



NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS

2009 ENERGY CODE CHANGES

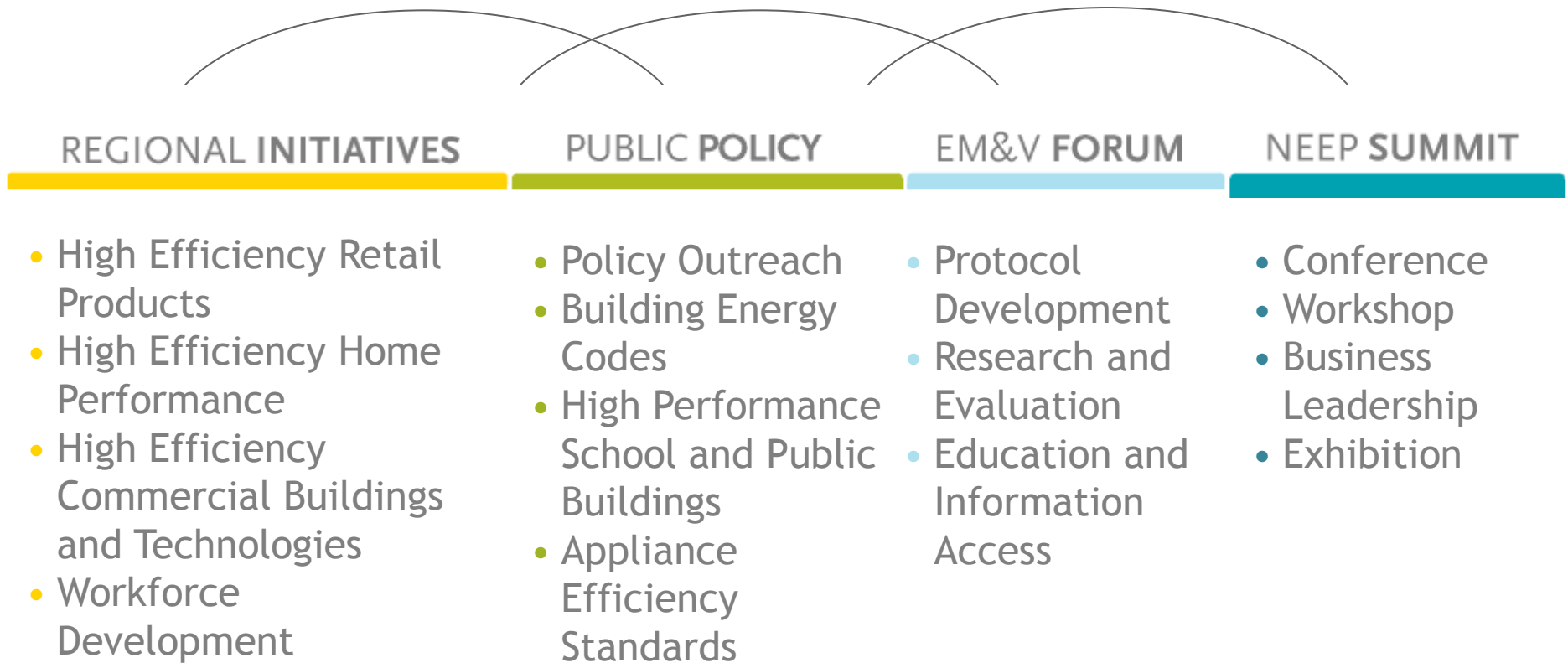
MAKING EFFICIENCY WORK

Donald J. Vigneau AIA
Northeast Energy Efficiency Partnerships

WHAT DOES NEEP DO?



FACILITATE PARTNERSHIPS...

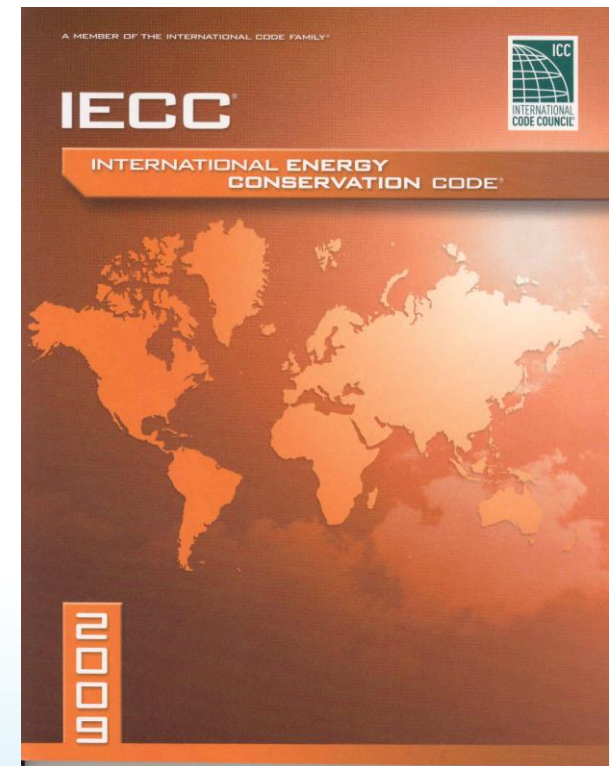


**TO ADVANCE THE EFFICIENT USE
OF ENERGY EFFICIENCY**



IECC 2009 CHANGES THAT
APPLY TO BOTH RESIDENTIAL
AND COMMERCIAL

GENERAL CHANGES



WHAT'S CHANGED SINCE IECC 2006?



- Stringency - some key differences
- New requirements
 - Building envelope tightness
 - Duct testing
 - Lighting equipment
 - Pool controls and covers
 - Snow melt controls
- Moisture control requirements moved to IBC
- No mechanical trade-offs allowed

ADMINISTRATION, GENERAL, DEFINITIONS



- 101.5.2.1 Exc. 3 (plus statutory chgs)
 3. Buildings and structures for which heating and cooling is supplied solely by utilization of non-purchased renewable energy sources including, but not limited to, on-site wind, on-site water or on-site solar power, or wood-burning heating appliances that do not rely on backup heat from other purchased, non-renewable sources.
- 102.1.1 (ADD)

Such energy efficiency program may include, but not be limited to, the Leadership in Energy and Environmental Design Rating system, the Green Globes USA design program, as established by the Green Building Initiative, the National Green Building Standard, as established by the National Association of Home Builders, or an equivalent rating system approved in accordance with section 29-256a of the Connecticut General Statutes.
- 202 DEFINITIONS
 - Insulation Product Rating

NEW DEFINITIONS

(202)



- Air barrier
- C-Factor
- F-Factor
- Entrance Door
- Storefront
- Daylight Zone
- Demand Control Ventilation
- Fan Systems definitions
- High-Efficiency Lamps
- Listed & Labeled

NEW DEFINITIONS

(202 - CT)



(NEW) (Amd) **SUNROOM.** A one-story structure, enclosing a habitable space, with glazing in excess of 40 per cent of the gross area of the exterior walls and roof, and with the area of windows and doors operable to the exterior equal to a minimum of 20 per cent of the area of the sunroom floor.

(NEW) (Add) **FULL CUTOFF LUMINAIRE.** A luminaire that allows no direct light emissions above a horizontal plane through the luminaire's lowest light-emitting part.

(NEW) (Add) **GREENHOUSE.** A one-story structure, enclosing a nonhabitable space, with glazing in excess of 50 per cent of the gross area of the exterior walls and roof.

(NEW) (Amd) **RESIDENTIAL BUILDING.** For this code, includes detached one and two-family dwellings and townhouses, as well as Group R-2, R-3 and R-4 buildings three stories or less in height.

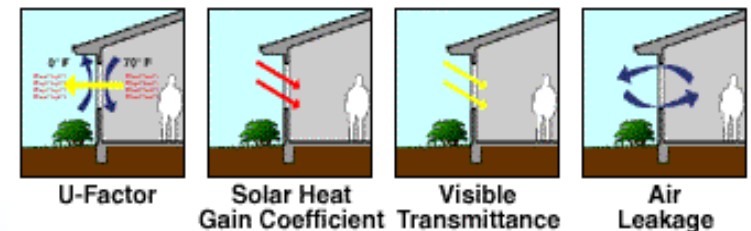
FENESTRATION PERFORMANCE

TABLE 402.1.1 / TABLE 502.3



- NFRC Ratings 303.1.3
 - NFRC 100, *U*-factors
 - NFRC 200, SHGC
 - Windows, doors, skylights
- Manufactured fenestration
 - Standardized infiltration rates
 - AAMA/WDMA I.S.2, or
 - NFRC 400
- “Site-built” fenestration
 - Caulk, gasket or weather-strip for infiltration control
- Default *U*-factors & SHGC’s 303.1.3

 National Fenestration Rating Council CERTIFIED	World's Best Window Co. Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider (per NFRC 100-97)
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) 0.35	Solar Heat Gain Coefficient 0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance 0.51	Air Leakage (U.S./I-P) 0.2
<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>	



SECTION 402.6.1 - VAPOR RETARDER



(NEW) (Add) 402.6.1 Class III vapor retarder

New vapor retarder requirements allow the use of a coat of vinyl paint to satisfy the requirement when:

- An impermeable insulating sheathing with a value of R-5 is located outside of a 2x4 stud wall with cavities insulated to R-3.4 per inch minimum in Zone 5;
- An impermeable insulating sheathing with a value of R-7.5 is located outside of a 2x6 stud wall with cavities insulated to R-3.4 per inch minimum in Zone 5;



VAPOR RETARDER (CT 402.6) - WILL MOVE



IECC / IRC

Moisture Control

- R302.10.1 Insulation
- R408.1 crawl spaces
- R506.2.3 Slabs
- R601.3 Walls (Table)
- R806.4 Attics
- N1102.2.9 Crawl Space
- M1601.4.5 Ducts

(Was in 402.5/N1102.5)

IBC

Moisture Control

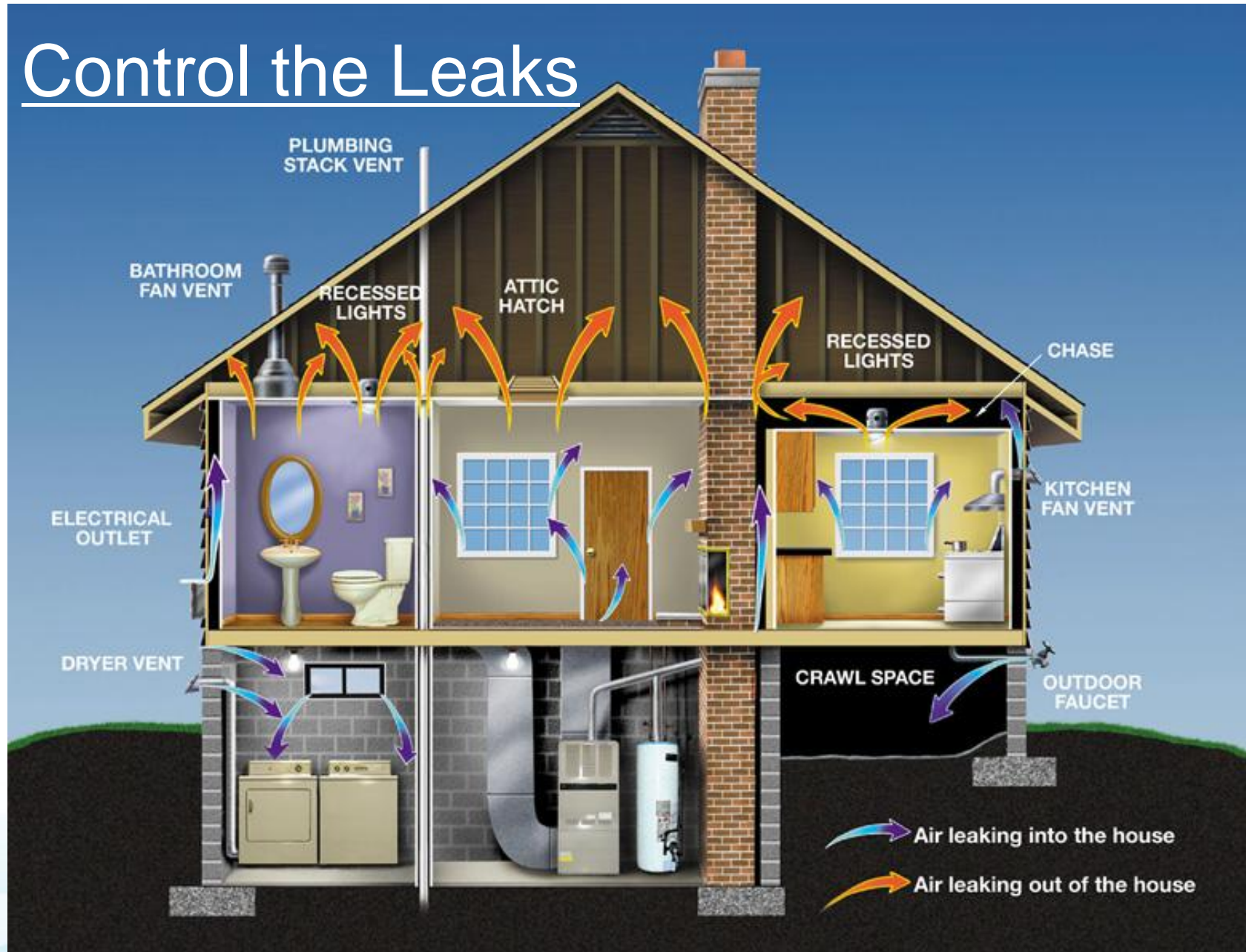
- 202 Definitions
- 719 Insulation facings
- 1203.3.2 Crawl Space.4
- 1405.3 Frame Walls
- 1502 Roofs (general)
- 1910.1 Floor Slabs

(Was in IECC 502.5)

HOW TO CONTROL VAPOR (MOISTURE)



Control the Leaks





Vigneau Residence
Mansfield Center CT

CONTROLLING THE ENVELOPE

MOISTURE DIFFUSION IN MATERIALS



MATERIAL	PERM RATING	VAPOR RETARDER(?)
½" GWB	38 -42	NO
TYVEK	52	NO
Latex <u>Primer</u>	7.0 – 10.0	NO
7/16" OSB (w/exterior glue)*	0.77* – 3.48	SOMETIMES
1" XPS	0.40 – 1.60	SOMETIMES
7/16" Plywood (exterior glue)	0.70	YES
Kraft Paper Facing	1.0	YES
2 mil polyethylene	0.06 – 0.22	YES
Alkyd-base or V/R paint	< 0.05	YES
1 mil aluminum foil laminate	< 0.05	YES
½" GWB + VWC	0.05 – 0.80	YES

POP QUIZ:



IS WATER VAPOR...

LIGHTER THAN AIR?

HEAVIER THAN AIR?

THE SAME?

Does it matter?

...ANY QUESTIONS?



RECESSED LIGHTING (402.4.5/502.4.8)



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
- Type IC rated and labeled in accordance with ASTM E 283 to allow ≤ 2.0 cfm of air movement from conditioned space to ceiling cavity
- **NO sealed boxes allowed**



THERMOSTAT CONTROLS

403.1.1 / 503.2.4.1



- One per dwelling - forced air only
- Programmable
- Heat or AC or HVAC
- Deadband $\geq 5^{\circ}$ F
- One per ZONE by commercial provisions



DESIGN LOADS/EQUIPMENT SIZING

403.6 503.2.1



ACCA Standards

- J - Load Calculations
- S - Equipment Selection
- D - Duct Design

- ASHRAE/ACCA 183



<http://www.acca.org/store/product.php?pid=97>

SNOW MELTING SYSTEMS (NEW)



- 403.8
- 503.2.4.5

Snowmelt Systems Automatic Controls

- Provide shutdown when pavement temperature $> 50^{\circ}\text{F}$ with no precipitation falling;
- Shutdown when air temperature $> 40^{\circ}\text{F}$

POOL REQUIREMENTS 403.9 / 504.7



- Pool heaters
 - Readily accessible on-off switch
 - Natural gas or LPG fired pool heaters will not have continuously burning pilot lights
- No changes to other Service Water requirements



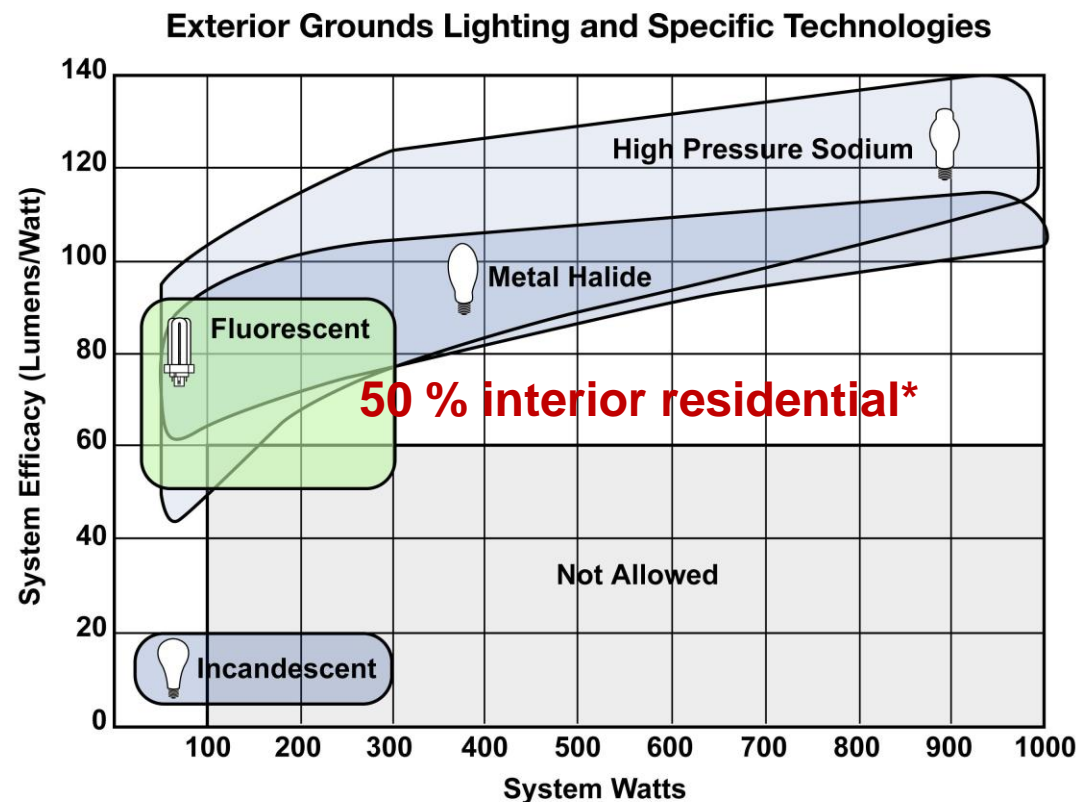


POOL HEATERS

LIGHTING EQUIPMENT (PRESCRIPTIVE)



- 404.1 A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps
- 505.1 Exception: (ILPA) Controls and equipment in residential dwelling units regulated by Section 5





CHAPTER 4 SPECIFICS - ZONE 5A

RESIDENTIAL CHANGES

TABLES T402.1.1 / 402.1.3 / 402.2.5



Table 402.1.1 COMPONENTS

- R-20 Walls
- Skylights - same U- & SHGC factors

Table 402.1.3 FENESTRATION

- U-factor for frame walls changes 0.057 (0.060 in '06)

Table 402.2.5 STEEL FRAMING

- Continuous insulation (ci) for R-13 equivalent walls

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE ^a
Steel Truss Ceilings^b	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings^b	
R-30	R-38 in 2 × 4 or 2 × 6 or 2 × 8 R-49 in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 × 6 R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6 R-19 + 12 in 2 × 8 or 2 × 10

a. Cavity insulation R-value is listed first, followed by continuous insulation R-value.

b. Insulation exceeding the height of the framing shall cover the framing.

ENVELOPE REQUIREMENT CHANGES



- 402.2 Ceilings
- Deletes exceptions for cathedral & raised heel truss reductions in U-factor & UA
- 402.3 Windows/Doors
- Deletes exceptions for 15sf window/24sf door in U-factor & UA
- (AMD/CT) Sunrooms 402.2.11 envelope
- (AMD/CT) Sunroom U-Factor 402.3.5; no separate skylight U-
- (ADD/CT temp*) Moisture Control

ATTIC OPENINGS - INSULATE & SEAL



402.2.3 Access hatches & doors

- Insulate per adjacent component
- Weatherstrip
- Protect insulation from damage
- Contain insulation from displacement

402.4.1(10) Air Sealing rough openings

AIR SEALING AND INSULATION 402.4.2



**TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA**

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material. Air-permeable insulation is inside of an air barrier.
Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above-garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are air tight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower/tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical/phone box on exterior walls	Air barrier extends behind boxes or air sealed-type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

AIR SEALING AND INSULATION



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

Measuring Leaks - Blower Door Test

CFM x 60/CF of house. Air natural leakage (1/20 of test) should be expected between <0.70 (leaky) and >0.35 (tight).



FIREPLACES 402.4.3



- New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.



MECHANICAL & CONTROL SYSTEMS



- “Right-sized“
 - Better than NAECA
 - ACCA: S/J/D/T
- Tested
 - Ductwork
 - Balancing
 - Proper charge



DUCT INSULATION & DUCT TESTING



403.2.1

- Supply in attic R-8
- All other R-6

403.2.2

- No insulation or test required inside conditioned space



(NEW) (Add) 403.2.1.1 Duct insulation values. Minimum duct insulation values stated in Section 403.2.1 shall be installed R-values.

- **(NEW) (Amd) 403.2.3 Building cavities (Mandatory).** Building framing cavities shall not be used as supply or return ducts.

PIPE INSULATION 403.4



- 403.4 Circulating Systems (no change)

(NEW) (Add) 403.4.1 Pipe insulation. All service hot water piping within 10 feet of service water heating equipment shall be insulated to at least R-2. Systems with distribution manifolds shall be insulated between service water heating equipment and the distribution manifold or 10 feet, whichever is less. In addition, the first 5 feet of cold water pipes from the water heating tanks shall be insulated to at least R-2.

LOADS - ACCA MANUALS J & S

403.6 SIZING / 403.7 MULTIPLES



- Ventilation
 - Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the system is not operating
- Equipment Sizing
 - CT references ACCA Manuals J & S
 - Load calculations determine the proper capacity (size) of equipment
 - Goal is big enough to ensure comfort but no bigger



(NEW) (Amd) 403.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

ACCA SYSTEM DESIGN PROCESS



AGGREGATED LOADS FOR INDIVIDUAL SPACES

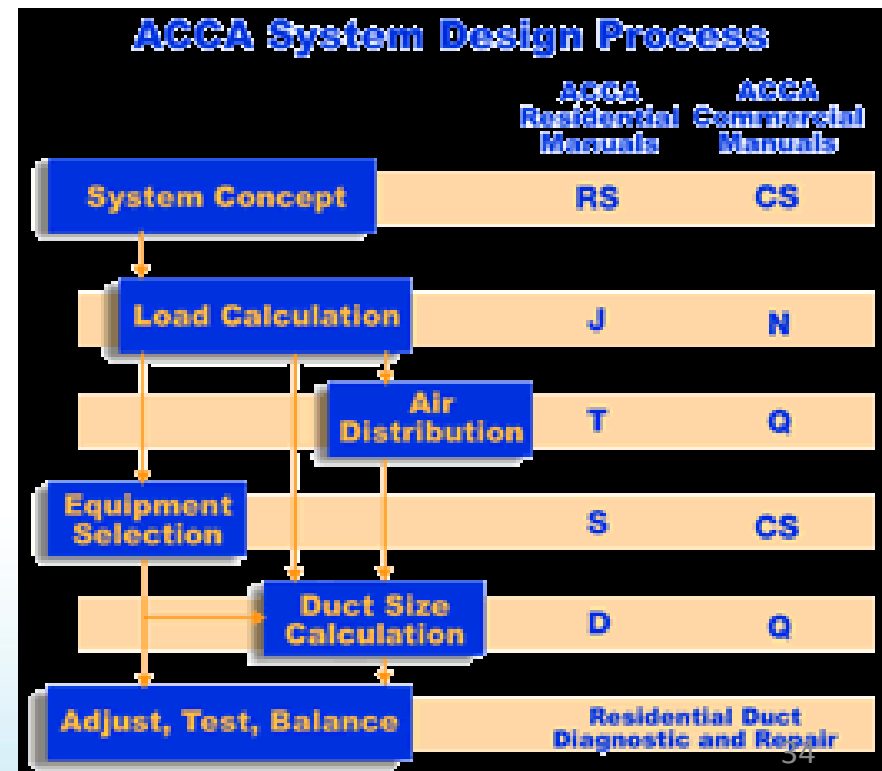
- Sensible: envelope, air leakage & exhaust, equipment, occupants & activities
- Latent: cooking, bathing, occupant, weather-related (A/C)

J. SYSTEM LOAD REQUIREMENTS

S. SELECTIONS OF EQUIPMENT

D. DELIVERY NETWORK SIZING

T. TESTING, LOAD BALANCING



SIMULATED PERFORMANCE 405



- Table 405.5.2(1) REVISED TO REFLECT CHANGES ABOVE
- 405.4.2 COMPLIANCE REPORT
 - Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*.



CHAPTER 5 SPECIFICS - 501.2

Use of ASHRAE 90.1 is exclusive

COMMERCIAL CHANGES

TABLES - ENVELOPE COMPONENTS



- T502.1.2 Opaque
- R Use Group/“Other”
- T502.2(1) U-factor
- R Use Group/”Other”
- C-Factor
- F-Factor
- T502.2(2) Metal Frame
- Spacer blocks R-3.5 (1”)
- T502.3 Fenestration
- No changes in Zone 5A
- Skylights combined - no separate glass/plastic

NEW C- AND F-FACTORS



This separate U-factor Table is NEW in 2009

**TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS**

CLIMATE ZONE	5	
	All other	Group R
Roofs		
Insulation entirely above deck	U-0.048	U-0.048
Metal buildings	U-0.055	U-0.055
Attic and other	U-0.027	U-0.027
Walls, Above Grade		
Mass	U-0.90	U-0.80
Metal building	U-0.069	U-0.069
Metal framed	U-0.064	U-0.064
Wood framed and other	U-0.064	U-0.051
Walls, Below Grade		
Below-grade wall ^a	C-0.119	C-0.119
Floors		
Mass	U-0.074	U-0.064
Joist/Framing	U-0.033	U-0.033
Slab-on Grade Floors		
Unheated slabs	F-0.730	F-0.540
Heated slabs	F-0.860	F-0.860

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

METAL BUILDINGS - R3.5 THERMAL BLOCKS (1")



TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

CLIMATE ZONE	5	
	ALL OTHERS	GROUP R
Roofs		
Insulation entirely above decks	R-20ci	R-20ci
Metal buildings (with R-5 thermal blocks ^{a,b})	R-13 + R-13	R-19
Attic and other	R-38	R-38
Walls, Above Grade		
Mass	R-11.4ci	R-13.3 ci
Metal building ^b	R-13 + R-5.6ci	R-13 + R-5.6ci
Metal framed	R-13 + R-7.5ci	R-13 + R-7.5ci
Wood framed and other	R-13 + R-3.8ci	R-13 + 3.8
Walls, Below Grade		
Below grade wall ^c	R-7.5ci	R-7.5ci
Floors		
Mass	R-10ci	R-12.5ci
Joist/framing Steel/(wood)	R-30	R-30
Slab-on-Grade Floors		
Unheated Slabs	R-3 thermal break at wall to floor joint R-7.5 for 24 inches below	R-10 for 24 in. below
Heated slabs	R-15 for 24 in. below	R-15 for 24 in. below
Opaque doors		
Swinging	U -0.70	U -0.70
Roll-up or sliding	U -0.50	U -0.50

For SI: 1 inch = 25.4mm.

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. 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.

PRESCRIPTIVE COMPLIANCE APPROACH METAL BUILDINGS



TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS—OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
R-19	<p>Standing seam roof with single fiberglass insulation layer.</p> <p>This construction is R-19 faced fiberglass insulation batts draped perpendicular over the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-13 + R-13 R-13 + R-19	<p>Standing seam roof with two fiberglass insulation layers.</p> <p>The first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-11 + R-19 FC	<p>Filled cavity fiberglass insulation.</p> <p>A continuous vapor barrier is installed below the purlins and uninterrupted by framing members. Both layers of uncompressed, unfaced fiberglass insulation rest on top of the vapor barrier and are installed parallel, between the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
WALLS		
R-16, R-19	<p>Single fiberglass insulation layer.</p> <p>The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.</p>	ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"
R-13 + R-5.6 ci R-19 + R-5.6 ci	<p>The first R-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated R-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.</p>	ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"

AIR BARRIERS REQUIRED

502.4.9



- Continuous, joints made airtight
- Permeability:
<math><0.004 \text{ cfm/sf@0.3wg}</math>
- Withstand pressures:
wind, fan, stack loads
- Flexible connections between dissimilar materials/systems

Still provide sealing of:

- Foundations/walls
- Walls to windows/doors
- Different materials
- Walls to roofs
- To unconditioned spaces
- Across all joints and penetrations

SECTION 503 BUILDING MECHANICAL SYSTEMS



Simplified to Include Only Four Sections:

- 1) What Provisions of the Code Apply (503.1)
- 2) Mandatory Provisions (503.2)
- 3) Simple HVAC Systems and Equipment (503.3)
- 4) Complex HVAC Systems and Equipment (503.4)



503.2 DUCTS & PIPES



- 503.2.7 Duct insulation
 - CT amendment

(NEW) (Add) 503.2.7.2 Duct insulation values. Minimum duct insulation values stated in Section 503.2.7 shall be installed R-values.

- 503.2.8 Piping insulation will have to be calculated for thickness if “k” factor of material is $> < 1.27/\text{inch}$

OUTSIDE HEAT CONTROLS



503.2.11 Heating Outside a Building

- To be radiant heat systems only
- Controlled by an occupancy sensing device or timer switch
 - System is automatically de-energized when no occupants are present

VENTILATION - DCV / ERV / FAN MOTORS



- 503.2.5.1 DCV

- 503.2.6 ERV



- 503.2.10 Air system fan HP & Operation

DEMAND CONTROLLED VENTILATION (503.2.5.1)



- DCV must be provided for each zone with spaces > 500 ft² with the average occupant load > 40 people/1000 ft² of floor area where the HVAC system has:
 - An air-side economizer;
 - Automatic modulating control of the outdoor air damper; or
 - A design outdoor airflow > 3,000 cfm

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

ECONOMIZERS - SIMPLE / COMPLEX



- 503.3.1(1) & Table - SIMPLE
- 503.4.1 (same table) - COMPLEX -different exceptions



SUPPLY/RETURN DUCT AND PLENUM INSULATION AND SEALING (503.2.7)



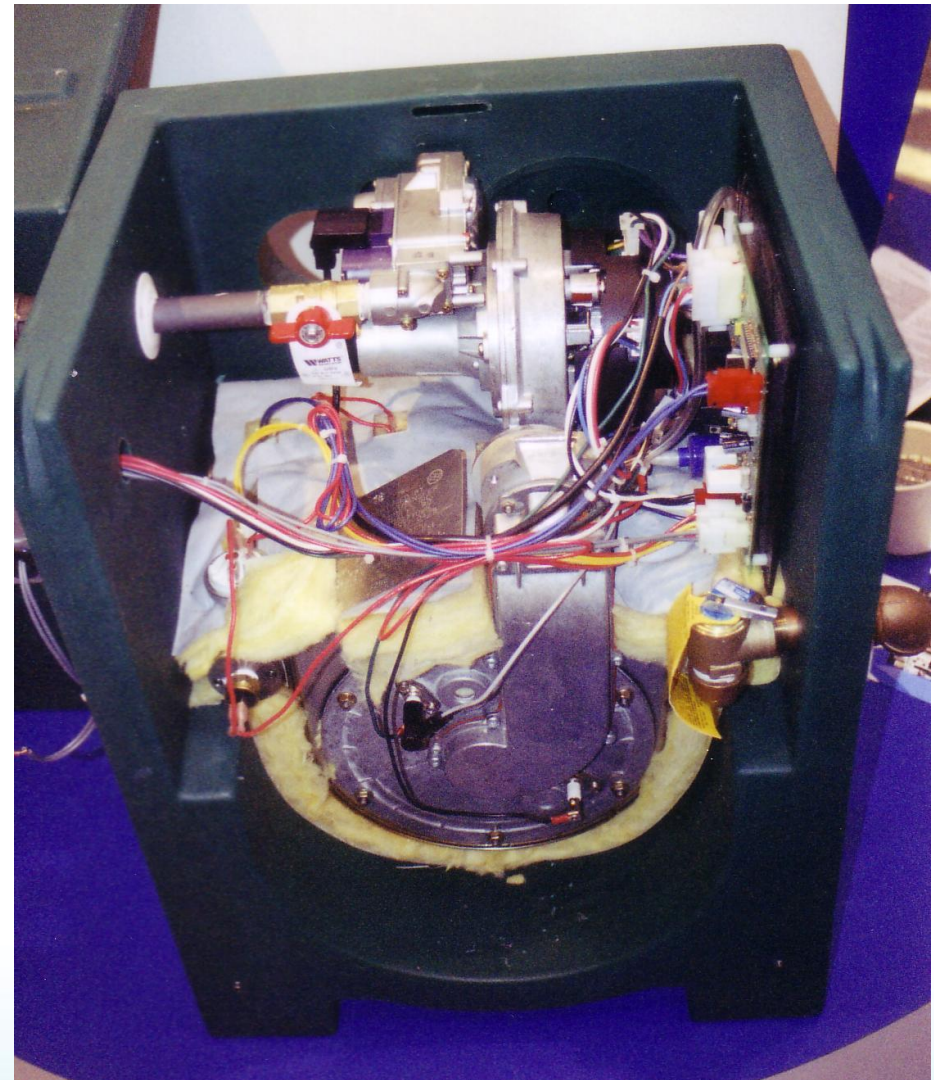
- All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the IMC.



SYSTEMS OPERATION & CONTROLS



- 503.4.3.3 Hydronic HPs
- 503.4.5.4 Supply air temperature resets
- 504.7 Pool heaters



HOT GAS BYPASS (503.4.7 - NEW) (ERRATA CORRECTION - 502.4.4)



- Don't use unless cooling system is designed with
 - multiple steps of unloading OR
 - Continuous capacity modulation
- Capacity limited per **Table 503.4.7**

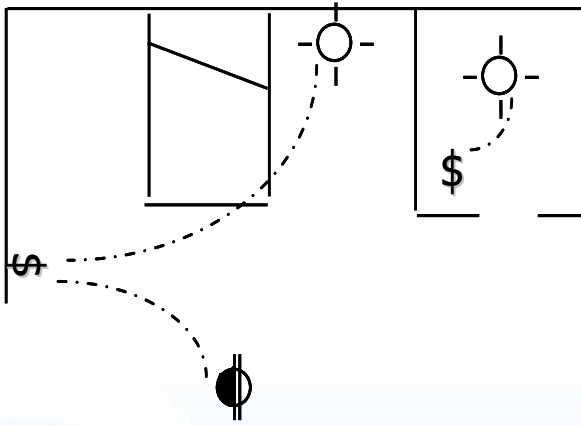
Rated Capacity	Maximum Hot Gas Bypass Capacity (% of total capacity)
$\leq 240,000$ Btu/h	50%
$> 240,000$ Btu/h	25%

- Exception to requirement:
 - Unitary packaged systems with cooling capacities $< 90,000$ Btu/h

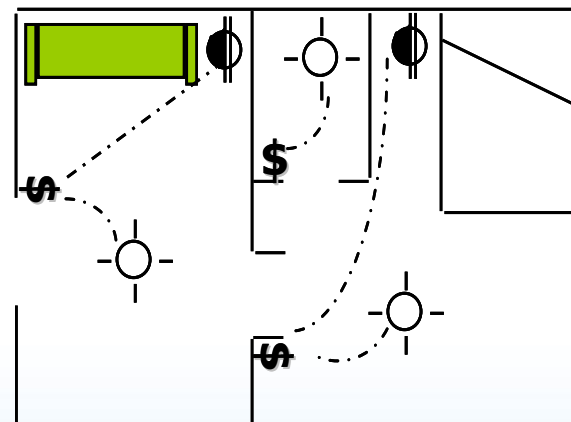
505.2.3 R-1 UNIT MASTER SWITCHING



- Applies to hotels, motels, boarding houses, or similar
- Master switch required at each room or main room entry
- Must control all permanently wired luminaires or switched receptacles
 - Exceptions: bathrooms



Standard Room



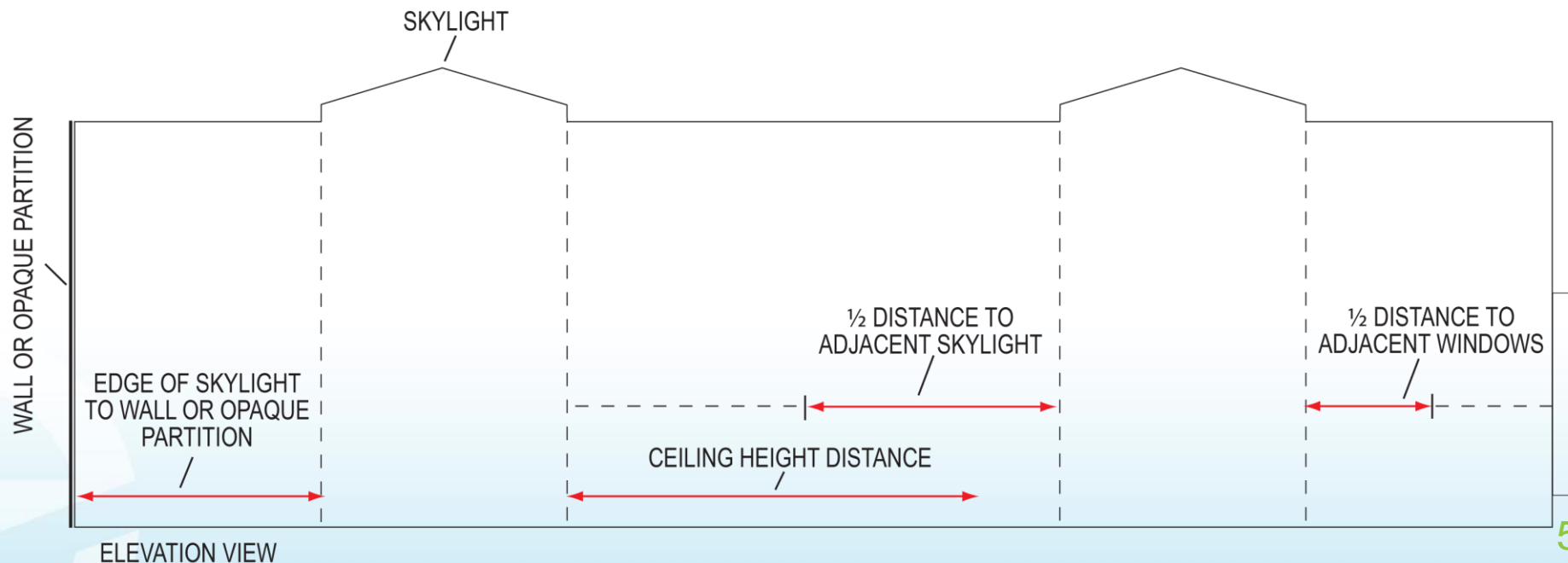
Suite

Intent: Allow occupant to turn off lights at exit point!

DAYLIGHT ZONE DEFINITION - AT WINDOWS OR UNDER SKYLIGHTS



- The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension plus the smaller of:
 - The floor-to-ceiling height, or
 - The distance to a ceiling height opaque partition, or
 - One-half the distance to adjacent skylights or windows



DAYLIGHT ZONE CONTROL



- Daylight zones
 - Must have individual control of the lights independent of general area lighting
- Contiguous daylight zones adjacent to vertical fenestration
 - Can be controlled by a single controlling device if the zone doesn't include areas facing more than two adjacent cardinal orientations (i.e., north, east, south, west)
- Daylight zones under skylights > 15 ft from the perimeter must be controlled separately
- Exception: Daylight spaces
 1. enclosed by walls or ceiling height partitions and
 2. containing two or fewer light fixtures
 - not required to have a separate switch for general area lighting

Note: required controls may be manual or automatic

T505.5 INTERIOR LIGHTING POWER ALLOWANCE EXCEPTIONS



Table 505.5.2

- Building Area Type
- Same values in the Table

• There are 15 more exceptions to the lighting list

• Note: Alternate Standard ASHRAE/IESNA 90.1-2007 provides whole building and space-by-space options

LIGHTING POWER DENSITY	
Building Area Type ^a	(W/ft ²)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare – clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail ^b	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

EXTERIOR LIGHTING CONTROLS (505.2.4 - NEW)



- For dusk-to-dawn lighting: astronomical time switch or photosensor
- For all other: astronomical time switch OR photosensor + time switch
- All time switches must have 10 hour battery backup



EXTERIOR LIGHTING EFFICACY (505.6.1)



Building grounds lighting luminaires over 100 watts must have source efficacy of at least 60 lumens per watt

Light Source	Typical System Efficacy Range in LPW (varies depending on wattage and lamp type)
Incandescent	10-18
Halogen incandescent	15-20
Compact fluorescent (CFL)	35-60
Linear fluorescent	50-100
Metal halide	50-90

Exceptions:

- Controlled by motion sensor
- Any of the exterior lighting power allowance exceptions
- As approved for a historical, safety, signage, or emergency consideration

EXTERIOR LIGHTING POWER LIMITS



(505.6.2)

What areas are covered under exterior lighting allowances?

- **Tradable surfaces**

Common exterior lighted needs that can be traded for other needs.

For example, wattage allowed for parking lot lighting can be “traded” and used for canopy lighting.

- **Nontradable surfaces**

Less common exterior lighted needs that **cannot** be traded for other needs.

These applications have more specific security or task illuminance needs.



TRADABLE SURFACES



- Uncovered parking lots and areas
- Walkways (under/over 10 feet wide)
- Stairways
- Pedestrian tunnels
- Main building entrances
- Other doors
- Entry canopies
- Free-standing and attached sales canopies
- Open sales areas
- Street frontage sales areas



NONTRADABLE SURFACES



- Building facades
- Automated teller machines and night depositories
- Entrances and gatehouse inspection stations at guarded facilities
- Loading areas for law enforcement, fire, ambulance and other emergency vehicles
- Drive-up windows/doors
- Parking near 24-hour retail entrances



EXEMPTIONS FROM EXTERIOR CALCULATION (505.6.2)



The following lighting does not need to be included in the proposed lighting calculation:

- Specialized traffic signal, directional, and lane marker lighting
- Advertising signage or directional signage
- Lighting integral to *equipment* or instrumentation and installed by its *manufacturer*
- Lighting for theatrical purposes, including performance, stage, film production, 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*



CT 505.6.3 LIGHT POLLUTION CONTROLS



(NEW) (Add) **505.6.3 Light pollution controls.** When the power for exterior lighting is supplied through the energy service to the building, luminaires used for exterior lighting shall be full cutoff luminaires.

Exceptions:

1. Luminaires with an output of 150 Watts incandescent or less, or the equivalent light output;
2. Luminaires intended to illuminate the façade of buildings or to illuminate other objects including, but not limited to, flagpoles, landscape and water features, statuary and works of art;
3. Luminaires for historic lighting on the premises of an historic building as defined in the 2003 International Existing Building Code or within a designated historic district;
4. Outdoor sports facility lighting of the participant sport area;
5. Emergency exit discharge lighting;
6. Low voltage landscape lighting;
7. Sign illumination;
8. Festoon lighting as defined in the 2005 NFPA 70 National Electrical Code; or
9. Temporary lighting for emergency, repair, construction, special events or similar activities.



506 TOTAL BUILDING PERFORMANCE



- Revised to reflect changes described in Chapter 5 changes



Your Instructor: Don Vigneau AIA



QUESTIONS?

RESOURCES



**Connecticut
Light & Power**

The Northeast Utilities System



CONNECTICUT
ENERGY EFFICIENCY FUND

www.CTEnergyInfo.com



The United Illuminating Company



The Northeast Utilities System

Northeast Utilities

<http://www.nu.com/>

Connecticut Light & Power Co.

<http://www.clp.com/>

United Illuminating Co.

<http://www.ui.com/>



THANK YOU

2009 ENERGY CODE CHANGES

DONALD VIGNEAU AIA
dvigneau@neep.org

Connecticut Design & Trades Conference
MARCH 15, 2011

5 Militia Drive Lexington, MA 02421
P: 781.860.9177 - x136
www.neep.org