

# 2009 International Energy Conservation Code With Wisconsin Amendments



**z Training As Developed by**

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# International Energy Conservation Code (IECC) Breakdown



- z Ch. 1 Administration
- z Ch. 2 Definitions
- z Ch. 3 Climate Zones
- z Ch. 4 Residential Energy Efficiency
- z Ch. 5 Commercial Energy Efficiency
- z Ch. 6 Reference Standards

# Fenestration U-factor

## IECC 102.1.3

 National Fenestration Rating Council CERTIFIED	<b>World's Best Window Co.</b>  Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider
<b>ENERGY PERFORMANCE RATINGS</b>	
U-Factor (U.S./I-P) <b>0.35</b>	Solar Heat Gain Coefficient <b>0.32</b>
<b>ADDITIONAL PERFORMANCE RATINGS</b>	
Visible Transmittance <b>0.51</b>	Air Leakage (U.S./I-P) <b>0.2</b>
Condensation Resistance <b>51</b>	—
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>	

z How to meet the requirement

y Fenestration product rating in accordance to NFRC 100

x Labeled & certified by the manufacturer

*Designer to define manufacturer on plans and provide product sheets demonstrating compliance*

y Non NFRC 100 rated fenestration

x Default Glazed Fenestration U-factor Table 102.1.3(1)

# ASHRAE Fundamental Data

## Comm 63.0303



**z** Information on thermal properties, performance of building envelope sections, and components and heat transfer shall be obtained from ASHRAE *Handbook of Fundamentals*.

**y** Exception:

- x** Laboratory Testing results
- x** See ***Comm 63.0303*** for acceptable test methods

# IECC Offers Multiple Building Envelope Compliance Options For:



- z Ch. 4 Low Rise Residential Buildings ( $\leq 3$  stories) (**Non-Transient--Do NOT use with for Hotels, Motels, etc.**)
- z Ch. 5 Commercial (Any Height) and High Rise Residential Buildings ( $\geq 4$  Stories)

# Certificate

Comm 63.0401



- z There is a Wisconsin amendment that does not require the installation of a permanent energy certificate.***

# Insulation & Fenestration Requirements by Climate Zone

## Table 402.1.1

### Insulation and Fenestration Requirements by Component<sup>a</sup>

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>b</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION <sup>b,e</sup> SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE <sup>i</sup>	FLOOR R-VALUE	BASEMENT <sup>c</sup> WALL R-VALUE	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>c</sup> WALL R-VALUE
1	1.20	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.65 <sup>j</sup>	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.50 <sup>j</sup>	0.65	0.30	30	13	5 / 8	19	5 / 13 <sup>f</sup>	0	5 / 13
4 except Marine	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5 <sup>h</sup>	13 / 17	30 <sup>g</sup>	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5 <sup>h</sup>	15 / 19	30 <sup>g</sup>	15 / 19	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38 <sup>g</sup>	15 / 19	10, 4 ft	10 / 13

<sup>a</sup> *R*-values are minimums, *U*-factors and SHGC are maximums, R-19 batts compressed into a nominal 2 x 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.

<sup>b</sup> The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

<sup>c</sup> "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

<sup>d</sup> R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

<sup>e</sup> There are no SHGC requirements in the Marine Zone.

<sup>f</sup> Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

<sup>g</sup> Or insulation sufficient to fill the framing cavity, R-19 minimum.

<sup>h</sup> "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

<sup>i</sup> The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

<sup>j</sup> For impact rated fenestration complying with Section R301.2.1.2 of the *IRC* or Section 1608.1.2 of the *IBC*, maximum *U*-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

# Air Sealing and Insulation

## IECC 402.4.2

- z 2 options to demonstrate compliance*
  - y When tested air leakage is  $< 7$  ACH when tested with a blower door at pressure of 33.5 psf (Section 402.4.2.1)*
    - x Testing after rough in and installation of building envelope penetrations*
  - y When items listed in Table 402.4.2, applicable to the method of construction, are field verified (Section 402.4.2.2)*

# Fireplaces

IECC 402.4.3

*z New wood-burning fireplaces shall have gasketed doors & outdoor combustion air.*



# Programmable Thermostat Controls

IECC 403.1.1

**Mandatory Requirements**

- z If primary heating system is a forced-air furnace
  - y *At least one programmable thermostat/dwelling unit*
  - y Capability to set back or temporarily operate the system to maintain zone temperatures
    - x down to 55°F (13°C) or
    - x up to 85°F (29°C)
  - y *Initially programmed with:*
    - x *heating temperature set point no higher than 70°F (21°C) and*
    - x *cooling temperature set point no lower than 78°F (26°C)*



# Ducts Insulation & Sealing

IECC 403.2.1 & Comm 63.0403

**Mandatory Requirements**

## z Insulation (Prescriptive)

y Ducts outside the building envelope: R-8

y All other ducts: *R-6*

## z Sealing (Mandatory)

y Joints & seams shall comply with IRC, Section M1601.4.1

## z Building framing cavities shall not be used as supply ducts



# Ducts Insulation & Sealing

Comm 64.0403(2)

- z All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints & seams shall comply with IMC section 603.9*

# Piping Insulation

IECC 403.3 & 403.4

**Mandatory Requirements**

- z Minimum *R-3* required on
  - y HVAC systems
    - x Exception: Piping that conveys fluids between 55 & 105°F
- z Minimum R-2 required on
  - y All circulating domestic hot water systems
    - x Systems also require a readily accessible manual switch



# Ventilation & Equipment Sizing

IECC 403.5 & 403.6

Mandatory Requirements

## *z Equipment Sizing*

- y IECC references Section M1401.3 of the IRC*
- y Load calculations determine the proper capacity (size) of equipment*
- y Calculations shall be performed in accordance with ACCA Manual J **OR***
- y other approved methods*



# Snow Melt System Controls

IECC 403.8 & 503.2.10

**Mandatory Requirements**

## *z Snow- and ice-melting system controls*

### *y Shall include*

- x Automatic controls capable of shutting off the system when the pavement temperature > 50°F and no precipitation is falling; and*
- x Automatic or manual control that will allow shutoff when the outdoor temperature is > 40°F*

# Snow Melt System Controls

IECC 403.8 & 503.2.10



**Before**



**After**

# Pool Covers

IECC 403.9/Comm 63.0403 & 504.7.3/  
Comm 0504

*z These sections to be amended so that heated pools do **NOT** require pool covers*



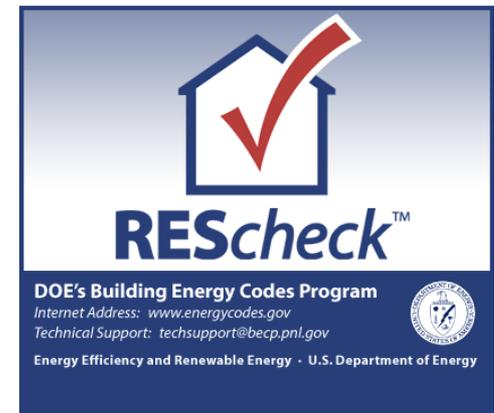
# Lighting Equipment (Prescriptive)

IECC 404.1

- z A minimum of 50% of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps*
- z Definition of "high-efficacy lamp"*
  - y Compact fluorescent lamps T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:*
    - x 60 lumens/W for lamps > 40 watts,*
    - x 50 lumens/W for lamps > 15 watts up to 40 watts, and*
    - x 40 lumens/W for lamps  $\leq$  15 watts or less.*

# Simulated Performance Alternative Comm 63.0405

- z Wisconsin Accepts use of REScheck when set for *"2009 IECC"*
- z Does NOT include both envelope and equipment for trade-offs.



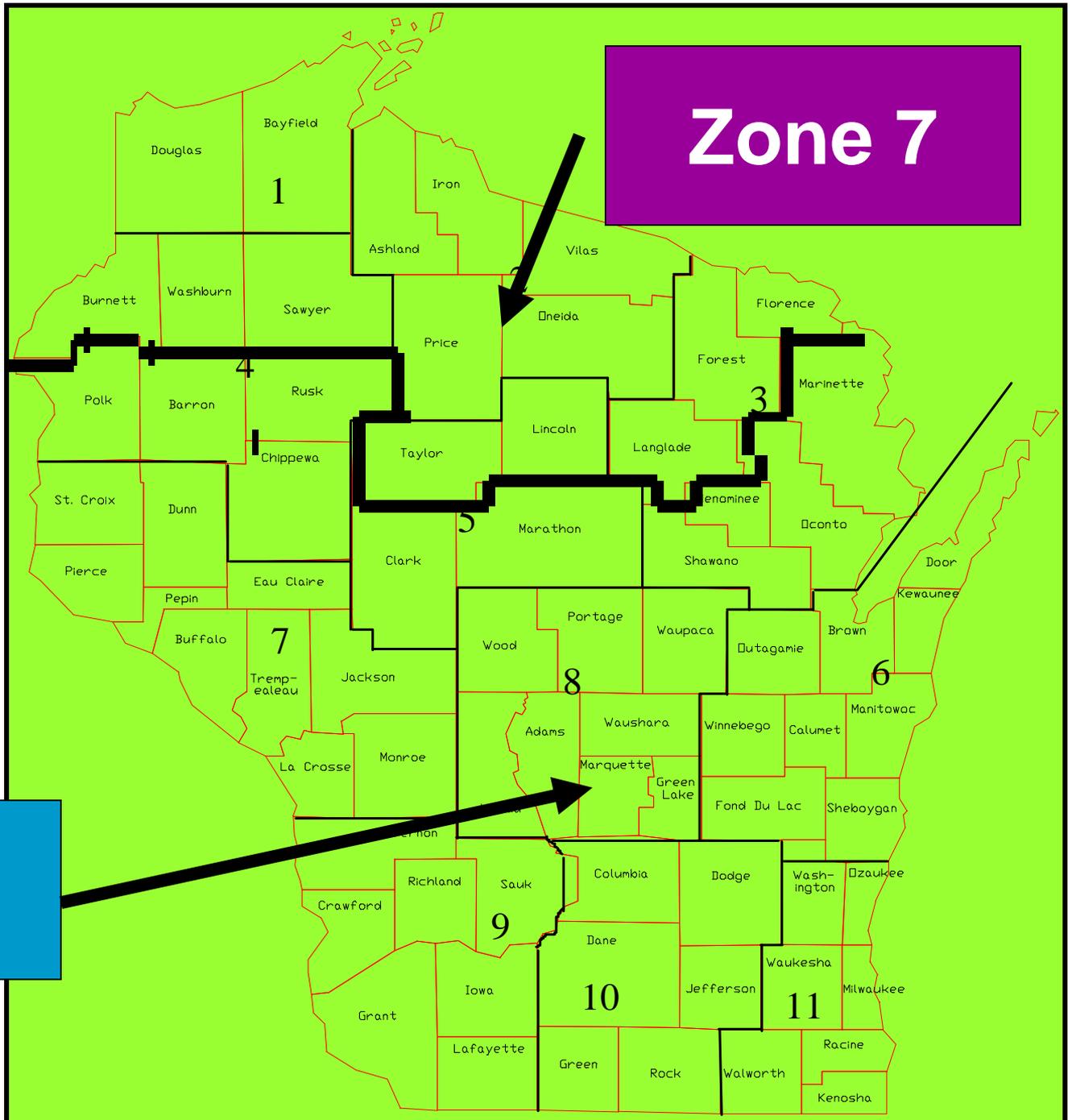
# What are My Building Envelope Options for Complying with the IECC?



- z Section 502 of the IECC (Prescriptive Approach)
  - x Use for  $\leq 40\%$  of gross wall area in vertical fenestration
  - x Use for  $\leq 3\%$  of gross roof area in skylights
- z COMcheck Computer Program (per Comm 63.0506)
- z Section 506 Total Building Performance Approach
- z **ASHRAE/IESNA Standard 90.1-2007**
  - y Section 501.2 "Application" requires 90.1 to be used in its **ENTIRETY** (Envelope, Lighting, Mechanical) if used as an alternate compliance path

**Zone 7**

**Zone 6**



# Changes to IECC Tables

502.1.2 & 502.2(1)



*z Table now separated by occupancy type*

*y Non-Group R occupancies use "All other" column*

*y Group R occupancies use "Group R" column*

# Compliance with Chapter 5 Prescriptive Approach

TABLE 502.2(1)  
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

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	All other	Group R	All other	Group R	All other	Group R	
<b>Roofs</b>																	
Insulation entirely above deck	R-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks <sup>a, b</sup> )	R-19	R-19	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-19	R-19	R-13 + R-19	R-19	R-11 + R-19	R-19 + R-10	
Attic and other	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	
<b>Walls, Above Grade</b>																	
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci <sup>c</sup>	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 <sup>b</sup>	R-16	R-16	R-16	R-16	R-19	R-19	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	
Metal framed	R-13	R-13	R-13	R-13 + 7.5ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + 7.5	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13 + R-18.8ci						
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13 + R-3.8ci	R-13 + R-3.8ci	R-13 + 3.8	R-13 + 7.5	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + 7.5ci	R-13 + R-15.6ci	R-13 + 15.6ci	
<b>Walls, Below Grade</b>																	
Below grade wall <sup>d</sup>	NR	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	NR	R-7.5ci	R-7.5ci	R-10ci	R-7.5ci	R-12.5ci	
<b>Floors</b>																	
Mass	NR	NR	R-6.3ci	R-8.3ci	R-6.3ci	R-8.3ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci	
Joist/framing Steel/(wood)	NR	NR	R-19	R-30	R-19	R-30	R-30	R-30	R-30	R-30	R-30	R-30 <sup>e</sup>	R-30	R-30 <sup>e</sup>	R-30 <sup>e</sup>	R-30 <sup>e</sup>	
<b>Slab-on-Grade Floors</b>																	
Unheated slabs	NR	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below				
Heated slabs	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below								
Opaque doors																	
Swinging	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.70	U - 0.50					
Roll-up or sliding	U - 1.45	U - 1.45	U - 1.45	U - 1.45	U - 1.45	U - 1.45	U - 0.50										

For SI: 1 inch = 25.4 mm.

ci = Continuous insulation. NR = No requirement.

a. When using R-value compliance method, a thermal spacer block is required, otherwise use the U-factor compliance method. [see Tables 502.1.2 and 502.2(2)].

b. Assembly descriptions can be found in Table 502.2(2).

c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-ft<sup>2</sup> F.

d. When heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

e. Steel floor joist systems shall to be R-38.

# Roof insulation should be installed "Properly"...



# Compliance with Chapter 5 Prescriptive Approach

TABLE 502.3  
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
<b>Vertical fenestration (40% maximum of above-grade wall)</b>								
<b><i>U</i>-factor</b>								
<b>Framing materials other than metal with or without metal reinforcement or cladding</b>								
<i>U</i> -factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
<b>Metal framing with or without thermal break</b>								
Curtain wall/storefront <i>U</i> -factor	1.0	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door <i>U</i> -factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other <i>U</i> -factor <sup>a</sup>	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
<b>SHGC-all frame types</b>								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
<b>Skylights (3% maximum)</b>								
<i>U</i> -factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

PF = Projection factor (see Section 502.3.2).

a. All others includes operable windows, fixed windows and nonentrance doors.

# Hot Gas Bypass

(common in large computer rooms)

## IECC 502.4.4

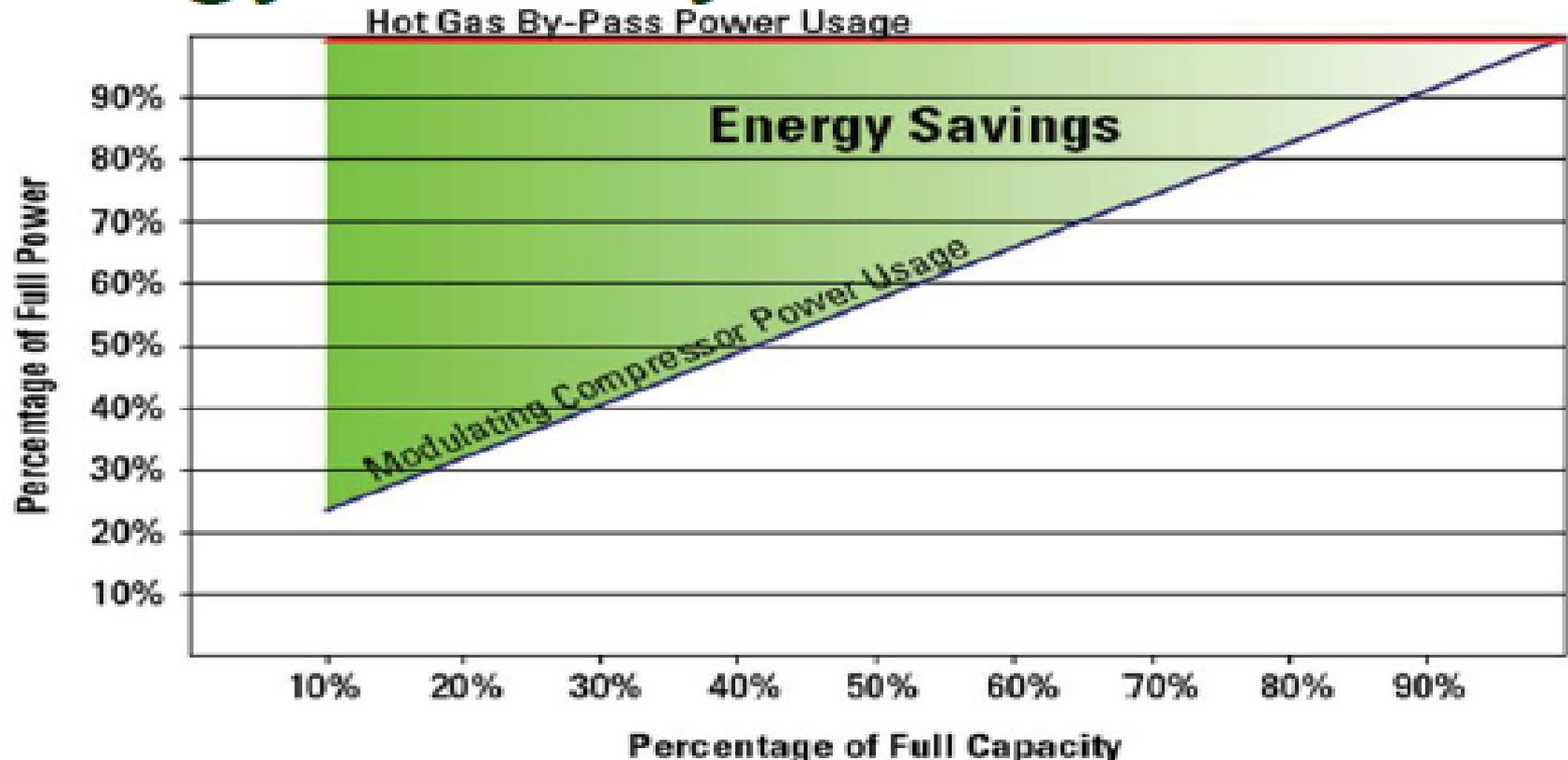
- z *Cooling systems can't use Hot Gas Bypass unless system designed w/*
  - y *Multiple steps of unloading; OR*
  - y *Continuous capacity modulation*
- z *Capacity limited per Table 502.4.4*
  - y *Exception: Unitary packaged systems w/ cooling capacities < 90,000 Btu/h*

<i>Rated Capacity</i>	<i>Maximum Hot Gas Bypass Capacity (% of total capacity)</i>
<i><math>\leq 240,000</math> Btu/h</i>	<i>50%</i>
<i><math>&gt; 240,000</math> Btu/h</i>	<i>25%</i>

# Hot Gas Bypass

IECC 502.4.4 (Graph via Brian Kammer, AAON Inc.)

## Energy Penalty



# Mandatory Requirements – Loading Dock Weatherseals IECC 502.4.6



- z Cargo doors & loading dock doors shall be equipped with weather seals to restrict infiltration when vehicles are parked in the doorway
- z Not req'd if adjacent to unconditioned spaces w/insulated separations

# Mandatory Requirements – Vestibules

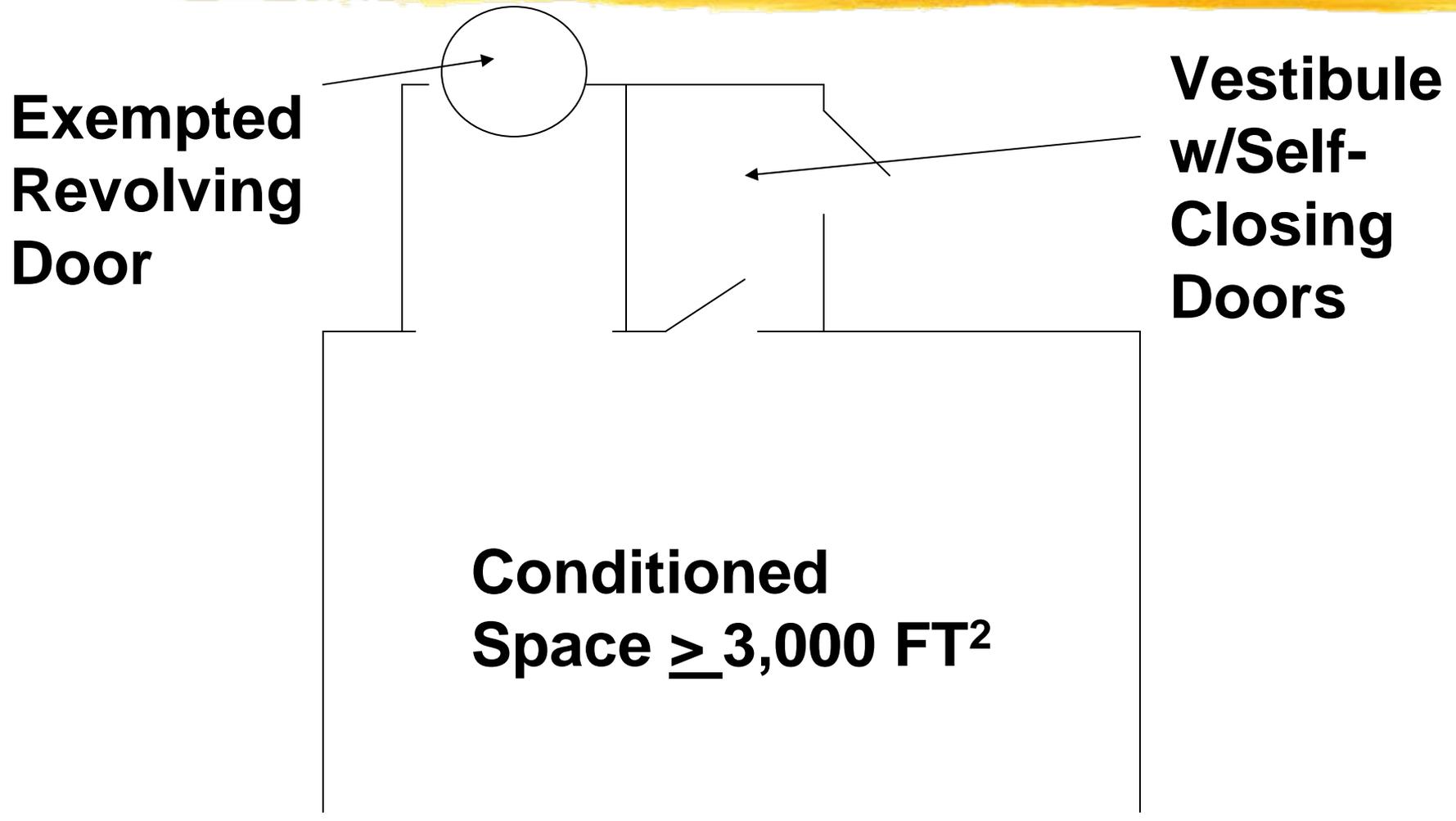
## IECC 502.4.7

### Vestibules on “Primary” Entrance Doors

- z Req'd to reduce infiltration into spaces
- z Req'd on entrance doors leading into spaces  $\geq$  3,000 ft<sup>2</sup>
- z Doors **MUST** have self-closing devices
- z Exceptions
  - y Doors from a guest room or dwelling unit
  - y Doors used primarily for vehicular movement, materials handling & adjacent personnel doors
  - y Not req'd if adjacent to unconditioned spaces w/insulated separations to conditioned spaces

# Mandatory Requirements - Vestibules

## IECC 502.4.7



# Ch. 5 Commercial Bldgs (Any Height) & High Rise Residential Buildings ( $\geq$ 4 Stories) **IECC 501 & Comm 63.0501**

*z ASHRAE 90.1-2007 may be used in its entirety in place of the 2009 IECC requirements for satisfying ALL of the following topics:*

*y IECC 502 Building Envelope*

*y IECC 503 Building Mechanical Systems*

*y IECC 504 Service Water Heating*

*y IECC 505 Lighting*

# Ch. 5 Commercial Bldgs (Any Height) & High Rise Residential Buildings ( $\geq$ 4 Stories) **IECC 501 & Comm 63.0501**

*z Designer's may NOT mix & match—ie. Lighting & Building Envelope requirements from ASHRAE, with Bldg Mechanical Systems & Service Water Heating from IECC. The design must be COMPLETELY based on either the IECC or ASHRAE for ALL topics referenced.*

*y Dept. review will default to IECC, unless designer indicates otherwise on plans.*

# Demand Controlled Ventilation

## IECC 503.2.5.1

- z *Demand Control Ventilation is req'd for spaces >500 sf and with an avg. occupant load of 40 per 1,000 sf of floor area and served by systems w/one or more of the following:*
  - y *An air-side economizer;*
  - y *Automatic modulating control of the outdoor air damper; or*
  - y *A design outdoor airflow > 3,000 cfm*
    - x *Exceptions*

# Demand Controlled Ventilation

## IECC 503.2.5.1

- z Sequencing & all associated controls shall be explicitly addressed on the HVAC plan set.**
- z Acceptable Example:**
  - y The HVAC system shall operate & distribute outdoor air at acceptable levels (as justified by the designer and determined acceptable by the Dept.), when the space is occupied, immaterial if the CO<sub>2</sub> sensor has met its operational set-point (to be clearly defined on the plans). Sensor to activate additional outdoor air over baseline***
  - y Exceptions: Natural ventilation or other listed code exception***

# Demand Controlled Ventilation

## IECC 503.2.5.1

### **z Acceptable Example:**

- y Fan & HVAC system serving room or space only operates so as to meet set point temperature when not occupied*
- y Occupancy sensor recognizes room is occupied, opens outside air damper, continuously provides defined amount of outdoor air until determined that the room or space is no longer occupied*

# Demand Controlled Ventilation

## IECC 503.2.5.1

### **z Acceptable Example:**

- y In those buildings with a key card entry system, the system could account for all occupants, and provide outdoor air in amounts proportional to the number of people recognized as being located within the bldg*
- y (7.5 cfm of outdoor air/person x # of people)*

# Demand Controlled Ventilation

## IECC 503.2.5.1

### *z Acceptable Example:*

*y Plans could indicate that the HVAC system will distribute outdoor air when the room or space is occupied. The content of CO<sub>2</sub> is to be compared between the relief air and the outdoor air. If the difference, as measured in ppm's, exceeds the predefined set-point as justified to the Dept. and found acceptable, additional outdoor air is to be distributed.*

# Demand Controlled Ventilation

## IECC 503.2.5.1

### *z Unacceptable Examples:*

- y Plans indicate that the HVAC system will ONLY distribute outdoor air when a pre-defined CO<sub>2</sub> set-point is met.*
- y Plans indicate the use of CO<sub>2</sub> sensors but do NOT define the how the sensors are to be used by way of a sequence of operation.*

# Piping Insulation

## IECC 503.2.8

*All piping serving heating or cooling system must be insulated in accordance with Table 503.2.8 shown below. Exceptions*

**MINIMUM PIPE INSULATION<sup>a</sup>**  
(thickness in inches)

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5"	> 1.5"
Steam	1 1/2 (R-5.5)	3 (R-11.1)
Hot water	1 1/2 (R-5.5)	2 (R-7.4)
Chilled water, brine or refrigerant	1 1/2 (R-5.5)	1 1/2 (R-5.5)

# Heating Outside a Building

## IECC 503.2.11

- z Systems providing heat outside a building shall be radiant systems.*
- z Systems shall be controlled by an occupancy sensing device or timer switch, so that the system is automatically de-energized when no occupants are present*



# Economizers

## IECC/COMM Table 63.0503

**z** Unless a listed exception is met (exception #1 is not viable), Economizers are required for:

**y** Split systems & water source heat pumps  **$\geq 54,000$  Btu/h**

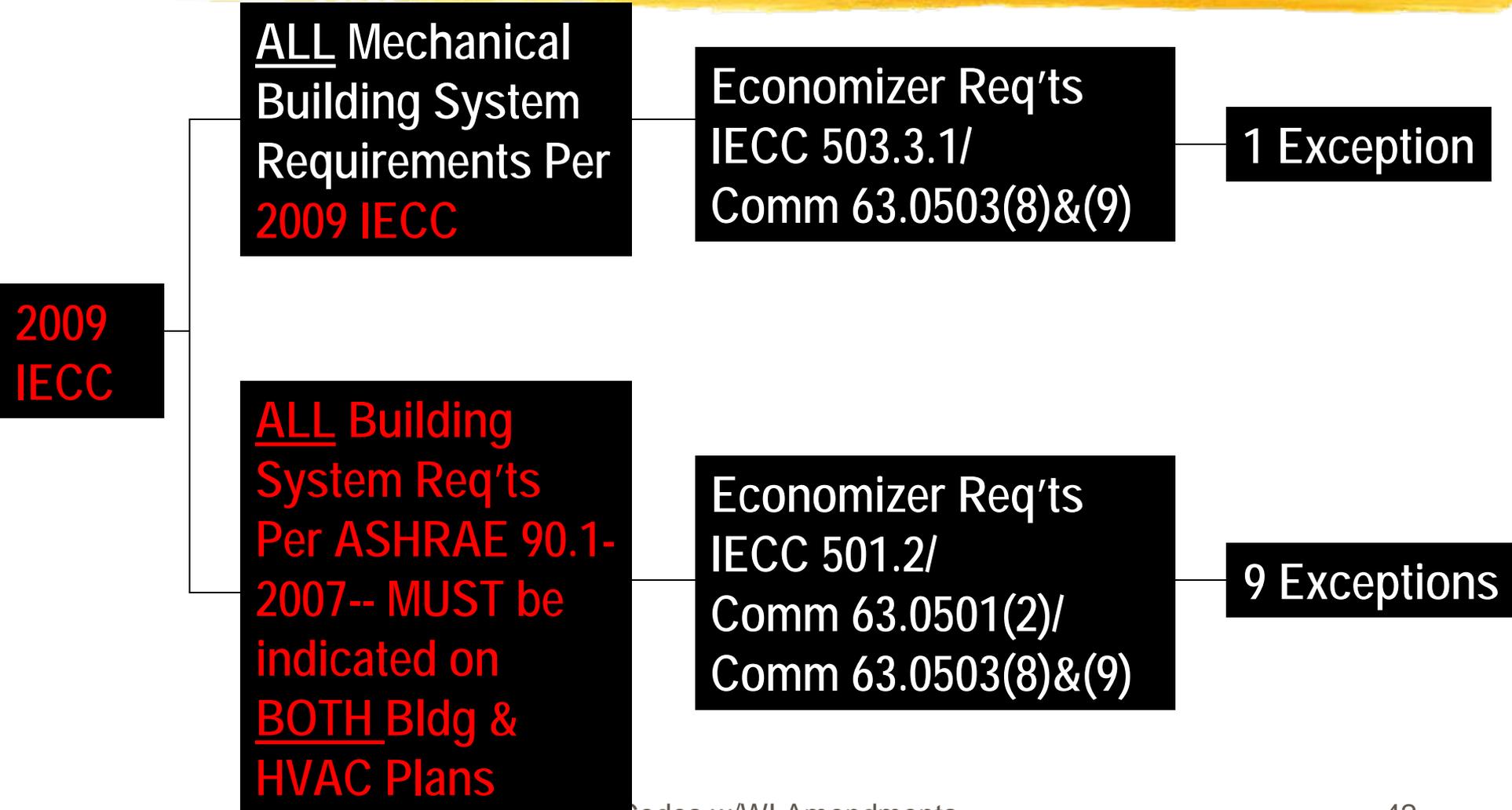
Split Systems (furnace & condenser similar to those found in homes, small businesses)

**y** All other systems  **$\geq 33,000$  Btu/h**

**x** Rooftop units, built-up VAV reheat/single fan dual duct, etc.

# Economizers

**IECC 503.3.1/COMM Table 63.0503 &  
IECC 501.2/Comm 63.0501**



# Economizers

IEBC/COMM 66.0300, 66.0607, 66.0711, 66.0808

IECC/COMM Table 63.0503

- z “Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying the requirement” (ie. for economizers)
  - y If the room is served by 2 split furnace/condenser systems, the total cooling capacity for the aggregate systems are referenced when determining when an economizer is required to be installed

# Low-Rise Residential Buildings IECC 404.1

## z IECC Chapter 4

- y In the residential portions of the building, a minimum of 50% of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.*
- y Basically, the code requires 50% of the lamps to incorporate compact fluorescents, long tube fluorescents, LED etc, but **NOT** incandescent.*

# High Rise Residential Bldgs

## IECC 505.1

### z IECC Chapter 5

#### y Unique requirement for High Rise Residential Bldgs

x > 3 stories above grade, and

x  $\geq$  3 dwellings or more

z *Lighting within dwelling units where 50% or more of the permanently installed interior light fixtures are fitted with high efficacy lamps.*

# Lighting Code Application

IECC 505

- z 1) Determine Required Controls
- z 2) Determine Power Allowance in watts for interior and exterior use (add base site allowance for exterior allowance per IECC 505.6.2)
- z 3) Determine Actual Lighting Installation (inclusive of ballasts) in watts for the interior and exterior of the building
- z 4) Compare--Actual installation wattage to be  $\leq$  Power allowance as applicable to interior and exterior use

# IECC Interior Controls

## IECC 505.2

- z IECC 505.2.1 Interior lighting controls
- z IECC 505.2.2.1 Lighting reduction controls
- z IECC 505.2.2.2 Automatic lighting shut-off
- z IECC 505.2.2.3 Daylight zone controls
- z IECC 505.2.3 Sleeping unit controls
- z IECC 505.2.4 Exterior lighting controls



# IECC Interior Controls

## IECC 505.2.2.3 / **COMM 63.0505(1)**

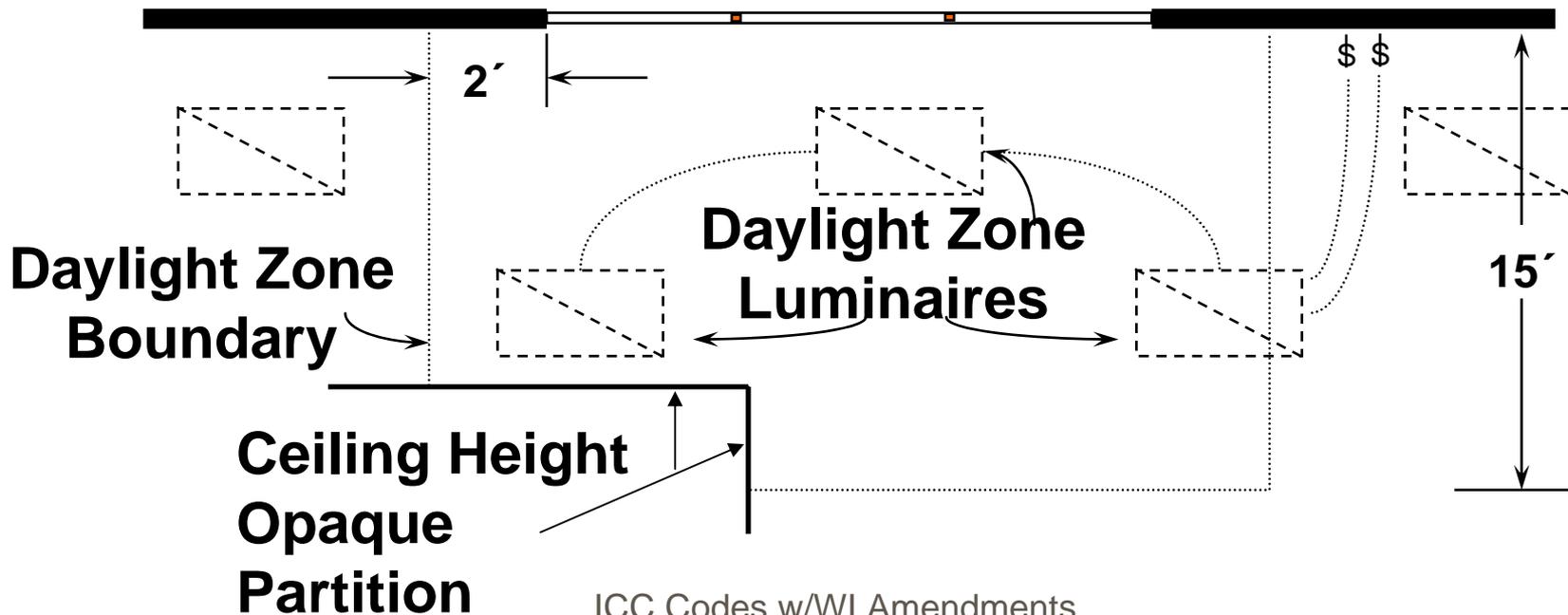
- z *Daylight Zone* control required for
  - y Spaces  $> 250\text{ft}^2$ ; and
  - y Spaces with a Lighting Power Density  $> 0.6\text{W}/\text{ft}^2$ ; &  
- *Spaces containing 3 or more light fixtures*
- z *Daylight Zones* to have separate controls
  - y Vertical & horizontal daylight areas separately switched from general area lighting
  - y Must apply lighting reduction controls as per IECC sec. 505.2.2.1
    - x Note – controlling all luminaires using daylighting controls is acceptable.

# IECC Interior Controls

## IECC 505.2.2.3

### *z Daylight Zone*

## Vertical Glazing (windows):

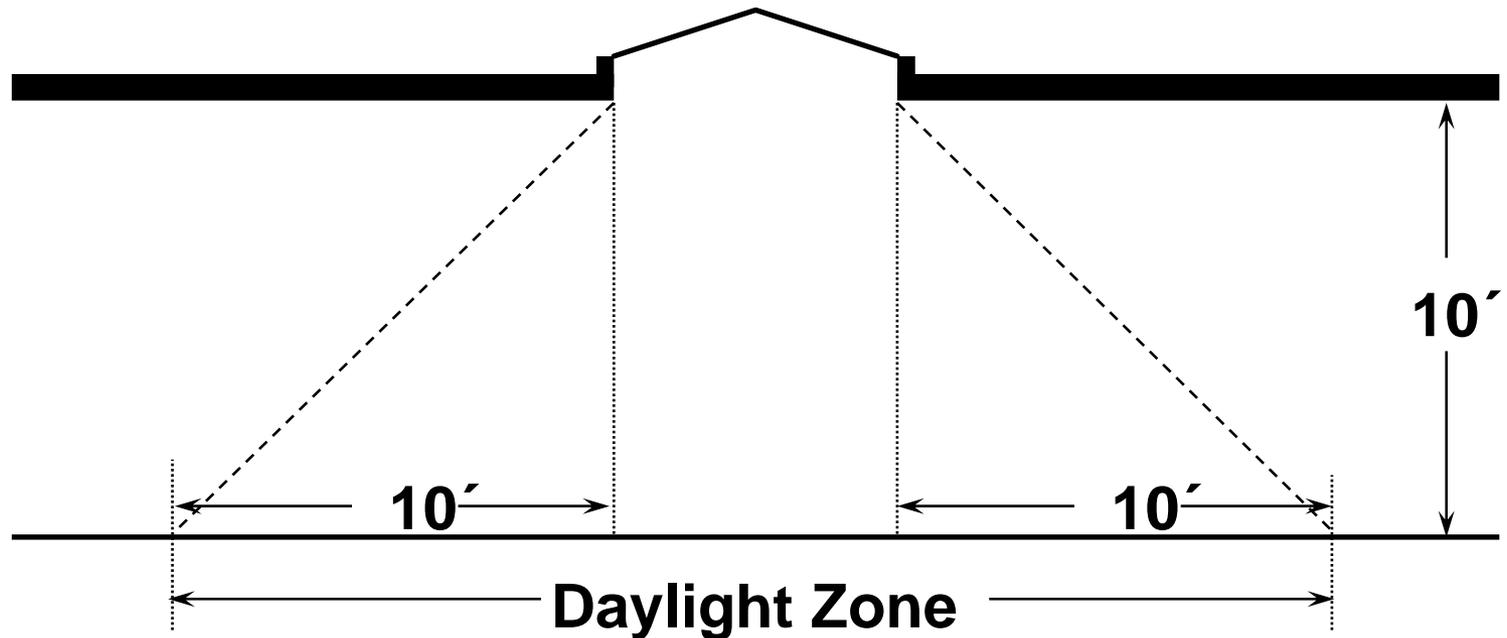


# IECC Interior Controls

## IECC 505.2.2.3

### *z Daylight Zone:*

Horizontal Glazing (skylights):



# IECC Interior Power Req.

## IECC Table 505.5.2 Footnote b

### Interior Lighting Power Allowances (ILPA)

#### Footnote b for Additional *Retail* Lighting

z Calculate Additional lighting power as follows:

$$\begin{aligned} \text{Additional Interior Lighting Power Allowance} = & \\ & \mathbf{1,000 \text{ watts} + (Retail Area 1 \times 0.6 \text{ W/ft}^2) +} \\ & \mathbf{(Retail Area 2 \times 0.6 \text{ W/ft}^2) + (Retail Area 3 \times 1.4} \\ & \mathbf{W/ft}^2) + (Retail Area 4 \times 2.5 \text{ W/ft}^2)} \end{aligned}$$

# IECC Interior Power Req.

## IECC Table 505.5.2 Footnote b

### z Where:

- y *Retail Area 1 = Floor area for all products not listed in Retail Areas 2, 3 or 4;*
- y *Retail Area 2 = Floor area used for the sale of vehicles, sporting goods and small electronics;*
- y *Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork;*
- y *Retail Area 4 = Floor area used for the sale of jewelry, crystal and china.*
  - x *Note: Other merchandise categories are permitted to be included in Retail Areas 2 through 4 based on justification provided to the Dept. deemed as reasonable.*

# IECC Interior Power Req.

## IECC Table 505.5.2 Footnote b

### z Additional Power Allowance Rules:

- y *Area must be the display area and NOT the floor area of the space*
- y *Must be switched on separate circuits from that of other general lighting*
- y *Must be in addition to general lighting*

# IECC Exterior Power Req.

## IECC 505.6.1 & 505.6.1

- z IECC 2009 & ASHRAE 2007 are equivalent
  - y Applies to lighting powered *through* the building service
    - x IECC Exception - low voltage landscape lighting
  - y *All exterior luminaires > 100 W shall have an efficacy of 60 L/W unless controlled by a motion sensor (unless it is exempted)*

# IECC Exterior Lighting Zones

IECC Table 505.6.2(1)]

<i>Lighting Zone</i>	<i>Description</i>
<i>1</i>	<i>Developed areas of national parks, state parks, forest land, &amp; rural areas</i>
<i>2</i>	<i>Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial w/limited nighttime use &amp; residential mixed use areas</i>
<i>3</i>	<i>All other areas</i>
<i>4</i>	<i>High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority</i>

# IECC Exterior Lighting Zones

		<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>	<u>Zone 4</u>
<b>Base Site Allowance</b>		<b>500 W</b>	<b>600 W</b>	<b>750 W</b>	<b>1300 W</b>
<b>Tradable Surfaces</b>	<b>Uncovered Parking Areas</b>				
	<i>Parking areas and drives</i>	<i>0.04 W/ft<sup>2</sup></i>	<i>0.06 W/ft<sup>2</sup></i>	<i>0.10 W/ft<sup>2</sup></i>	<i>0.13 W/ft<sup>2</sup></i>
	<b>Building Grounds</b>				
	<i>Walkways less than 10 ft wide</i>	<i>0.7 W/linear foot</i>	<i>0.7 W/linear foot</i>	<i>0.8 W/linear foot</i>	<i>1.0 W/linear foot</i>
	<i>Walkways 10 ft wide or greater</i> <i>Plaza areas, Special Feature Areas</i>	<i>0.14 W/ft<sup>2</sup></i>	<i>0.14 W/ft<sup>2</sup></i>	<i>0.16 W/ft<sup>2</sup></i>	<i>0.2 W/ft<sup>2</sup></i>
	<i>Stairways</i>	<i>0.75 W/ft<sup>2</sup></i>	<i>1.0 W/ft<sup>2</sup></i>	<i>1.0 W/ft<sup>2</sup></i>	<i>1.0 W/ft<sup>2</sup></i>
	<i>Pedestrian Tunnels</i>	<i>0.15 W/ft<sup>2</sup></i>	<i>0.15 W/ft<sup>2</sup></i>	<i>0.2 W/ft<sup>2</sup></i>	<i>0.3 W/ft<sup>2</sup></i>

		<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>	<u>Zone 4</u>
<i>Tradable Surfaces</i>	<i>Building Entrances and Exits</i>				
	<i>Main entries</i>	<i>20 W/linear ft of door width</i>	<i>20 W/linear ft of door width</i>	<i>30 W/linear ft of door width</i>	<i>30 W/linear ft of door width</i>
	<i>Other doors</i>	<i>20 W/linear ft of door width</i>			
	<i>Entry Canopies</i>	<i>0.25 W/ft<sup>2</sup></i>	<i>0.25 W/ft<sup>2</sup></i>	<i>0.4 W/ft<sup>2</sup></i>	<i>0.4 W/ft<sup>2</sup></i>
	<i>Sales Canopies</i>				
	<i>Free-standing &amp; attached</i>	<i>0.6 W/ft<sup>2</sup></i>	<i>0.6 W/ft<sup>2</sup></i>	<i>0.8 W/ft<sup>2</sup></i>	<i>1.0 W/ft<sup>2</sup></i>
	<i>Outdoor Sales</i>				
	<i>Open areas (including vehicle sales lots)</i>	<i>0.25 W/ft<sup>2</sup></i>	<i>0.25 W/ft<sup>2</sup></i>	<i>0.5 W/ft<sup>2</sup></i>	<i>0.7 W/ft<sup>2</sup></i>
	<i>Street frontage for vehicle sales lots in addition to "open area" allowance</i>	<i>No Allowance</i>	<i>10 W/linear ft</i>	<i>10 W/linear ft</i>	<i>30 W/linear ft</i>

**Non-Tradable Surfaces**

	<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>	<u>Zone 4</u>
<b>Building Facades</b>	No allowance	0.1 W/ft <sup>2</sup> for each illuminated wall or surface or 2.5 W/linear ft for each illuminated wall or surface length	0.15 W/ft <sup>2</sup> for each illuminated wall or surface or 3.75 W/linear ft for each illuminated wall or surface length	0.2 W/ft <sup>2</sup> for each illuminated wall or surface or 5.0 W/linear ft for each illuminated wall or surface length
<b>Automated teller machines &amp; night depositories</b>	270 W per location plus 90 W per add'l ATM per location	270 W per location plus 90 W per add'l ATM per location	270 W per location plus 90 W per add'l ATM per location	270 W per location plus 90 W per add'l ATM per location
<b>Entrances and gatehouse inspection stations at guarded fac.</b>	0.75 W/ft <sup>2</sup> of covered & uncovered area	0.75 W/ft <sup>2</sup> of covered & uncovered area	0.75 W/ft <sup>2</sup> of covered & uncovered area	0.75 W/ft <sup>2</sup> of covered & uncovered area
<b>Loading areas for law enforcement, fire, ambulance &amp; other emergency service vehicles</b>	0.5 W/ft <sup>2</sup> of covered & uncovered area	0.5 W/ft <sup>2</sup> of covered & uncovered area	0.5 W/ft <sup>2</sup> of covered & uncovered area	0.5 W/ft <sup>2</sup> of covered & uncovered area
<b>Drive-up windows/doors</b>	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
<b>Parking near 24-hour retail entrances</b>	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

# Simulated Performance Alternative Comm 63.0506

- z Wisconsin Accepts use of COMcheck when set for *"2009 IECC"*
- z Does NOT include both envelope and equipment for trade-offs

Note: Lighting controls are not adequately addressed via Comcheck, thus the designer is still responsible to address by other means

ICC Codes w/WI Amendments

