Decoding 2016 Title 24 Part 6

Let's Talk About What's New

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Energy Code Ace™
HELPING YOU PLAY YOUR CARDS RIGHT

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Welcome

HELPING YOU PLAY YOUR CARDS RIGHT

Agenda

Agenda for Today — Approx. Length

- Welcome..... 10 minutes
- Why?!..... 10 minutes
- Let's Talk..... 80 minutes
  - *Challenge A: Nonresidential..... 35 minutes*
  - *Challenge B: Residential Envelope..... 20 minutes*
  - *Challenge C: Residential Mechanical. 15 minutes*
  - *Challenge D: Residential Lighting..... 10 minutes*
- Next Steps..... 15 minutes
- Wrap Up..... 5 minutes

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California Statewide Codes & Standards

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Who Are We?

Gabel Associates, LLC
gina@gabelenergy.com

Host: Gina Rodda

Gina Rodda, our host for the Decoding Talk series, is a Certified Energy Analyst (CEA), and LEED Accredited Professional (AP).

She is involved in providing residential and non-residential energy calculations for a variety of building types throughout California; an instructor of full day trainings; and host of various webinars specific to Title 24 (Part 6) Building Energy Efficiency Standards.

Gina has been in the energy modeling field since 1991, through the course of *eight* California building energy code cycles.

GABEL ASSOCIATES, LLC
BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE

Who Are We?

Co-Host: Martyn Dodd

Martyn Dodd, the founder and principal of EnergySoft in Novato, CA, is an industry expert in performance-based building analysis. He has written software programs used in California for Title 24 energy code compliance since 1985, including EnergyPro, COMPLY 24, and the California Energy Commission's Perform software.

He is also one of the original authors of the 1992 Non-residential Alternative Calculation Method Manual, which defines the rules for code compliance software and has become the model for national and international code compliance software procedures.

ENERGY SOFT

Our Goal Today

- Review the changes to Title 24 Part 6 with the 2016 code cycle:
  - What are the major changes to this code cycle.
  - How might this code affect our work, and how to prepare.
  - Where can you get more information on this code cycle.

We would like to know about *you*.

Why?

Why? Intent Behind the Code

2020 – Net Zero "New" Residential Homes

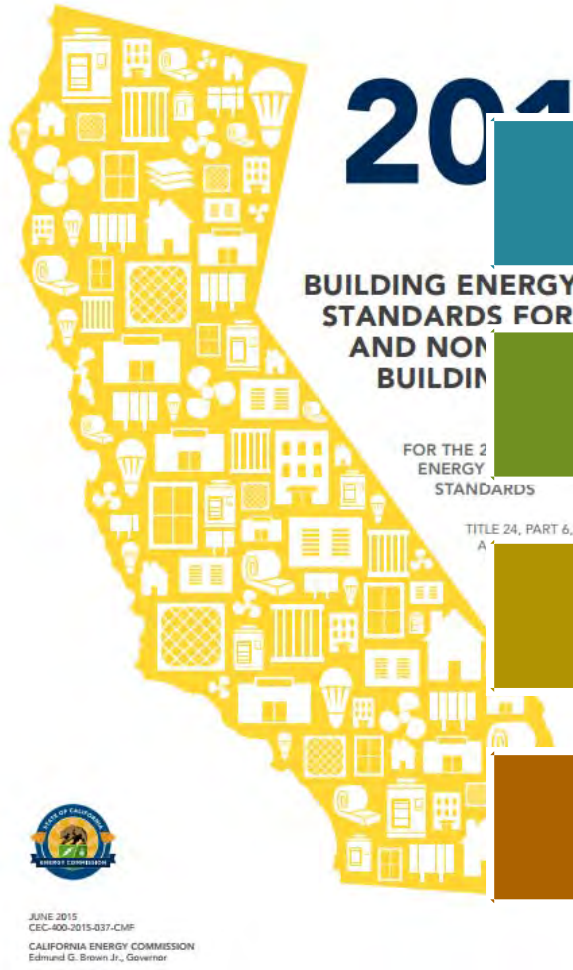
2030 – Net Zero "New" Nonresidential buildings

History of 2016 Code Cycle

- **1978:** Title 24, Part 6, *California State Building Energy Efficiency Standards* established; updates every 3 years
- **2003:** *California Energy Action Plan* adopted; efficiency 1st choice in meeting future energy needs
- **2006:** AB32, *Global Warming Solutions Act*, adopted to reduce greenhouse gas emissions
- **2008:** *"Big Bold Strategies"* adopted – California Energy Efficiency Strategic Plan (CEESP)

What? When?

January 1, 2017



Subchapters **1 – 2**	All Occupancies
Subchapters **3 – 6**	Nonres, High-Rise Res, & Hotel/Motel Occupancies
Subchapters **7 – 9**	Low-Rise Residential
Appendix **1-A**	Standards & Documents Referenced in the Standards

Ace Resources™

Quick reference component-by-component summaries of sections of Title 24, Part 6 "triggered" based on project scope.

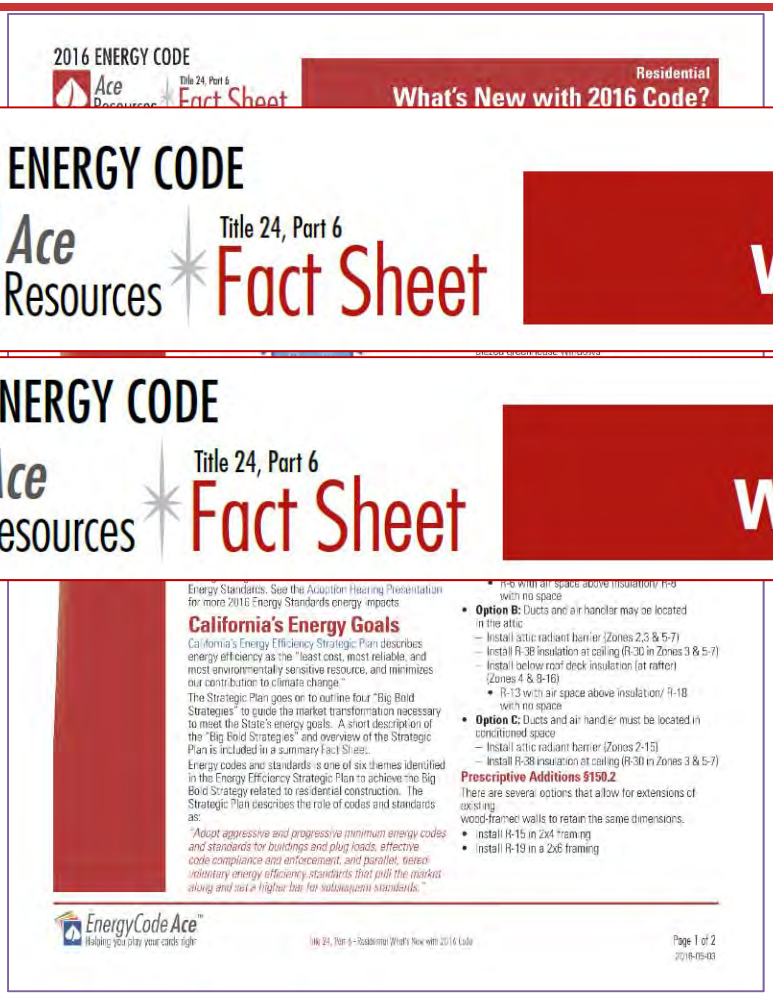
Quick reference summaries of key requirements, forms, definitions and resources for implementing Title 24, Part 6 and Title 20

Step-by-step guidance for plans checks and field inspections

A list of useful links, telephone numbers and handy documents

FAQs on the program, the site and the code, and
A place to submit your own questions

Ace Resources | Title 24, Part 6 Fact Sheet


2016 ENERGY CODE

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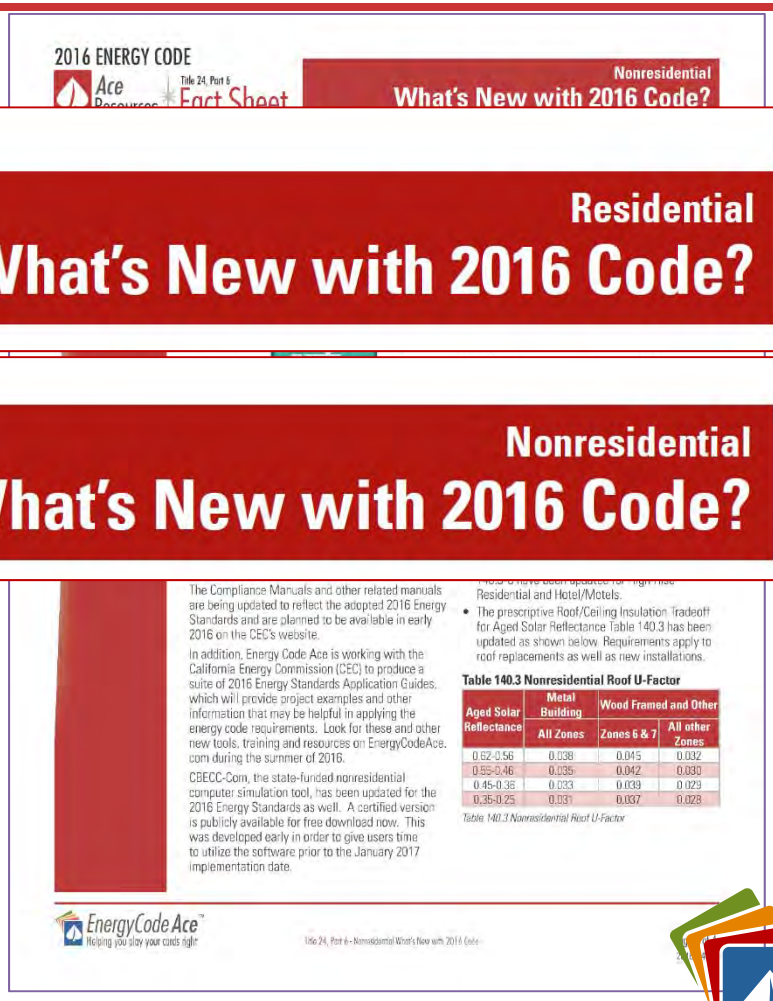
Residential

What's New with 2016 Code?


2016 ENERGY CODE

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Nonresidential

What's New with 2016 Code?

CALIFORNIA'S 2016 — RESIDENTIAL

BUILDING ENERGY EFFICIENCY STANDARDS

CALIFORNIA ENERGY COMMISSION

The state's energy efficiency standards for new buildings and appliances have saved consumers billions in reduced electricity and natural gas bills. The building standards include better windows, insulation, lighting, air conditioning systems and other features that reduce energy consumption in homes and businesses. Since 1978 these standards have helped protect the environment by reducing more than 250 million metric tons of greenhouse gas emissions (or the equivalent of removing 37 million cars off California roads).

$7,400 SAVINGS OVER A 30 YR. MORTGAGE | INITIAL COST $2,700

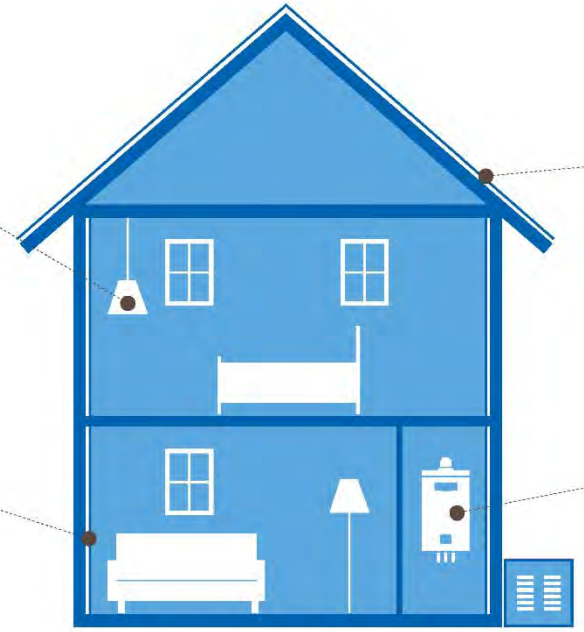
28% more stringent

HIGH EFFICACY LIGHTING

All lighting in new homes must be efficient. Installation of high quality lighting with controls that nearly halve the energy required for lights in new homes.

HIGH PERFORMANCE WALLS

Increased wall insulation keeps the sun's heat out of your home during hot summer months and warm air in during winter months, improving comfort and reducing energy consumption.



These are cost effective measures that home builders may consider to achieve new levels of efficiency. They can be traded for other efficient technologies such as higher efficiency HVAC units, higher efficiency water heaters, etc.

HIGH PERFORMANCE ATTICS

Attics with additional insulation at the roof deck keep attic temperatures closer to ambient, improving the home's heating and cooling performance. Extra insulation at the roof deck, in addition to the ceiling insulation, will reduce the attic temperature by 35 degrees or more during hot summer days.

IMPROVED WATER HEATING SYSTEM EFFICIENCY

Installing tankless water heating technology and better distribution systems reduces the energy needed to provide hot water to the home by about 35 percent.

CALIFORNIA'S 2016 — NONRESIDENTIAL
BUILDING ENERGY EFFICIENCY STANDARDS

CALIFORNIA ENERGY COMMISSION

The state's energy efficiency standards for new buildings and appliances have saved consumers billions in reduced electricity and natural gas bills. The building standards include better windows, insulation, lighting, air conditioning systems and other features that reduce energy consumption in homes and businesses. Since 1978 these standards have helped protect the environment by reducing more than 250 million metric tons of greenhouse gas emissions (or the equivalent of removing 37 million cars off California roads).

5% Increased Stringency

DOOR AND WINDOW INTERLOCKS

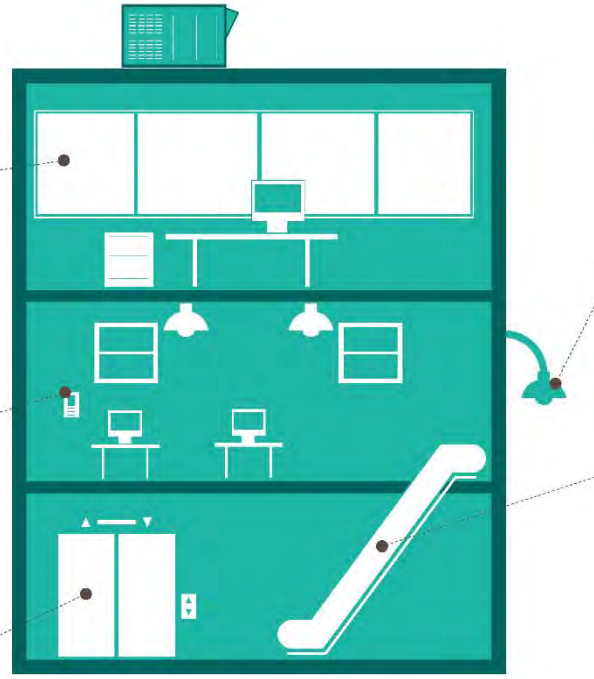
Sensors on doors and windows adjust the thermostat to turn off the heating or cooling if a door or window is left open for more than five minutes. This allows occupants to take advantage of outside temperatures and save on heating and cooling costs.

DIRECT DIGITAL CONTROLS

For larger heating, ventilation and air conditioning systems, installing digital controls enables communication with building energy management systems, allowing managers to tailor the building's heating and cooling demands and prevent waste.

ELEVATORS

Efficient ventilation fans and lighting sources installed within the elevator, along with controls that turn off the cab lighting and fans when the elevator is empty, save energy both when the elevator is in use and when empty.



These are cost effective measures that builders may consider to achieve new levels of efficiency. They can be traded for other efficient technologies such as higher efficiency HVAC units, higher efficiency water heaters, etc.

OUTDOOR LIGHTING

The general power allowance for outdoor lighting has been lowered to include newer, more efficient luminaires which are widely available and commonly used for outdoor lighting applications.

ESCALATORS

Requires escalators and moving walkways in transit areas to run at a lower, less energy-consuming speed when not in use.

Let's Talk

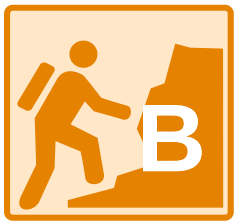
HELPING YOU PLAY YOUR CARDS RIGHT

Our Question To You

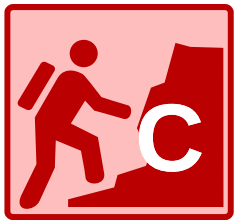
- Why does the energy code change every 3 years?
- What resources are you using to help prepare for this next code cycle?
- What are your top 3 concerns regarding the 2016 code changes?
- If you could wave your magic wand, what would help you be more successful in regards to Title 24 Part 6?

Challenges

- **Challenge A:**
  - **Nonresidential: Envelope, Mechanical and Lighting**



- **Challenge B:**
  - **Residential: Envelope**



- **Challenge C:**
  - **Residential: Mechanical**

- **Challenge D:**
  - **Residential: Lighting**

Challenge A

Challenge A

Nonresidential: Envelope, Mechanical and Lighting

Mandatory, Prescriptive, Performance

Software is available NOW!

Mandatory Measures

Envelope: §110.6/7/8; 120.7
Solar Ready: §110.10
Mechanical: §110.2/3/5, 120.0
Lighting: §110.9; 120.8; 130.0-4
Electrical: §130.5
Commissioning: §120.5
Covered Process: §110.2; 120.6/8

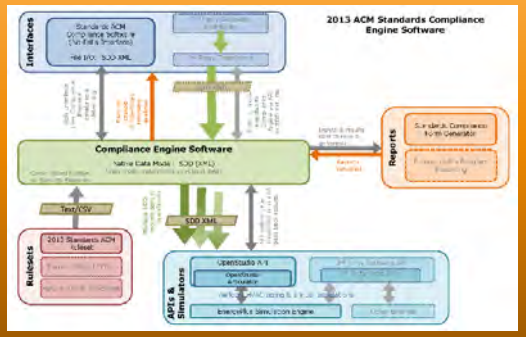
Prescriptive Approach

ENV	HVAC	LTG	Process
§140.3	§140.4 DHW §140.5	§140.3 140.6 140.7 140.8	§140.9

Alterations: §141.0; 141.1

Performance Approach

CBECC-Com



Envelope

- Roof
- Walls
- Floors
- Fenestration

Roof

Table 140.3-B Prescriptive Envelope for Nonresidential buildings (not including High-Rise or Hotel/Motel)																		
max. U-factor			Mandatory U-factor	Climate Zone														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roof and Air Barrier	Roofs/ Ceilings	Metal Building	0.098	0.041														
		2013	*0.098*	*0.065*														
		Wood Framed and Other	0.075	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
		2013	*0.075*	*0.049*	*0.039*	*0.039*	*0.039*	*0.049*	*0.075*	*0.067*	*0.067*	*0.039*	*0.039*	*0.039*	*0.039*	*0.039*	*0.039*	*0.039*	*0.039*
	Low- sloped	Aged Solar Reflectance		0.63														
		Thermal Emittance		0.75														
	Steep- Sloped	Aged Solar Reflectance		0.20														
		Thermal Emittance		0.75														
	2013			*No Change*														
	Air Barrier			NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	2013			*No Change*														

Example Span deck roof in CZ 1-5; 9-16

New:

Mandatory U-factor = 0.075

- 4" concrete / R-10 (2") / Cool roof

Prescriptive U-factor = 0.034 (was 0.039)

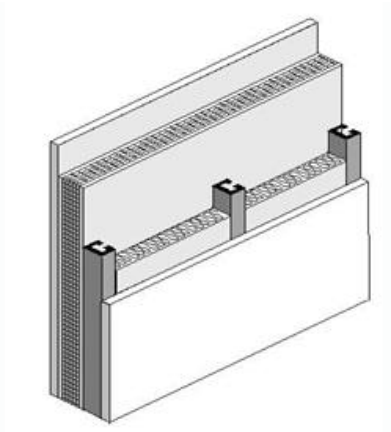
- 4" concrete / R-29 (5") (was 4")+ fireproofing / Cool roof

Wall

Table 140.3-B Prescriptive Envelope for Nonresidential buildings (not including High-Rise or Hotel/Motel)

	max. U-factor	Mandatory U-factor	Climate Zone 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Walls	Metal-framed	0.151	0.069	0.062	0.082	0.062	0.062	0.069	0.069	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
	2013	*0.105*	*0.098*	*No Change*				*0.098*	*0.098*	*No Change*								

Example metal framed wall in CZ 2;4-5;8-16



New:

Mandatory: U-factor = 0.151

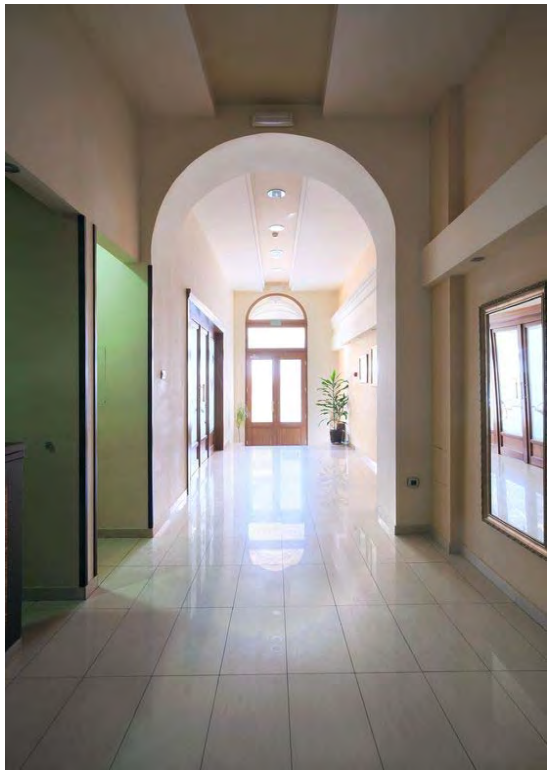
- 8" metal wall + R-22 insulation

Prescriptive U-factor = 0.062

- 6" metal wall + R-19 AND additional 2" polyicocyanurate outside framing

Demising Wall

MANDATORY Envelope for Nonresidential buildings			
	max. U-factor		
Walls	*Demising Walls (not Climate Zone dependent)*		
	Metal framed:	Wood framed:	
	0.151	0.099	
2013	*R-13*		



Unconditioned lobby

New

Metal Wall U-factor = 0.151

- 4″ wall with R-13 + R-2 *or*
- 8″ wall with R-22 *or*…

Wood Wall U-factor = 0.099

- 4″ wall with R-15

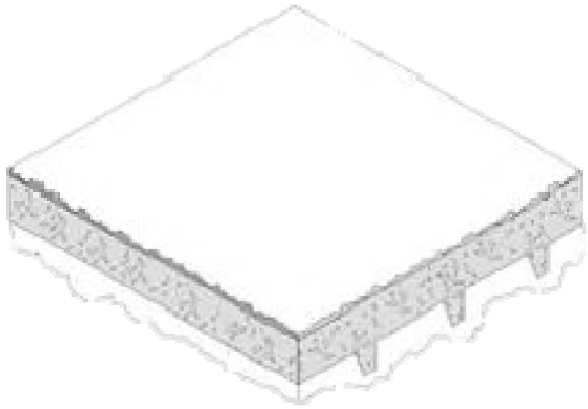
In our opinion…

Floors

No Change!

Table 140.3-B Prescriptive Envelope for Nonresidential buildings (not including High-Rise or Hotel/Motel)																	
max. U-factor		Mandatory U-factor	Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Floor	Raised Mass	0.269	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058
	Other	0.037	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039

Example raised mass floor in CZ 1-2;11-15



New:

Mandatory U-factor = 0.269

- No insulation

Prescriptive U-factor = 0.092

- 4" concrete
- R-7.25 (1-1/2") spray on insulation

Fenestration

No Change!

Table 140.3-B Prescriptive Envelope for Nonresidential buildings (not including High-Rise or Hotel/Motel)						
All Climate Zones						
	Fenestration		**Fixed Window**	**Operable Window**	**Curtainwall or Storefront**	**Glazed Doors**
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45
		Max RSHGC	0.25	0.22	0.26	0.23
		Min VT	0.42	0.32	0.46	0.17
	Maximum WWR%	40%				

New:

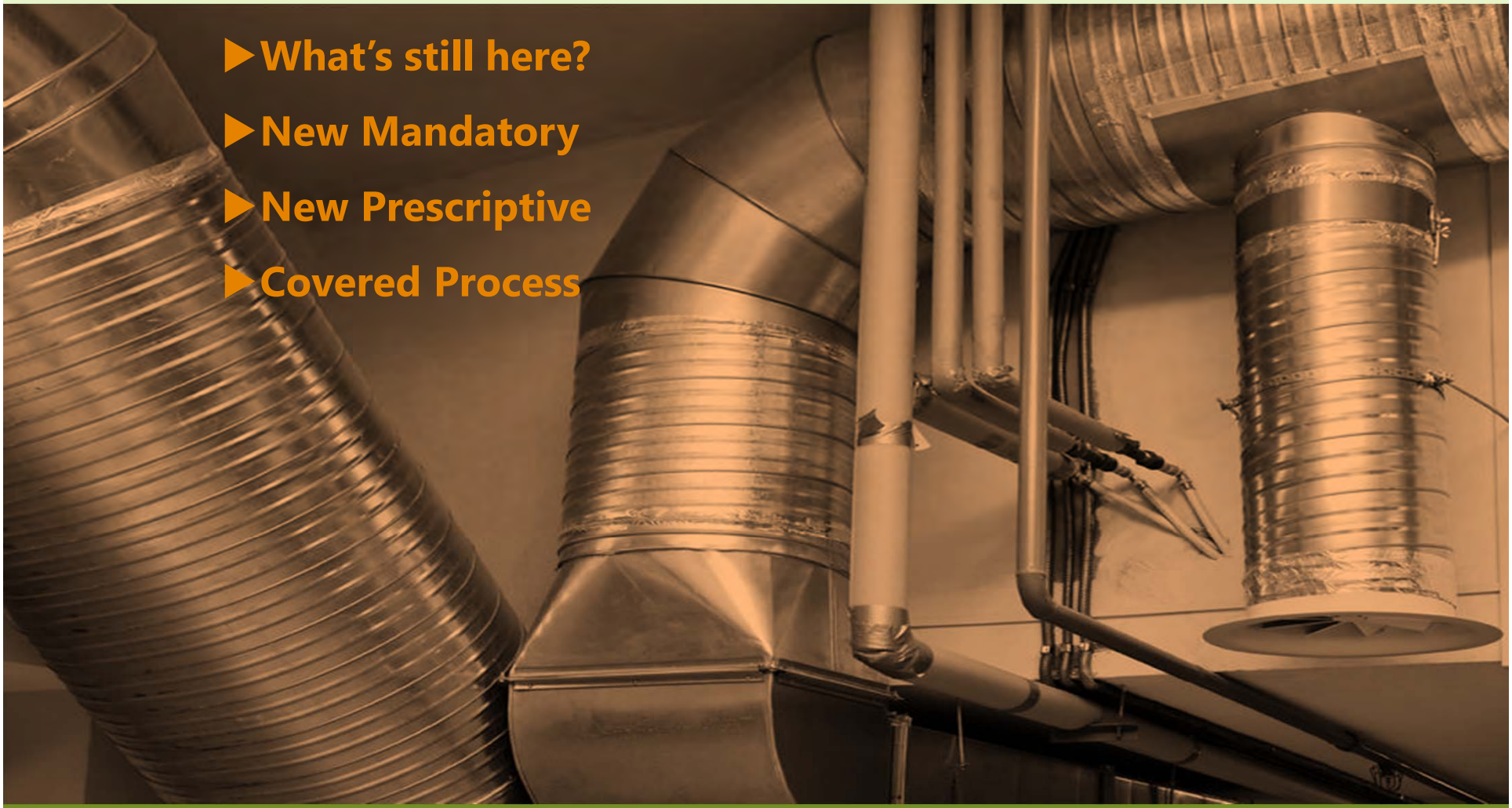
- Typical Curtainwall system:
  - U-factor=0.41:

  Thermally broken frame
  - RSHGC=0.26:

  Triple silver coated product
  - VT=0.46:

  Clear product allowing 46% of sunlight to shine through

Mechanical



- What's still here?
- New Mandatory
- New Prescriptive
- Covered Process

What's Still Here?

Mandatory

- Controls: §110.2(c); §120.2(a)(b)(c)(e)
- Dampers: §120.2(f)
- Min. equipment efficiency: §110.2(a)
- Ventilation:
  - Calculations: §120.1 min. required
  - Demand Ventilation Control: §120.1(c)3,4
  - Occupancy Sensor Control: §120.1(c)5

Prescriptive

- Equipment
  - Sizing: §140.4(a)(b) Cooling: 21% / Heating: 43%
  - Zonal controls: §140.4(d)(f) Prevent reconditioning
  - Electric Resistance: §140.4(g) Discouraged
  - Economizer: §140.4(e) >54,000 BTUH of cooling
  - Duct testing: §140.4(l) constant volume, single zone
  - Built-up systems: §140.4(h)(i)(j)(k)
- Fan
  - Power: §140.4(c) Fans systems >25 BHP
  - Control: §140.4(m) ≥1/4 HP fans VSD

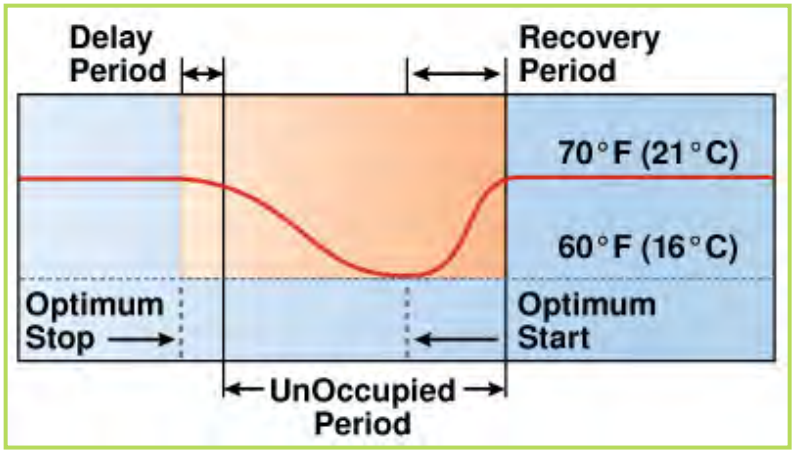
120.2(j) Direct Digital Control

- DDC being capable of the following, in addition to meeting the control logic of ventilation control (120.1(c)) and automatic demand shed control (120.2(h)):
  - Monitoring demand for fan/pump pressure, heating & cooling and then transferring that information to system controllers
  - Detecting systems excessively driving the reset logic and generate alarms
  - Providing trending and input/output point graphic displays (new building only)
  - Resetting setpoint after a demand shed event (120.2(h))

120.2(j) Direct Digital Control

Table 120.2-A: When DDC To Be Provided	
NEW APPLICATIONS	QUALIFICATIONS
Air handling system and all zones served by the system	Individual systems supplying more than three zones and with design heating or cooling capacity of 300 kBtu/h and larger
Chilled water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300 kBtu/h (87.9 kW) and larger
Hot water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300 kBtu/h (87.9 kW) and larger
ALTERATIONS/ADDITIONS APPLICATIONS	QUALIFICATIONS
VAV boxes or other zone terminal units	Where existing zones served by the SAME air handling, chilled water, or hot water systems that have DDC
AH system or fan coil	Where existing AH or fan coil(s) served by the SAME chilled water, or hot water systems have DDC
New AH unit and ALL new zones served by unit	Individual systems with design heating or cooling capacity of 300 kBtu/h and larger and supplying more than three zones and more than 75 percent of zones are new
New or upgraded chillwed water plant and/or hot water plant	Where all chillers and/or boilers are new and plant design cooling and/or heating capacity is 300 kBtuh (87.9 kW) and larger

120.2(k) Optimum start/stop controls

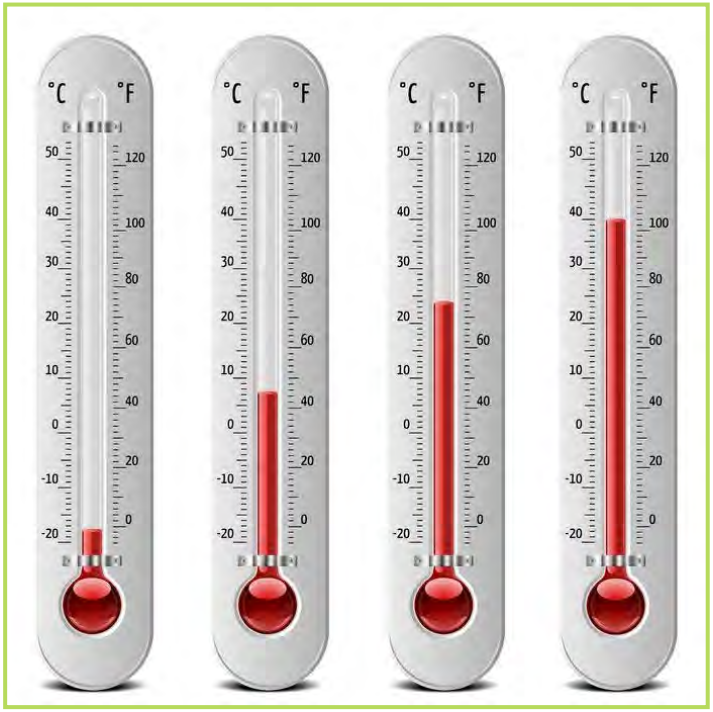


Graphic by tekmar control systems

- A building experiences delays in dropping down its temperature at the beginning of the setback period, and increasing its temperature at the end of the setback period.
- This function learns the response of the system in order to calculate a start and stop time for the system so that the building is comfortable when the occupied period begins.
- Space conditioning systems with DDC to the zone level shall have optimum start/stop controls.

In our opinion…

140.4(e)5 Dx Systems with Economizers



- Direct expansion (DX) systems with economizers that are:
  - >65,000 BTUH AND
  - Control the capacity of cooling based on space temperature
    - *Must have minimum 2 stage cooling capacity*

This was phased in during the 2013 code cycle, but did you know that?

140.4(n) System Shut-off

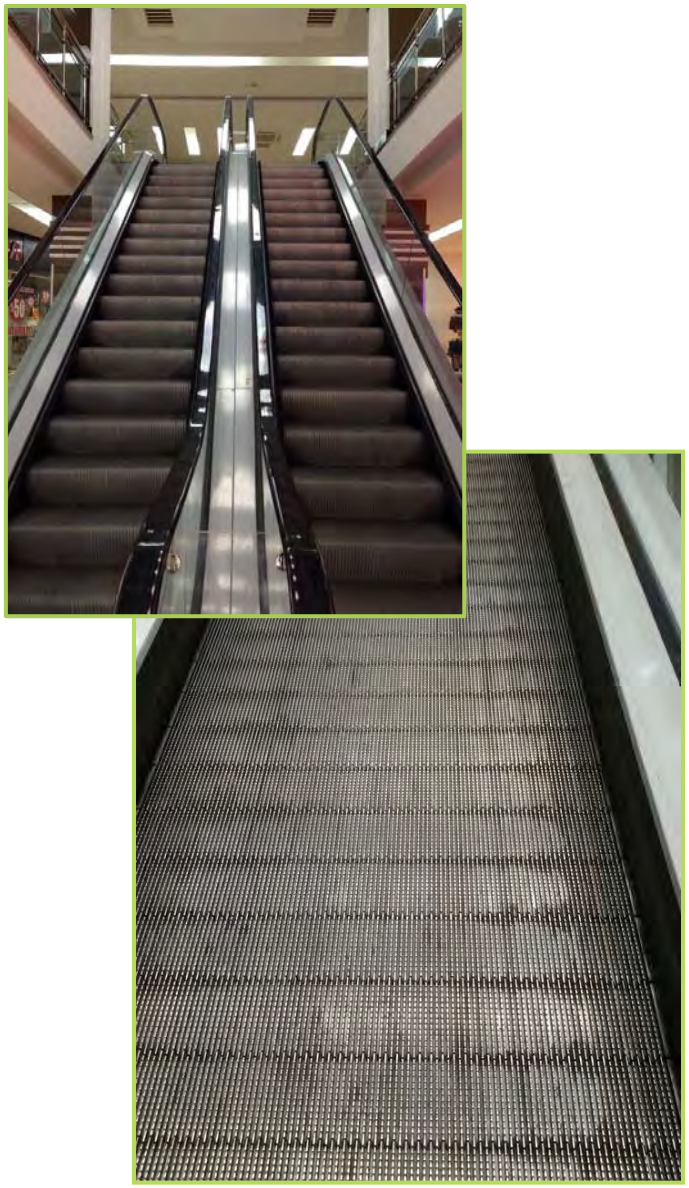
- Directly conditioned space that have a thermostatic control **and** OPERABLE openings to the outside (i.e. windows/non self-closing doors/skylights):
  - When openings are left open for more than 5 minutes *then*
    - Interlocked controls will disable *or* reset temperature setpoint to:
      - Cooling = 90°F
      - Heating = 55°F
- N/A to Alterations

In our opinion…

120.6(f) Elevators

- Lighting ≤0.6 watts per sq. ft.
- Ventilation: 0.33 watts per CFM (if no space conditioning)
- Auto Shut-off: Stopped and unoccupied >15 minutes then lighting and ventilation to automatically turn off
  - Emergency: If stuck with people, then everything stays on
- Acceptance testing by installing contractor for the above

120.6(g) Escalators/Moving Walkways

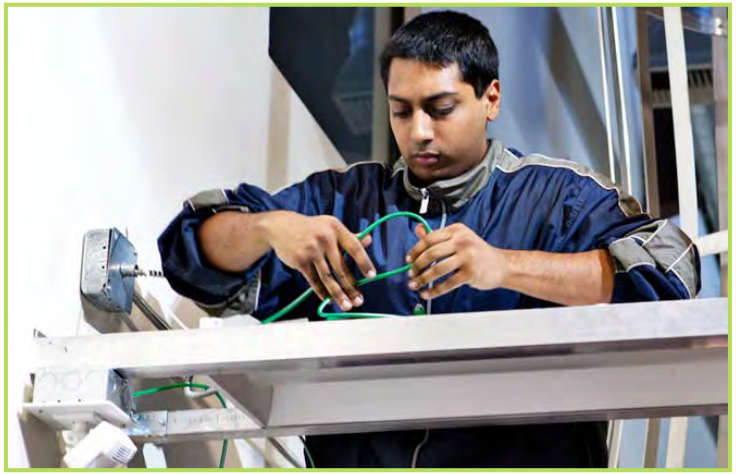


- Airports, hotels and transportations function areas ONLY:
  - Not occupied: Automatically slow to minimum speed per ASME A17-1/CSA B44
  - Acceptance testing by the installing contractor for the above

In our opinion…

Indoor Lighting

Lighting



- **New:** Lighting installed for first time, remodels including lighting changes, and adding to the connected load and must meet all the requirements of the code.
- **Alterations:** ≥10% move or change; or replace more than 2 fixtures in a space.
- **Modifications:** 70 fixtures or more per year.
- **Wiring:** §130.1(a) area controls; §130.1(b) multi level can be one control step between 30-70%; §130.1(c) Shut-off; §130.1(d) auto daylighting if rewiring 10 fixture or more in primary

Lighting

Revised Power Adjustment Factors

- AKA: Control Credits

TABLE 140.6-A LIGHTING POWER ADJUSTMENT FACTORS (PAF)			
TYPE OF CONTROL	**TYPE OF AREA**		**FACTOR**
Daylight Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone		**0.10**
Occupant Sensing Controls in Large Open Plan Offices	In open plan offices >250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	**0.40**
		From 126 to 250 square feet	**0.30**
		From 251 to 500 square feet	**0.20**
Institutional Tuning	Luminaires in non-daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		**0.10**
	Luminaires in daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		**0.05**
Demand Responsive Control	All building types less than 10,000 square feet. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		**0.05**

2016 TABLE 140.6-C AREA CATEGORY METHOD *Lighting Power Density (LPD) (Watt/Ft²) / <85% of LPD for Alteration Control Exceptions*

PRIMARY FUNCTION AREA		2013 100%	2016 100%	2016 85%
Auditorium Area		1.5 [3]	1.4 [3]	1.19
Auto Repair Area			0.9 [2]	0.77
Beauty Salon Area			1.7	1.45
Civic Meeting Place Area			1.3 [3]	1.11
Classroom, Lecture, Training, Vocational Areas			1.2 [5]	1.02
Commercial and Industrial Storage Areas (conditioned and unconditioned)			0.6	0.51
Commercial and Industrial Storage Areas (refrigerated)			0.7	0.60
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 [3]	1.2 [3]	1.02
Corridor, Restroom, Stair, and Support Areas			0.6	0.51
Dining Area		1.1 [3]	1.0 [3]	0.85
Electrical, Mechanical, Telephone Rooms		0.7 [2]	0.55 [2]	0.47
Exercise Center, Gymnasium Areas			1.0	0.85
Exhibit, Museum Areas		2.0	1.8	1.5
Financial Transaction Area		1.2 [3]	1.0 [3]	0.85
General Commercial and Industrial Work Areas	Low bay		0.9 [2]	0.77
	High bay		1.0 [2]	0.85
	Precision		1.2 [4]	1.02
Grocery Sales Area			1.2 [6 and 7]	1.02
Hotel Function Area		1.5 [3]	1.2 [3]	1.19
Kitchen, Food Preparation Areas		1.6	1.2	1.02
Laboratory Area, Scientific			1.4 [1]	1.19
Laundry Area		0.9	0.7	0.60

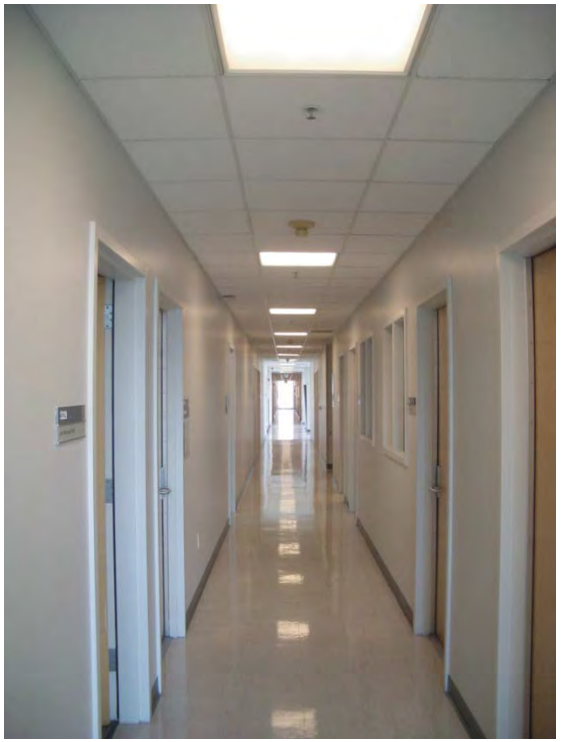
PRIMARY FUNCTION AREA		2013 100%	2016 100%	2016 85%
Library Area	Reading areas	1.2 [3]	1.1 [3]	0.94
	Stack areas		1.5 [3]	1.28
Lobby Area	Hotel lobby	1.1 [3]	0.95 [3]	0.81
	Main entry lobby	1.5 [3]	0.95 [3]	0.81
Locker/Dressing Room		0.8	0.7	0.60
Lounge Area		1.1 [3]	0.90 [3]	0.77
Malls and Atria		1.2 [3]	0.95 [3]	0.81
Medical and Clinical Care Area			1.2	1.02
Office Area	> 250 square feet		0.75	0.64
	≤ 250 square feet		1.0	0.85
Parking Garage Area	Parking Area [10]		0.14	N/A
	Dedicated Ramps		0.3	N/A
	Daylight Adaptation Zn [9]		0.6	N/A
Religious Worship Area			1.5 [3]	1.28
Retail Merchandise Sales, Wholesale Showroom Areas			1.2 [6 and 7]	1.02
Theater Area	Motion picture		0.9 [3]	0.77
	Performance		1.4 [3]	1.19
Transportation Function Area	Concourse & Baggage		0.5	0.43
	Ticketing	1.2	1.0	0.85
Videoconferencing Studio			1.2 [8]	1.02
Waiting Area		1.1 [3]	0.8 [3]	0.68
All other areas		0.6	0.5	0.43

Footnote #	Type of lighting system allowed	Maximum allowed added lighting power.
1	Specialized task work	0.2 W/ft²
2	Specialized task work	0.5 W/ft²
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2.	0.5 W/ft²
4	Precision commercial and industrial work	1.0 W/ft²
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional	0.3 W/ft²
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination	0.2 W/ft²
8	Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii	1.5 W/ft²
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	
10	Additional allowance for ATM locations in Parking Garages (allowance per ATM)	200 watts for the 1st ATM location; 50 watts for each additional ATM locations in a group

Mandatory Controls §130.1

Area Controls 130.1(a)

- On/off switch need not be accessible to public in:
  - Public restrooms with more than 2 stalls, parking areas, stairwells and corridors



Mandatory Controls §130.1

Multi Level Controls 130.1(b)

- Ability to control lights at multiple levels of light using:
  - Dimmers or
  - Auto daylighting or
  - Demand response

Source + **Luminaire** + **Controls**

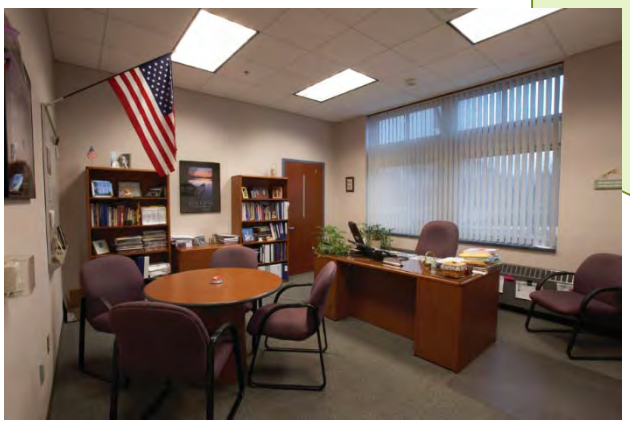
Image: Cree

Image: Cree

Image: Enlighted

Mandatory Controls §130.1

Auto Shut-Off 130.1(c)



- Stairwells can be controlled per building (not per floor as required in 2013)
- 0.10 w/ft2 exempt for emergency lighting *ALL* building types
- IF an office <250ft^2, multipurpose room <1,000 ft^2, classroom or conference room trigger multi-level control, then;
  - partial-on OR
  - vacancy sensor is required
  - If the space does NOT trigger a multi-level control, then
    - occupancy sensor is allowed.

Mandatory Controls §130.1

Auto Daylighting 130.1(d)

- Auto daylighting has minor changes on how illuminance levels are measure in parking garages

Demand Response 130.1(e)

- Non habitable spaces no longer exempt from the 10,000 ft^2 trigger (spaces less than 0.5 w/sf is still excluded)

Acceptance testing not required for alteration projects where controls added to control 20 or less luminaires for entire project.

Lighting: Reduced Wattage Approach

§141.0(b)2J: Luminaire Component Modification

- **Reduce Area Category LPD** (Table 140.6-C) by 85% or more, then only the following controls required:
  - §130.1(a) Area controls
  - §130.1(b) Multi level can be one control step between 30-70%;
  - §130.1(c) Shut-off

- **Reduce installed wattage** 50% for hotel, office and retail occupancies and 35% for all others, then only the following controls are required:
  - §130.1(a)1-3: **Area controls**
    - ~~4~~: *Excluding* separately controlled lighting systems
  - §130.1(c) 1A-C; 2, 3, 4, 5, 6A, 7B: **Auto shut-off**
    - ~~1D:~~ *Excluding* separately controlled lighting systems
    - ~~6B,C:~~ *Excluding* Partial-Off in libraries, stairwells and corridors
    - ~~7A:~~ *Excluding* lighting in multi family and hotel/motel corridors and stairs
    - ~~8:~~ *Excluding* hotel/motel guest room controls

2016 Indoor Lighting Alterations

In our opinion…

2016 Indoor Luminaire Component Modification: ≥70 per floor/tenant per year changed fixtures: 3 or more fixtures per room				
Alteration: ≥10% moved, changed, replaced fixtures: 3 or more fixtures per room				
Mandatory Control	*Table 141.0-E*		NEW Reducing installed wattage from existing method* §141.0(b)2Jii	Adding to connected load or remodeling
	Resulting LPD (§140.6) ≤85% of allowable	Resulting LPD (§140.6) >85% of allowable		
Area device (on/off): §130.1(a)1,2,3	Yes *Excluding 130.1(a)4: separately controlled lighting systems.*	Yes *Excluding 130.1(a)4: separately controlled lighting systems.*	Yes *Excluding 130.1(a)4: separately controlled lighting systems.*	Yes
Multi-level control: §130.1(b)	Yes *2 level or 130.1(b) Only for modified luminaires*	Yes *Only for modified luminaires*	No	Yes
Auto shut-off control: §130.1(c)	Yes	Yes	Yes, Excluding *130.1(c)1D: separate controls* *130.1(c)6B: Partial OFF @ libraries* *130.1(c)6C: Partial OFF @ stairs/corridors* *130.1(c)7A: Partial OFF @ 24 hr stairs & corridors* *130.1(c)8: Hotel/Motel guest room 30 min. controls*	Yes
Daylighting control: §130.1(d)	No	Yes *Only for modified luminaires*	No	Yes
Demand response: §130.1(e)	No	No	No	Yes

*50% Office, retail and hotel occupancies / *35% All other occupancies

Acceptance test technician required when any number of controls for **≥20** fixtures being added for project

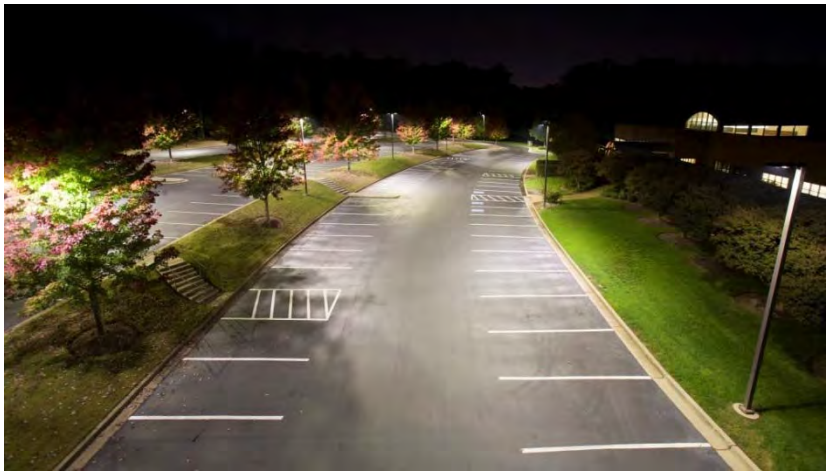
Outdoor Lighting

Photo: Cree

Lighting: Outdoor

- **New lighting zone:** 0
- **Table 140.7-A & B:** Reduced LPD and wattage allowances
- **Mandatory:**
  - **§130.2(b)** Cutoff for >150w lamps
    - See Title 24 Part 11 for *backlight* requirements of BUG
  - **§130.2(c)** Controls
    1. Photo control or astronomical time-switch
    2. Lighting controlled independently from other loads
    3. If fixture with 24 feet of ground, then motions sensor required
       - Exception:
         - Pole: ≤75 watts
         - Non pole: ≤ 35 watts
         - Linear: ≤4 watts per ft
    4. Sales frontage: Part night or motion sensor
    5. Façade, ornamental hardscape, outdoor dining: Part night, motion sensor, centralized time system; AND if within 24 ft of ground §130.2(c)3
- **Acceptance test technician** required when any number of controls for >20 fixtures being added for project.

Hardscape Lighting Power



- **Area Wattage Allowances (AWA)**
  - The total illuminated hardscape area.
- **Linear Wattage Allowances (LWA)**
  - The total perimeter *illuminated* length of the hardscape.
- **Initial Wattage Allowances (IWA)**
  - The Initial Wattage Allowance may be used once per project site.

Table 140.7-A General Hardscape Lighting Power Allowance					
Type of Power Allowance	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**
Area Wattage Allowance (AWA)	No Allowance	0.020 W/ft²	0.030 W/ft²	0.040 W/ft²	0.050 W/ft²
2013		0.035 W/ft²	0.045 W/ft²	0.090 W/ft²	0.115 W/ft²
Linear Wattage Allowance (LWA)		0.15 W/lf	0.25 W/lf	0.35 W/lf	0.45 W/lf
2013		0.25 W/lf	0.45 W/lf	0.60 W/lf	0.85 W/lf
Initial Wattage Allowance (IWA)		340 W	450 W	520 W	640 W
2013		340 W	510 W	770 W	1030 W

2016 Outdoor Lighting Alterations

2016 Outdoor Lighting Retrofits: If housing stays intact and lighting technology is changed = repair. Replacing fixture head = alteration. Alteration: ≥10% moved, changed, replaced fixtures: 5 or more fixtures per site			
Requirements	NEW Reducing installed wattage by 40% method	Altering 10-50% fixtures on site §141.0(b)2Liii exception	Adding to connected load OR Altering >50% fixtures on site
Meet lighting power allowances: §140.7	No	No	Yes
Incandescent >100 w controlled by motion sensor: §130.2(a)	Yes	Yes *For altered fixtures only*	Yes
Luminaries >150 w to provide cut-off (BUG): §130.2(b)	Yes	Yes *For altered fixtures only*	Yes
Photocontrol/astronomical time clock: §130.2(c)1	Yes	Yes *For altered fixtures only*	Yes
Control separately from other electrical loads: §130.2(c)2	Yes	Yes *For altered fixtures only*	Yes
Motion Sensor if within 24 ft of ground: §130.2(c)3	Yes	Yes *For altered fixtures only*	Yes
Part night OR motion sensor for Sales Frontage: §130.2(c)4	Yes	Yes *For altered fixtures only*	Yes
Part night OR motion sensor OR time-based for façade, ornamental, dining: §130.2(c)5	Yes	Yes *For altered fixtures only*	Yes

Acceptance test technician required when any number of controls for **≥20** fixtures being added for project

Check your understanding

Challenge B

Mandatory, Prescriptive, Performance

Mandatory Measures

Mechanical: §110.2, 110.3

Solar Ready §110.10

§150.0

Insulation

HVAC (including IAQ)

DHW Distribution

Lighting

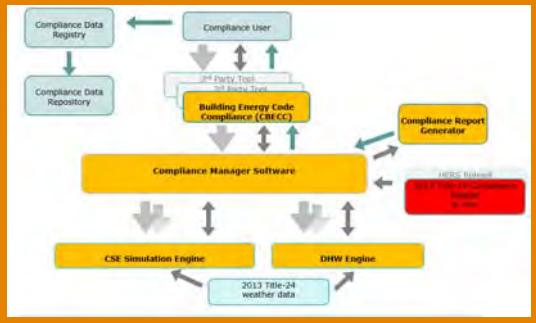
Prescriptive Approach

ENV	HVAC	DHW
§150.1	§150.1	§150.1

Alterations: §150.2

Performance Approach

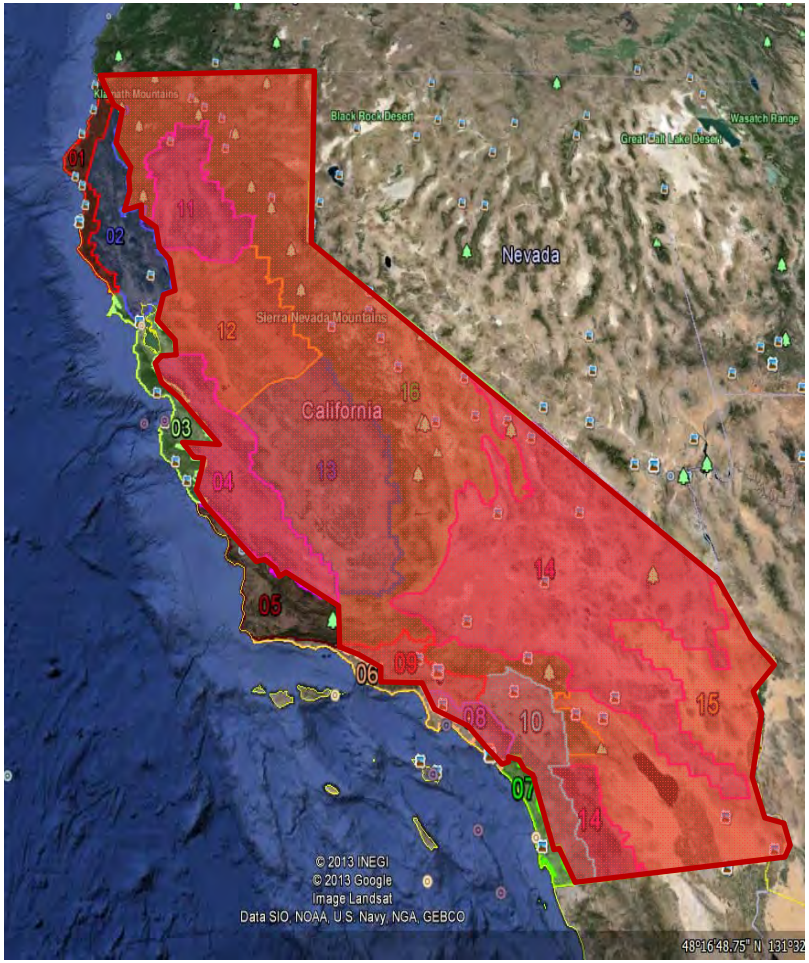
CBECC-Res



Software is available NOW!

Prescriptive Package A: §150.1

Hot/Cold Climate Zones



Mild Climate Zones

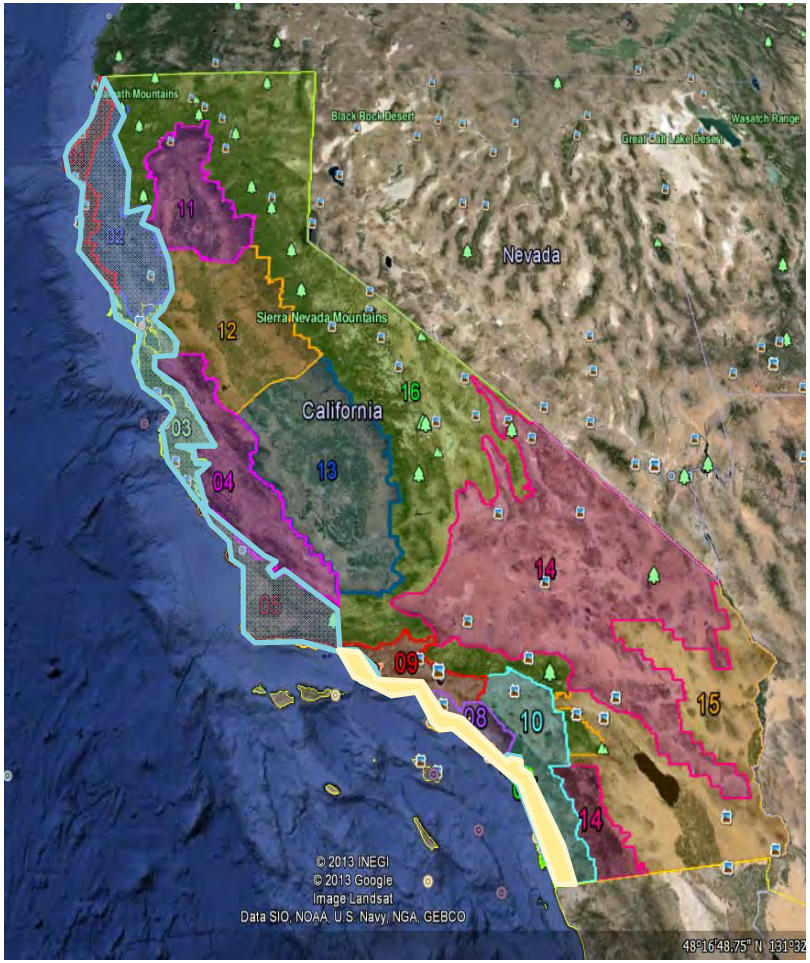


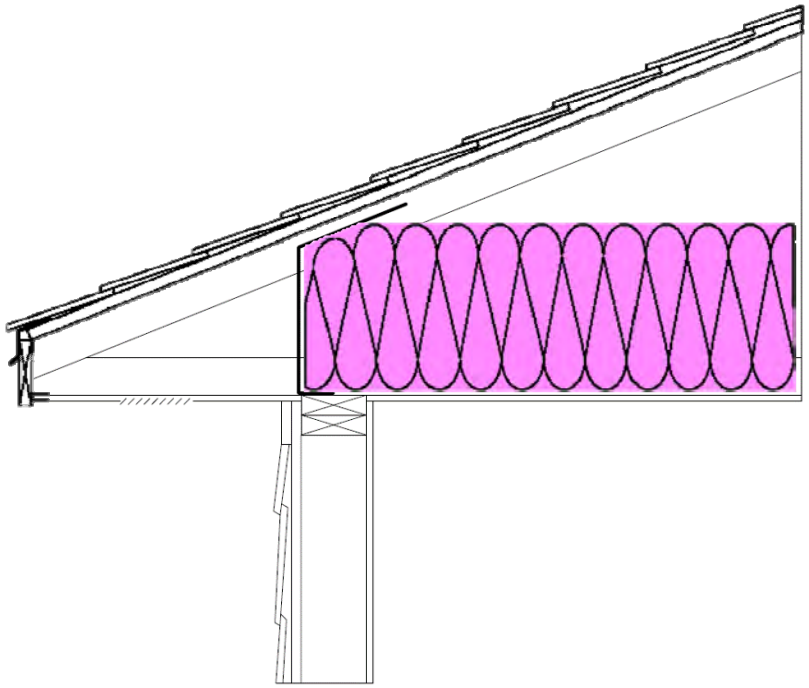
Table 150.1-A - ROOF

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN - ROOF																		
					Mandatory U-factor	Climate Zone												
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Envelope Insulation: Roofs/Ceilings	Option A §150.1(c)9A	Continuous Insulation Above Roof Rafter	Roofing Type	No Air Space	0.043 (R-22)	NR	NR	NR	R 8	NR	NR	NR	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8
				With Air Space		NR	NR	NR	R 6	NR	NR	NR	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6
		Ceiling Insulation				R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier				NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Option B §150.1(c)9A	Below Roof Deck	Roofing Type	No Air Space		NR	NR	NR	R 18	NR	NR	NR	R 18	R 18	R 18	R 18	R 18	R 18	R 18	R 18	R 18
				With Air Space		NR	NR	NR	R 13	NR	NR	NR	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13
		Ceiling Insulation				R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier				NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Option C §150.1(c)9B	Ceiling Insulation				R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier				NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
2013 Roofs /Ceilings					*0.031 R-30*	*U 0.025 R 38*	*U 0.031 R 30*									*U 0.025 R 38*					

Roof: Mandatory Measures

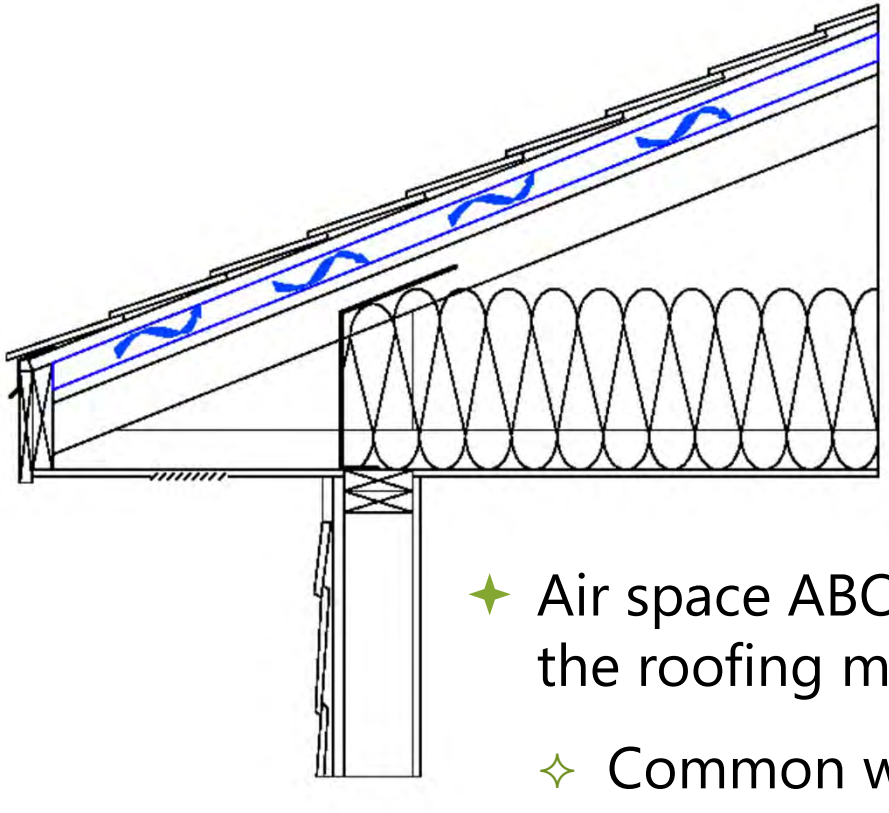
Roof

- U-factor (wood framed attic): 0.043
  - Example: R-22 (JA4.2.1-1A)



Roof: Air Space Example

Roofs/Ceilings	Option A §150.1(c)9A Continuous Insulation Above Roof Rafter	Roofing Type																	
			No Air Space	0.043 (R-22)	NR	NR	NR	R 8	NR	NR	NR	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8
			With Air Space		NR	NR	NR	R 6	NR	NR	NR	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6

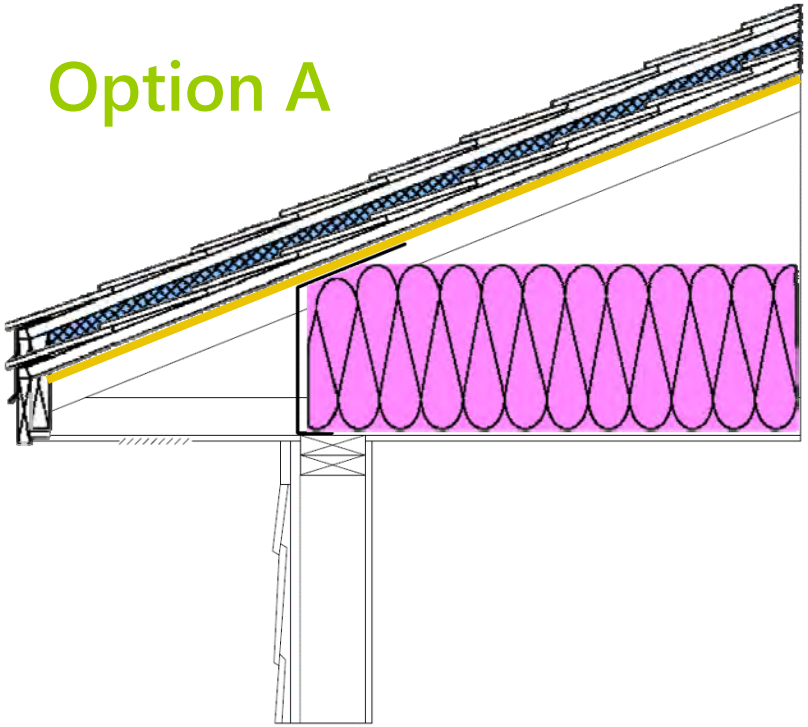


With Air Space?
No Air Space?

- Air space ABOVE the roof deck but BELOW the roofing material
  - Common with tile roofing

Roof: Vented Attic

Option A



Ceiling insulation AND above roof deck insulation

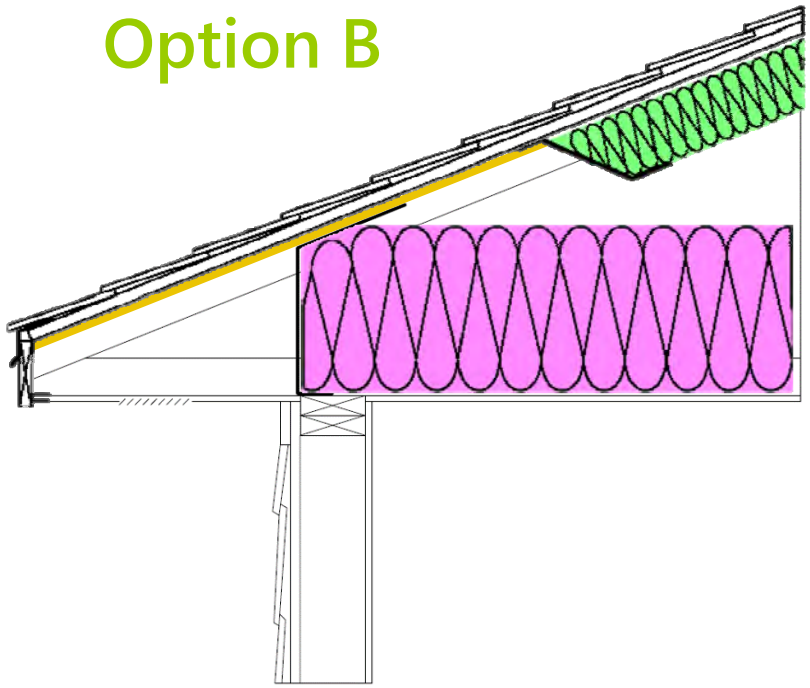
- Above roof deck, which is typically in the purview of the roofer. R-value depends on with or without "airspace".
- Ceiling insulation must also be provided.
- Radiant Barrier dependent on CZ.
- Upper insulation dependent upon CZ.

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN - ROOF

				Mandatory U-factor	Climate Zone														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofs/Ceilings	Option A §150.1(c)9A	Continuous Insulation Above Roof Rafter	Roofing Type: No Air Space		NR	NR	NR	R 8	NR	NR	NR	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8
			Roofing Type: With Air Space	0.043 (R-22)	NR	NR	NR	R 6	NR	NR	NR	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6
		Ceiling Insulation			R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier			NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR

Roof: Vented Attic

Option B



Ceiling insulation AND below roof deck insulation

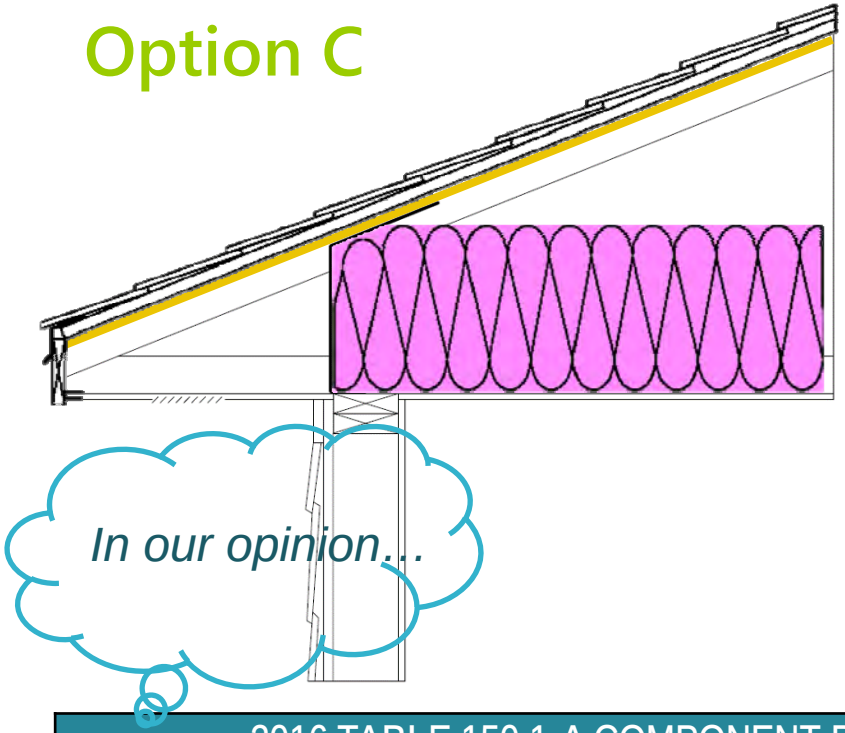
- Below roof deck. R-value depends on with or without "airspace" above roof deck.
- Ceiling insulation must also be provided.
- Radiant Barrier dependent on CZ.
- Upper insulation dependent upon CZ.

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN - ROOF

					Mandatory U-factor	Climate Zone														
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofs/Ceilings	Option B §150.1(c)9A	Below Roof Deck	Roofing Type	No Air Space		NR	NR	NR	R 18	NR	NR	NR	R 18	R 18	R 18	R 18	R 18	R 18	R 18	R 18	R 18
				With Air Space	0.043 (R-22)	NR	NR	NR	R 13	NR	NR	NR	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13
		Ceiling Insulation				R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier				NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR

Roof: Vented Attic

Option C



In our opinion…

Ducts and air handler in conditioned space

- Conditioned space = habitable space!
- Ceiling insulation only.
  - **Must be a vented attic**
- Radiant Barrier dependent on CZ.

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN - ROOF

			Mandatory U-factor	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofs/Ceilings	Option C §150.1(c)9B	Ceiling Insulation	~~0.043~~ (R-22)	R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38
		Radiant Barrier		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR

Table 150.1-A - Walls

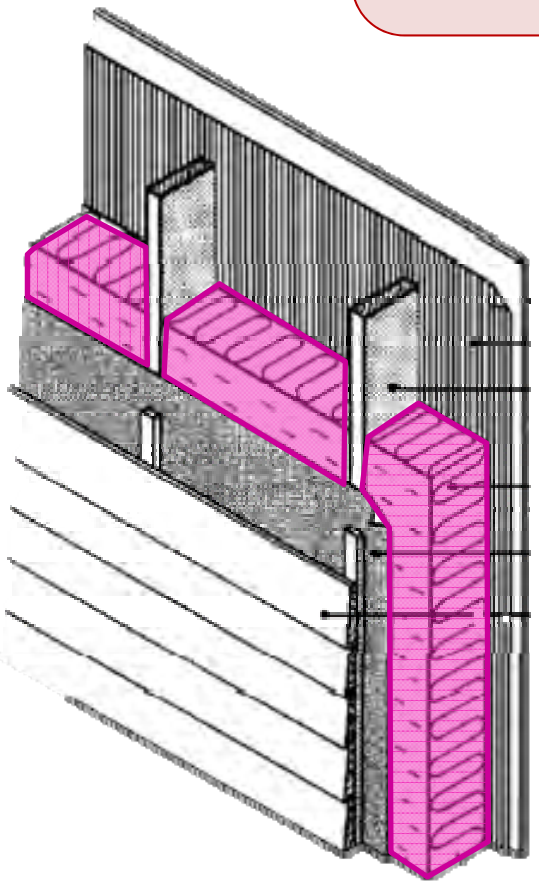
2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

U-factors			Mandatory	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2013 Above Grade Framed			*0.102 (2x4) or 0.074 (2x6)*	*U 0.065: R 15+4 or R 13+5*															
Envelope insulation: Walls	Above Grade	Framed		0.051	0.051	0.051	0.051	0.051	0.065	0.065	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
		Mass Wall Interior	0.102	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.059 R 17
		Mass Wall Exterior		0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.070 R 13
	Below Grade	Below Grade Interior	N/A	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.066 R 15
		Below Grade		0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.200 R 5.0	0.100 R 10	0.100 R 10	0.053 R 19

Walls: Mandatory Measures

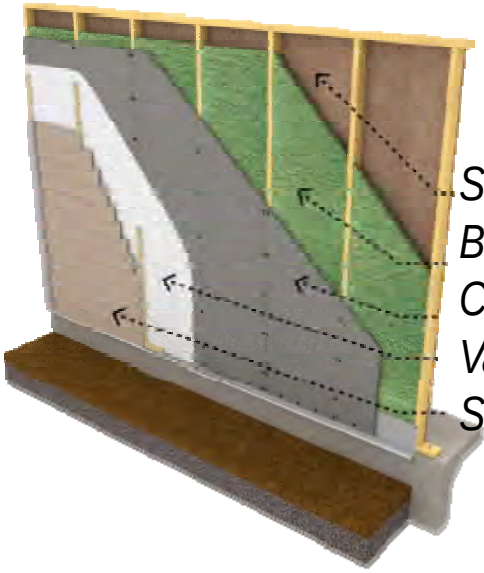
Walls §150.0

- U-factor (wood framed 2 x 4): 0.102
  - Example: R-13 (JA4.3.1-3A)
- U-factor (wood framed 2 x 6): 0.074
  - Example: R-19 (JA4.3.1-5A)



No change from 2013 standards.

Wall: Above Grade - Framed



Source: BASF Corporation

U-factor = 0.051

- 2 x 6 R-19 + R-5 continuous
- Or....??

U-factor = 0.065

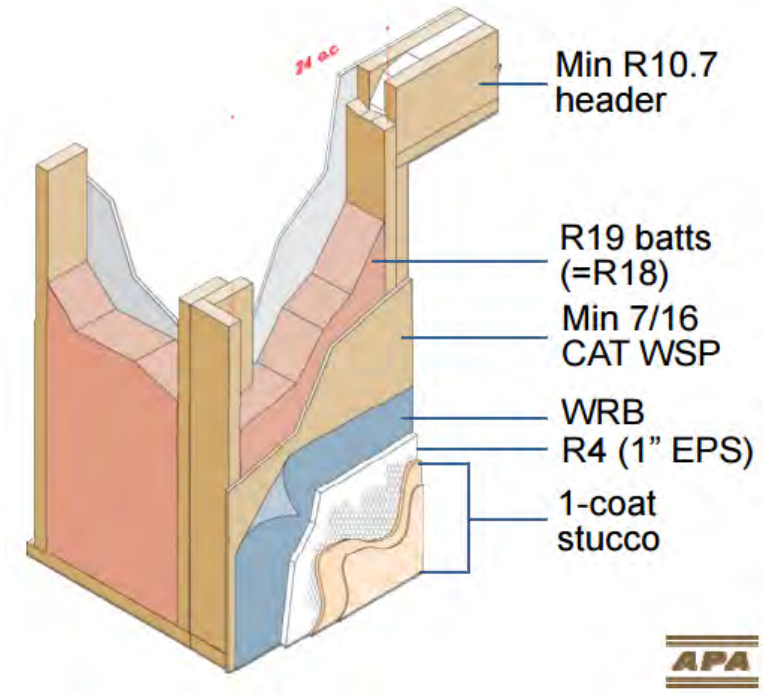
- 2 x 4 R-13 + R-5 continuous

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

U-factors			Mandatory	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2013 Above Grade Framed			*0.102 (2x4) or 0.074 (2x6)*	*U 0.065: R 15+4 or R 13+5*															
Walls	Above Grade	Framed		0.051	0.051	0.051	0.051	0.051	0.065	0.065	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051

Framed Wall Assembly

Slide courtesy of CAHP - Master Builder
Advanced Home Design and Building Practices
2016 Code Readiness Program



In our opinion…

U-factor	Framing	Stud Spacing	Cavity Insulation	Exterior Insulation	Cavity Insulation Type
0.050	2x6	24" OC	R-19	R-5 (1")	Low density fiberglass batt
0.051	2x6	16" OC	R-21	R-4 (1")	High density batt or BIB
0.049	2x6	16" OC	R-19	R-6 (1.25")	Low density fiberglass batt
0.050	2x4	16" OC	R-15	R-8 (2")	High density batt

**Multiple combinations of similar materials will achieve these same U-factors

Wall: Above Grade – Non Framed

Mandatory U-factor = 0.102

Example: Any 5" or thicker solid concrete wall

Prescriptive U-factor = 0.125

Example: 6" solid concrete wall with R-8

In Our Opinion

- *New mandatory minimum not a big deal unless you are using nonfilled CMU blocks, which will need to be filled or insulated*

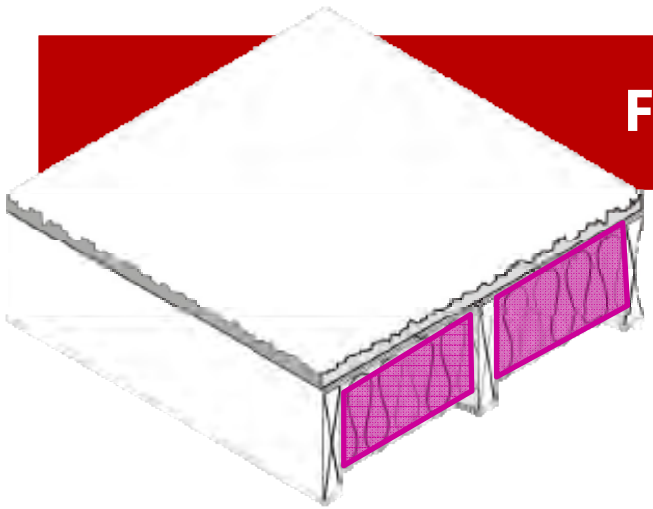
2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

U-factors			Mandatory	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Walls	Above Grade	Mass Wall Interior	0.102	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.070 R 13	0.059 R 17
		Mass Wall Exterior		0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.125 R 8.0	0.070 R 13

Floor: Mandatory & Prescriptive Measures

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

U-factors		Mandatory	Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2013 Floors		*0.037*	*Same as 2016*															
Envelope Insulation: Floors	Slab Perimeter	N/A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.58 R 7.0
	Raised	0.037	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19	0.037 R 19
	Concrete Raised	N/A	0.092 R 8.0	0.092 R 8.0	0.269 R 0	0.269 R 0	0.269 R 0	0.269 R 0	0.269 R 0	0.269 R 0	0.269 R 0	0.269 R 0	0.092 R 8.0	*0.138 R 4.0*	0.092 R 8.0	0.092 R 8.0	*0.138 R 4.0*	0.092 R 8.0

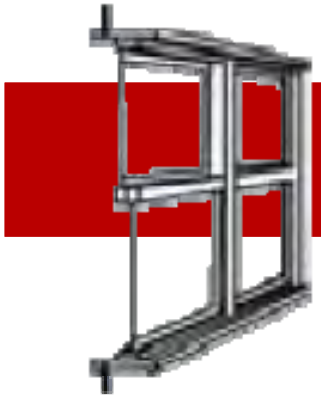


- U-factor (raised wood): 0.037
  - Example: R-19 (JA4.4.1-4A)
- Mass (slab on grade and raised concrete): none

Fenestration: Mandatory & Prescriptive Measures

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

		Mandatory	Climate Zone														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2013 Fenestration			*Same as 2016*															
Building Envelope: Fenestration	Max. U-factor	0.58	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
	Maximum SHGC	N/A	NR	0.25	NR	0.25	NR	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Maximum Total Area	N/A	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West Facing Area	N/A	NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%



Fenestration

- U-factor: 0.58
  - Example: Dual paned non-metal (Table 110.6-A Default U-factors)

Check your understanding

Challenge C

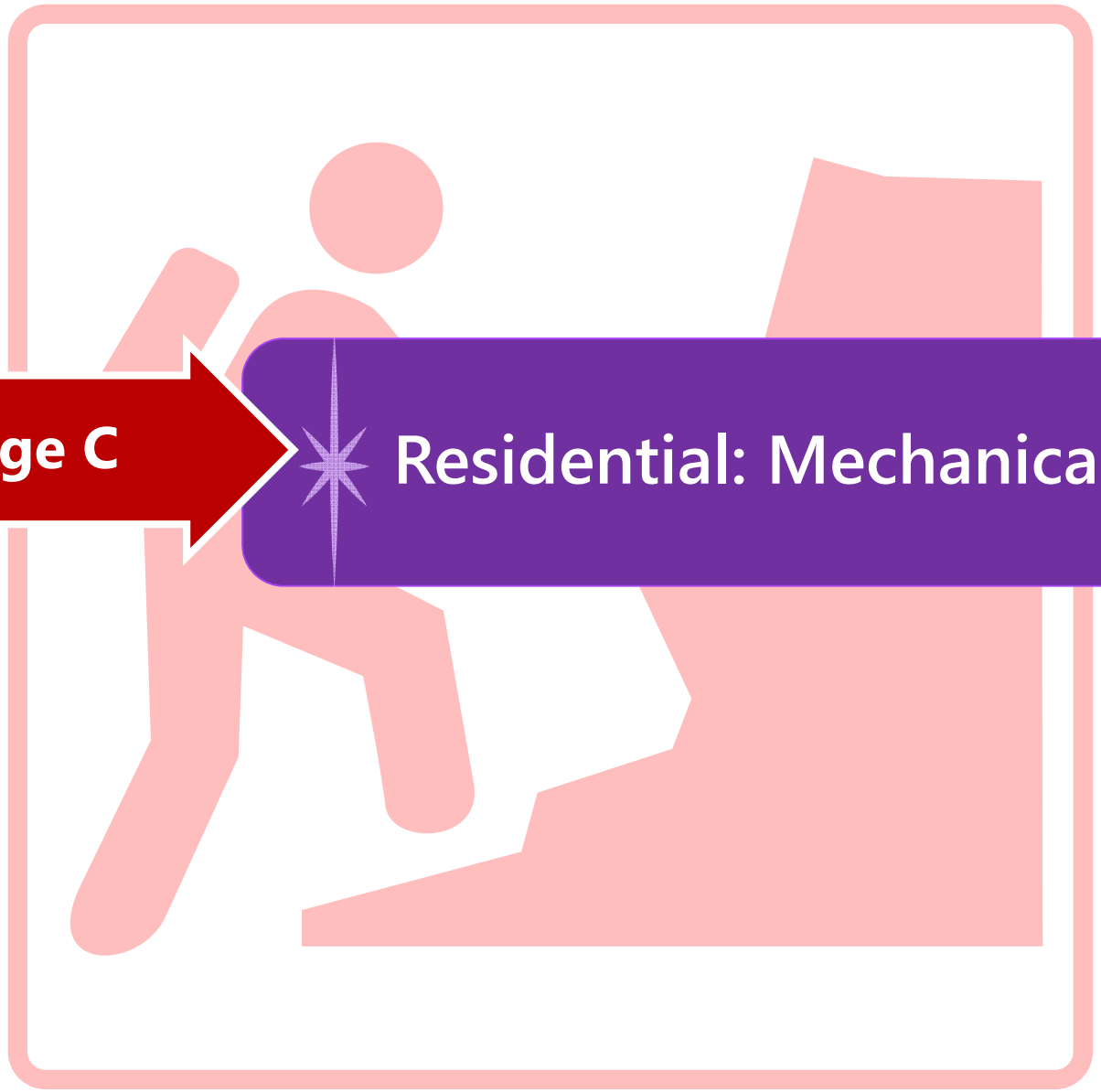


Table 150.1-A: Mechanical

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN – Mechanical																		
				Climate Zone														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HVAC SYSTEM	Space Heating	Electric-Resistance Allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
		If gas, AFUE		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		If Heat Pump, HSPF		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Space cooling	SEER		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		Refrigerant Charge Verification or Fault Indicator Display		NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Whole House Fan		NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR
	Central System AH	Central Fan Integrated Ventilation System Fan Efficacy		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	2013 Ducts in Unconditioned Attic			*R-6*										*R-8*	*R-6*		*R-8*		
	Ducts	Roof/Ceiling Options A & B	Duct Insulation	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
			§150.1(c)9A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Roof/Ceiling Option C	Duct Insulation	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6
			§150.1(c)9B	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
DHW	All Buildings			System Shall meet Section 150.1(c)8															

Ace Resources™

Ace Resources 2013 Residential - Title 24, Part 6 Climate Zone Quick Reference

EnergyCode Ace

Minimum Cooling Efficiencies

(Smaller) Central Air Conditioners and Heat Pumps — Minimum Cooling Efficiencies

Adapted from Table 4-6 from 2013 Residential Compliance Manual

Appliance	Type	Size	SEER Before 1/1/2015	SEER Effective 1/1/2015	EER Effective 1/1/2015
Central Air Conditioners	Split System	<45,000	13.0	14.0	12.2
		≥45,000 and <65,000	13.0	14.0	11.7
	Single Package	<65,000	13.0	14.0	11.0
Central Air Source Heat Pumps	Split System	<65,000	13.0	14.0	NR
	Single Package	<65,000	13.0	14.0	
Space Constrained Air Conditioner	Split System	<65,000	12.0	12.0	NR
	Single Package	<65,000	12.0	12.0	NR
Space Constrained Heat Pump	Split System	<65,000	12.0	12.0	NR
	Single Package	<65,000	12.0	12.0	NR
Through-the-wall Air Conditioner	Split System	<65,000	10.9	10.9	NR
	Single Package	<65,000	10.6	10.6	NR
Through-the-wall Heat Pump	Single Package	<65,000	10.9	10.9	NR
	Split System	<65,000	10.6	10.6	NR
Small Duct, High Velocity Air Conditioner	All	<65,000	13.0	13.0	NR
Small Duct, High Velocity Heat Pump	All	<65,000	13.0	13.0	NR

Source: California Appliance Efficiency Regulations Table C-2
NR = No Requirement

Continued on reverse

Ducts

2016 TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN – Mechanical																			
			Mandatory	Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ducts	Roof/Ceiling Options A & B	Ducts in attic	R-6	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
	Roof/Ceiling Option C	Ducts in conditioned	R-4.2	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6

- Mandatory duct insulation:
  - Min. R-4.2 conditioned space
  - R-6 everywhere else.
- Mandatory HERS Duct testing:
  - 5%

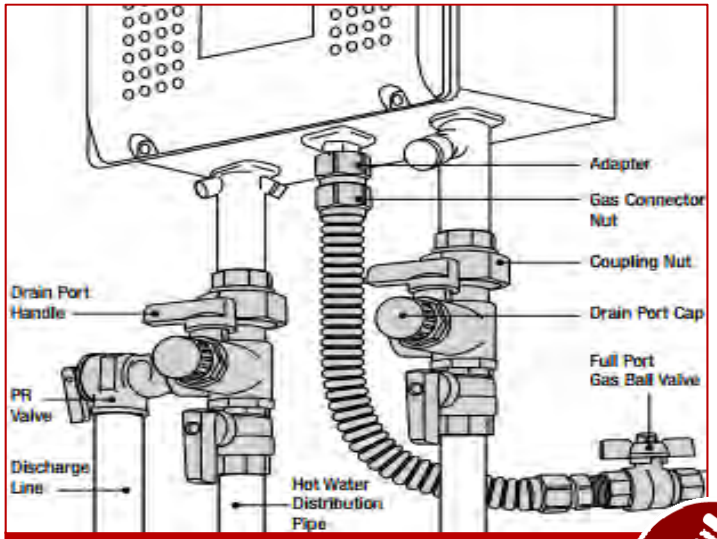
Whole House Fans

Prescriptive

- Reduced from 2 cfm/sqft to 1.5 cfm/sqft
- Attic vent area reduced to 1 sqft per 750 cfm of airflow

In our opinion…

DHW: New Construction



Mandatory

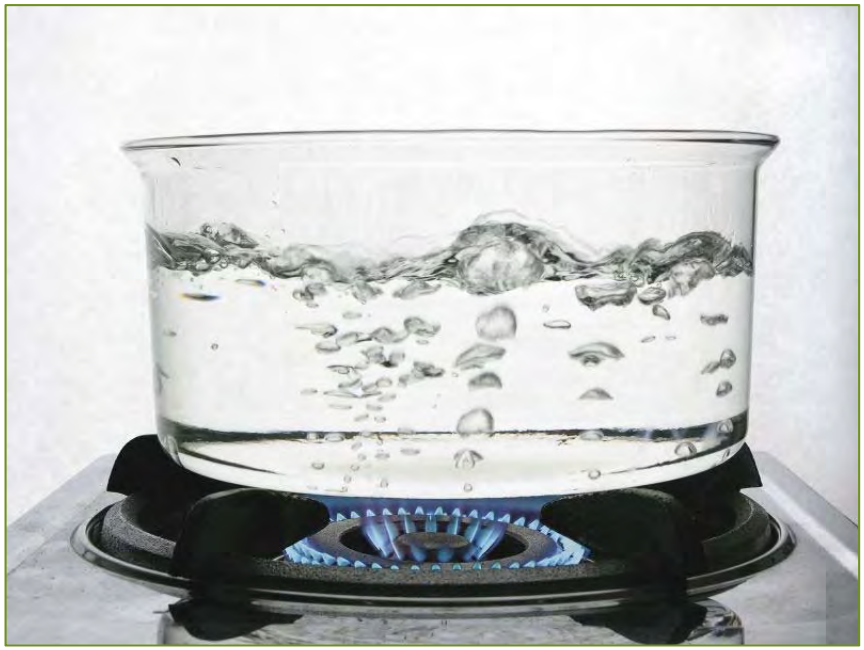
- Isolation valves on both the cold water supply and the hot water pipe leaving the water heater, and hose bibbs on each valve for flushing the water heater.

Prescriptive

- (1) gas or propane tankless DHW
  - Input of <200,000 BTUH; EF 0.82
  - No storage tank

2013: (1) small gas tank DHW

DHW: New Construction



Gas Tank System

- **Small Storage:**
  - Input ≤105,000 BTUH, ≤55 gallons @ minimum efficiency
  - *HERS verified QII* ***AND***
    - *HERS compact hot water distribution system* ***OR***
    - *HERS "All DHW hot water piping insulated"*
- **Large Storage:**
  - Input ≤105,000 BTUH, >55 gallons @ minimum efficiency
  - *HERS compact hot water distribution system* ***OR***
    - *HERS "All DHW hot water piping insulated"*

In our opinion…

DHW

Same as 2013

Recirculation

- If a recirculation pump is installed, prescriptively it can ONLY be
  - A manual pump control
  - Any other type of control (i.e. no control, motion sensor, timer) will require a performance run.

http://aquamotionhvac.com/wp-content/uploads/2008/08/Hot-Brochure-1.pdf

Residential PV Systems

* kilowatts direct current

A typical 1kWdc system often has approximately four PV panels

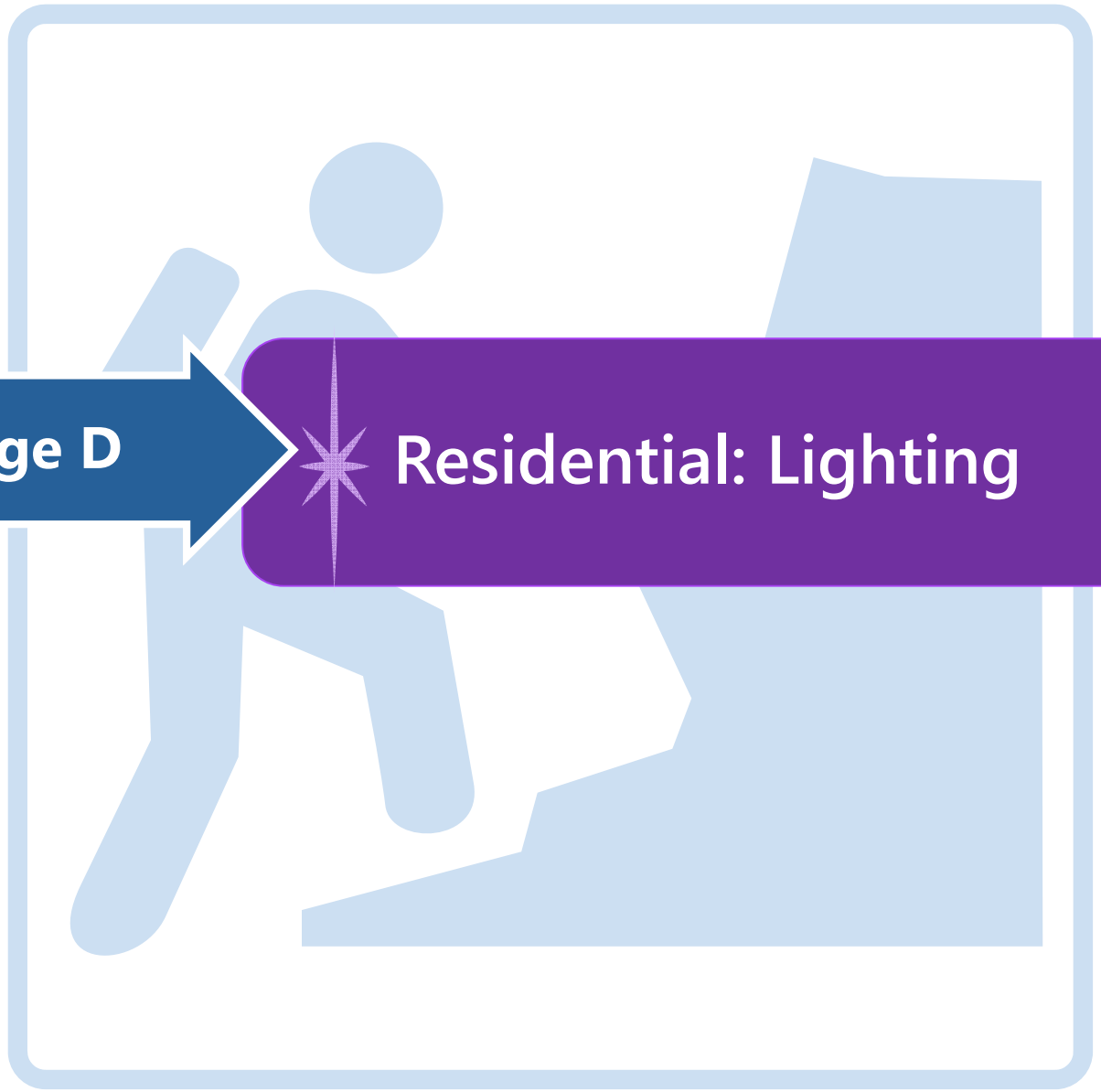
In our opinion…

Increased PV Credit

- The PV System Credit is available only if:
  - The Performance Approach is used
  - The project is in Climate Zones 1-5, 8-16
  - The system is:
    - ≥ 2 kWdc* for Single Family
    - ≥ 1 kWdc* for Multi Family
  - The amount of credit will depend upon the Climate Zone and the Conditioned Floor Area of the dwelling.
- PV System credit does not require HERS verification unless getting rebate from the New Solar Homes Partnership (NSHP)

For the 2019 Standards, the PV tradeoff will no longer be available to trade away the 2016 HPA and HPW (AND not allowed for current CAHP programs)

Challenge D



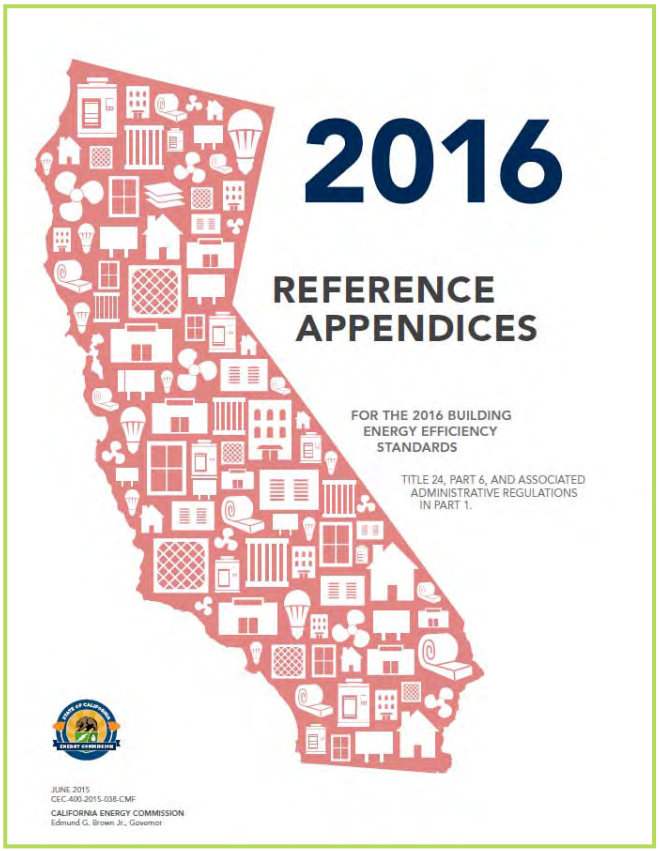
Challenge D

Residential: Lighting

What's High Efficacy?

Indoor High Efficacy Luminaires	JA8 High Efficacy Lighting	Recessed Downlights in Ceilings
❑ Pin-based linear fluorescent ❑ Pin-based compact fluorescent ❑ GU-24 other than LEDs ❑ Inseparable SSL luminaires with colored light sources for decorative lighting purpose	❑ LED luminaires with integral sources ❑ Screw-based LED lamps ❑ Pin-based LED lamps ❑ GU-24 based LED light source	❑ **Shall not have screw based sockets** ❑ Shall contain JA8-certified light sources

Joint Appendices Chapter 8



"JA8-2016" or "JA8-2016-E" LAMP

Appendix JA8: Qualification Requirements for High Efficacy Light Sources – Partial List

Specification	Requirement
Initial Efficacy	≥ 45 lumens/Watt
Power Factor at Full Rated Power	≥ 0.90
Correlated Color Temperapture (CCT)	For inseparable SSL luminaires, LED light engines and GU24 LED lamps, ≤4000 Kelvin. For all other sources, ≤3000 Kelvin.
Color Rendering Index (CRI)	≥90
R9	≥50
Rated Life	≥15,000 hours
Minimum Dimming Level	≤10%
Flicker	<30% for frequencies of 200 Hz or below, at 100% and 20% light output.

This table contains a partial list of requirements. Additional qulification requirements may be found in JA8.

A list of compliant products will be found a: https://cacertappliances.energy.ca.gov

In our opinion…

Lighting Controls

Switches

Dimmers

Vacancy Sensors

- Hallways & Closets
  - Switch, dimmer or vacancy sensor
- Kitchens
  - Under cabinet lighting switched separately*
  - **High efficacy:** Switch, dimmer or vacancy sensor
  - **JA8-2016/JA-2016-E:** Dimmer or vacancy sensor
- Bathrooms, Utility/Laundry Rooms, Garage
  - One fixture must be on vacancy sensor
  - 2nd fixture:
    - **High efficacy:** Switch, dimmer or vacancy sensor
    - **JA8-2016/JA-2016-E:** Dimmer or vacancy sensor
- All Other
  - **High efficacy:** Switch, dimmer or vacancy sensor
  - **JA8-2016/JA-2016-E:** Dimmer or vacancy sensor

***Applies to all rooms types**

Outdoor Lighting

- High Efficacy Fixture

- Controls:
  - On/Off switch AND
  - Photocell AND motion sensor OR
  - Photocontrol AND automatic time switch OR
  - Astronomical time clock OR
  - EMCS that provides the functionality of a astronomical time clock AND meets installation criteria of §130.4 AND does not allow the luminaire to always be on, AND is programmed to turn the outdoor lights off during the day.

Check your understanding

Next Steps

HELPING YOU PLAY YOUR CARDS RIGHT

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Ace Resources Fact Sheets

Ace Resources 2016 Title 24, Part 6 Fact Sheet

Residential
What's Changed in 2016

HVAC AND DOMESTIC HOT WATER: Mandatory Measures

Color background indicates code language: ☐ NO CHANGE REVISED NEW FOR 2016

Ace Resources Fact Sheet
What's Changed in 2016
HVAC AND DOMESTIC HOT WATER: Mandatory Measures
Color background indicates code language: ☐ NO CHANGE REVISED NEW FOR 2016

Measure	T-24 Section	Notes
Systems & Equipment *§110.0 has added new language regarding conformance to Title 20*	110.0(b)	New language regarding certification of manufactured systems, equipment, appliances and building components that need to meet Title 20 requirements (regulated appliances), or certification requirements per Title 24, Part 6 (not a regulated appliance under Title 20). Certification to the Energy Commission is the responsibility of the manufacturer.
Heating Equipment Efficiency	110.2(a)	Table 110.2-B: Heating mode water and groundwater source heat pumps COP minimum values (1/1/2017). Table 110.2-E: SPVHP and PTHP COP minimum values (1/1/2017). Table 110.2-J: Oil-fired unit heater minimum efficiency increased to 81% E_t (1/1/2017). Table 110.2-K: Boiler minimum efficiencies to change 3/2/2020.
Cooling Equipment Efficiency	110.2(a)	Table 110.2-A: Air conditioners: air cooled and water cooled IEER minimum values (1/1/2016). Table 110.2-B: Air and water cooled heat pumps IEER and EER minimum values (1/1/2016). Table 110.2-D: Air and water cooled chillers Path A and B minimum efficiencies (1/1/2017). Table 110.2-E: Cooling mode PTAC , PTHP and SPVAC EER minimum values (1/1/2017). Table 110.2-G: Evaporative cooling towers added.
Space Conditioning Equipment	110.2(b-f)	No Change
Service Water Heating Systems & Equipment Installation	110.3(a)(b) 110.3(c)7	No Change. NOTE: Temperature control listed in ASHRAE Handbook HVAC Applications Guide volume 2011 is Table 3 (as is stated within Standards); in volume 2015 it can be found in Chapter 50, Table 19. Isolation valves. Instantaneous water heaters with an input rating greater than 6.8 kBTU/hr (2 kW) shall have isolation valves on both the cold water supply and the hot water pipe leaving the water heater, and hose bibbs or other fittings on each valve for flushing the water heater when the valves are closed.
Pool & Spas	110.4(a)(b)	No Change
Pilot Lights	110.5(a-d)	No Change
Residential HVAC & Water Heating	150.0(e) Fireplaces 150.0(h) 3B Equipment 150.0(i) Thermostats 150.0(j) Water system insulation 150.0(m)1 Air distribution 150.0(m)2-12 150.0(m)13 Duct and air grille sizing 150.0(n-p)	No Change Liquid line filter dryers required per manufacturers' instructions for AC and heat pump systems. Allows for EMCS instead of setback thermostat when required per §110.2(c). Since federal standards have increased minimum efficiency on tank water heaters, an R-12 external blanket is no longer required since they are provided via internal tank insulation by manufacturer (to meet minimum federal efficiency). Minor changes in language regarding below grade piping, cooling system piping, and insulation protection. Minimum duct insulation, no matter where it is located, such as inside the conditioned space, must be insulated with a minimum of R-4.2. 11. Duct testing: Total leakage shall not exceed 5% for single family homes and townhouses. All others: No Change Slight change in language specifically to single zone central forced air system for the airflow fan watt draw minimum requirements. Zonally controlled central forced air systems shall be capable of simultaneously delivering, in every zonal control mode, airflow from the dwelling, through the air handler fan and delivered to the dwelling ≥350 CFM per ton of nominal cooling capacity, and operating at an air-handling unit fan efficacy of ≤ 0.58 W/CFM as confirmed by field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.3 Some new exceptions apply for small duct high velocity systems and multispeed/variable speed compressor systems. No Change

on of manufactured systems, equipment, appliances and building components needing to meet Title
fication requirements per Title 24, Part 6 (not considered an appliance) and that it is the responsibility

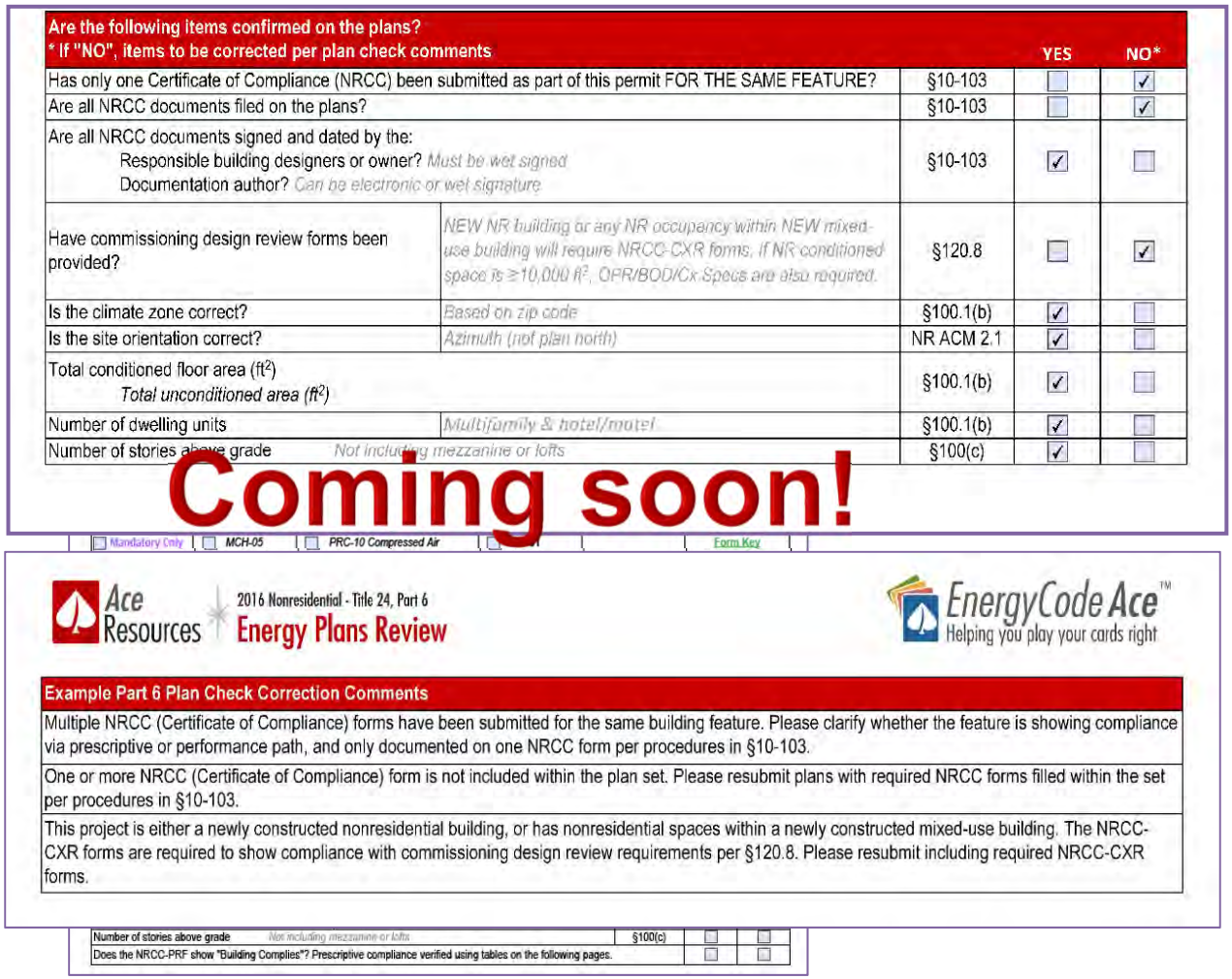
nd groundwater source heat pumps COP minimum values (1/1/2017).
minimum values (1/1/2017).
nimum efficiency increased to 81% E_t (1/1/2017).
ncies to change 3/2/2020.

oled and water cooled IEER minimum values (1/1/2016).
eat pumps IEER and EER minimum values (1/1/2016).
chillers Path A and B minimum efficiencies (1/1/2017).
THP and SPVAC EER minimum values (1/1/2017).
wers added.

ol listed in ASHRAE Handbook HVAC Applications Guide volume 2011 is Table 3 (as is stated within
found in Chapter 50, Table 19.

heaters with an input rating greater than 6.8 kBTU/hr (2 kW) shall have isolation valves on both the
ipe leaving the water heater, and hose bibbs or other fittings on each valve for flushing the water

Ace Resources Checklists



Are the following items confirmed on the plans? * If "NO", items to be corrected per plan check comments			YES	NO*
Has only one Certificate of Compliance (NRCC) been submitted as part of this permit FOR THE SAME FEATURE?		§10-103	☐	☑
Are all NRCC documents filed on the plans?		§10-103	☐	☑
Are all NRCC documents signed and dated by the: Responsible building designers or owner? *Must be wet signed* Documentation author? *Can be electronic or wet signature*		§10-103	☑	☐
Have commissioning design review forms been provided?	*NEW NR building or any NR occupancy within NEW mixed-use building will require NRCC-CXR forms, if NR conditioned space is ≥10,000 ft². OPR/BOD/Cx Specs are also required.*	§120.8	☐	☑
Is the climate zone correct?	*Based on zip code*	§100.1(b)	☑	☐
Is the site orientation correct?	*Azimuth (not plan north)*	NR ACM 2.1	☑	☐
Total conditioned floor area (ft²) *Total unconditioned area (ft²)*		§100.1(b)	☑	☐
Number of dwelling units	*Multifamily & hotel/motel*	§100.1(b)	☑	☐
Number of stories above grade	*Not including mezzanine or lofts*	§100(c)	☑	☐

Coming soon!

Ace Resources 2016 Nonresidential - Title 24, Part 6 Energy Plans Review

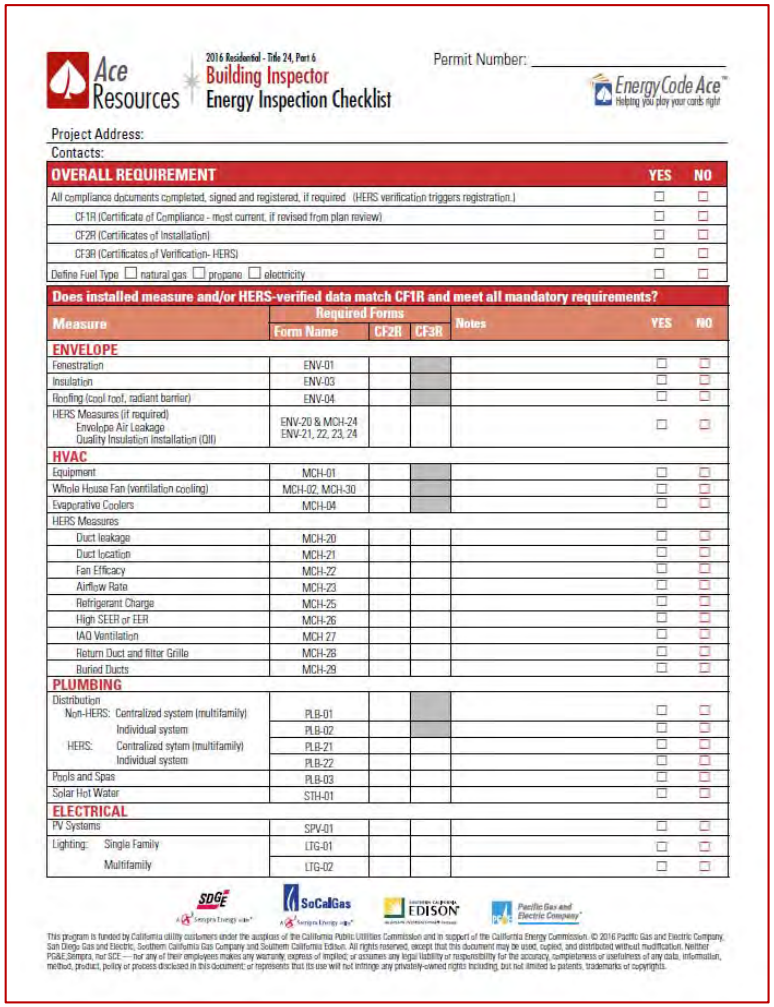
EnergyCode Ace™ Helping you play your cards right

Example Part 6 Plan Check Correction Comments
Multiple NRCC (Certificate of Compliance) forms have been submitted for the same building feature. Please clarify whether the feature is showing compliance via prescriptive or performance path, and only documented on one NRCC form per procedures in §10-103.
One or more NRCC (Certificate of Compliance) form is not included within the plan set. Please resubmit plans with required NRCC forms filled within the set per procedures in §10-103.
This project is either a newly constructed nonresidential building, or has nonresidential spaces within a newly constructed mixed-use building. The NRCC-CXR forms are required to show compliance with commissioning design review requirements per §120.8. Please resubmit including required NRCC-CXR forms.

Dynamic or Static

- Dynamic:
  - Computer is required
  - Adobe Reader is required
  - Organized to help organize plan check for all the Title 24 Part 6 certificate of Compliance forms (NRCC)
  - You can choose to have predetermined "Plan Check Responses" populated for items *not* meeting code.

Ace Resources Checklists



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2016 Residential - Title 24, Part 6
Building Inspector
Energy Inspection Checklist

Permit Number: _____

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Project Address:
Contacts:

OVERALL REQUIREMENT	YES	NO
All compliance documents completed, signed and registered, if required (HERS verification triggers registration.)	☐	☐
CF1R (Certificate of Compliance - must current, if revised from plan review)	☐	☐
CF2R (Certificates of Installation)	☐	☐
CF3R (Certificates of Verification- HERS)	☐	☐
Define Fuel Type ☐ natural gas ☐ propane ☐ electricity	☐	☐

Does installed measure and/or HERS-verified data match CF1R and meet all mandatory requirements?

Measure	Required Forms: Form Name	CF2R	CF3R	Notes	YES	NO
ENVELOPE						
Fenestration	ENV-01				☐	☐
Insulation	ENV-03				☐	☐
Roofing (cool roof, radiant barrier)	ENV-04				☐	☐
HERS Measures (if required) Envelope Air Leakage Quality Insulation Installation (QII)	ENV-20 & MCH-24 ENV-21, 22, 23, 24				☐	☐
HVAC						
Equipment	MCH-01				☐	☐
Whole House Fan (ventilation cooling)	MCH-02, MCH-30				☐	☐
Evaporative Coolers	MCH-04				☐	☐
HERS Measures						
Duct leakage	MCH-20				☐	☐
Duct location	MCH-21				☐	☐
Fan Efficacy	MCH-22				☐	☐
Airflow Rate	MCH-23				☐	☐
Refrigerant Charge	MCH-25				☐	☐
High SEER or EER	MCH-26				☐	☐
IAQ Ventilation	MCH 27				☐	☐
Return Duct and filter Grille	MCH-28				☐	☐
Buried Ducts	MCH-29				☐	☐
PLUMBING						
Distribution Non-HERS: Centralized system (multifamily)	PLB-01				☐	☐
Individual system	PLB-02				☐	☐
HERS: Centralized sytem (multifamily)	PLB-21				☐	☐
Individual system	PLB-22				☐	☐
Pools and Spas	PLB-03				☐	☐
Solar Hot Water	STH-01				☐	☐
ELECTRICAL						
PV Systems	SPV-01				☐	☐
Lighting: Single Family	LTG-01				☐	☐
Multifamily	LTG-02				☐	☐

SDGE · SoCalGas · EDISON · Pacific Gas and Electric Company

Static

- No computer required
- Provides guidance on which building features must be documented with which forms
- These forms are designed to be a verification tool in the field.

Coming soon!

Trade Organizations

Who Is Doing This Already?

EfficiencyFirstCalifornia

http://www.efficiencyfirstca.org/

About Us

Efficiency First California (formerly CBPCA) is a 501(c)(6) nonprofit trade association organized in 2001.

CBPCA has been California's premier home performance advocate and a leader of the home performance industry's growth. CBPCA has trained contractors and provides them access to a vibrant home performance contractor community and valuable industry-related knowledge. Efficiency First California/CBPCA's high-level industry partnerships benefit the home performance contractors and the homeowner. CBPCA has participated in every Home Performance with ENERGY STAR® program in California since 2002.

Efficiency First California Mission

To lead the growth of, and advocate on behalf of, California's home performance industry by supporting home performance contractors and those with whom they work, providing access to a vibrant contractor community, helping develop and disseminate systematic industry-related knowledge, and creating partnerships among like-

Energy Consultants

Certified Energy Analysts

California Association of Building Energy Consultants
CABEC

www.cabec.org

- California Association of Building Energy Consultants
  - Education & Training – Title 24 Code, building science and energy modeling
  - Certified Energy Analyst certification
  - Information Network
  - Code related advocacy

Wrap Up

HELPING YOU PLAY YOUR CARDS RIGHT