2015

IECC vs. ASHRAE 90.1 Compared

Funding for this presentation has been provided through electric Universal System Benefits funds collected from NorthWestern Energy Customers. The views and opinions expressed are those of the presenter and do not necessarily reflect those of NorthWestern Energy.

NCAT

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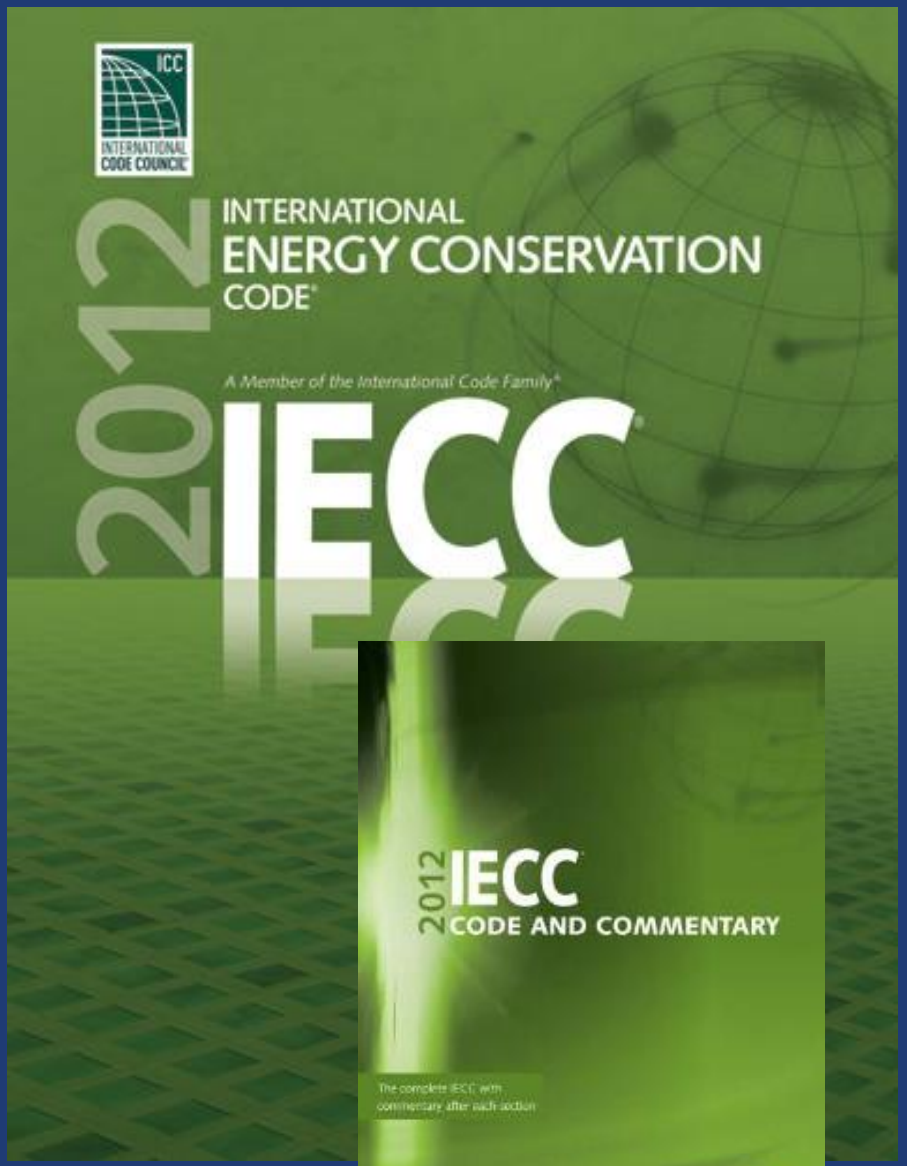
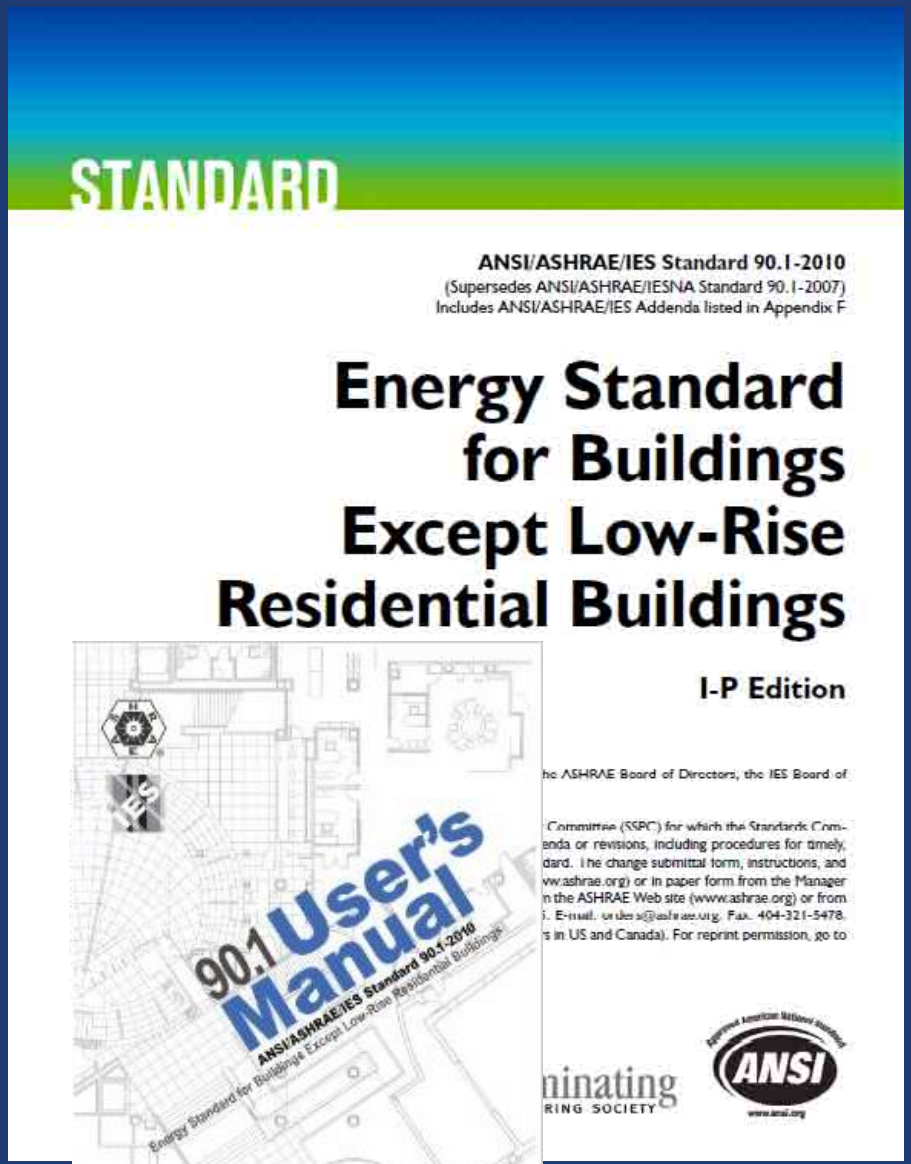
Energy Program Manager


ICC
INTERNATIONAL CODE COUNCIL
2012
INTERNATIONAL
ENERGY CONSERVATION
CODE®
A Member of the International Code Family®
IECC
2012 IECC
CODE AND COMMENTARY
The complete IECC with commentary after each section


STANDARD
ANSI/ASHRAE/IES Standard 90.1-2010
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2007)
Includes ANSI/ASHRAE/IES Addenda listed in Appendix F
Energy Standard for Buildings Except Low-Rise Residential Buildings
I-P Edition
90.1 User's Manual
ANSI/ASHRAE/IES Standard 90.1-2010
Energy Standard for Buildings Except Low-Rise Residential Buildings
ANSI

Why More Jurisdictions Adopt The IECC

- Model code
- Set of model building codes
- Addresses low-rise residential
- Updated on 3-Year Cycle

2012 INTERNATIONAL ENERGY CONSERVATION CODE®

A Member of the International Code Family®

IECC®

Source: Yellowstone NP Photo Archives

ASHRAE Standard 90.1

- Consensus standard developed and maintained by ASHRAE (7th Edition)
- Energy Standard for Buildings (Except Low-Rise Residential Buildings)
- Continuous maintenance

IECC

1. Scope and Applications
2. Definitions
3. General Requirements
4. Energy Efficiency Requirements

401 - General
402 – Building Envelope
403 – Mechanical Systems
404 – Service Water Heating
405 – Power and Lighting
406 – Additional EE Packages
407 – Total Building Performance
408 – System Commissioning

5. Referenced Standards

90.1

1. Purpose
2. Scope
3. Definitions
4. Admin. & Enforcement
5. Building Envelope
6. HVAC
7. Service Water Heating
8. Power
9. Lighting
10. Other Equipment
11. Energy Cost Budget Method
12. Normative References

Appendices

90.1 Compliance Inspection Requirements

Inspection requirements not specified.

More specific regarding what is required to be inspected after installation:

- Wall insulation after the insulation and vapor retarder are in place
- Roof/ceiling insulation after roof/insulation
- Slab/foundation insulation
- Fenestration
- Continuous air barrier after installation
- Mechanical systems and equipment
- Electrical equipment and systems

(Ref 4.2.2)

First Question: Does My Project Need to Comply with Commercial or Residential Provisions?

Commercial Building Definition

"Not Residential"

Source: Going Beyond Code USDOE Building Energy Codes Program

IECC Residential Provisions Applicability

Single family detached houses and duplexes

R-2 ≤ 3 stories : Occupants primarily permanent. (apartments, dormitories, fraternities and sororities, convents, monasteries)

R-3: Catchall. (Single family detached houses and duplexes > 3 stories) Adult facilities and child care facilities that provide accommodation for <= 5 occupants

R-4 ≤ 3 stories : Residential care/assisted living facilities 6-15 occupants

Applicability Based on Occupancy and Number of Stories

Applying the IECC and 9.1 to Building Occupancies		Low-rise (3 stories or less)			High-rise (more than 3 stories)	
		IECC		90.1	IECC	90.1
		Residential	Commercial			
R1	Hotel/Motel Guest Rooms		Yes	Yes	Yes	Yes
R1	Boarding Houses		Yes	Yes	Yes	Yes
R1	Hostels		Yes	Yes	Yes	Yes
R2	Apartments	Yes			Yes	Yes
R2	Dormitories	Yes			Yes	Yes
R2	Fraternities/Sororities	Yes			Yes	Yes
R3	Single-Family Houses	Yes				
R3	Duplexes	Yes				
R3	Residential Care < 6 occupants	Yes		Yes	Yes	Yes
R4	Residential Care 6 - 15 occupants	Yes		Yes	Yes	Yes
I2	Patient Rooms in Hospitals		Yes	Yes	Yes	Yes
I2	Residential Care, Nursing Homes > 15 Occ.		Yes	Yes	Yes	Yes
I3	Prisons/Jails		Yes	Yes	Yes	Yes
Other			Yes	Yes	Yes	Yes

Application to Existing Buildings R101.4

C101.4.1 Not Retroactive

C101.4.2 Historic Buildings….Exempt

C101.4.3 Additions, alterations & repairs to existing buildings
"Whatever is new has to comply."

C101.4.4 Change in occupancy – full compliance.

C101.4.5 Unconditioned to conditioned - full compliance.

C101.4.6 Mixed occupancy - *Residential* and *commercial* separately considered

Application to Existing Buildings

C101.4.3 Additions, alterations & repairs to existing buildings

"Whatever is new has to comply."

Exceptions:

1. Storm window installation.
2. Glass only replacements.
3. If exposed cavities are filled with insulation.
4. If roof, wall or floor cavity is not exposed.
5. If reroofing (insulation adjacent to roof deck), can be required to install insulation to code.
6. Replacement of existing doors, new vestibule not required.
7. If < 50% luminaires in space replaced, no greater LPD.
8. Bulb/ballast replacement, no greater LPD.

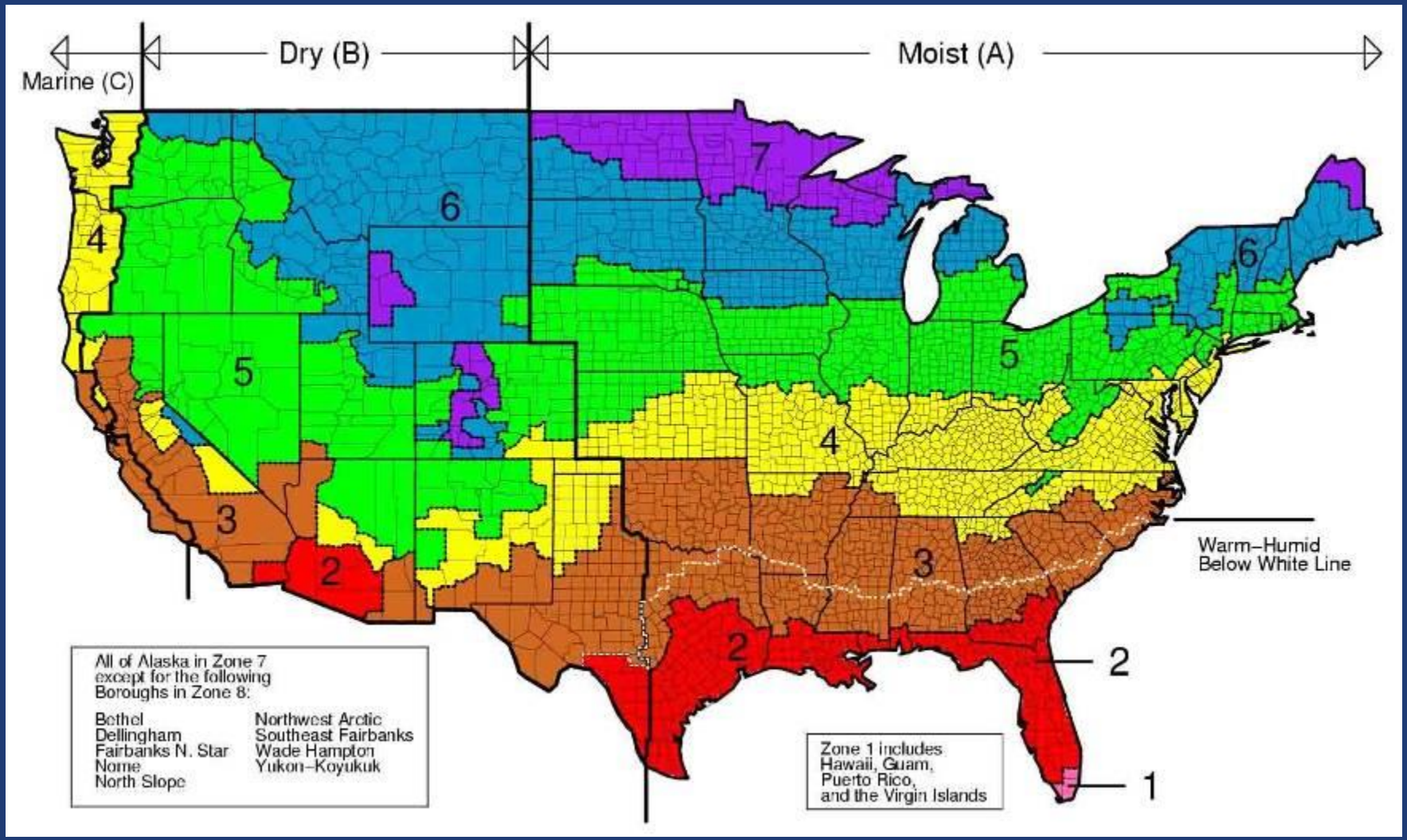
Does Residential or Commercial Apply?

In this 3-story mixed occupancy building would the commercial or residential sections apply to each floor?

Does Residential or Commercial Apply?

In this 4-story mixed occupancy building would the commercial or residential sections apply to each floor?

Climate Zones 2012 IECC - Chapter 3



Determining Your Climate Zone is the First Step in the Process

Compliance Paths

2012 IECC Compliance Options

IECC Chapter 4

Building System	Prescriptive		Total Building Performance
Envelope	+ Mandatory Provisions		+ Mandatory Provisions <=85% of reference building
HVAC	+ Mandatory Provisions		
SWH	+ Mandatory		
Lighting & Power	Building Area Method + Mandatory Provisions	Space-by-Space Method + Mandatory Provisions	
Additional Efficiency Packages	Choose One of 3 Option Packages		

ASHRAE 90.1

Building System	Prescriptive		Trade Off	Simplified	Energy Cost Budget
Envelope	+ Mandatory Provisions		+ Mandatory Provisions	Not Available	+ Mandatory Provisions
HVAC	+ Mandatory Provisions		Not Available	The mandatory provisions are not required.	
SWH	+ Mandatory Provisions		Not Available	Not Available	
Power	+ Mandatory Provisions		Not Available	Not Available	
Lighting	Building Area Method + Mandatory Provisions	Space-by-Space Method + Mandatory Provisions	Not Available	Not Available	
Other	+ Mandatory Provisions		Not Available	Not Available	

Building Envelope Trade-Offs

IECC has no Trade-off Option.

COMCheck software may be used for tradeoffs.

Includes a building envelope Trade-Off Option (Appendix C)

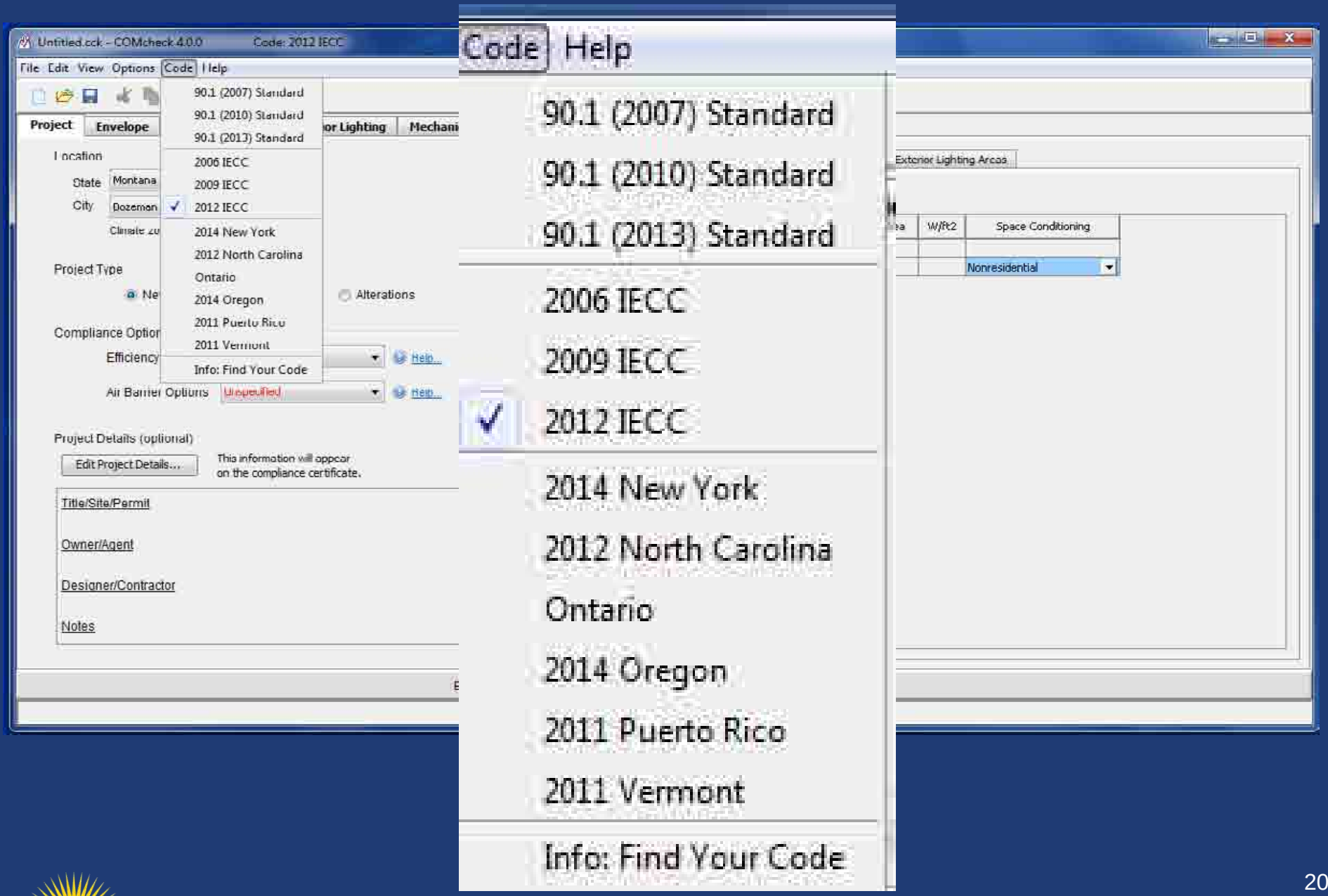
(Ref 5.6)

COMCheck

COMCheck Desktop

COMCheck Web

COMCheck


Untitled.cck - COMcheck 4.0.0
Code: 2012 IECC
File Edit View Options Code Help
90.1 (2007) Standard
90.1 (2010) Standard
90.1 (2013) Standard
2006 IECC
2009 IECC
2012 IECC
2014 New York
2012 North Carolina
Ontario
2014 Oregon
2011 Puerto Rico
2011 Vermont
Info: Find Your Code
Project
Envelope
Location
State
Montana
City
Bozeman
Project Type
Alterations
Compliance Option
Efficiency
Air Barrier Options
Unspecified
Help...
Project Details (optional)
Edit Project Details...
This information will appear on the compliance certificate.
Title/Site/Permit
Owner/Agent
Designer/Contractor
Notes
Exterior Lighting Areas
W/ft2
Space Conditioning
Nonresidential

COMCheck

Envelope

example_Ontario.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

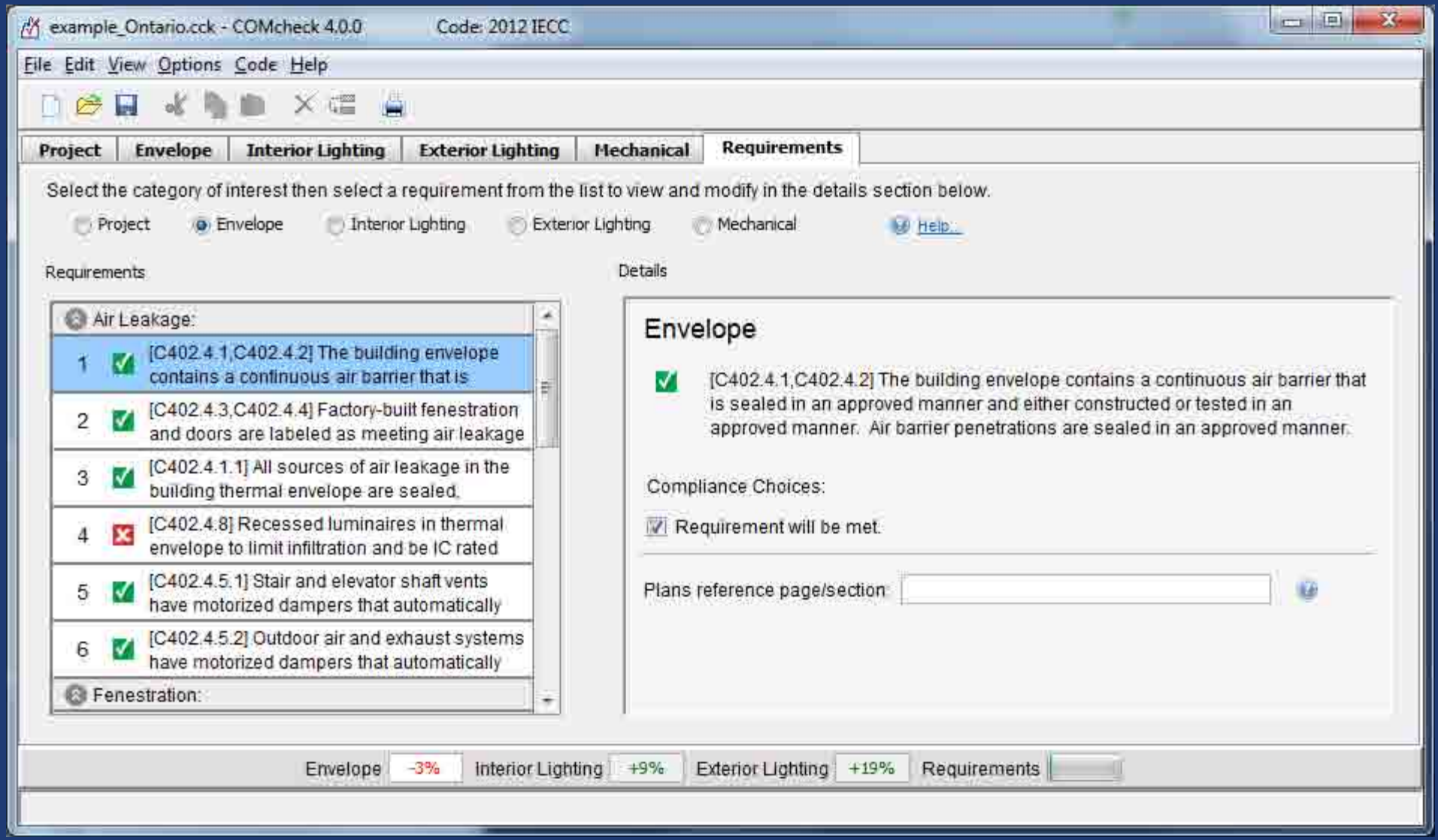
Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Roof | Skylight | Exterior Wall | Window | Door | Basement | Floor

	Component	Assembly	Building Area Type	Orientation	Fenestration Details	Construction Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC	Projection Factor	VT
	Building													
1	Roof 1	Insulation Entirely Above...	1 - Law library (...				10000	ft2		30.0	0.032			
2	Exterior Wall 1	Wood-Framed, 24" o.c.	1 - Law library (...	North			1500	ft2	19.0	5.0	0.047			
3	Window 1	Metal Frame:Fixed			Product ID: AX321 ...		500	ft2			0.420	0.40	0.00	0.44
4	Exterior Wall 1	Wood-Framed, 24" o.c.	1 - Law library (...	East			1500	ft2	19.0	5.0	0.047			
5	Window 1	Metal Frame:Fixed			Product ID: AX321 ...		500	ft2			0.420	0.40	0.00	0.44
6	Exterior Wall 1	Wood-Framed, 24" o.c.	1 - Law library (...	West			1500	ft2	19.0	5.0	0.047			
7	Window 1	Metal Frame:Fixed			Product ID: AX321 ...		500	ft2			0.420	0.40	0.00	0.44
8	Exterior Wall 1	Wood-Framed, 24" o.c.	1 - Law library (...	South			1500	ft2	19.0	5.0	0.047			
9	Window 1	Metal Frame:Fixed			Product ID: AX321 ...		500	ft2			0.420	0.40	0.00	0.44
10	Exterior Wall 5	Wood-Framed, 24" o.c.	2 - Paralegal off...	North			500	ft2	19.0	5.0	0.047			
11	Exterior Wall 5 cop	Wood-Framed, 24" o.c.	2 - Paralegal off...	East			500	ft2	19.0	5.0	0.047			
12	Floor 2	Slab-On-Grade:Unheated	1 - Law library (...			Insulation:...	400	ft		20.0				

Envelope -3% | Interior Lighting +9% | Exterior Lighting +19%

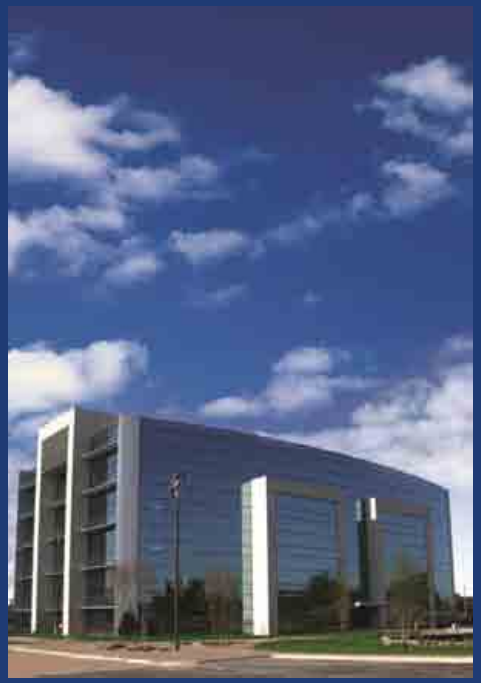
COMCheck Requirements



Total Building Performance C401.2

Proposed building must have an annual cost less than the standard reference design.

The building energy cost must be <= 85% of the standard reference design. Plus……



- C402.4 – Air Leakage
- C403.2 - Mandatory General Mech Provisions
- C404 - All Service Water Heating Provisions
- C405.2 – Lighting Controls
- C405.3 – Tandem Wiring
- C405.4 – Exit Signs
- C405.6 - Exterior Building Lighting Controls
- C405.7 – Residential Separate Electric Metering

Source: NREL Image Gallergy; NASA Marshall Space Flight Center; Photographer: Marshall Space Flight Ctr.

Building Envelope

Semi-Heated Spaces

Either heated or unheated.

Requirements apply to two space conditioning categories:

- Nonresidential
- Residential

Semi-heated space has a heating system output capacity ≥ 3.4 Btu/h-ft2 but is not a conditioned space. Conditioned space may be cooled (system > 5 Btu/h-ft^2), heated (system > 20 Btu/h-ft^2), or indirectly conditioned space.
(Ref 3.2)

Requirements apply to three space conditioning categories

- Nonresidential
- Residential
- Semiheated

Indirectly Conditioned Spaces

No similar definition.

Heat transfer rate to conditioned space > heat transfer rate to the exterior or
Air transfer rate between the space and conditioned space > 3ACH. (Ref 3.2)

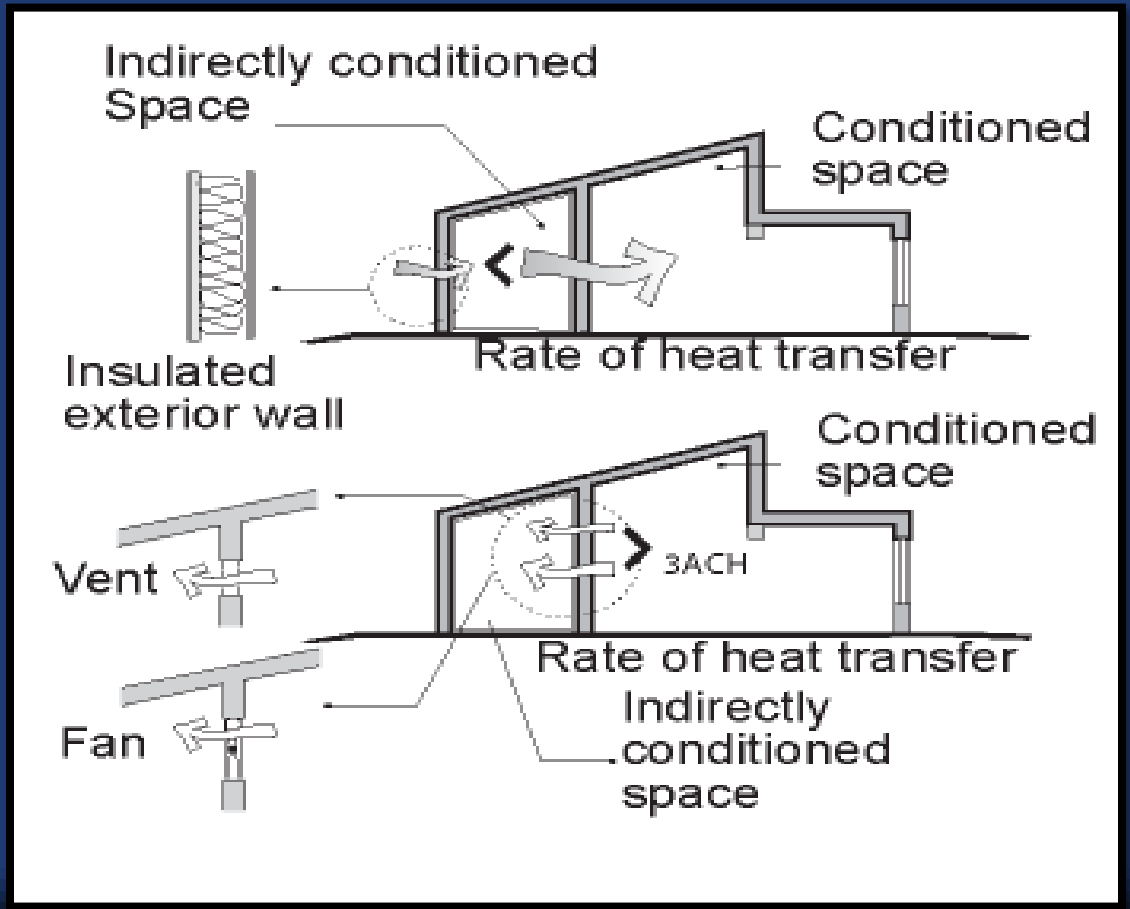


Figure 5-A
Indirectly Conditioned Spaces
(User's Manual – 90.1.-2010)

Prescriptive Envelope Requirements

	2012 IECC		90.1-2010		
	All Other	Group R	Non-Residential	Residential	Semi-Heated
Roofs					
Insulation above deck	R-30ci ●	R-30ci ●	R-20ci	R-20ci	R-10ci
Metal buildings (with R-5 thermal blocks)	R-25 + R-11 LS ●	R-25 + R-11 LS ●	R-13 + R-19	R-13 + R-19	R-16
Attic and other	R-49 ●	R-49 ●	R-38	R-38	R-30
Walls, Above Grade					
Mass	R-13.3ci	R-15.2ci	R-13.3ci	R-15.2ci	R-5.7ci
Metal building	R-13 + R-13ci ●	R-13 + R-13ci ●	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13
Metal framed	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13
Wood framed and other	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13
Walls, Below Grade					
Below-grade wall	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	NR
Floors					
Mass	R-12.5ci	R-12.5ci	R-12.5ci	R-14.6ci ●	R-4.2ci
Joist/framing	R-30	R-30[e]	R-30	R-30	R-19
Slab-on-Grade Floors					
Unheated slabs	R-10 for 24 below	R-15 for 24 below	R-10 for 24 below	R-15 for 24 below	NR
Heated slabs	R-15 for 36 below ●	R-20 for 48 below	R-15 for 24 below	R-20 for 48 below	R-7.5 for 12 below
Opaque Doors					
Swinging	U-0.37 ●	U-0.37 ●	U-0.7	U-0.5	U-0.7
Roll-up or sliding	R-4.75 ●	R-4.75 ●	U-0.5	U-0.5	U-1.45

Prescriptive Envelope Requirements

	2012 IECC		90.1-2010		
	All Other	Group R	Non-Residential	Residential	Semi-Heated
Roofs					
Insulation above deck	R-30ci ●	R-30ci ●	R-20ci	R-20ci	R-10ci
Metal buildings (with R-5 thermal blocks) [a, b]	R-25 + R-11 LS ●	R-25 + R-11 LS ●	R-13 + R-19	R-13 + R-19	R-16
Attic and other	R-49 ●	R-49 ●	R-38	R-38	R-30

Prescriptive Envelope Requirements

	2012 IECC		90.1-2010		
	All Other	Group R	Non-Residential	Residential	Semi-Heated
Walls, Above Grade					
Mass	R-13.3ci	R-15.2ci	R-13.3ci	R-15.2ci	R-5.7ci
Metal building	R-13 + R-13ci ●	R-13 + R-13ci ●	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13
Metal framed	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13
Wood framed and other	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13
Walls, Below Grade					
Below-grade wall[d]	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	NR

Prescriptive Envelope Requirements

	2012 IECC		90.1-2010		
	All Other	Group R	Non-Residential	Residential	Semi-Heated
Floors					
Mass	R-12.5ci	R-12.5ci	R-12.5ci	R-14.6ci ●	R-4.2ci
Joist/framing	R-30	R-30[e]	R-30	R-30	R-19
Slab-on-Grade Floors					
Unheated slabs	R-10 for 24 below	R-15 for 24 below	R-10 for 24 below	R-15 for 24 below	NR
Heated slabs[d]	R-15 for 36 below ●	R-20 for 48 below	R-15 for 24 below	R-20 for 48 below	R-7.5 for 12 below
Opaque Doors					
Swinging	U-0.37 ●	U-0.37 ●	U-0.7	U-0.5	U-0.7
Roll-up or sliding	R-4.75 ●	R-4.75 ●	U-0.5	U-0.5	U-1.45

TABLE C402.2 OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

	2012 IECC		2009 IECC	
	Climate Zone 6		Climate Zone 6	
	All Other	Group R	All Other	Group R
Walls, Above Grade				
Mass	R-13.3ci	R-15.2ci	R-13.3ci	R-15.2ci
Metal building	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-5.6ci	R-13 + R-5.6ci
Metal framed	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5 or R-20 + R-3.8ci	R-13 + R-7.5ci or R-21	R-13 + R-7.5ci or R-21
Walls, Below Grade				
Below-grade wall	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci

TABLE C402.2 OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

	2012 IECC		2009 IECC	
	Climate Zone 6		Climate Zone 6	
	All Other	Group R	All Other	Group R
Roofs				
Insulation above deck	R-30ci	R-30ci	R-20ci	R-20ci
Metal buildings (with R-5 thermal blocks) [a, b]	R-25 + R-11 LS	R-25 + R-11 LS	R-13 + R-19	R-19
Attic and other	R-49	R-49	R-49	R-49

Compressed

Between Purlins

"Liner System"

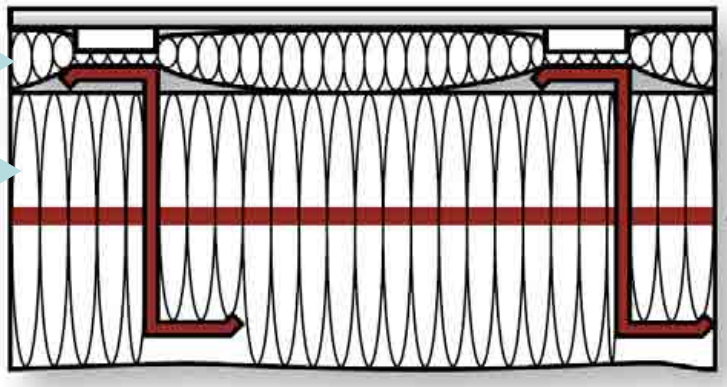


TABLE C402.2 OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

	2012 IECC		2009 IECC	
	Climate Zone 6		Climate Zone 6	
	All Other	Group R	All Other	Group R
Floors				
Mass	R-12.5ci	R-12.5ci	R-12.5ci	R-14.6ci
Joist/framing	R-30	R-30[e]	R-30	R-30[e]
Slab-on-Grade Floors				
Unheated slabs	R-10 for 24 below	R-15 for 24 below	R-10 for 24 below	R-15 for 24 below
Heated slabs[d]	R-15 for 36 below	R-20 for 48 below	R-15 for 24 below	R-20 for 48 below
Opaque Doors				
Swinging	U-0.37	U-0.37	U-0.7	U-0.5
Roll-up or sliding	R-4.75	R-4.75	U-0.5	U-0.5

Fenestration Update

TABLE C402.3 BUILDING ENVELOPE REQUIREMENTS: FENESTRATION			
2012 Categories	Climate Zone 6		2009 Categories
Vertical fenestration	2012 IECC	2009 IECC	Vertical fenestration
U- factor			
Fixed fenestration	0.36		
Operable fenestration	0.43		
		0.35	Non-Metal Frame
		0.45	Metal Frame Curtain Wall/Storefront
		0.55	Metal Frame - All Other
Entrance doors	0.77	0.80	
SHGC			
SHGC	0.40	0.40	
Skylights			
U- factor	0.50	0.60	
SHGC	0.40	0.40	

Prescriptive Envelope Requirements

CZ6 Building Envelope Requirements: Fenestration

IECC			90.1-2010					
Categories	All		Nonresidential		Residential		Semiheated	Categories
Vertical fenestration								
	U-factor	SHGC	U-factor	SHGC	U-factor	SHGC	U-factor	
Fixed	0.36 ●	0.40						
Operable	0.43	0.40						
			0.55	0.40	0.55	0.40	0.65	Metal Framing (all other)
			0.35 ●	0.40	0.35 ●	0.40	0.65	Non-Metal Framing
			0.45	0.40	0.45	0.40	0.65	Metal Framing (storefront/curtainwall)
Entrance	0.77 ●	0.40	0.8	0.40	0.8	0.40	0.9	Metal Entrance Door
Skylights								
U-factor	0.5 ●	0.4 ●	1.17	0.49	0.98	0.46	NR	Skylight w/ curb, Glass, 0%-2.0% *
			1.17	0.49	0.98	0.36	NR	Skylight w/ curb, Glass, 2.1%-5.0% *
			0.87	0.71	0.74	0.65	NR	Skylight w/ curb, Plastic, 0%-2.0% *
			0.87	0.58	0.74	0.55	NR	Skylight w/ curb, Plastic, 2.1%-5.0% *
			0.69	0.49	0.58	0.49	NR	Skylight w/o curb, All, 0%-2.0% *
			0.69	0.49	0.58	0.39	NR	Skylight w/o curb, All, 2.1%-5.0% *
								* - % of Roof Area

Fenestration U-Factor R303.1.3

IECC Change

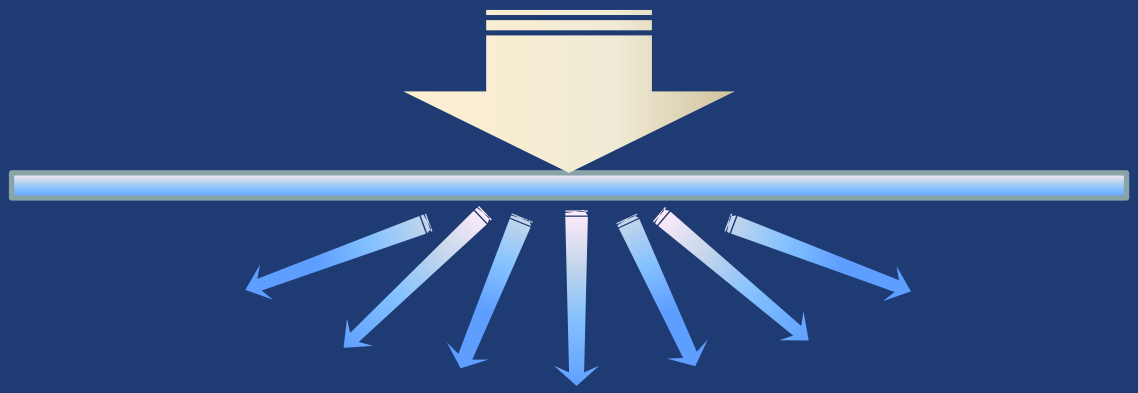
How Do You Meet the Requirement?

Fenestration product rating in accordance to NFRC 100, tested by independent laboratory, labeled and certified by the manufacturer. If not then use default Glazed Fenestration U-factor Table C303.1.3(1)

Haze Factor C402.3.2.2

- **Skylights in certain space types to have a glazing material or diffuser with a measured haze factor > 90%**

  Office, storage, automotive service, manufacturing, non-refrigerated warehouse, retail store, and distribution/sorting area



- **Exception**

  Skylights designed to exclude direct *sunlight* entering the occupied space by use of fixed or automated baffles, or the geometry of skylight and light well

Window to Wall Ratios

Up to 30% Window-to-Wall Ratio (WWR).

Adjustment up to 40% if 50% of floor area is in daylight zones with automatic lighting controls.

(Ref C402.3)

Up to 40% Window-to-Wall Ratio (WWR).

(Ref 5.5.4.2.1 and 5.5.4.2.2)

Walls Partially Below Grade

Only above-grade walls are included in WWR calculation.

Below-grade walls at least 85% below grade.

Above-grade walls > 15% above grade.

(Ref C402.2.2)

Both above- and below-grade walls are included in WWR calculation.

A below-grade wall is the portion of a wall in the building envelope that is below the finish grade and in contact with the ground.

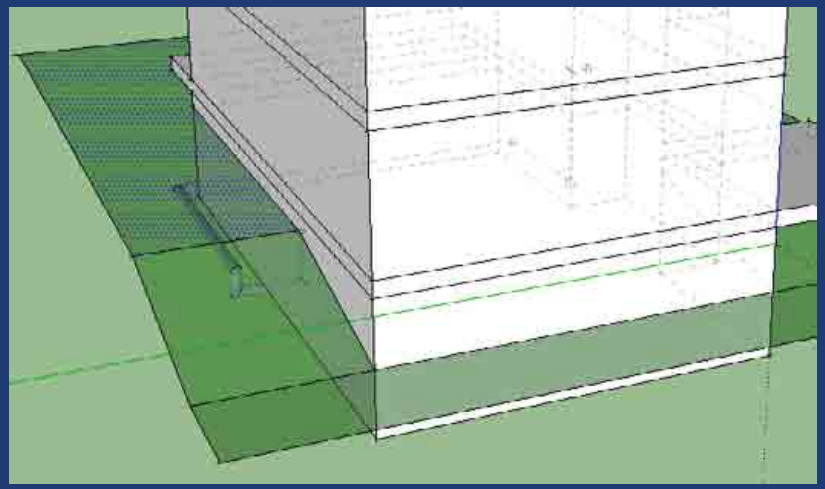
(Ref 3.2)

Definition Clarification C402.2.2

~~**Above-Grade Wall: C202 Definition > 50% above grade.**~~
~~**Basement Wall: C202 Definition >= 50% below grade.**~~

C402.2.2.1

Above-grade-wall more than 15% above grade.
Basement wall at least 85% below grade.



Above	Below	Classification
16%	84%	ABOVE
15%	85%	BASEMENT
14%	86%	BASEMENT

Source: NCAT

The conflicting definitions in Chapter 2 for "Above-grade-wall" and "Basement wall" have been deleted by errata.

Maximum Vertical Fenestration Area C402.3.1

IECC Change

Percentage of Vertical Fenestration Area to Gross Wall Area

Allows up to 30% maximum of above grade wall

Up to 40% vertical fenestration area allowed in Climate Zone 6, provided:

At least 50% conditioned floor area within daylight zone
Automatic daylighting controls; and
VT of vertical fenestration is ≥ 1.1 times SHGC

Skylight to Roof Ratio

Up to 3% Skylight-to-Roof Area Ratio.

Adjustment up to 5% if skylight daylighting zones have automatic lighting controls.

(Ref C402.3)

Up to 5% Skylight-to-Roof Area Ratio.

(Ref 5.5.4.2.1 and 5.5.4.2.2)

SHGC Adjustment for Vertical Fenestration

Adjustment based on projection factor and the multipliers of Table C402.3.3.1.

(Ref C402.3.1)

Adjustment based on projection factor and the multipliers of Table 5.5.4.4.1.

The 90.1 table of multipliers is more complex than that of the IECC.

(Ref 5.5.4.4.1)

SHGC Adjustment for Skylights

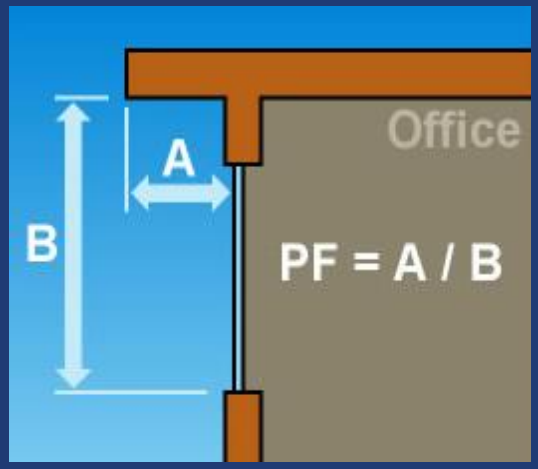
Less stringent SHGC (0.75) under skylights with automatic daylighting controls.

(Ref C402.3.3.4)

No similar adjustment.

SHGC Adjustment C402.3.3.1

When PF ≥ 0.2, the required maximum SHGC may be adjusted by multiplying the required maximum SHGC by the multiplier in Table C402.3.3.1



US DOE Building Codes University

TABLE C402.3.3.1 SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
0.2 ≤ PF < 0.5	1.1	1.2
PF ≤ 0.5	1.2	1.6

Increased Skylight SHGC C402.3.3.3

In Climate Zone 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

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

Skylights Requirements

Skylight Requirements Summary			
	% of Roof Area*	U-factor	SHGC
Zone 6 Provisions	**3%**	**0.5**	**0.4**
with Auto Daylighting Controls	**5%**	**0.75**	**0.6**
	* - Gross roof area		

Vertical Fenestration Requirements

Vertical Fenestration Requrements Summery								
		U-factor			SHGC		VT	
	% of Wall Area*	Fixed	Operable	Entrance Doors	Within 45° of North	Other Orient.	Within 45° of North	Other Orient.
Zone 6 Provisions								
PF<0.2	30%	0.36	0.43	0.77	0.40	0.40	N/A	N/A
0.2<=PF<0.5	30%	0.36	0.43	0.77	0.44	0.48	N/A	N/A
PF>=0.5	30%	0.36	0.43	0.77	0.48	0.64	N/A	N/A
>=50% floor area in Daylight Zones with Auto Controls								
PF<0.2	40%	0.36	0.43	0.77	0.40	0.40	0.44	0.44
0.2<=PF<0.5	40%	0.36	0.43	0.77	0.44	0.48	0.48	0.528
PF>=0.5	40%	0.36	0.43	0.77	0.48	0.64	0.53	0.704

* - Gross above grade wall area

Dynamic Glazing C402.3.3.5

SHGC determined using manufacturer's lowest-rated SHGC

Considered separately from other fenestration

- Area-weighted averaging isn't allowed

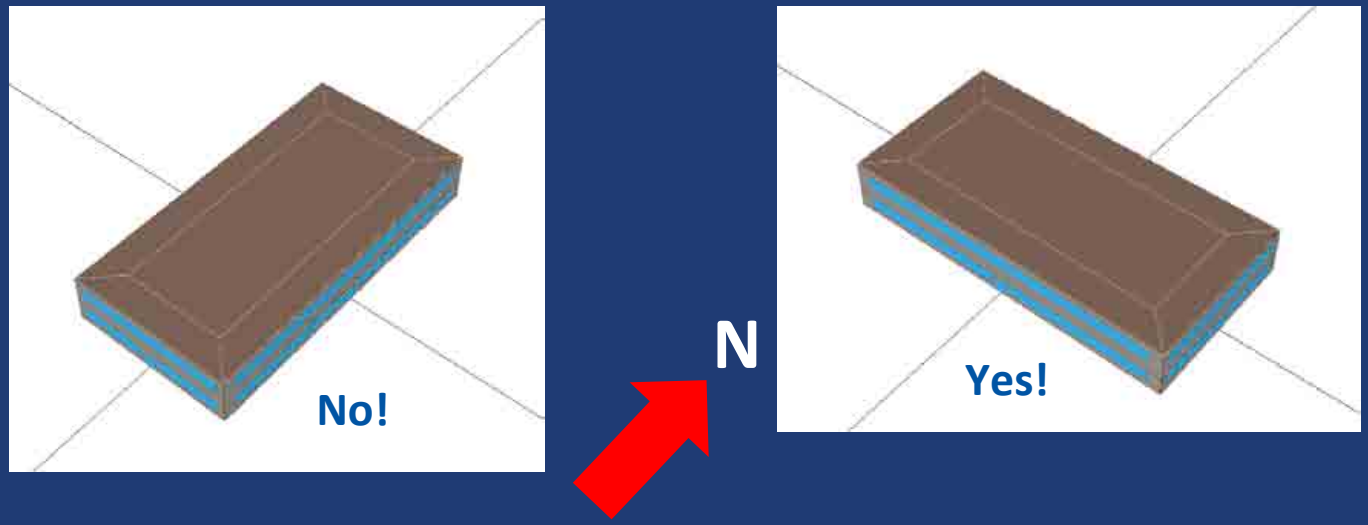
Source: Solar Innovations

Fenestration Orientation 5.5.4.5

90.1 CHANGE

Vertical fenestration area to meet this requirement:

Area South ≥ Area West and Area South ≥ Area East



Exceptions:

- Buildings shaded by other buildings within 20 ft. to the south which is at least ½ as tall as the proposed building
- Buildings with shade on 75% of the west and east
- Alterations and additions that don't increase vertical fenestration area

Insulation of Radiant Heating Systems C402.2.8

Radiant Panels to be insulated with R-3.5

Radiant Panel for Sensible Heating of Indoor Space	Must Comply with U and R-Value Tables	Must Comply with R-3.5
Slab in contact with ground <=24" Below Grade	Yes	Yes
Slab in contact with ground >24" Below Grade	No	Yes
Slab not in contact with ground	No	Yes
Not a slab	No	Yes

Air Barrier

Compliance:

- Appropriate materials

or

- Assemblies

or

- Whole-building tightness testing (per ASTM E 779)

(C402.4.1.1)

Compliance:

- Appropriate materials

or

- Assemblies

No tightness testing.

Air barrier not required in semiheated spaces.

(Ref 5.4.3.1.2)

Air Barriers & Construction C402.4.1 and C402.4.1.1

Air barrier requirements:

1. Continuous for all assemblies that are a part of the thermal envelope and across joints and assemblies.*
2. Joints and seams to be sealed.
3. Recessed lighting to comply with C404.2.8. Where objects are installed that penetrate the air barrier, make provisions to maintain the air barrier's integrity*

* - Items 1 and 3 not required if tightness is tested.

Air Barrier Materials *C402.4.1.2.1*

Materials with air permeance ≤ 0.004 cfm/ft² under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2178

C402.4.1.2.1 Materials Deemed to Comply as Air Barrier	
1	3/8 inch plywood
2	3/8 inch oriented strand board
3	1/2 inch extruded polystyrene insulation board
4	1/2 inch foil-back polyisocyanurate insulation board
5	1 1/2 inch 1.5 pcf closed cell spray foam
6	4.5 inch (0.4 and 1.5 pcf) open cell spray foam
7	1/2 inch exterior or interior gypsum board
8	1/2 inch cement board
9	Built up roofing membrane
10	Modified bituminous roof membrane
11	Fully adhered single-ply roof membrane
12	5/8 inch Portland cement/sand parge, or gypsum plaster
13	Cast-in-place and precast concrete.
14	Fully grouted concrete block masonry.
15	Sheet steel or aluminum.

Air Barrier Penetrations C402.4.2

- Penetrations of air barrier and air leakage paths to be caulked, gasketed, or otherwise sealed
- Joints and seals
  - Sealed in same manner or taped or covered with a moisture vapor-permeable wrapping material
  - Securely installed in or on the joint for the entire length
    - To resist positive and negative pressure from wind, stack effect and mechanical ventilation
  - Sealing materials appropriate to construction materials

Air Barrier Building Test *C402.4.1.2.3*

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 (75 Pa).

Source: Energy Conservatory

Source: Retrotec

Air Leakage of Fenestration C402.4.3

Fenestration Assembly	cfm/ft^2	Test Procedure
Windows, sliding glass doors, and swinging doors	0.20	AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400
Skylights - with condensation weepage openings	0.30	
Skylights – all other	0.20	
Curtain walls and storefront glazing	0.06	NFRC 400 or ASTM E283 at 1.57 psf
Commercial glazed swinging entrance doors	1.00	
Revolving doors	1.00	
Garage doors	0.4	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf
Rolling doors	1.00	

Exceptions

– Field-fabricated fenestration assemblies

– Fenestration in buildings that meet the building test for air barrier compliance option

Mandatory Requirements C402.4.5.1
Stairway and Shaft Vents

- To have Class I motorized dampers with maximum leakage rate of 4 cfm/ft^2 at 1.0 inch water gauge
- Dampers to be installed with controls to be able to open automatically upon
  - Activation of any fire alarm initiating device of building's fire alarm system or
  - Interruption of power to the damper

Mandatory Requirements C402.4.5.2

IECC Change

Outdoor Air Intakes and Exhausts

Buildings ≥ 3 stories in height above grade

Class IA motorized leakage-rated damper

- Maximum leakage rate ≤ 4cfm /ft^2 @ 1.0 inch w.g.

Buildings < 3 stories in height

- Gravity (nonmotorized) with maximum leakage rate of 20 cfm/ft^2 at 1.0 inch water gauge allowed
  - For exhaust and relief dampers
  - Where design outdoor air intake or exhaust capacity is < 300 cfm
- Dampers < 24 inches in either dimension may have a leakage of 40 cfm/ft2 at 1.0 inch water gauge

Mandatory Requirements C402.4.7 Vestibules

IECC Change

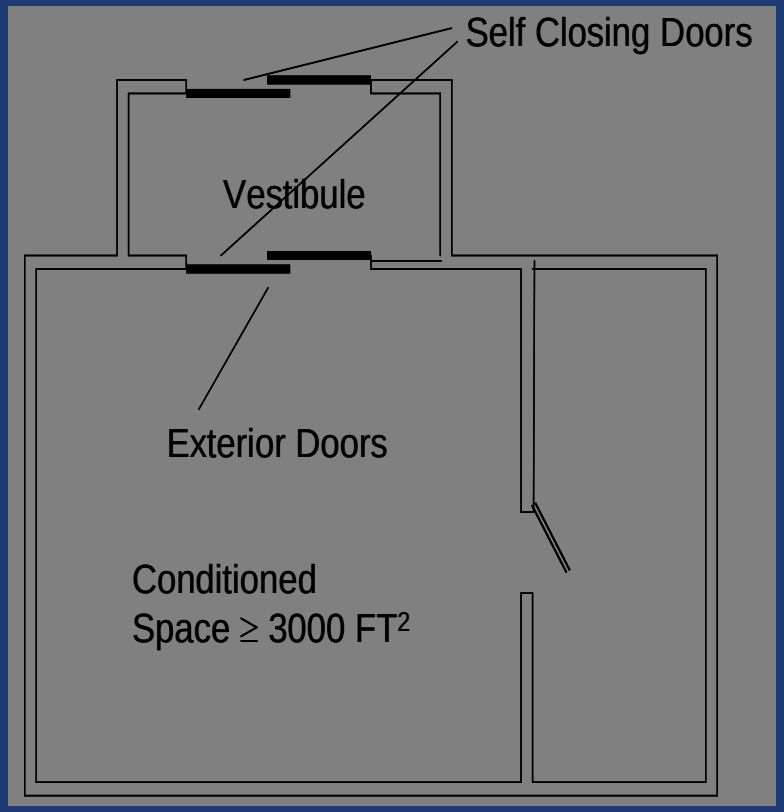
Required to reduce infiltration into spaces

Required on entrance doors leading into spaces ≥ 3,000 ft^2

Doors must have self-closing devices

Exceptions

- **Doors from a sleeping unit or dwelling unit**
- **Revolving doors**
- **Doors not intended for public use or intended solely for employee use**



Mandatory Requirements C402.4.8 Recessed Lighting

All recessed luminaires installed in the building envelope

Type IC rated and sealed with gasket or caulk between housing and interior wall or ceiling covering

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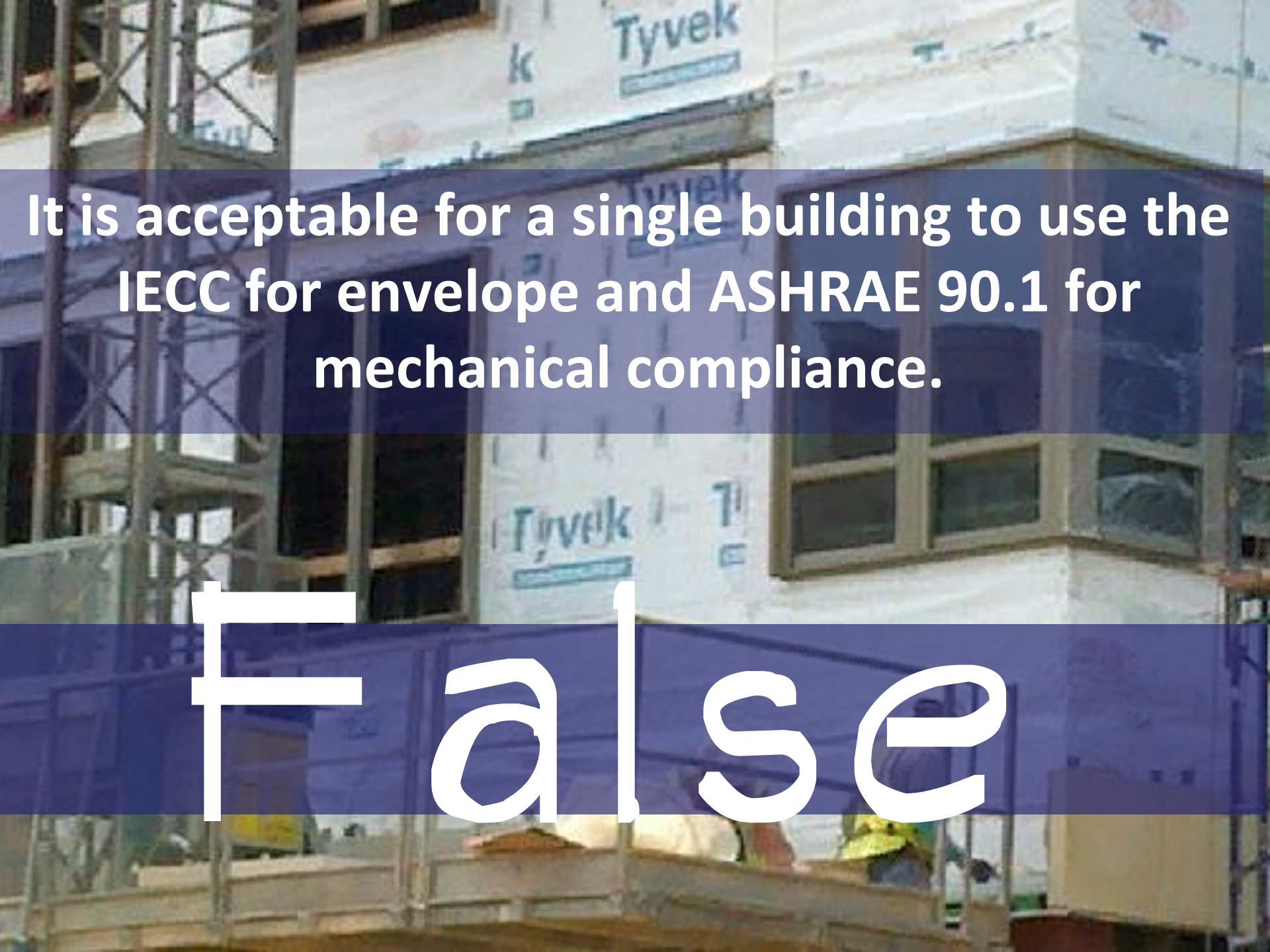
Type IC rated and labeled in accordance with ASTM E 283 to allow ≤ 2.0 cfm of air movement between conditioned and unconditioned spaces


It is acceptable for a single building to use the IECC for envelope and ASHRAE 90.1 for mechanical compliance.
T/F



It is acceptable for a single building to use the IECC for envelope and ASHRAE 90.1 for mechanical compliance.

False

Mechanical Systems

Minimum Equipment Efficiencies

- New equipment types have been added.
- Minimum efficiencies have been changed.
- Size categories have been changed.

TABLE C403.2.3(1) UNITARY AIR CONDITIONERS & CONDENSING UNITS

"Heating Section Type"
New Column
Differentiates Electric Resistance From Other Heating Types

"Electric Resistance"

"All Other"

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE				URE[a]
Air conditioners, air cooled	< 65,000 Btu/h[b]	All				
Through-the-wall (air cooled)	≤ 30,000 Btu/h[b]	All				
Small-duct high-velocity (air cooled)	< 65,000 Btu/h[b]	All				
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)				
		All other				
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)				
		All other	Package	11.0 IEER	11.0 IEER	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Pac	10.0 EER	10.0 EER	
		All other	Split Syster Pac			
	≥ 760,000 Btu/h	Electric Resistance (None)	Split Syster Package	9.8 IEER	9.8 IEER	
		All other	Pac			
Air conditioners, water cooled	< 65,000 Btu/h[b]	All	Split Syster Pac			
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split Syste Package	11.7 IEER	12.3 IEER	
		All other	Split System and Single Package	11.3 EER 11.5 IEER	11.9 EER 12.1 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	12.5 EER 12.7 IEER	
		All other	Split System and Single Package	10.8 EER 11.0 IEER	12.3 EER 12.5 IEER	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.1 IEER	12.4 EER 12.6 IEER	
		All other	Split System and Single Package	10.8 EER 10.9 IEER	12.2 EER 12.4 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.1 IEER	12.0 EER 12.4 IEER	
		All other	Split System and Single Package	10.8 EER 10.9 IEER	12.0 EER 12.2 IEER	

TABLE C403.2.3(1) UNITARY AIR CONDITIONERS & CONDENSING UNITS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 6/1/2011	As of 6/1/2011	
Air conditioners, air cooled	< 65,000 Btu/h[b]	All	Split System	13.0 SEER	13.0 SEER	AHRI 210/240
				13.0 SEER	13.0 SEER	
Through-the-wall (air cooled)	≤ 30,000 Btu/h[b]			12.0 SEER	12.0 SEER	
				12.0 SEER	12.0 SEER	
Small-duct high-velocity (air cooled)	< 65,000 Btu/h[b]			10.0 SEER	10.0 SEER	
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Elec		11.2 EER 11.4 IEER	11.2 EER 11.4 IEER	AHRI 340/360
				11.0 EER 11.2 IEER	11.0 EER 11.2 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Elec		11.0 EER 11.2 IEER	11.0 EER 11.2 IEER	
				10.8 EER 11.0 IEER	10.8 EER 11.0 IEER	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Elec		10.0 EER 10.1 IEER	10.0 EER 10.1 IEER	
				9.8 EER 9.9 IEER	9.8 EER 9.9 IEER	
	≥ 760,000 Btu/h	Elec	None	Package	9.7 EER 9.8 IEER	9.7 EER 9.8 IEER
					9.5 EER 9.6 IEER	9.5 EER 9.6 IEER
Air conditioners, water cooled	< 65,000 Btu/h[b]			12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Elec		11.5 EER 11.7 IEER	12.1 EER 12.3 IEER	AHRI 340/360
				11.3 EER 11.5 IEER	11.9 EER 12.1 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Elec		11.0 EER 11.2 IEER	12.5 EER 12.7 IEER	
				10.8 EER 11.0 IEER	12.3 EER 12.5 IEER	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Elec		11.0 EER 11.1 IEER	12.4 EER 12.6 IEER	
				10.8 EER 10.9 IEER	12.2 EER 12.4 IEER	
	≥ 760,000 Btu/h	Elec		11.0 EER 11.1 IEER	12.0 EER 12.4 IEER	
			Package	10.8 EER 10.9 IEER	12.0 EER 12.2 IEER	

Integrated Energy Efficiency Ratio (IEER) has been added

Integrated Part-Load Values no longer included

Table C403.2.3(2) UNITARY AND APPLIED HEAT PUMPS

Higher SEER Ratings for Through-the-Wall Units

Added IEER Values

New Heating Rating for Small-Duct High-Velocity Heat Pumps (air-cooled) – 6.8 HSPF

TABLE C403.2.3(2) MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (cooling mode)			Split System	.0 SEER	AHRI2 10/240
			Single Packaged	0 SEER	
Through-the-wall, air cooled			Split System	13.0 SEER	
			Packaged	13.0 SEER	
Single-duct high-velocity air cooled			Split System	10.0 SEER	
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	
				10.6 EER 10.7 IEER	
				10.4 EER 10.5 IEER	
				9.5 EER 9.6 IEER	
				9.3 EER 9.4 IEER	
Water source (cooling mode)				11.2 EER	ISO 13256-1
				12.0 EER	
				12.0 EER	
Ground water source (cooling mode)	< 135,000 Btu/h	All	59°F entering water	16.2 EER	
		All	77°F entering water	13.4 EER	
Water-source water to water (cooling mode)	< 135,000 Btu/h	All	86°F entering water	10.6 EER	ISO 13256-2
			59°F entering water	16.3 EER	
Ground water source Brine to water (cooling mode)	< 135,000 Btu/h	All	77°F entering fluid	12.1 EER	
Air cooled (heating mode)	< 65,000 Btu/h[b]	—	Split System	7.7 HSPF	AHRI 210/240
		—	Single Package	7.7 HSPF	
Through-the-wall, (air cooled, heating mode)	≥ 30,000 Btu/h[b] (cooling capacity)	—	Split System	7.4 HSPF	
		—	Single Package	7.4 HSPF	
Small-duct high velocity (air cooled, heating mode)	< 65,000 Btu/h[b]	—	Split System	6.8 HSPF	

Table C403.2.3(2) UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUB-CATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
			°F wb Air	3.3 COP	AHRI 340/360
			°F wb Air	2.25 COP	
			°F wb Air	3.2 COP	
	(cooling capacity)		17°F db/15°F wb Outdoor Air	2.05 COP	
Water source (heating mode)	< 135,000 Btu/h (cooling capacity)	—	68°F entering water	4.2 COP	
Ground water source (heating mode)	< 135,000 Btu/h (cooling capacity)	—	50°F entering water		
Ground source (heating mode)	< 135,000 Btu/h (cooling capacity)	—	32°F entering fluid		
Water-source water to water (heating mode)	< 135,000 Btu/h (cooling capacity)	—	68°F entering water		
		—	50°F entering water		
Ground source brine to water (heating mode)	< 135,000 Btu/h (cooling capacity)	—	32°F entering fluid	2.5 COP	

Replaced HSPF Factor for Heat Pumps in Heating Mode with COP Values

Added New Categories for Water Source (water to water) and Ground Source (brine to water) Heat Pumps

Table C403.2.3(3) PTACs, PACKAGED TERMINAL HEAT PUMPS, ETC.

Higher EER Values for PTAC and PTHP Units

Added New Categories and Ratings for SPVAC and SPVHP Units

Added Categories and Ratings for Room Air Conditioners

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
			Before 10/08/2012	As of 10/08/2012	
PTAC (cooling mode) new construction			5 - (0.213 × Cap/1000) EER	8 - (0.300 × Cap/1000) EER	AHRI 310/380
PTAC (cooling mode) replacements			9 - (0.213 × Cap/1000) EER	10.9 - (0.213 × Cap/1000) EER	
PTHP (cooling mode) new construction	All Capacities	95°F db outdoor air	3 - (0.213 × Cap/1000) EER	14.0 - (0.300 × Cap/1000) EER	
PTHP (cooling mode) replacements[b]	All Capacities	95°F db outdoor air	10.8 - (0.213 × Cap/1000) EER	10.8 - (0.213 × Cap/1000) EER	
PTHP (heating mode) new construction	All Capacities	—	3.2 - (0.26 × Cap/1000) COP	3.2 - (0.26 × Cap/1000) COP	
PTH			/1000)	2.9 - (0.26 × Cap/1000) COP	
				9.0 EER	AHRI 390
				8.9 EER	
				8.6 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	outdoor air		9.0 EER	
	≥65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	8.9 EER	8.9 EER	
				8.6 EER	
				3.0 COP	AHRI 390
(heating mode)				3.0 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/ 75°F wb outdoor air	2.9 COP	2.9 COP	

TABLE C403.2.3(8) HEAT REJECTION EQUIPMENT

EQUIPMENT TYPE[a]	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED[b, c, d]	TEST PROCEDURE[e, f]
Propeller or axial fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥ 38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan open circuit cooling towers	All	95°F Entering Water [illegible] wb	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or axial fan closed circuit cooling towers	All	[illegible] Water 90°F Leaving Water 75°F Entering wb	≥ 14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal closed circuit cooling towers	All	102°F Entering Water 90°F Leaving Water [illegible] wb	≥ 7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Air-cooled condensers	All	[illegible] 15°F Subcooling 95°F Entering db	≥ 176,000 Btu/h•hp	ARI 460

New Tables!

TABLE C403.2.3(9) HEAT TRANSFER EQUIPMENT

EQUIPMENT TYPE	SUBCATEGORY	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Liquid-to-liquid heat exchangers	Plate type	NR	AHRI 400

Off-Hours Controls Exemption

Exempts:
Zones with full HVAC load demand < 6,800 Btu/h.

Zones that operate continuously.

(Ref C403.2.4.3)

Exempts:
Spaces with a design heating capacity and cooling capacity of < 15,000 Btu/h.

Zones that operate continuously.

(Ref 6.4.3.3)

Off-Hour Controls C403.2.4.3 Mandatory

1. Thermostatic Setback (55° to 85°)
2. Automatic Setback and Shutdown – Auto timeclock or programmable controls with daily scheduling capabilities
3. Automatic Start Capabilities (Added)

Automatic Start Capabilities C403.2.4.3.3 Mandatory

Automatic start controls for each HVAC system

Capable of automatically adjusting daily start time to bring each space to desired occupied temperature immediately prior to scheduled occupancy

Off-Hour Controls

Setback: 7-day time clock or programmable controls with optimum start (called "automatic start" in IECC).	Setback: 7-day time clock, programmable control, or occupancy sensor with optimum start.
No minimum cfm capacity for optimum start.	Optimum start if system is > 10,000 cfm.
(Ref C403.2.4)	**(Ref 6.4.3)**

Shutoff Damper Controls

Gravity dampers allowed in any building less than 3 stories.

(Ref C403.2.4.4)

Gravity dampers not allowed.

(Ref 6.4.3.4.2)

Demand Control Ventilation

Required for spaces > 500 ft^2 and with occupant load ≥ 25 people/1,000 ft^2.

(Ref C403.2.5.1)

Required for occupant load ≥ 40 people/1,000 ft^2.

(Ref 6.4.3.9)

Energy Recovery Ventilation Systems C403.2.6

Mandatory

Applies to fan systems with supply airflow rates > values in Table C403.2.6

TABLE C403.2.6 ENERGY RECOVERY REQUIREMENT

	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)					
Climate Zone 6B	≥ 11000	≥ 5500	≥ 4500	≥ 3500	≥ 2500	≥ 1500

Replaces a single fixed trigger point of 5,000 cfm and 70% outside air.

Duct and Plenum Insulation

R-6 in unconditioned spaces. R-8 outside the building.

(Ref C403.2.7)

Same as IECC for combined heating and cooling supply and return ducts. Reduced values for heating-only and cooling-only ducts.

(Ref 6.4.4.1.2)

High-Pressure (Static > 3 in. w.c.) Duct Leakage

Air leakage maximum allowed is 6 cfm/100 ft^2.

(Ref C403.2.7.1.3)

Air leakage maximum allowed is 4 cfm/100 ft^2.

(Ref 6.4.4.2.2)

Heating Outside a Building

Radiant system controlled by occupancy sensor or timer switch.

(Ref C403.2.11)

"Heating unenclosed spaces". No controls requirement.

(Ref 6.5.8.1)

Simple Systems (IECC) & Simplified Approach (90.1)

Difficult to do a side-by-side comparison.

Applicable to single zone systems only.

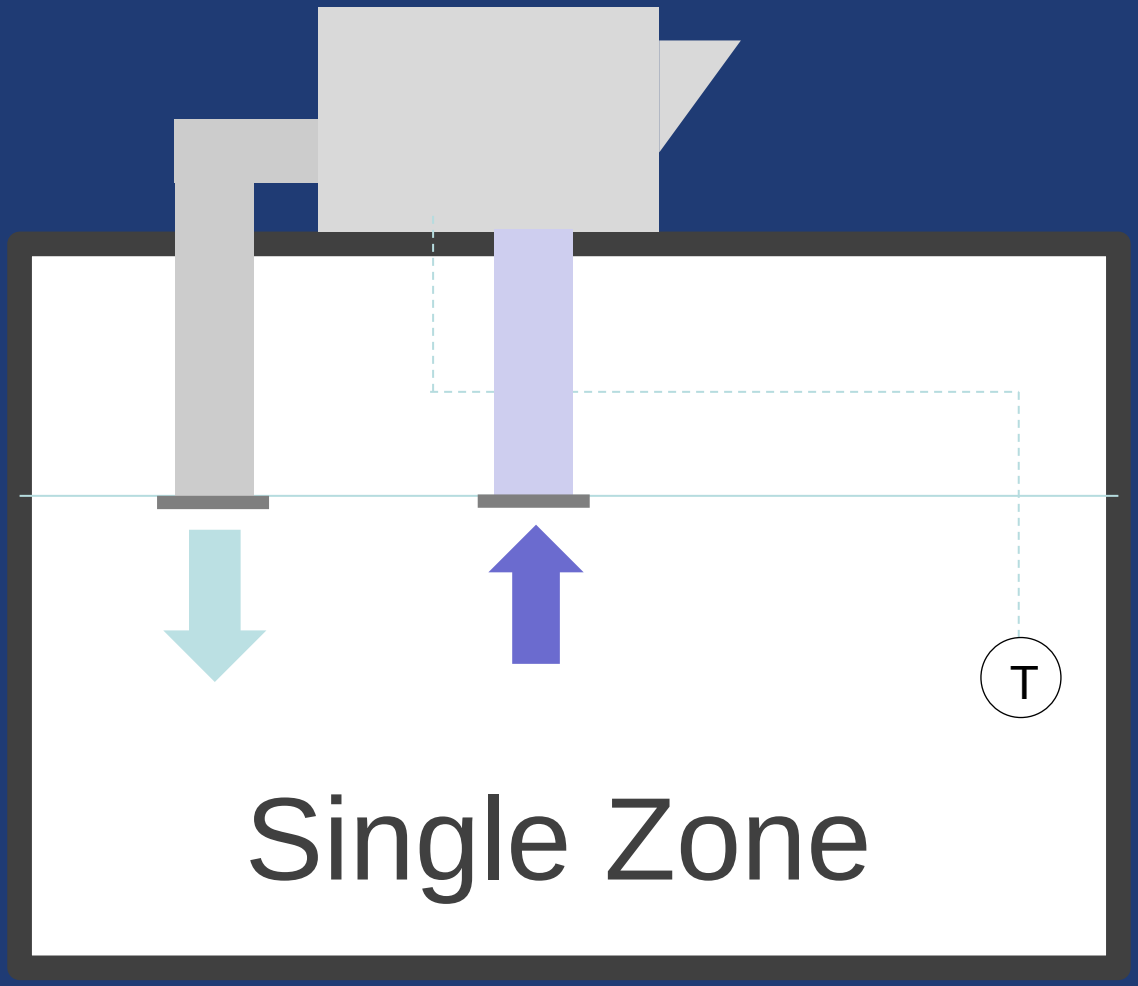
(Ref C403.3)

Simplified Approach Option Section 6.3 same systems.

The building must be < 3 stories and floor area must be < 25,000 ft2.

(Ref 6.3)

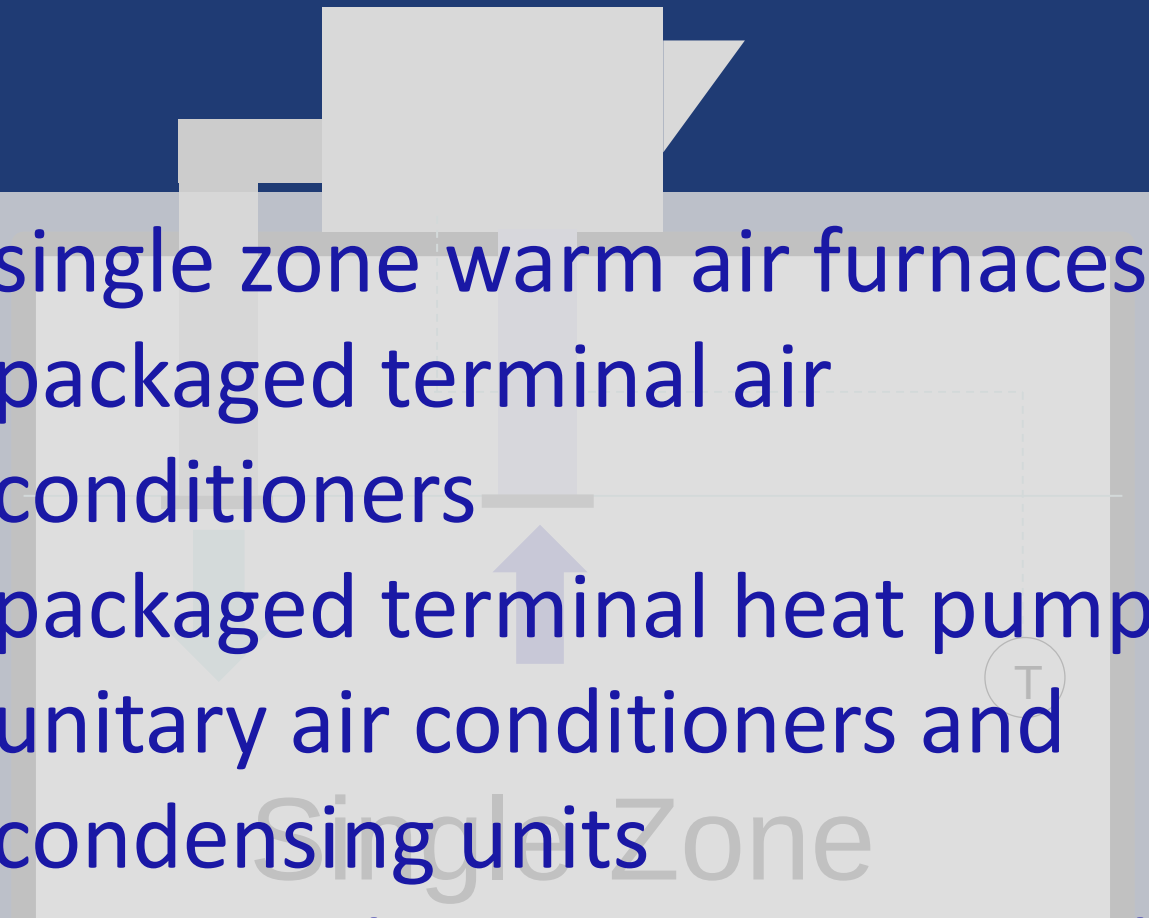
Simple HVAC Systems C403.3



All systems that do not qualify as simple HVAC systems fall under the complex system requirements.

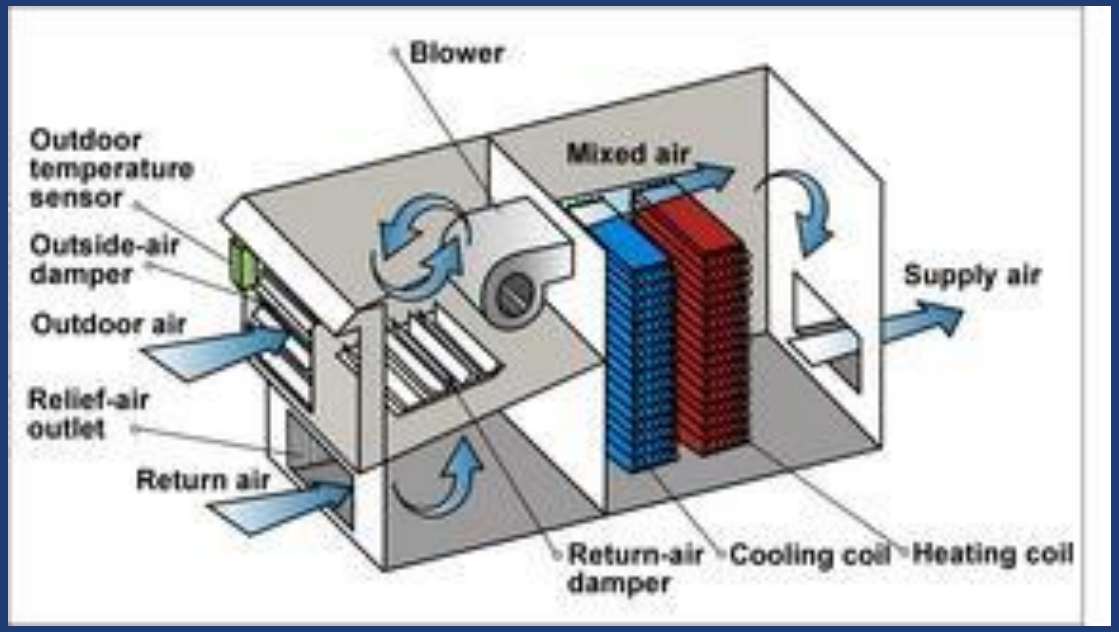
Simple HVAC Systems C403.3

- single zone warm air furnaces
- packaged terminal air conditioners
- packaged terminal heat pumps
- unitary air conditioners and condensing units
- two-pipe heating systems with no cooling



Simple HVAC Systems & Equipment C403.3

- Must include economizers Climate Zone 6
- Capable of providing 100-percent outdoor air even if additional mechanical cooling is required *(integrated economizer)*



Economizer Size Threshold

Required for systems ≥ 33,000 Btu/h.

(Ref C403.3.1)

Required for systems ≥ 54,000 Btu/h.

(Ref 6.5.1 & Table 6.3.2)

Economizer Size Threshold

Not required on systems that operate less than 20 h /wk.

(Ref C403.3.1)

Not required on systems that operate < 20 h/wk.

Not required in residential spaces where system capacity is < 270,000 Btu/h.

Not required if cooling efficiency exceeds 65%.

(Ref 6.5.1 and Table 6.3.2)

Simple HVAC System Economizers C403.3

TABLE C403.3.1(1) ECONOMIZER REQUIREMENTS	
	ECONOMIZER REQUIREMENT
Climate Zone 6	**Economizers on all cooling systems ≥ 33,000 Btu/h[a]**

[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.

Simple Systems High-Limit Shutoff

- **Air economizers to be capable of automatically reducing outdoor air intake to design minimum outdoor air quantity when outdoor air intake will no longer reduce cooling energy usage**
- **High-limit shutoff control types to be chosen from Table C403.3.1.1.3(1) for specific climates**

TABLE C403.3.1.1.3(1) HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
Climate Zone 6B	Fixed dry bulb	Fixed enthalpy
	Differential dry bulb	
	Electronic enthalpy[a]	
	Differential enthalpy	
	Dew-point and dry-bulb temperatures	

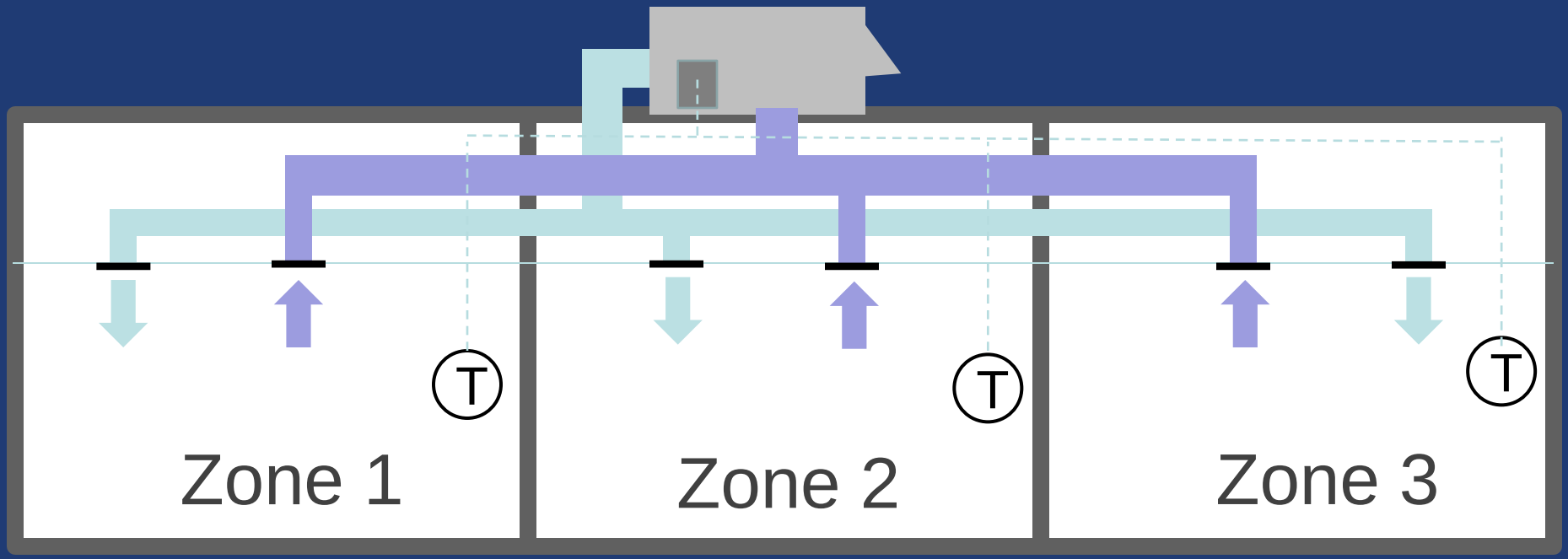
Simple System Air Economizers

C403.3.1.1.4 Relief of Excess Outdoor Air

- **Systems to be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building**
- **Relief air outlet to be located to avoid recirculation into the building**

Complex HVAC Systems C403.4

Examples: VAV systems, systems serving more than one zone, 4-Pipe Systems.



Source: NCAT

All systems that do not qualify as simple HVAC systems fall under the complex system requirements.

Complex System Economizers

Design Capacity C403.4.1.1

Water Economizer Systems

Must be capable of providing up to 100% of the cooling system load at OD temp of 50°F dry bulb/45°F wet bulb and below

Exception:

Water economizer systems where dehumidification requirements can't be met at 50°F dry bulb/45°F wet bulb shall satisfy 100% of expected cooling load at 45°F dry bulb/40°F wet bulb

Complex System (Water) Economizer Design

No computer room exceptions.

(Ref C403.4.1)

Exceptions for computer rooms.

(Ref 6.5.1.2.1)

Integrated Economizer Control

Capable of providing partial cooling even when additional mechanical cooling is required

Exception Individual DX Units < 54,000 Btu/h

(Ref C403.4.1)

Removes all exceptions (including climate zone exceptions) from the requirement for integrated economizer control.

(Ref 6.5.1.3)

System Variable Air Volume Fan Control

Individual VAV fans with motors ≥ 7.5 hp must be:

- Driven by a mechanical or electrical variable speed drive

OR

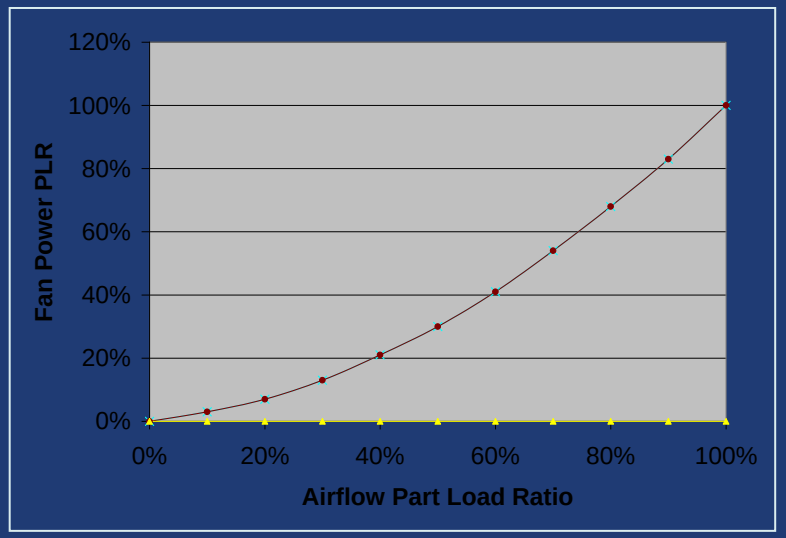
- Driven by a vane-axial fan with variable-pitch blades

OR

- Have controls or devices to result in fan motor demand ≤ 30% of their design wattage at 50% of design airflow

(Ref C403.4.2)

> 10 hp must have variable speed control.



(Ref 6.5.3.2.1)

Static Pressure Sensor Location C403.4.2.1

Sensors used to control VAV fans

- **Placed so that the controller setpoint is ≤ 1/3 the total design fan static pressure**
  - Exception: systems with zone reset control complying with C403.4.2.2

Sensors installed downstream of major duct splits

- **At least one sensor to be located on each major branch so that static pressure can be maintained in each branch**

Zone Isolation Controls

The IECCC has no similar provisions.

Detailed provisions regarding how a multi-zone systems must isolate zones that are occupied nonsimultaneously.

(Ref 6.4.3.3.4)

Enclosed Parking Garage Ventilation 6.4.3.4.5

90.1 CHANGE

- Allows for reduction in ventilation in uncontaminated garages.
- Requires automatic control capable of staging fans or modulating fan volume required to maintain the contaminant, carbon monoxide below ASHRAE 62.2 levels.
- Garage must comply with 6.4.4.3.1 for shutting off or reducing fan volume when garage is not in use.

Single-Zone VAV Controls 6.4.3.10

90.1 CHANGE

Adds requirement for variable fan speed controls to single zone units

For both chilled water and DX units

Can be met by Electronically Commutated Motors (ECM) , 2-speed motors, or variable speed drives

Duct Sealing 6.4.4.2.1

Requires Class A duct sealing on all ductwork.

Class A duct sealing was added to definitions:

Seal Class A: Seal all transverse (perpendicular) joints, longitudinal (parallel) seams, and duct wall penetrations

US DOE Building Codes University

Economizer Table 6.5.1 A & B

90.1 CHANGE

Requires economizers:

- All fan-cooling units ≥ 54,000 Btu/h supply capacity.
- All Computer Room fan-cooling units ≥ 65,000 Btu/h supply capacity

Water Economizer 6.5.1.2

- Computer Room Requirement – capable of 100% of cooling at 40° DB/55°WB

General Requirement – capable of 100% of cooling load at 50° DB/45°WB

- Added design conditions for dry cooler (If cooling towers not used)

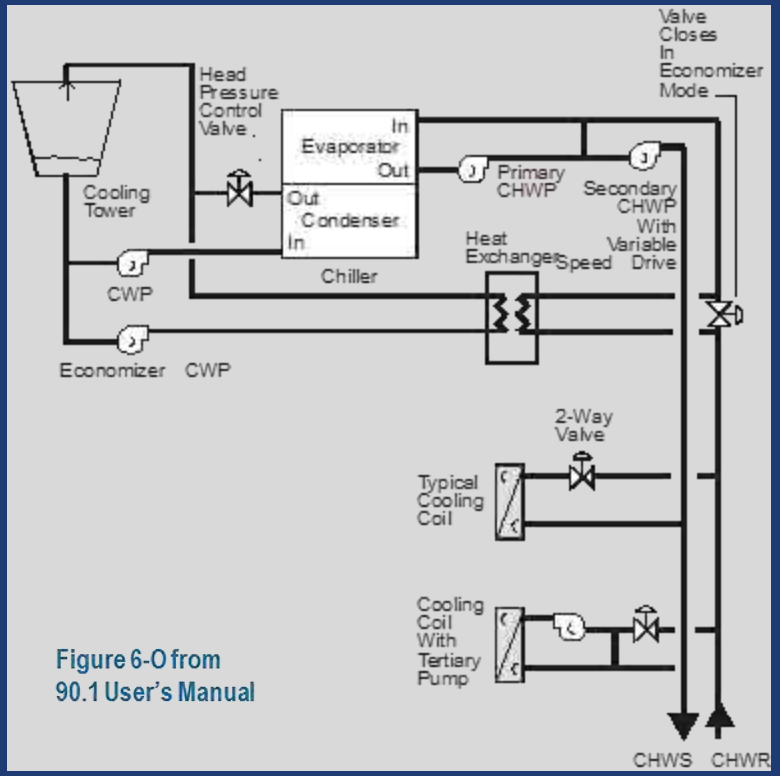


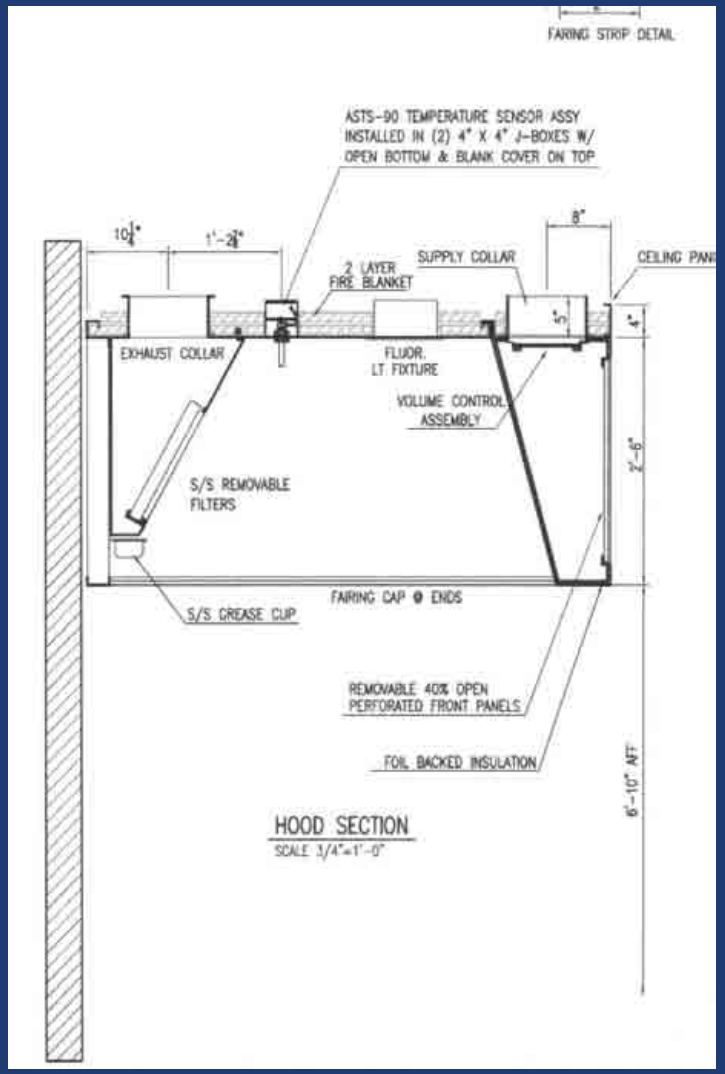
Figure 6-O from 90.1 User's Manual

Kitchen Exhaust Systems 6.5.7.1

90.1 CHANGE

Eliminates the use of short circuit kitchen hoods. Table added for maximum flow rate based on the hood length and type of equipment served.

Exempt:
Exhaust hoods ≤ 5,000 cfm.



Service Water Heating

Pool Covers

Vapor-retardant cover for heated pools and in-ground, permanently installed spas.

(Ref C404.7.3)

Insulated pool cover (≥ R-12) for pools heated to greater than 90°F.

(Ref 7.4.5.2)

Pool Covers

Exception: Systems with 70% of energy from site-recovery or solar energy.

(Ref C404.7.3)

Exception: Systems with 60% of energy from site-recovery or solar energy.

(Ref 7.4.5.2)

Lighting and Power Systems

Alterations

Replace < 50% of luminaires in space exempt.

(Ref C401.4.3)

Replace < 10% of luminaires in space exempt.

(Ref 9.1.2)

Dwelling Units

Similar to residential IECC provisions, requires 75% of fixtures to be high-efficacy lamps, excluding low-voltage lighting.

(Ref C405.1)

Lighting within dwelling units is exempted.

(Ref 9.1.1)

General Exception for Dwelling Units C405.1

75% High Efficacy Lamps in Permanently Installed Fixtures

High Efficacy Lamps

1. Compact Fluorescent Lamps (CFL)
2. T-8 or small Diameter Linear Fluorescent Lamps
3. Lamps that meet the minimum lumens/watt

Low-wattage do not count.

Automatic Receptacle Controls

90.1 CHANGE

No similar requirements.

At least 50% of all 125v 15 and 20 amp receptacles in private offices, open offices, and computer classrooms to be controlled by automatic controls (time=of-day, occupancy sensor, or other)
(Ref 8.4.2)

Lighting Controls Overview C405

"The Requirements Multiple Layer Cake"

Interior Lighting Power Density

Building Area Method **OR** Space-By-Space Method*

Manual Lighting Controls

Interior Manual Controls **AND** Light Reduction Controls*

+

Additional Lighting Controls

Automatic Time Switch* **OR** Occupancy Sensors*

+

Daylight Zone Controls

Manual * **OR** Automatic *

+

Specific Application Controls *

*Indicates Change from previous code.

Interior Controls – General Exemptions

Emergency, security, and stair/corridor egress lighting.

(Ref C405.2.1.1)

Emergency lighting that is automatically off during normal building operation, lighting required for life safety.

(Ref 9.1.1)

Interior Controls – Readily Accessible Control Device

Automatic Control Required

Readily accessible control device (may be an override switch) in each space.

(Ref C405.2.1.1)

Automatic Control Required

Readily accessible override switch in each space.

Maximum control zone is 2,500 ft^2 for spaces ≤ 10,000 $ft^2$and 10,000 ft^2 for spaces > 10,000 ft^2.

(Ref 9.4.1.2c)

Interior Controls – Lighting Power Reduction

Area reduction by at least 50% (in addition to all-off).

Exceptions:

- Areas with 1 fixture <100w
- Areas with occupancy sensors
- Corridors, equipment rooms, storerooms, restrooms, public lobbies, electrical/mechanical rooms
- Sleeping units
- Spaces with < 0.6 w/sf
- Daylight areas with automatic controls

(Ref C405.2.1.2)

Area reduction 30% - 70% (in addition to all-off). Similar exceptions apply.

(Ref 9.4.1.2c)

Interior Controls – Automatic Control (Lighting Shutoff)

Areas must have automatic lighting control (time schedule or occupant sensing off within 30 minutes).

Exempt:

- Direct patient-care spaces
  - If occupant safety endangered
  - Continuous operation

(Ref C405.2.2)

Areas must have automatic lighting control (either time schedule [≤ 2,500 ft^2/control zone] or occupant sensing off within 30 minutes).

Exempt:

- Same as IECC plus……
- Multi-scene control systems
- Shop & laboratory classrooms

(Ref 9.4.2b)

Interior Controls – Lighting On

Manual or to ≤ 50% by an occupant sensor. May go to full-on:

- Public corridors
- Stairways
- Restrooms
- Primary entrance areas
- Safety or security endangered

(Ref C405.2.2.2)

Same as IECC

(Ref 9.4.1.2c)

Interior Controls – Occupancy Sensors or Timer Switches Required

Occupancy sensors within 30 minutes in:	Occupancy sensors or timer switches in 30 min.:
Classrooms	Same
Conference/meeting rooms	Same
Employee lunch/break	Same
Private office	Not Included
Restrooms	Same
Storage room	Storage/Supply Rooms between 50 ft^2 & 1,000 ft^2
Janitorial closets	Not Included
Other rooms ≤ 300 ft^2	Other rooms ≤ 250 ft^2
Not Included	Dressing, locker, fitting rooms
Not Included	Document Copying and Printing
(Ref C405.2.2.2)	(Ref 9.4.1.2b)

Interior Controls – Independent Special Applications

Dedicated independent controls required for:

- Display and accent lighting
- Display case lighting
- Nonvisual applications (i.e., plant growth and food warming)
- Lighting equipment for sale or demonstration in lighting education
- Supplemental task lighting, permanently installed under-shelf or under-cabinet lighting

(Ref C405.2.3)

90.1 similar.

(Ref 9.4.1.6)

Interior Controls – Guest Room Lighting

Master control at main room entry (permanently installed fixtures and all switched receptacles).

(Ref C405.2.3)

Master control device at main room entry (permanently installed fixtures and all switched receptacles)
Also requires bathroom occupancy sensor to turns lights off within 60 minutes.

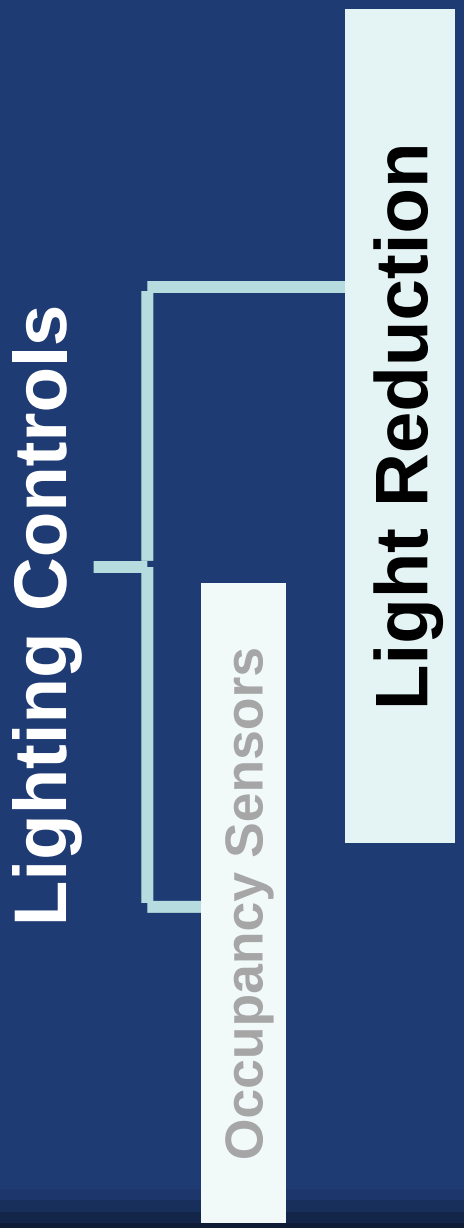
(Ref 9.4.1.6)

Lighting Controls

Exceptions:
Emergency & Security Areas
Stair and Corridor Egress Lighting

Lighting Controls

Lighting Controls

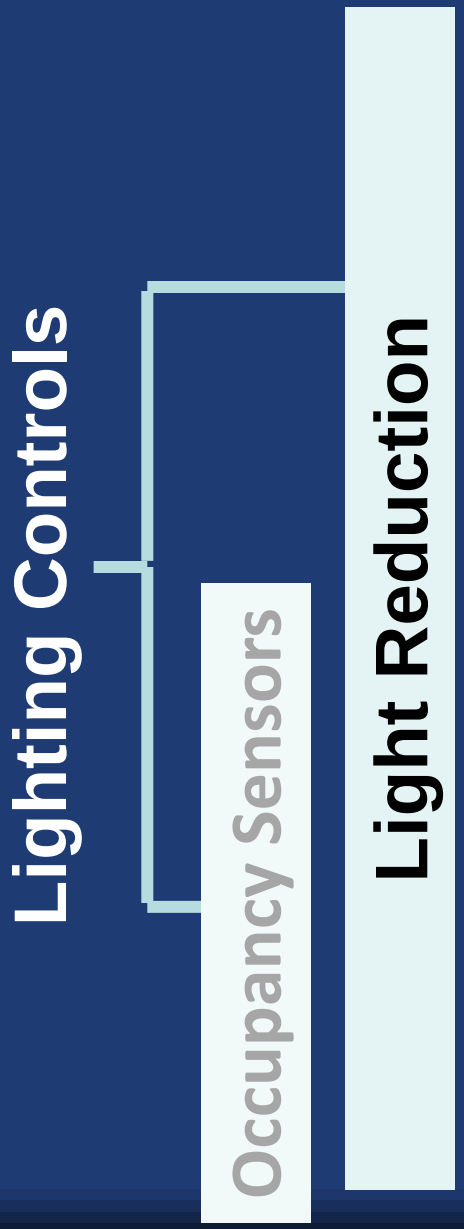


Minimum 50% Reduction

Approved Methods:

- *Control lamps or fixtures*
- *Dual switching*
- *Middle lamp independent switched*
- *Switch each fixture*

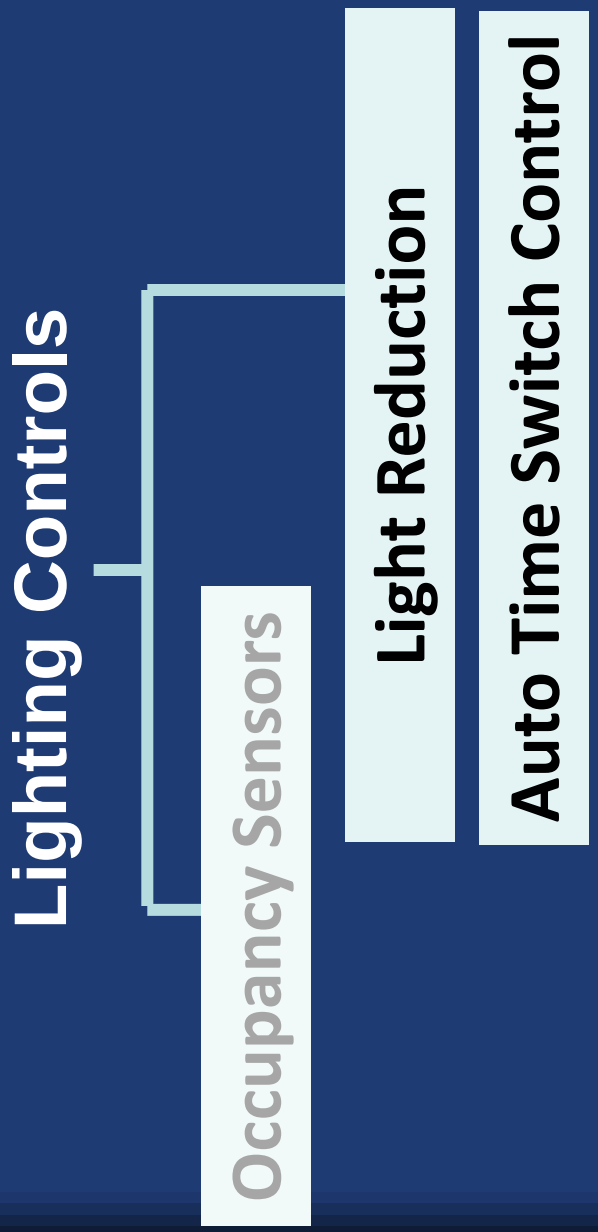
Lighting Controls



Need not be provided:

- Areas 1 fixture <100w
- Corridors, equipment rooms, storerooms, restrooms, public lobbies, electrical/mech rooms
- Sleeping unit
- Spaces with < 0.6 w/sf
- Daylight areas with auto controls

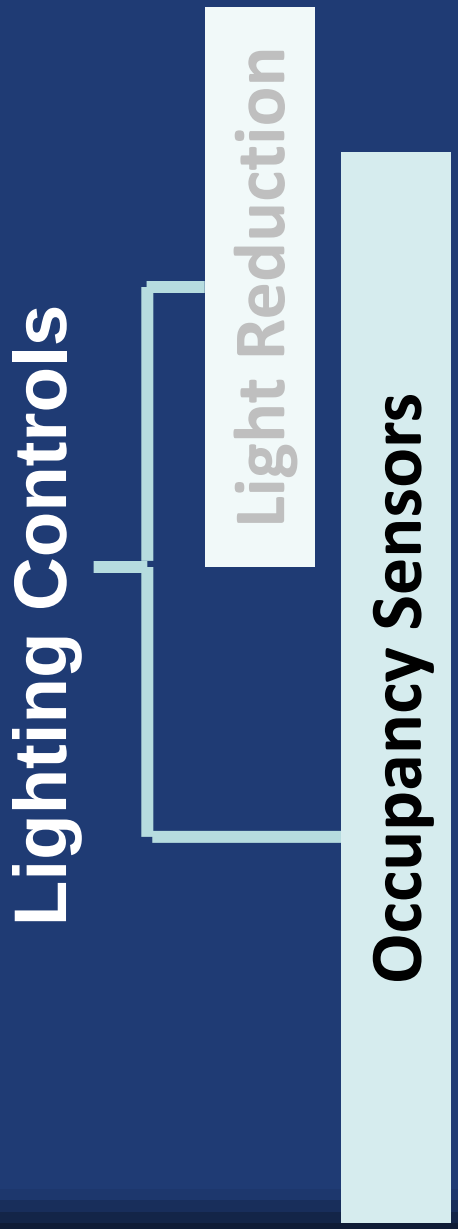
Lighting Controls



Exceptions

- *Sleeping Units*
- *Direct patient care spaces*
- *Occupant safety endangered*
- *Continuous operation*
- *Emergency egress*
- *Removed Buildings >5,000 SF*

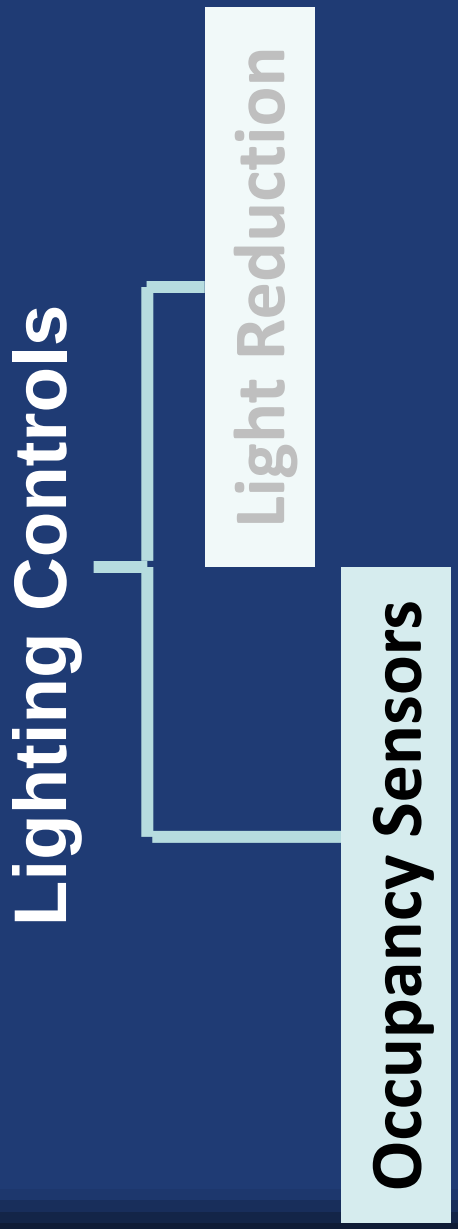
Lighting Controls



Required in:

- *Classrooms*
- *Conference/meeting rooms*
- *Employee lunch/break*
- *Private offices*
- *Restrooms*
- *Storage Rooms*
- *Janitorial closets*
- *Other rooms <=300 SF Spaces*

Lighting Controls



Not required:

- Direct patient care spaces
- If occupant safety endangered
- Continuous operation
- Emergency egress

Lighting Controls

Lighting Controls

- Light Reduction
- **Occupancy Sensors**

Installation:

Turn off within 30 min

Manual on or auto to <50%

"Full on" ok in:

- *Public corridors*
- *Stairways*
- *Restrooms*
- *Primary entrance areas*
- *Safety or security endangered*

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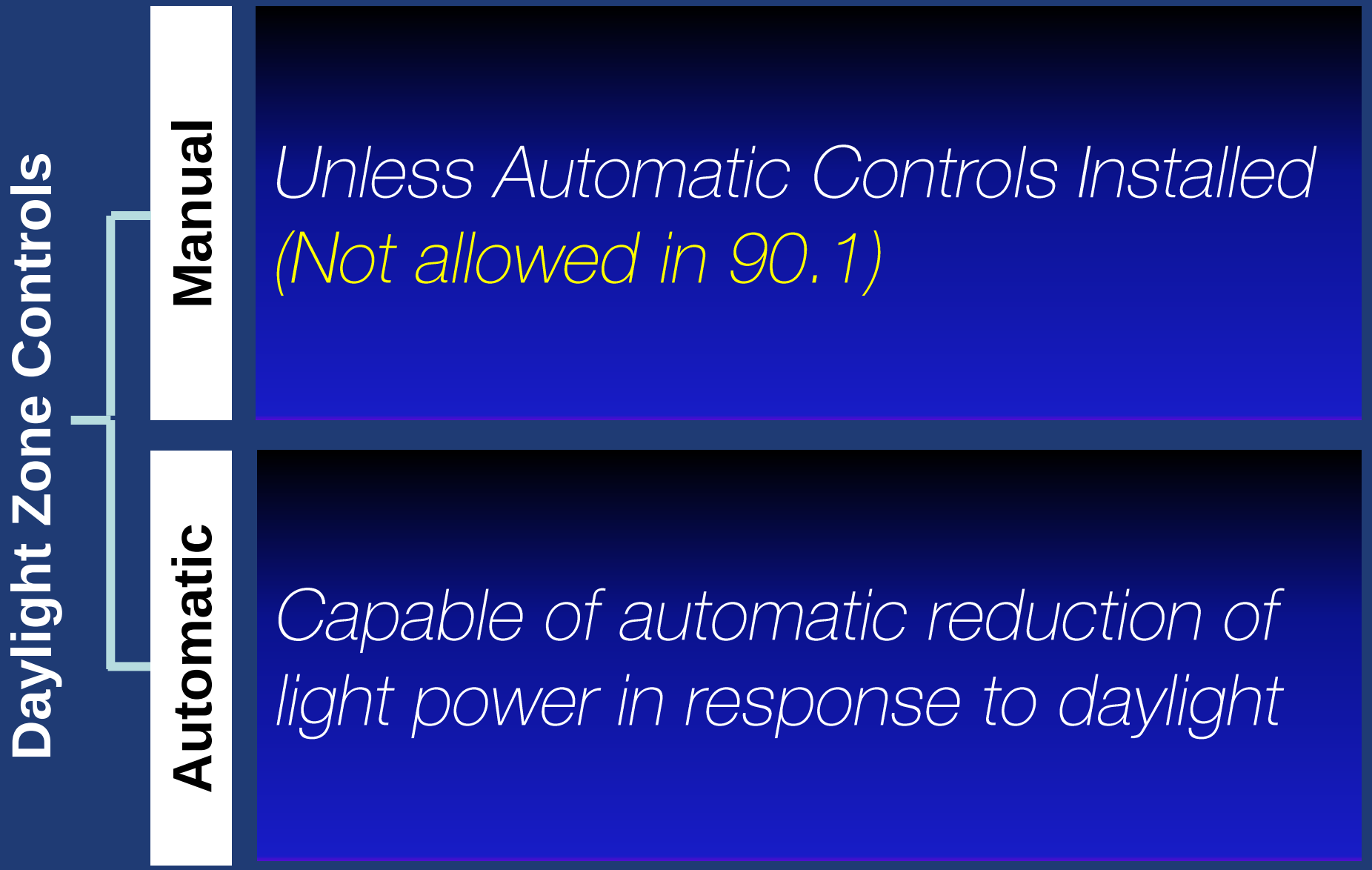
Daylight Zone Controls

Independent of General Lighting

- Control Zone <= 2,500 SF
- Adjacent to vertical fenestration contiguous zones use one control devise (max. 2 cardinal directions)
- Under skylights more than 15’ from perimeter must be separate from vertical fenestration daylight zone

Daylight Zone Controls



Daylight Zone Controls

- Daylight Zone Controls
  - Manual
  - **Automatic**

Methods:

Continuous dimming to <35%

Stepped dimming with 2 control steps:

- *50% and 70%*
- *<35%*

Daylight Zone Controls

General provisions:

- Controlled independent of the general lighting
- Control Zone ≤ 2,500 ft^2
- Adjacent to vertical fenestration contiguous zones may use one control device if no more than 2 cardinal directions

Automatic control provisions:

- Not required unless related to other design considerations such as WWR
- Capable of automatic reduction of light power in response to daylight
-

(Ref C405.2.2.3)

Sidelight: Automatic controls required in primary sidelighted areas .

Exceptions:

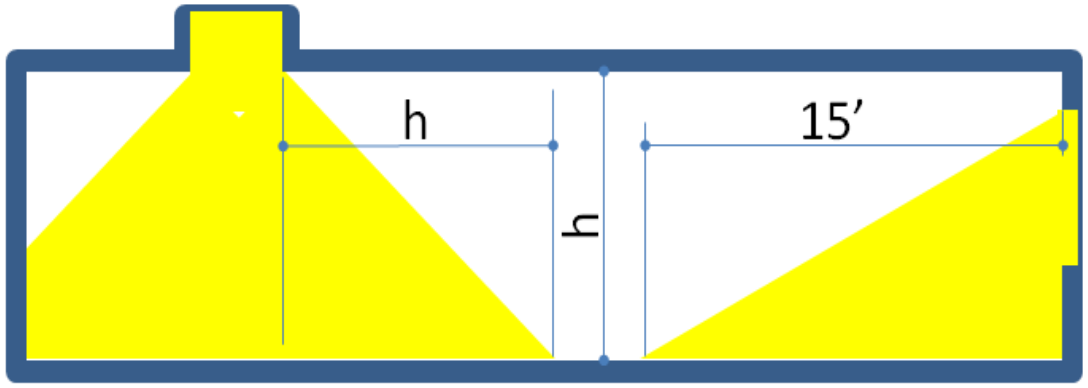
- Sidelight area < 250 ft^2 in space
- Top of adjacent structures are twice the height above the windows than distance away
- Effective aperture < 0.1
- Retail Spaces

Toplighting/Roof monitor: Automatic controls required when combined areas in enclosed space > 900 ft^2.

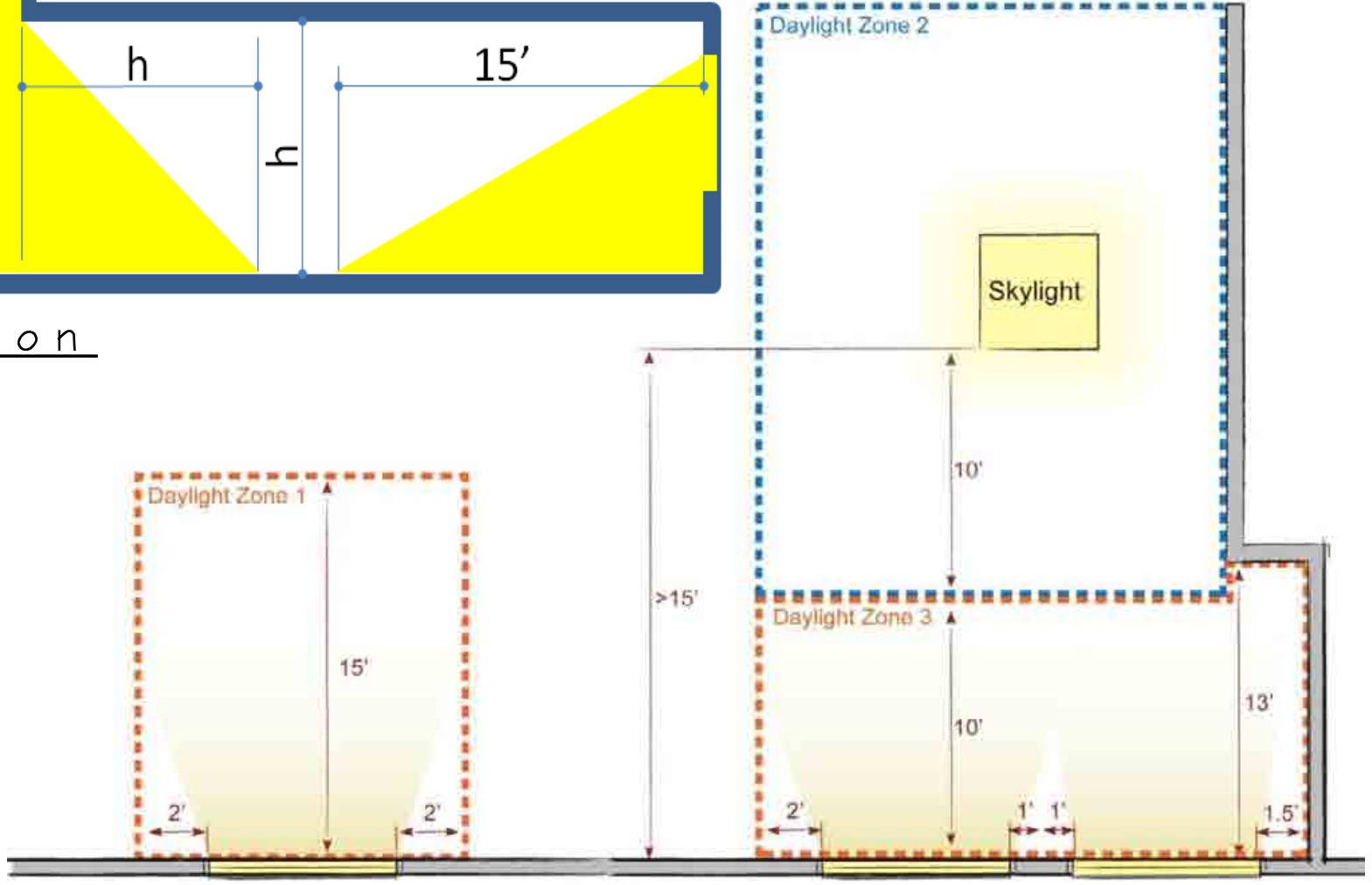
(Ref 9.4.1.4 and 9.4.1.5)

Daylight Zone Definition C202

Source: Kenergy



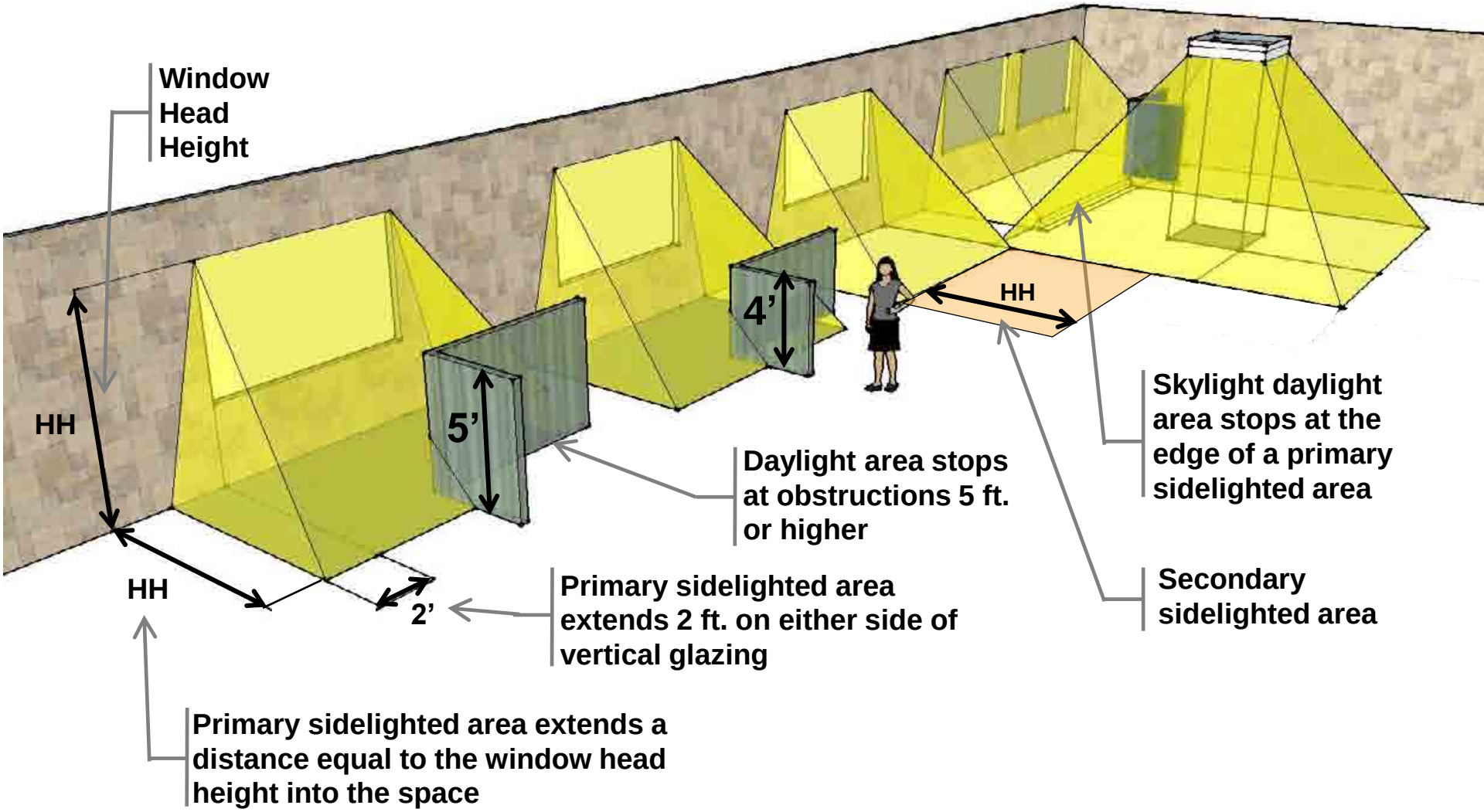
Section



Plan

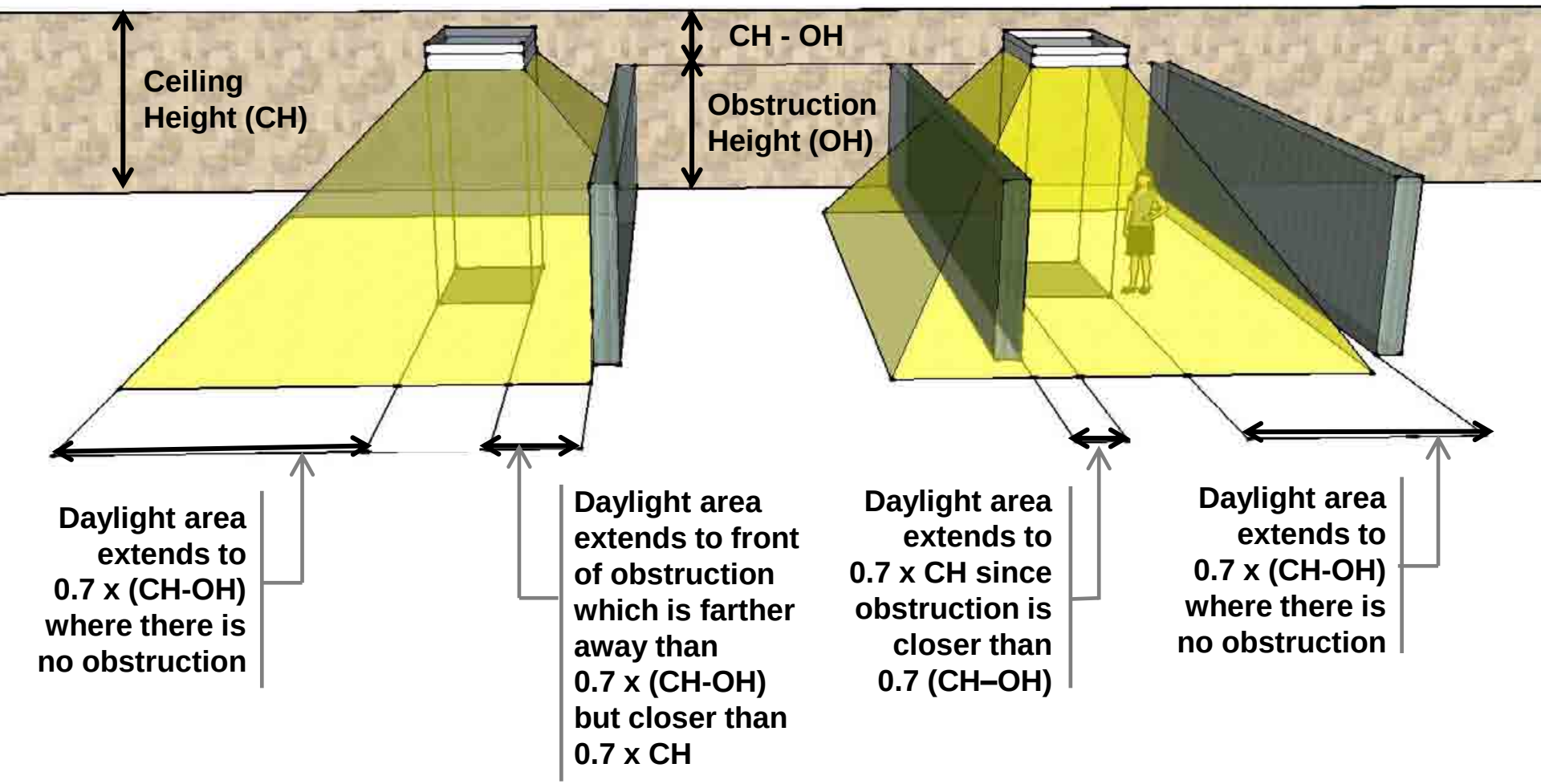
Primary Sidelighted Area Definition

90.1 CHANGE



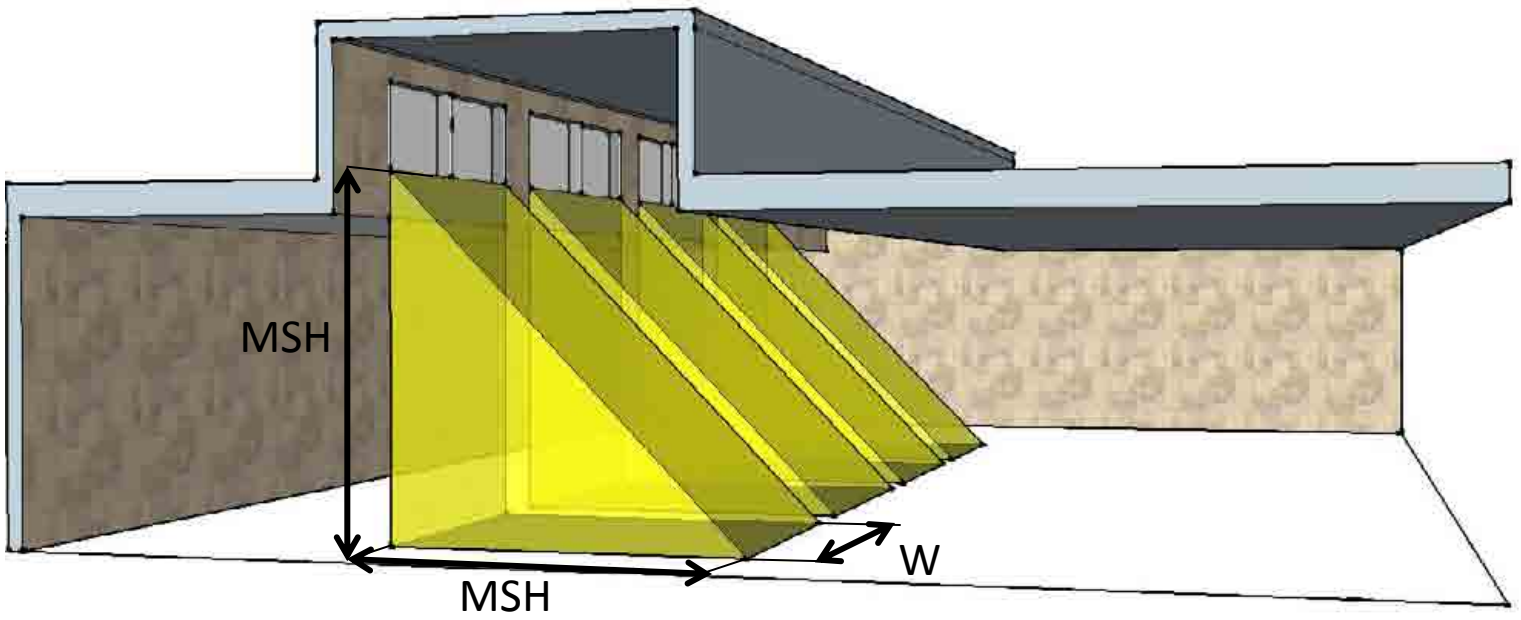
Toplighted Area Definition

90.1 CHANGE



Roof Monitor Daylight Area Defintion

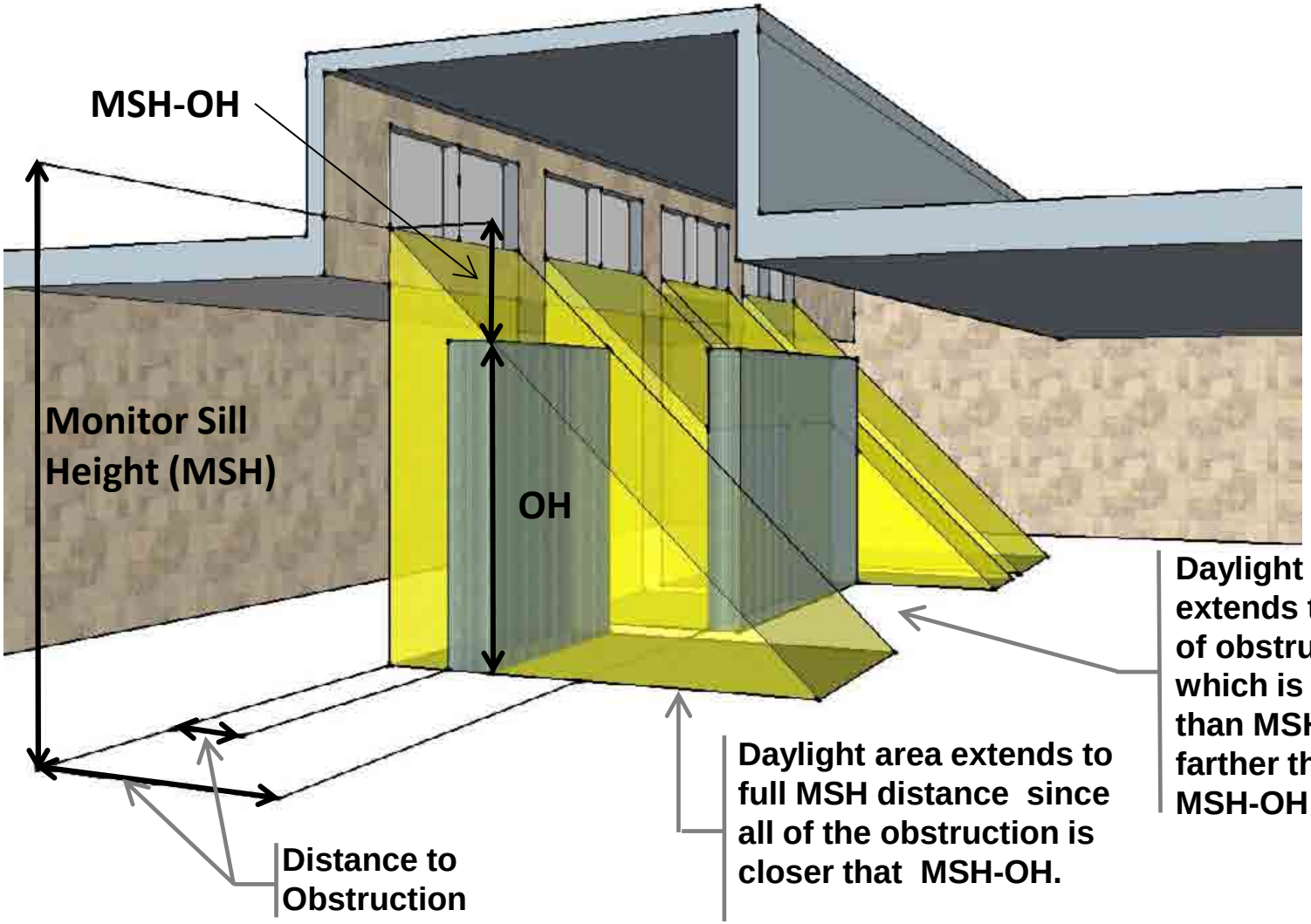
90.1 CHANGE



Daylight area created by the roof monitor is the width (W) of the vertical glazing in one direction and the monitor sill height (MSH) in the other direction.

Roof Monitor Daylight Area Defintion

90.1 CHANGE



Sidelight Daylighting Controls 9.4.1.4

Exceptions:

- Top of existing adjacent structures 2x as high as above windows as distance away from windows.
- Sidelighting effective aperature is < 0.1
- Retail Spaces

$$\text{Sidelighting Effective Aperture} = \frac{\text{Sum of window areas x VT}}{\text{Area of sidelighted area}}$$

90.1 CHANGE

Toplight Daylighting Controls 9.4.1.5

Multilevel Control Characteristics

Step 1 – 50% to 70%

Step 2 - =<35%

Exceptions:

- Adjacent structures block direct sunlight 1500 daytime hours/year between 8AM and 4PM
- Skylight effective aperture <0.006 (0.6%)

$$\text{Skylight Effective Aperture} = \frac{0.85 \times \text{Skylight area} \times \text{VT} \times \text{Well Factor}}{\text{daylight area under skylight}}$$

Well Factor .9 if light well depth <2’ or .7 if => 2’

Light well depth vertically from of lowest point on skylight glazing to the ceiling plan under the skylight

Interior Power Lighting Allowance

IECC Change

Building Area Method
or
Space-by-Space

(Ref C405.5.2)

Building Area Method
or
Space-by-Space

90.1 values are generally more stringent.

(Ref 9.5.1 and 9.6.1)

Interior Lighting Power C405.5.2
Building Area Method vs. Space-by-Space

TABLE C405.5.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD	
BUILDING AREA TYPE	LPD (w/ft^2)
Automotive facility	0.9
Convention center	1.2
Courthouse	1.2
Dining: bar lounge/leisure	1.3
Dining: cafeteria/fast food	1.4
Dining: family	1.6
Dormitory	1
Exercise center	1
Fire station	0.8
Gymnasium	1.1
Health care clinic	1
Hospital	1.2

TABLE C405.5.2(2)—continued INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD	
COMMON SPACE-BY-SPACE TYPES	LPD (w/ft^2)
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	1.3
Conference/meeting/multipurpose	1.2
Corridor/transition	0.7
Dining area	
Bar/lounge/leisure dining	1.4
Family dining area	1.4

Interior Lighting Power Density Comparison

	Building Area Method		Reduced INT LTG Power		Spaceby-Space Method	
2009 LPD w/ft^2	Building Area Type	2012 LPD w/ft^2	Building Area Type	LPD w/ft^2	Space Type	LPD w/ft^2
1.00	Hotel	1.00	Hotel/Motel	0.88	Dining area	1.3
					Guest rooms	1.1
					Hotel lobby	2.1
					Highway lodging dining	1.2
					Highway lodging guest rooms	1.1
1.00	Office	0.90	Office	0.90/0.85*	Office – enclosed	1.1
					Office – open plan	1

* - First LPD value applies if at least 30% of conditioned floor area is in daylight zones with automatic controls. In all other cases, second LPD value applies.

Interior Lighting Power Allowances: Building Area Method

	IECC	IECC Addional Efficiency Package	90.1
BUILDING AREA TYPE	LPD (w/ft^2)	LPD (w/ft^2)	LPD (w/ft^2)
Automotive facility	0.9	0.82	0.82
Convention center	1.2	1.08	1.08
Courthouse	1.2	1.05	1.05
Dining: bar lounge/leisure	1.3	0.99	0.99
Dining: cafeteria/fast food	1.4	0.90	0.90
Dining: family	1.6	0.89	0.89
Dormitory	1.0	0.61	0.61
Exercise center	1.0	0.88	0.88
Fire station	0.8	0.71	0.71
Gymnasium	1.1	1.00	1.00
Health care clinic	1.0	0.87	0.87
Hospital	1.2	0.88	1.21
Hotel	1.0	1.10	1.00
Library	1.3	1.18	1.18
Manufacturing facility	1.3	1.11	1.11
Motel	1.0	0.88	0.88
Motion picture theater	1.2	0.83	0.83
Multifamily	0.7	0.60	0.60
Museum	1.1	1.06	1.06
Office	0.9	0.90/0.85[b]	0.90
Parking garage	0.3	NA	0.25
Penetentiary	1.0	NA	0.97
Performing arts theater	1.6	1.39	1.39
Police station	1.0	0.96	0.96
Post office	1.1	0.87	0.87
Religious building	1.3	1.05	1.05
Retail	1.4	1.4/1.3[b]	1.40
School/university	1.2	0.99	0.99
Sports arena	1.1	0.78	0.78
Town hall	1.1	0.92	0.92
Transportation	1.0	0.77	0.77
Warehouse	0.6	0.60	0.60
Workshop	1.4	1.20	1.20

Space-by-Space Method

Interior Lighting Power Allowance: Space-by-Space LPD

	IECC	90.1
COMMON SPACE-BY-SPACE TYPES	LPD (w/ft^2)	LPD (w/ft^2)
Atrium – First 40 feet in height	0.03 per ft. ht.	0.03 per ft. ht.
Atrium – Above 40 feet in height	0.02 per ft. ht.	0.02 per ft. ht.
Audience/seating area – permanent		
For auditorium	0.9	0.79
For performing arts theater	2.6	2.43
For motion picture theater	1.2	1.14
Classroom/lecture/training	1.3	1.24
Conference/meeting/multipurpose	1.2	1.23
Corridor/transition	0.7	0.7
Dining area		0.65
Bar/lounge/leisure dining	1.4	1.31
Family dining area	1.4	0.89
Dressing/fitting room performing arts theater	1.1	0.4
Electrical/mechanical	1.1	0.95
Food preparation	1.2	0.99
Laboratory for classrooms	1.3	1.28
Laboratory for medical/industrial/research	1.8	1.81
Lobby	1.1	0.9
Lobby for performing arts theater	3.3	2.0
Lobby for motion picture theater	1	0.52
Lobby for elevator	NA	0.64
Locker room	0.8	0.75
Lounge recreation	0.8	0.73
Office – enclosed	1.1	1.1
Office – open plan	1	0.98
Restroom	1	0.98
Sales area	1.6[a]	1.68
Stairway	0.7	0.69
Storage	0.8	0.63
Workshop	1.6	1.59
Courthouse/police station/penetentiary		
[illegible]	[illegible]	[illegible]

	IECC	90.1
	LPD (w/ft^2)	LPD (w/ft^2)
Radiology/imaging	1.3	1.32
Operating room	2.2	1.89
Recovery	1.2	1.15
Lounge/recreation	0.8	1.07
Laundry – washing	0.6	0.6
Hotel		
Dining area	1.3	0.82
Guest rooms	1.1	1.11
Hotel lobby	2.1	1.06
Highway lodging dining	1.2	0.88
Highway lodging guest rooms	1.1	0.75
Library		
Stacks	1.7	1.71
Card file and cataloguing	1.1	0.72
Reading Area	1.2	0.93
Manufacturing		
Corridors/transition	0.4	0.41
Detailed manufacturing	1.3	1.29
Equipment room	1	0.95
Extra high bay (> 50-foot floor-ceiling height)	1.1	1.05
High bay (25-– 50-foot floor-ceiling height)	1.2	1.23
Low bay (< 25-foot floor-ceiling height)	1.2	1.19
Museum		
General exhibition	1	1.05
Restoration	1.7	1.02
Parking garage – garage areas	0.2	0.19
Convention center		
Exhibit space	1.5	1.45
Audience/seating area	0.9	0.82
Fire stations		
Engine room	0.8	0.56
[illegible]	[illegible]	[illegible]

Additional LPD Adjustments

Available only for the Space-by-Space method for display lighting.

(Ref Table C405.5.2(2))

90.1 also includes:

- Advanced controls control factor adjustment
- Room geometry adjustment

(Ref 9.6.2)

Only be used with space-by-space method

Additional Allowances – Merchandise **C405.5.2.1**

- **Deleted from Building Area Method**
- **Relocated to the Space-by-Space Method**

There is now no additional merchandise lighting power allowance using the Building Area Method.

Area 1: All Other (0.6 W/SF)
Area 2: Vehicles, sporting goods, small electronics (0.6 W/SF)
Area 3: Furniture, clothing, cosmetics, artwork (1.4 W/SF)
Area 4: Jewelry, crystal, china (2.5 W/SF)

Additional Interior Lighting Power 9.6.2(C)

Lighting Power Under Control x Control Factor

Partial Table 9.6.2 Control Factors Used in Calculating Additional Interior Lighting Power

Additional Control Method (in Addition to Mandatory Requirements).	Space Type				
	Open Office	Private Office	Conference Room, Meeting Room, Classroom (Lecture/ Training)	Retail Sales Area	Lobby, Atrium, Dining Area, Corridors/ Stairways, Gym/ Pool, Mall Concourse, Parking Garage
Manual, continuous dimming control or Programmable multi-level dimming control	0.05	0.05	0.10[1]	0.10	0
Programmable multi-level dimming control using programmable time scheduling	0.05	0.05	0.10[1]	0.10	0.10
Multi-level occupancy sensors	0.05	0.05	0.05	0	0

Room Cavity Ratio (RCR) Adjustment 9.6.3

Change allows 20% more lighting power to be used in small spaces with tall ceilings where RCR of space > the RCR Threshold

Exterior Lighting Allowance

Power allowance includes the base allowance plus individual area allowances.

Minimum efficacy provision has been removed.

(Ref C405.6.2)

90.1 the same but includes a “landscape area allowance” which is not in the IECC.

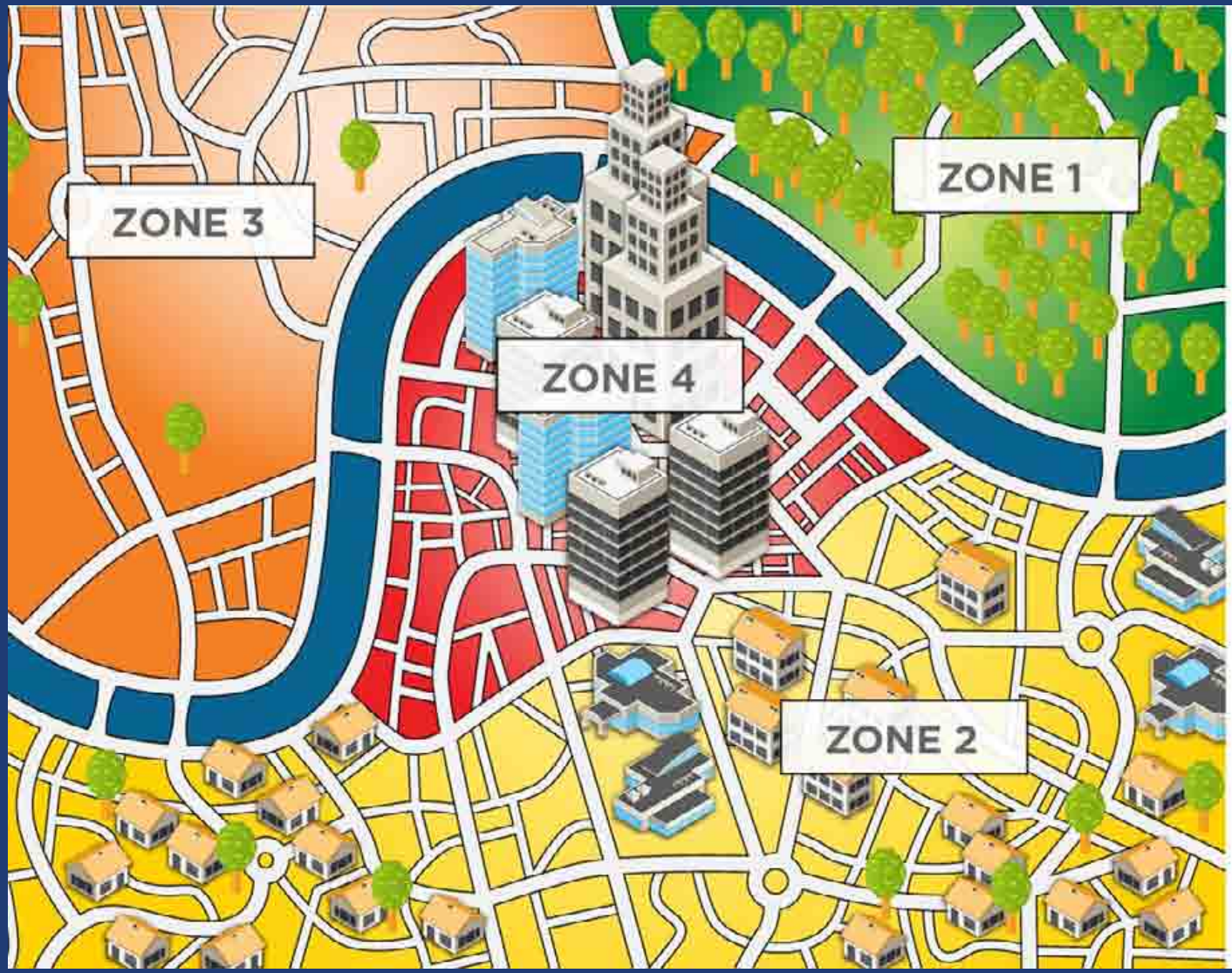
(Ref 9.4.3)

Exterior Lighting Power 9.4.3

Change applies a 5-zone LPD approach similar to IECC.

Change deleted 5% additional power allowances which is replaced by base wattage allowance per site

Exterior Lighting Power 9.4.3



ZONE 1
Developed areas of parks, forest, and rural areas.

ZONE 2
Residential and mixed use, neighborhood business, light industrial with limited night use.

ZONE 3
All other.

ZONE 4
High activity commercial in major metro as designated by AHJ.

In 2010, Zone 0 was introduced to represent undeveloped areas within national parks, forest land, and rural areas as defined by AHJ.

Source: USDOE Building Energy Codes University

Exterior Lighting Power 9.4.3

- Sum of the base site allowance plus individual lighting power densities [LPD]….
- Trade-offs are allowed only among “Tradable Surfaces” applications
- Some exemptions apply

US DOE Building Codes University

Exterior Lighting Power 9.4.3

Zones

Base Allowance

Tradeable and Non-tradeable Areas & Surfaces

TABLE 9.4.3B Individual Lighting Power Allowances for Building Exteriors

	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)					
	No Base Site in Zone 0	500 W	600 W	750 W	1300 W
Tradable Surfaces (LPDs for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs, and outdoor sales areas may be traded.)					
Uncovered parking areas					
Parking areas and drives	No allowance	0.04 W/ft²	0.06 W/ft²	0.10 W/ft²	0.13 W/ft²
Building grounds					
Walkways less than 10 ft wide	No allowance	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
Walkways 10 ft wide or greater Plaza areas Special feature areas	No allowance	0.14 W/ft²	0.14 W/ft²	0.16 W/ft²	0.2 W/ft²
Stairways	No allowance	0.75 W/ft²	1.0 W/ft²	1.0 W/ft²	1.0 W/ft²
Pedestrian tunnels	No allowance	0.15 W/ft²	0.15 W/ft²	0.2 W/ft²	0.3 W/ft²
Landscaping	No allowance	0.04 W/ft²	0.05 W/ft²	0.05 W/ft²	0.05 W/ft²
Building entrances and exits					
Main entries	No allowance	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
Other doors	No allowance	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
Entry canopies	No allowance	0.25 W/ft²	0.25 W/ft²	0.4 W/ft²	0.4 W/ft²
Sales Canopies					
Free standing and attached	No allowance	0.6 W/ft²	0.6 W/ft²	0.8 W/ft²	1.0 W/ft²

Grounds Lighting 9.4.4

Change eliminated the requirement for minimum efficacy of exterior lamps.

Exterior Lighting Allowance Exemptions

90.1 CHANGE

- Specialized signal, directional, and marker lighting associated with transportation
- Lighting that is integral to advertising signage or directional signage
- Lighting that is integral to equipment or instrumentation and is installed by its manufacturer
- Lighting for theatrical purposes, including performance, stage, film, and video production;
- Lighting for athletic playing areas
- Temporary lighting
- Lighting for industrial production, material handling, transportation sites, and associated storage areas
- theme elements in theme/amusement parks
- Lighting used to highlight features of public monuments and registered historic landmark structures or buildings
- Lighting for hazardous locations
- Lighting for swimming pools and water features;
- Searchlights.

(Ref C405.6.2)

Exemptions are the same with the exception of the last three bullets listed for the IECC, which are not included 90.1.

(Ref 9.4.3)

Using the Space-by-Space method, the LPD for each space may not exceed the installed allowance for that space.

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Additional Energy-Efficiency Packages Options

Additional Energy-Efficiency Packages Options

One of three additional efficiency package options must be included:

1. Efficient HVAC Performance
2. Efficient Lighting System
3. On-site Renewable Energy

(Ref C406)

No similar provision.

(Ref 9.4.1.2c)

Additional Efficiency Package Options C406

- **Efficient HVAC performance (C406.2)**
  - Per Tables C406.2(1) thru C406.2(7)
  - Only used when efficiencies in the above tables are greater than those in the efficiency tables in C403
- **Efficient lighting system (C406.3)**
  - Whole building LPD complies with C406.3.1
  - Determine total LPD of building using reduced whole building interior lighting power in Table 406.3 x floor area for the building types
- **On-site supply of renewable energy (C406.4)**
  - Total minimum ratings to comply with
    - Provide ≥ 1.75 Btu or ≥ 0.50 watts per ft^2 of conditioned floor area OR
    - Provide ≥ 3% of energy used for mechanical and SWH equipment and lighting

Individual tenant spaces to comply with either C406.2 or C406.3 unless documentation is provided that demonstrates compliance with C406.4 for the entire building

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Commissioning

HVAC Commissioning Requirements

HVAC Commissioning Plan
Heating ≥ 600,000 Btu/h & Cooling ≥ 480,000 Btu/h

- Drawings
- Manuals
- Systems Adjustments & Balancing
- HVAC Functional Testing
- Lighting Functional Testing
- Commissioning Report

Commissioning Plan

> 50,000 ft^2

All projects:

- Drawings
- Manuals
- System Balancing
- Commissioning…calibrated, adjusted, in working condition
- Lighting Functional Testing

Commissioning Plan (> 50,000 ft^2)

Level of commissioning left up to design professional.

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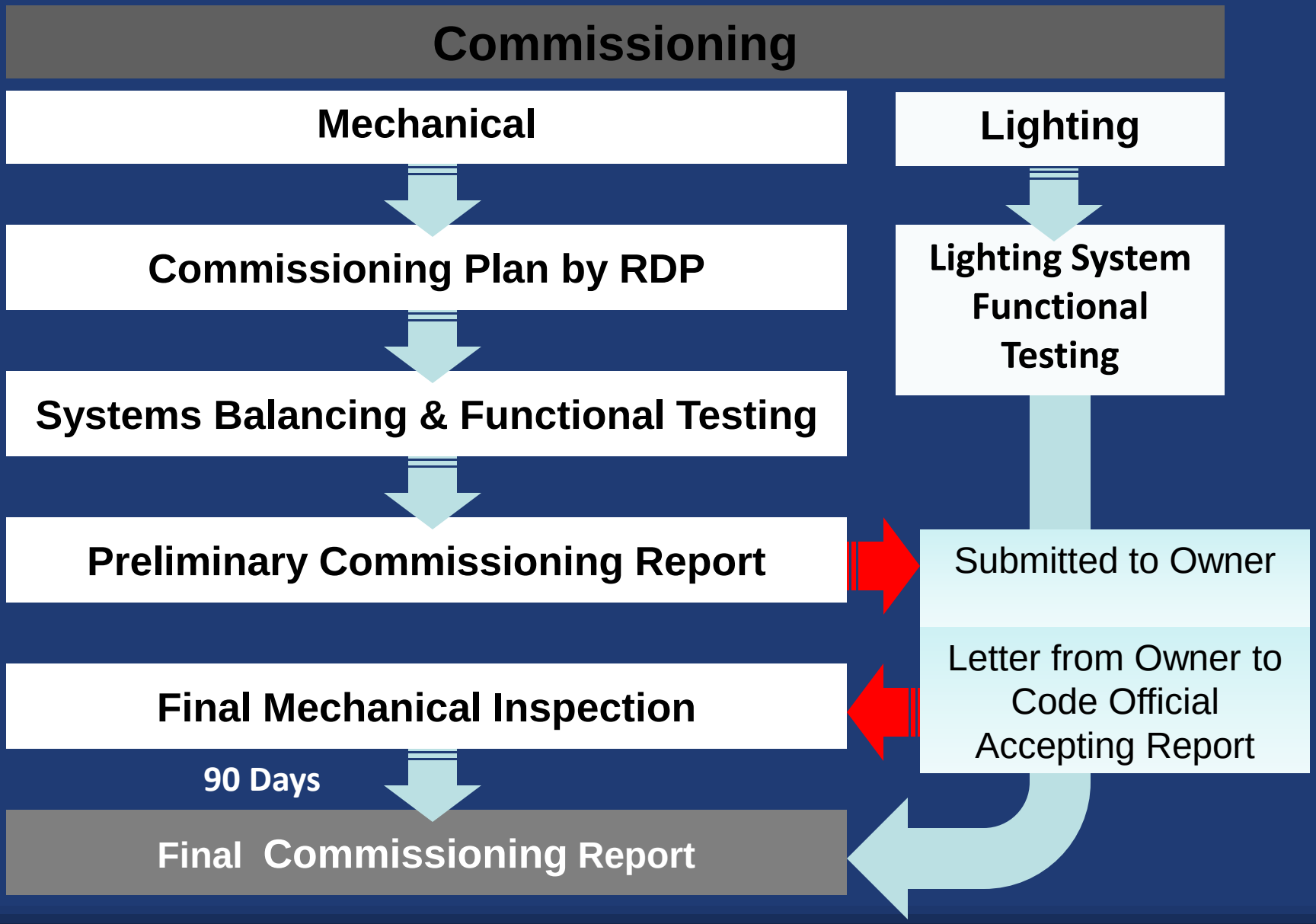
System Commissioning C408.1



Mechanical Systems Commissioning and Completion Requirements C408.2 Exceptions

These systems are exempt from mechanical commissioning requirements

- In buildings where total mechanical equipment capacity is < 480,000 Btu/h cooling capacity and 600,000 Btu/h heating capacity
- Included in Section C403.3 (Simple Systems) that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

Mechanical Systems Commissioning

C408.2.1 Commissioning Plan

Registered Design Professional to clearly detail:

- Who is to perform commissioning and provide documentation
- What equipment and systems are to be tested and by whom
- When commissioning is to take place and documentation turned over
- How tests are to be conducted with conditions of testing and measurable criteria

Mechanical Systems Commissioning

Preliminary Commissioning Report C408.2.4

Registered design professional or approved agency to complete, certify, and submit to the building owner and will identify:

- Itemization of deficiencies found during testing that haven't been corrected at the time of report preparation
- Deferred tests that can't be performed at the time of report preparation due to climatic conditions
- Climatic conditions required for performance of deferred tests

Lighting System Functional Testing C408.3.1

- **Testing to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working order per construction documents and manufacturer's installation instructions**
- **Construction documents to state who will conduct the testing**
- **Where required by the code official….**

  …….an approved independent party shall be responsible for the testing and documentation certifying the installed controls meet the provisions

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