughout the state of Iowa. Any construction of buildings or facilities which are intended for human occupancy and which are heated or cooled is covered, with the exception of renovation and remodeling of residential buildings of one or two dwelling units, which are not covered. Rule 661—303.2(103A) establishes standards for design and construction of residential buildings of three or fewer stories. Rule 661—303.3(103A) establishes standards for design and construction of commercial buildings and residential buildings of four or more stories. The occupancy of any building covered by this chapter shall be determined based upon the occupancy definitions in chapter 3 of the International Building Code, 2006 edition.

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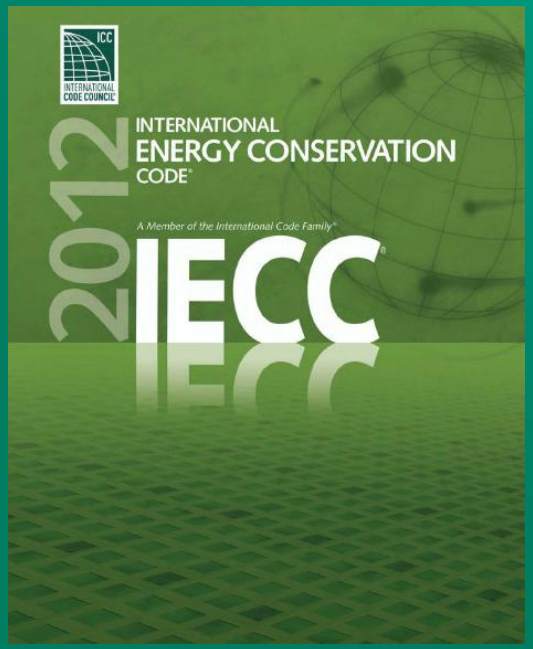
Resources

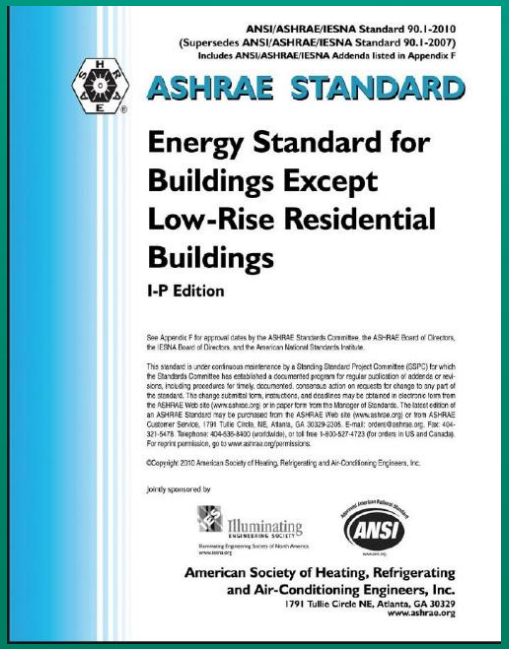
www.energycodes.gov

www.buildingscience.com

www.iccsafe.org

Published by: International Codes Council





100,000 CF Statement

Review required by an Architect or Engineer

Review Required. The plans and specifications for all buildings to be constructed which exceed a total volume of 100,000 cubic feet of enclosed space that is heated or cooled shall be reviewed by a registered architect or licensed professional engineer for compliance with applicable energy efficiency standards.

- Statewide Code Compliance June 1st 2014

Structure of the 2012 IECC

Commercial Section

Ch. 1 C101 - Scope and Application / Administrative and Enforcement

Ch. 2 C201 - Definitions

Ch. 3 C301 - General Requirements

Ch. 4 C401 - Commercial Energy Efficiency

Ch. 5 C501 - Referenced Standards

Index

Residential Section

Ch. 1 R101 - Scope and Application /Administrative and Enforcement

Ch. 2 R201 - Definitions

Ch. 3 R301 - General Requirements

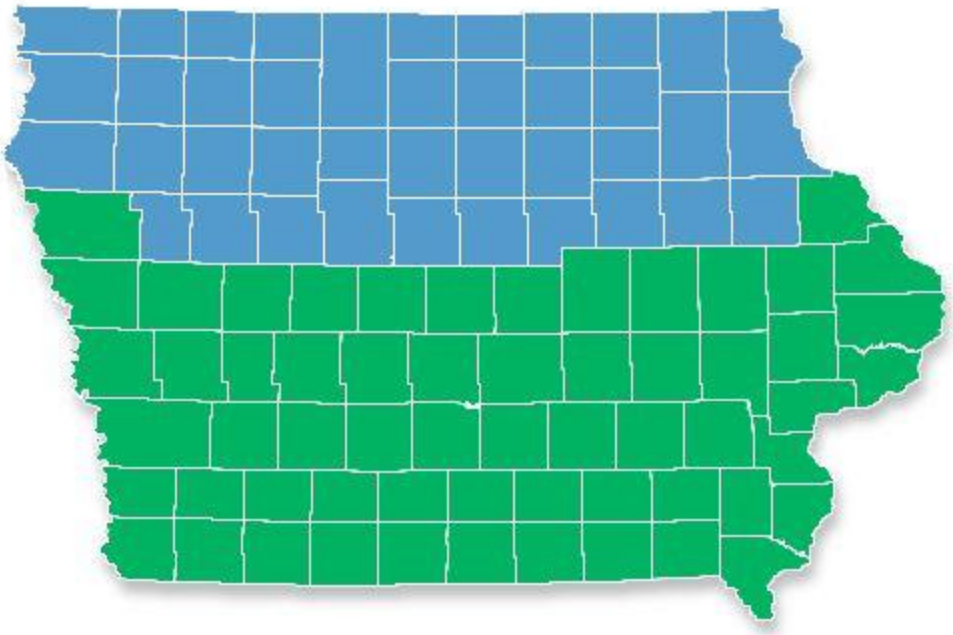
Ch. 4 R401 - Residential Energy Efficiency

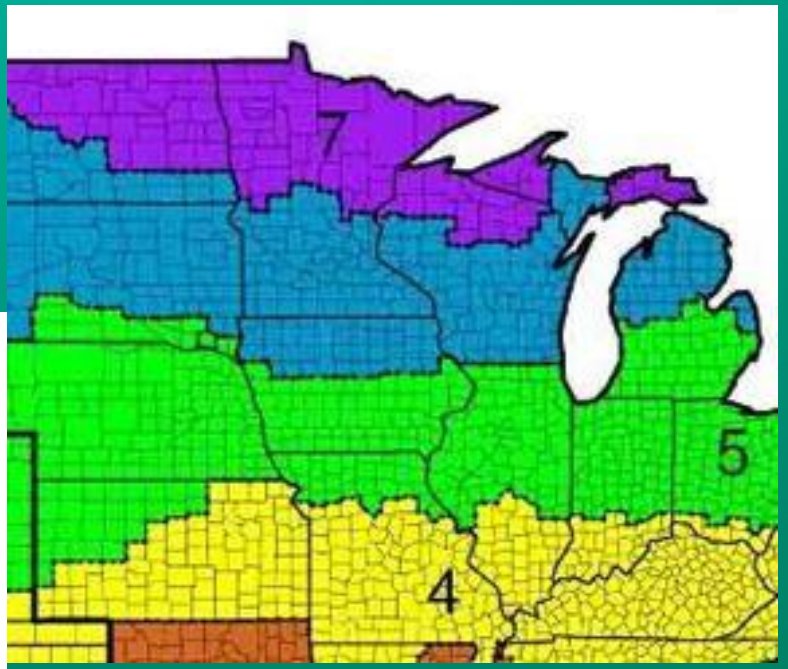
Ch. 5 R501 - Referenced Standards

Index

IECC Compliance - Two Climate Zones

- Iowa Has Two Climate Zones
  - Zone 5
  - Zone 6





IECC Compliance - Three Options

Prescriptive

- R-values
- Table R402.1.1
- Table C402.2

U-Factor and "UA" Alternatives

- U-factor
- R402.1.3 - REScheck
- C402.3 - COMcheck

Simulated Performance (software)

- Simulated Performance Alternative
- R405 - REMrate
- C407 – DOE II

- There are three paths of Compliance
  - Prescriptive
  - Trade-off
  - Performance

Building Types

C 101.4 - Applicability – What is NOT covered under this code:

- C101.4.1 - Historic Buildings – State, National or Local historic property
- C101.4.3 – Exceptions for Additions, Alterations, Renovations or Repairs
  - Exceptions – 1 to 8
- C101.4.6 – Mixed occupancy – Where the building is covered by the IECC Residential Provisions
- C101.5.2 – Low Energy Buildings – with energy use below 3.4 Btu/h Sf of floor area for space conditioning purposes.

Building Types

C101.4.3 – Exceptions for Additions, Alterations, Renovations or Repairs

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed.
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

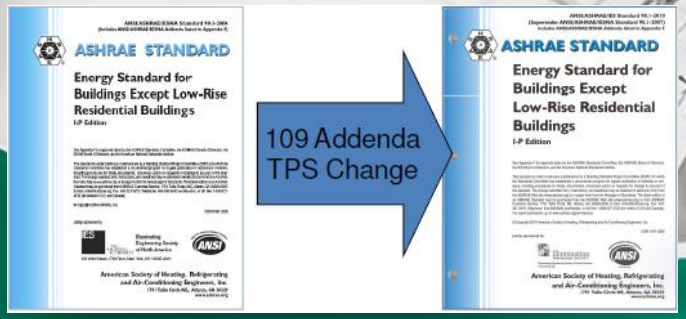
Structure of the 2012 IECC

Commercial Energy Efficiency

Chapter 4 (CE)

2012 vs. 2009… Commercial

- 30% Improvement over 2006 IECC;
- Equivalent savings to 90.1-2010;
- Must select an additional efficiency package:
  - Efficient lighting system,
  - Purchase higher efficiency HVAC equipment, or
  - Design for on-site renewable energy at least 0.5 W/ft^2;
- Continuous air barrier requirement for most buildings;
- Automatic daylighting controls for buildings seeking 30% < WWR ≤ 40%;
- Skylights/daylighting for large (>10,000 ft^2) spaces w/ tall (15') ceilings;
- Equipment efficiencies higher, energy recovery in more applications;
- Commissioning required where HVAC ≥ 40 tons cooling ***and*** ≥ 600 Kbtuh heating;
- Functional performance testing (Cx) for LTG systems; and
- Updated reference to ASHRAE 90.1-2010



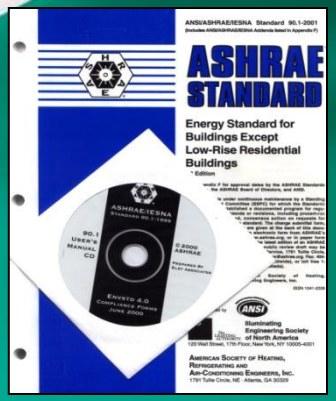
2010 vs. 2007… ASHRAE 90.1

- 30% Improvement over 90.1-2004
- Change to Title, Purpose, Scope to address process (plug, data) loads;
- Process cooling (data centers) now addressed;
- Continuous air barrier requirement for most buildings;
- Cool/High albedo roof requirements added for Zones 1-3;
- WWR ≤ 40% w/ South-facing glass area > West-facing, > East-facing
- Skylights/daylighting for large (>5,000 ft^2) spaces w/ tall (15’) ceilings;
- Automatic daylighting controls required in most spaces;
- Equipment efficiencies higher, energy recovery in more applications;
- VRF systems added; New term (IEER) for unitary focus on part-load;
- Plug load control for half of all receptacles in certain spaces;
- Exterior lighting power allocated by Zoning; and
- LEED – **Appendix G is not a compliance path**.

Choose a Commercial Path

2012 IECC or ASHRAE 90.1-2010

"All-In!"



2012 IECC

1. Scope & Administration
2. Definitions
3. General Requirements
4. Commercial
   - 402) ENVELOPE
   - 403) MECH
   - 404) SERVICE WATER HEATING
   - 405) LIGHTING
   - 406) HIGH EFF MEASURES
   - 407) PERFORMANCE
   - 408) COMMISSIONING
5. Referenced Standards

ASHRAE 90.1-2010

1. Purpose
2. Scope
3. Definitions & Abbreviations
4. Administration & Enforcement
5. ENVELOPE
6. HVAC
7. SERVICE WATER HEATING
8. POWER
9. LIGHTINGG
10. EQUIPMENT
11. ENERGY COST BUDGET METHOD
12. Normative References

2012 Commercial IECC
Mandatory Requirements

Mandatory Sections Regardless of Compliance Path

- C402.4 Air Leakage – With sections C402.4.1 through C402.4.8
  - Typo on C402.4.1.1 paragraph 3 recessed lighting fixtures shall comply with section C402.4.8
- C403.2 Provisions applicable to all mechanical systems – With sections C403.2.1 through C403.2.11
- C404 Service Water Heating – With sections C404.1 through 404.7.3

Cont…..

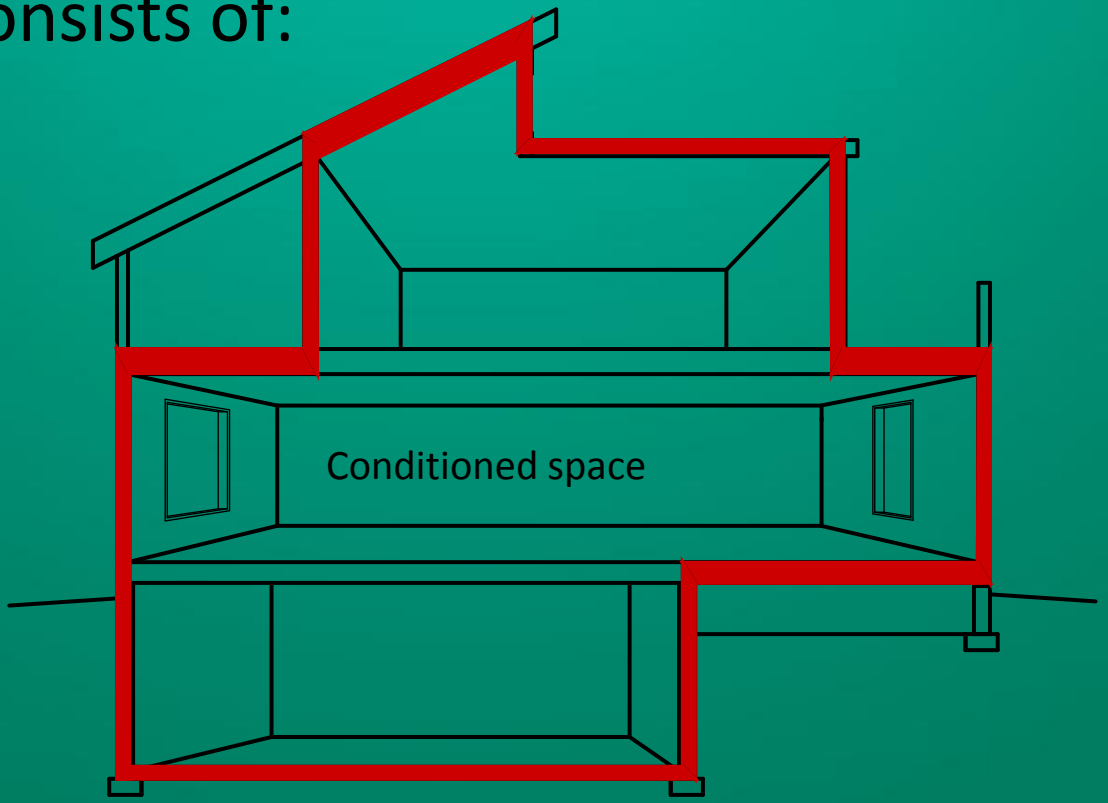
2012 Commercial IECC
Mandatory Requirements

Mandatory Sections Regardless of Compliance Path

- C405 Electrical Power and Lighting Systems – With Mandatory Sections
  - C405.2 Lighting controls – With sections C405.2.1, C405.2.2, C405.2.3 and C405.2.4
  - C405.3 Tandom Wiring
  - C405.4 Exit Signs
  - C405.6 Exterior Lighting
  - C405.7 Electrical Energy Consumption – Multi-Family
- C 408 Commissioning
  - Mandatory from section C403.2.9

Building Envelope

- Building Envelope consists of:
  - Fenestration
  - Ceilings
  - Walls
    - Above grade
    - Below grade
    - Mass walls
  - Floors
  - Slab
  - Crawl space



2012 Commercial Insulation and Fenestration by Climate Zone - Prescriptive

Table C402.2

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[a, b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24 below	R-10 for 24 below	R-10 for 24 below	R-10 for 24 below	R-10 for 24 below	R-15 for 24 below	R-15 for 24 below	R-15 for 24 below	R-15 for 24 below	R-20 for 24 below
Heated slabs[d]	R-7.5 for 12 below	R-7.5 for 12 below	R-7.5 for 12 below	R-7.5 for 12 below	R-10 for 24 below	R-10 for 24 below	R-15 for 24 below	R-15 for 24 below	R-15 for 36 below	R-15 for 36 below	R-15 for 36 below	R-20 for 48 below	R-20 for 24 below	R-20 for 48 below	R-20 for 48 below	R-20 for 48 below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

2012 Commercial Insulation and Fenestration by Climate Zone - Prescriptive

Table C402.3

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
***U*-factor**								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
***U*-factor**	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

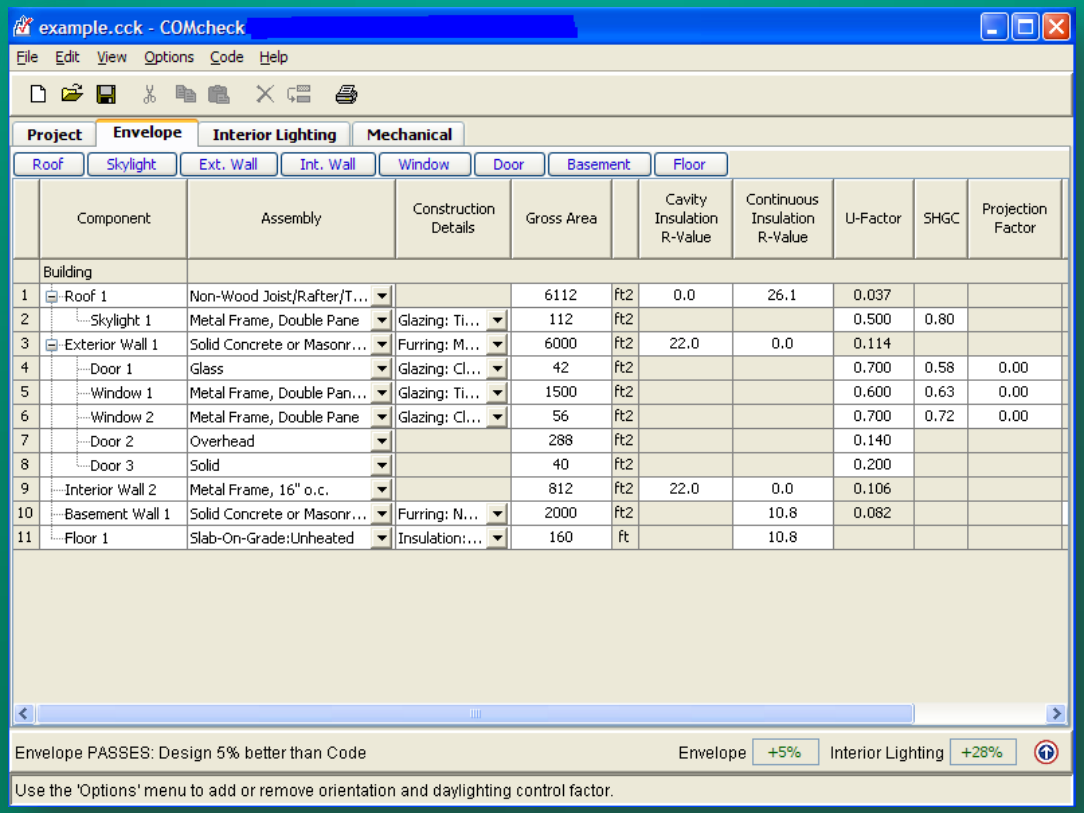
NR = No requirement.

2012 Commercial Compliance Approach
Trade-off Method

COMcheck™

Use when the envelope assemblies don't fit in the prescriptive table

- Works for 95% of all projects
- Trades off over insulated areas for under-insulated areas
- Free and simple program
- Tied to table C402.2



2012 Commercial Compliance Approach Performance Method

State Requirements for Performance Energy Modeling

- Department of Energy DOEII – Energy Modeling Engine Software
  - Free and simple programs, Energy Plus, eQUEST, EPquick OpenStudio Etc.
- The International Energy Conservation Code 2012 Section C407 outlines the Total Building Performance Method and ASHRAE 90.1 2010, Section 11.1 outlines the Energy Cost Budget Method. ASHRAE 90.1 2010 Appendix G can be used in specific circumstances but each project will need to be approved before using this method. The preferred method in Iowa is the ASHRAE 90.1 2007 Energy Cost Budget Method, the other methods can be used, only with prior approval.

Vertical Fenestration Requirement
C402.3.1 – Prescriptive (Max area)

Percentage of Vertical Fenestration Area to Gross Wall Area

- Allowed up to 30% maximum of above grade wall
  - In Climate Zones 1-6, up to 40% maximum of above grade wall with daylighting controls

Increased Vertical Fenestration with Daylighting Controls – *Prescriptive C402.3.1.1*

- Up to 40% vertical fenestration area allowed in Climate zones 1-6, provided
  - No less than 50% of the conditioned floor area is within a daylight zone
  - Automatic daylighting controls are installed in daylight zones; and
  - Visual Transmittance of vertical fenestration is ≥ 1.1 times SHGC

Exception:

Fenestration that is outside the scope of NFRC 200 isn't required to comply with VT

Skylight Minimum Fenestration Area

***C402.3.1.2* Prescriptive**

- Limited to ≤ 3% of Roof Area
- Up to 5% allowed if automatic daylighting controls installed in daylight zones under skylights

Minimum Skylight Fenestration Area
C402.3.2 – Prescriptive

- In certain types of enclosed spaces > 10,000 ft^2 directly under a roof with ceiling heights > 15 ft
  - total daylight zone under skylights to not be < ½ the floor area and to provide a minimum skylight area to daylight zone of either
    - Minimum of 3% of roof area with a skylight VLT at least 0.40 **OR**
    - Provide a minimum skylight effective aperture of at least 1%

Exceptions

- Climate zones 6-8
- Spaces with LPDs < 0.5 W/ft^2
- Documented shaded spaces
- Daylight area under rooftop monitors is > 50% of floor area

Lighting Controls in Daylight Zones – Under Skylights

C402.3.2.1 – Prescriptive

- All lighting in the daylight zone shall be controlled by multilevel lighting controls that comply with C405.2.2.3.3

Exceptions:

- Climate zones 6-8
- Spaces with LPDs < 0.5 W/ft^2
- Documented shaded spaces
- Daylight area under rooftop monitors is > 50% of floor area

Increased Skylight SHGC

C402.3.3.3

- In Climate Zones 1-6, skylights above daylight zones with automated daylight controls are permitted a maximum SHGC of 0.60

Increased Skylight U-Factor

C402.3.3.4 – Prescriptive

- Skylights above daylight zones with automated daylight controls are permitted a maximum U-factor of
  - 0.9 in Climate Zones 1-3
  - 0.75 in Climate Zones 4-8

New and Improved!!! And required regardless of compliance path!

Air Barriers and Construction
C402.4.1 and C402.4.1.1 – (Mandatory)

Air Barriers and Construction
C402.4.1 and C402.4.1.1 - Mandatory

Continuous air barrier required in:

- Iowa's climate zones 5 & 6

Air barrier requirements:

- Placement allowed
  - Inside of building envelope
  - Outside of building envelope
  - Located within assemblies composing envelope OR
  - Any combination thereof
- Continuous for all assemblies part of the thermal envelope and across joints and assemblies
- Joints and seams to be sealed per C402.4.2
- Recessed lighting to comply with C404.2.8.
- Where similar objects are installed that penetrate the air barrier, make provisions to maintain the air barrier's integrity

Air Barrier Compliance Options
C402.4.1.2 - Mandatory

Three ways to comply with air barrier requirements

- Materials
- Assemblies
- Building

Air Barrier Materials (Compliance)
C402.4.1.2.1 - Mandatory

Materials with air permeance ≤ 0.004 cfm/ft^2 under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2178

These materials meet this requirement:

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Closed cell spray foam minimum density of 1.5 pcf	1-1/2 in.
Open cell spray foam density between 0.4 and 1.5 pcf	4.5 in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	
Modified bituminous roof membrane	
Fully adhered single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	5/8 in.
Cast-in-place and precast concrete	
Sheet metal or aluminum	

Air Barrier Assemblies (Compliance)
C402.4.1.2.2

OR

Assemblies of materials and components (sealants, tapes, etc.) with average air leakage ≤ 0.04 cfm/ft^2 under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2357, 1677 or 283

These assemblies meet this requirement:

- Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating OR
- Portland cement/sand parge, stucco or plaster minimum ½ thick

Air Barrier Building Test (Compliance)
C402.4.1.2.3

OR

Air leakage rate of completed building tested and confirmed to not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3 inches water gauge per ASTM E779 or equivalent method approved by code official

Air Leakage
C402.4.2 to C402.4.8 (Mandatory)

C402.4.2 Air Barrier Penetrations

- Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed.

C402.4.3 Air Leakage of Fenestration

- Shall meet Table C402.4.3 and tested to referenced standard.

C402.4.4 Doors and Access Openings to Shafts, Stairways etc.

- Shall meet either C402.4.3 or shall be gasketed, weather stripped or sealed

C402.4.5 Air Intakes, Exhausts, Stairways and Shafts

- Shall be provided with dampers in accordance with C402.4.5.1 &2

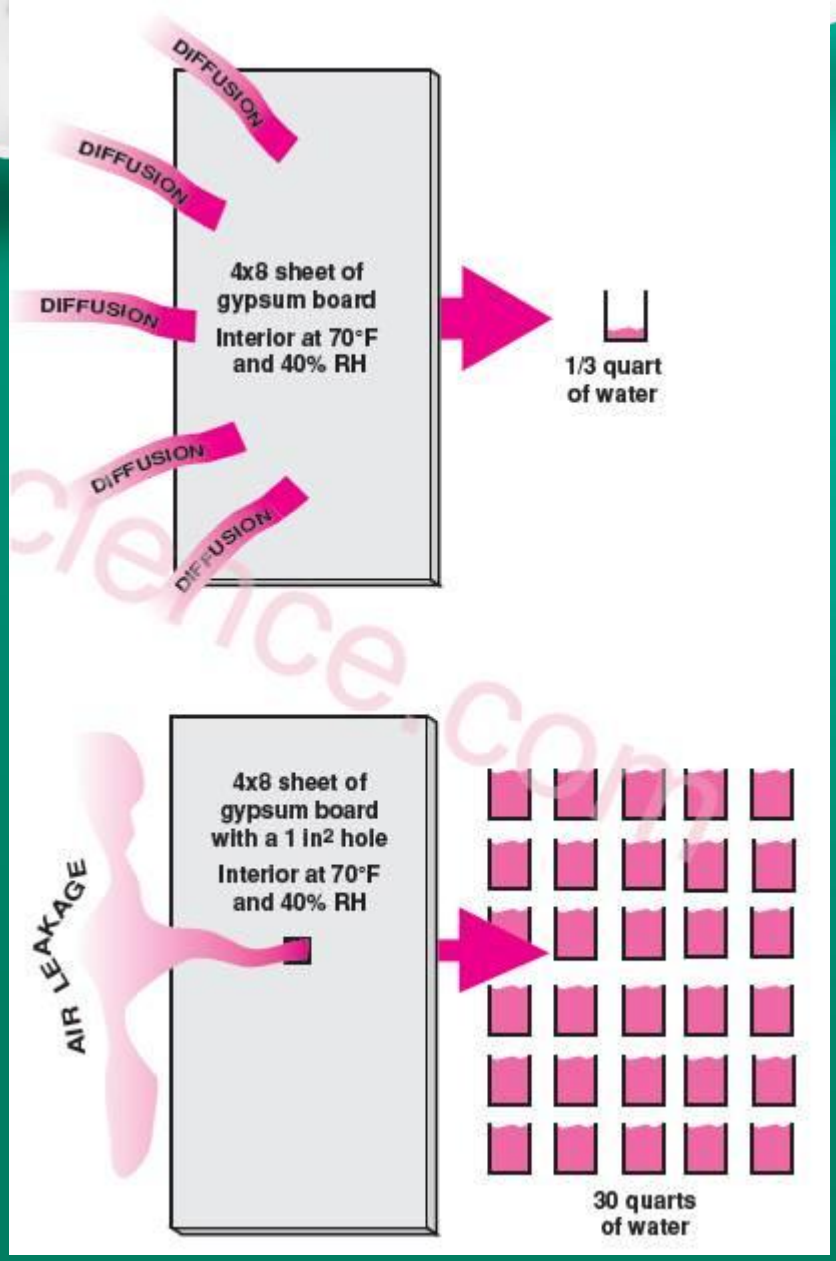
C402.4.6 Loading Dock Weatherseals

C402.4.7 Vestibules

- Required from a space 3,000 Sf in area or more.

C402.4.8 Recessed Lighting

- All recessed luminaires shall be IC-rated and labeled as having a leakage rate of not more than 2.0 cfm@75 Pa


DIFFUSION
DIFFUSION
DIFFUSION
DIFFUSION
DIFFUSION
4x8 sheet of gypsum board
Interior at 70°F and 40% RH
1/3 quart of water
4x8 sheet of gypsum board with a 1 in² hole
Interior at 70°F and 40% RH
AIR LEAKAGE
30 quarts of water

Commercial HVAC

Chapter 4 (CE)

HVAC Load Calculations

C403.2.1 **-** Mandatory

Heating and cooling load sizing calculations required

- ✓ ASHRAE/ACCA Standard 183
- ✓ Other approved computation procedures – using design parameters specified in Chapter 3
  - Exterior design conditions
    - Specified by ASHRAE
  - Interior design conditions
    - Specified by Section 302 of the IECC
      - ≤ 72°F for heating load
      - ≥ 75°F for cooling load

HVAC Performance

C403.2.3 **-** Mandatory Minimum Efficiency Requirements

Water-cooled centrifugal chilling packages

- Adjustment calculation for systems not operating at AHRI Standard 550/590 test conditions
  - 44 degree F leaving chilled water temperature
  - 85 degree F entering water temperature
  - 3 gpm/ton condenser water flow

Table C403.2.3(1)to(9)

Mandatory

Applies to all equipment used in heating and cooling of buildings

- Must comply with all listed efficiencies

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled, (Cooling mode)	< 65,000 Btu/h	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.1 EER (before Jan. 1, 2010) 11.0 EER (as of Jan. 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.3 EER (before Jan. 1, 2010) 10.6 EER (as of Jan. 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	9.0 EER 9.2 IPLV (before Jan. 1, 2010) 9.5 EER 9.2 IPLV (as of Jan. 1, 2010)	

Demand Controlled Ventilation *C403.2.5.1* Mandatory

DCV must be provided for each zone with spaces > 500 ft² and the average occupant load > 25 people/1000 ft² of floor area where the HVAC system has:

- ✓ An air-side economizer,
- ✓ Automatic modulating control of the outdoor air damper, or

Demand control ventilation (DCV): a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

Energy Recovery Ventilation Systems *C403.2.6* Mandatory

- ✓ Applies to fan systems with supply airflow rates > values in Table C403.2.6
- ✓ Exhaust air recovery efficiency must be ≥ 50%
- ✓ When an air economizer is required
  - include a bypass or controls that permit operation of economizer per C403.4

Energy Recovery Ventilation Systems

C403.2.6 Mandatory

Exceptions:

- ✓ Where energy recovery ventilation systems prohibited by the IMC
- ✓ Lab fume hood system with at least one of the following:
  - VAV hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to ≤ 50% of design values
  - Direct makeup (auxiliary) air supply equal to at least 75% of exhaust rate, heated no warmer than 2ºF below room setpoint, cooled to no cooler than 3ºF above room setpoint, no humidification added, and no simultaneous heating and cooling use for dehumidification control
- ✓ Systems serving uncooled spaces and heated to < 60ºF
- ✓ Where > 60% of outdoor heating energy is from site-recovered or site solar energy
- ✓ Cooling energy recovery in Climate Zones 5 & 6
- ✓ Systems requiring dehumidification that employ energy recovery in series with the cooling coil
- ✓ Where largest source of air exhausted at a single location at building exterior is < 75% of design outside air flow rate
- ✓ Systems operating at < 20 hours per week

Energy Recovery Ventilation Systems *C403.2.6* Mandatory

TABLE C403.2.6
ENERGY RECOVERY REQUIREMENT

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE					
	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	DESIGN SUPPLY FAN AIRFLOW RATE (cfm)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥ 5000	≥ 5000
1B, 2B, 5C	NR	NR	≥ 26000	≥ 12000	≥ 5000	≥ 4000
6B	≥ 11000	≥ 5500	≥ 4500	≥ 3500	≥ 2500	≥ 1500
1A, 2A, 3A, 4A, 5A, 6A	≥ 5500	≥ 4500	≥ 3500	≥ 2000	≥ 1000	> 0
7, 8	≥ 2500	≥ 1000	> 0	> 0	> 0	> 0

NR = not required

C403.3.1 – Economizers
6.5.1 – Economizers

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 Btu/h[a]

For SI:1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

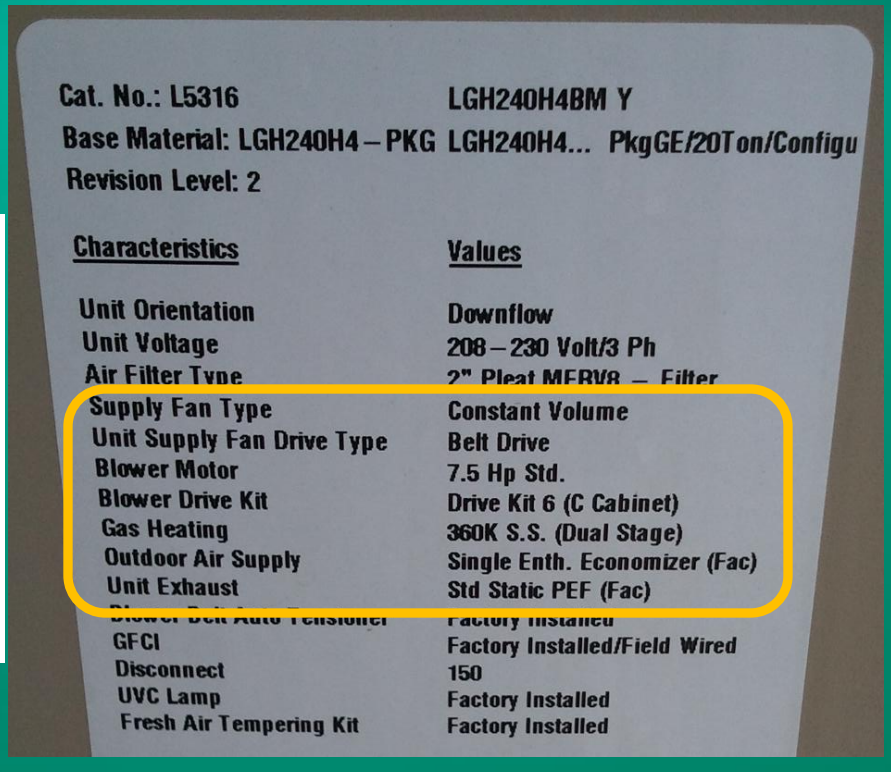


TABLE 6.5.1A Minimum Fan-Cooling Unit Size for Which an Economizer is Required for Comfort Cooling

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

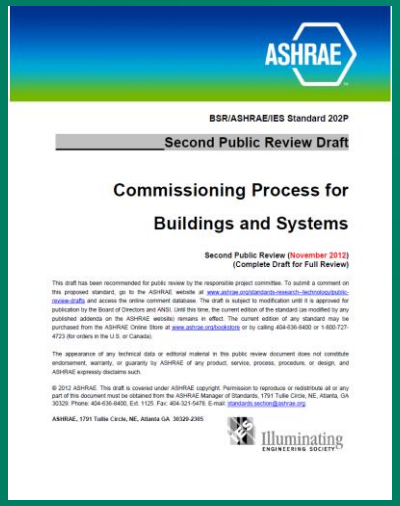
Mechanical Systems Commissioning and Completion *C403.2.9* - Mandatory

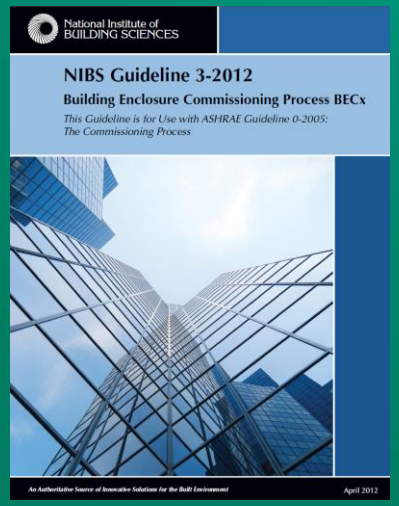
HVAC Commissioning

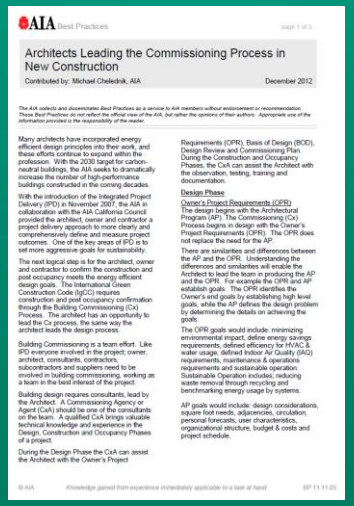
- Applies to buildings with a total building equipment capacity ≥:
  - 480,000 Btu/h cooling capacity, or
  - 600,000 Btu/h heating capacity
- Requires:
  - Commissioning plan
  - Systems adjusting and balancing
  - Functional performance testing
    - Equipment
    - Controls
    - Economizers
  - Preliminary commissioning report
  - Construction documents and O&M Manuals
  - Final commissioning report and air balancing report

Mechanical Systems Commissioning and Completion *C403.2.9* - Mandatory

- Use ASHRAE guideline 202 for specific MEP commissioning requirements.
- NIBS Guidelines 3-2012 for Building Enclosure Commissioning
- AIA papers on System Commissioning and Enclosure Commissioning are helpful for building owners and staff







Commercial Lighting

Chapter 4 (CE)

Interior Lighting Power Allowance

Two methods to determine allowance:

- ✓ Building Area Method
  - ❑ Floor area for each building area type x value for the area
  - ❑ "area" defined as all contiguous spaces that accommodate or are associated with a single building area type as per the table
  - ❑ When used for an entire building, each building area type to be treated as a separate area

- ❑ Space-by-Space Method
  - ❑ Floor area of each space x value for the area
  - ❑ Then sum the allowances for all the spaces
  - ❑ Tradeoffs among spaces are allowed

Space-By-Space Method Table

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE-BY-SPACE TYPES	LPD (w/ft²)
Atrium – First 40 feet in height	0.03 per ft. ht.
Atrium – Above 40 feet in height	0.02 per ft. ht.
Audience/seating area – permanent	
For auditorium	0.9
For performing arts theater	2.6
For motion picture theater	1.2
Classroom/lecture/training	1.30
Conference/meeting/multipurpose	1.2
Corridor/transition	0.7
Dining area	
Bar/lounge/leisure dining	1.40
Family dining area	1.40
Dressing/fitting room performing arts theater	1.1
Electrical/mechanical	1.10
Food preparation	1.20
Laboratory for classrooms	1.3
Laboratory for medical/industrial/research	1.8
Lobby	1.10
Lobby for performing arts theater	3.3
Lobby for motion picture theater	1.0
Locker room	0.80
Lounge recreation	0.8
Office – enclosed	1.1
Office – open plan	1.0
Restroom	1.0
Sales area	1.6[a]
Stairway	0.70
Storage	0.8
Workshop	1.60
Courthouse/police station/penitentiary	

(partial table)

Interior Lighting Control
C405.2.2 Automatic Shutoff - **Mandatory**

Each area required to have a manual control to also have controls meeting:

C405.2.2.1 – Automatic time switch control devices, or

C405.2.2.2 – Occupancy sensors, or

C405.2.2.3 – Daylight zone control

Exempted spaces

- ✓ Sleeping units
- ✓ Lighting for patient care
- ✓ When an automatic shutoff would endanger occupant safety or security
- ✓ Lighting intended for continuous operation

Interior Lighting Control

C405.2.2.1 – *Occupancy Sensors Req'd*

9.4.1.2(b) – Occupancy Sensors Req'd

- Occupancy sensors required in:
  - Classrooms/lecture halls, conference/meeting rooms, employee lunch and break rooms, restrooms, storage rooms, janitorial closets;
  - **2012 IECC** in private offices and other spaces < 300 ft^2
  - **90.1-2010** in private offices < 250 ft^2, copy/print rooms, storage/supply rooms 50 ft^2 > x < 1,000 ft^2, and dressing/locker/fitting rooms
- Features:
  - Automatic "lights-off" within 30 minutes of occupant vacancy; **and**
  - *Manual on* or *automatic on* **with first step at 50% power**.
- Full auto-on controls allowed in:
  - Public corridors and stairways (i.e., means of egress)
  - Restrooms
  - Primary building entrance areas and lobbies
  - Areas with a safety or security concern

Additional Efficiency Requirements - Prescriptive

- One Additional Efficiency Feature Must Be Selected to Comply with the IECC
  - More efficient lighting system (consistent with 90.1-2010), or
  - More efficient HVAC system
  - Installation of onsite renewables
    - 3% of the regulated energy

High Efficiency HVAC

More Efficient Lighting System

Onsite Renewables

Additional Efficiency Requirements - Prescriptive

- HVAC
  - Efficiencies based on Consortium for Energy Efficiency (CEE)
  - Option not available to all HVAC system types
  - Ruled “legal” by AHRI

High Efficiency HVAC

Additional Efficiency Requirements - Prescriptive

- Lighting
  - Whole building LPD's consistent with ASHRAE 90.1-2010
  - No additional lighting allowed for retail lighting
  - Daylighting controls option for retail and office lighting
  - 70% daylit floor area for warehouse occupancies

More Efficient Lighting System

Additional Efficiency Requirements - Prescriptive

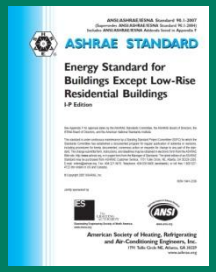
- Installation of onsite renewables compliance options:
- Option 1: Provide ≥ 1.75 btu's, or 0.50 watts, per square foot of conditioned floor area.
- Option 2: Provide ≥ 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 5.

Onsite Renewables

2015 IECC / ASHRAE 90.1-2013 Preview
COMMERCIAL CONSTRUCTION

Overall Efficiency Improvements

- 2015 IECC could be as much as +2% but no more than +5% upon 2012 IECC
  - Slight reduction in building thermal envelope
  - Modest gains in mechanical systems efficiency
  - Modest gains in lighting systems and controls
  - New! Vertical and horizontal people movers



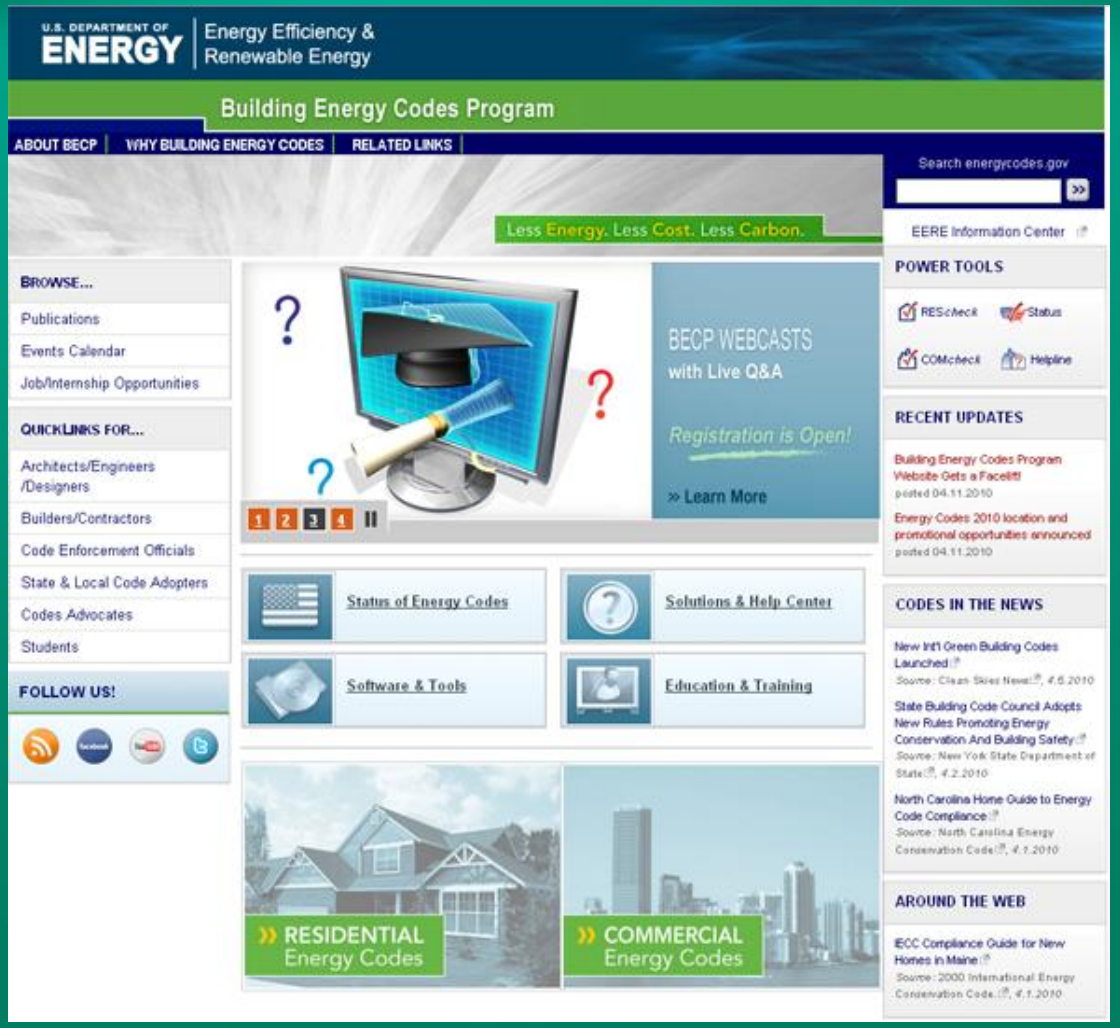
- ASHRAE SSPC 90.1, PNNL Progress Indicator depicts a +7.8% improvement upon 90.1-2010

Resources

www.energycodes.gov

ICCSAFE.ORG

Buildingscience.org



Questions