



**ALL OCCUPANCIES:**

Article 1 of Title 24, Part 1 (10-101 through 10-114)

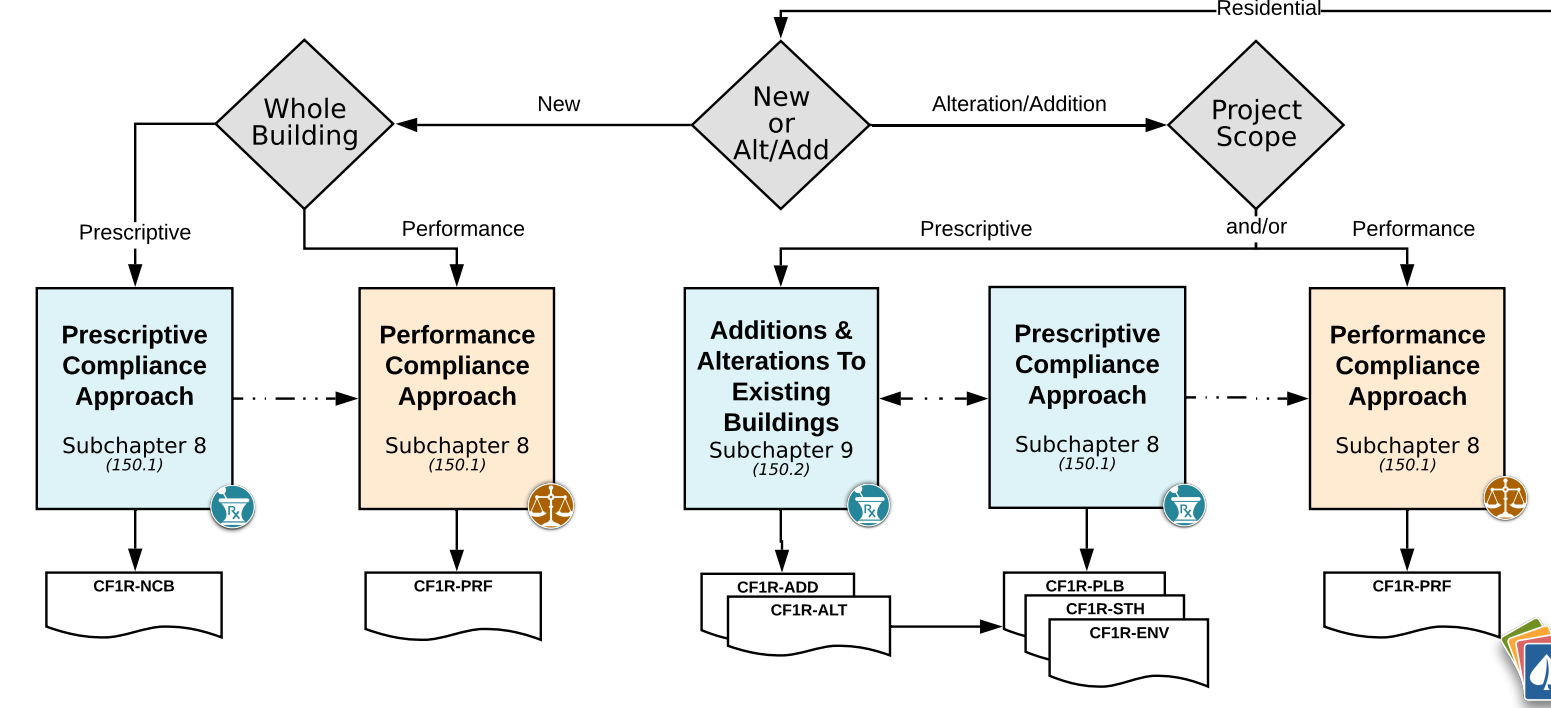
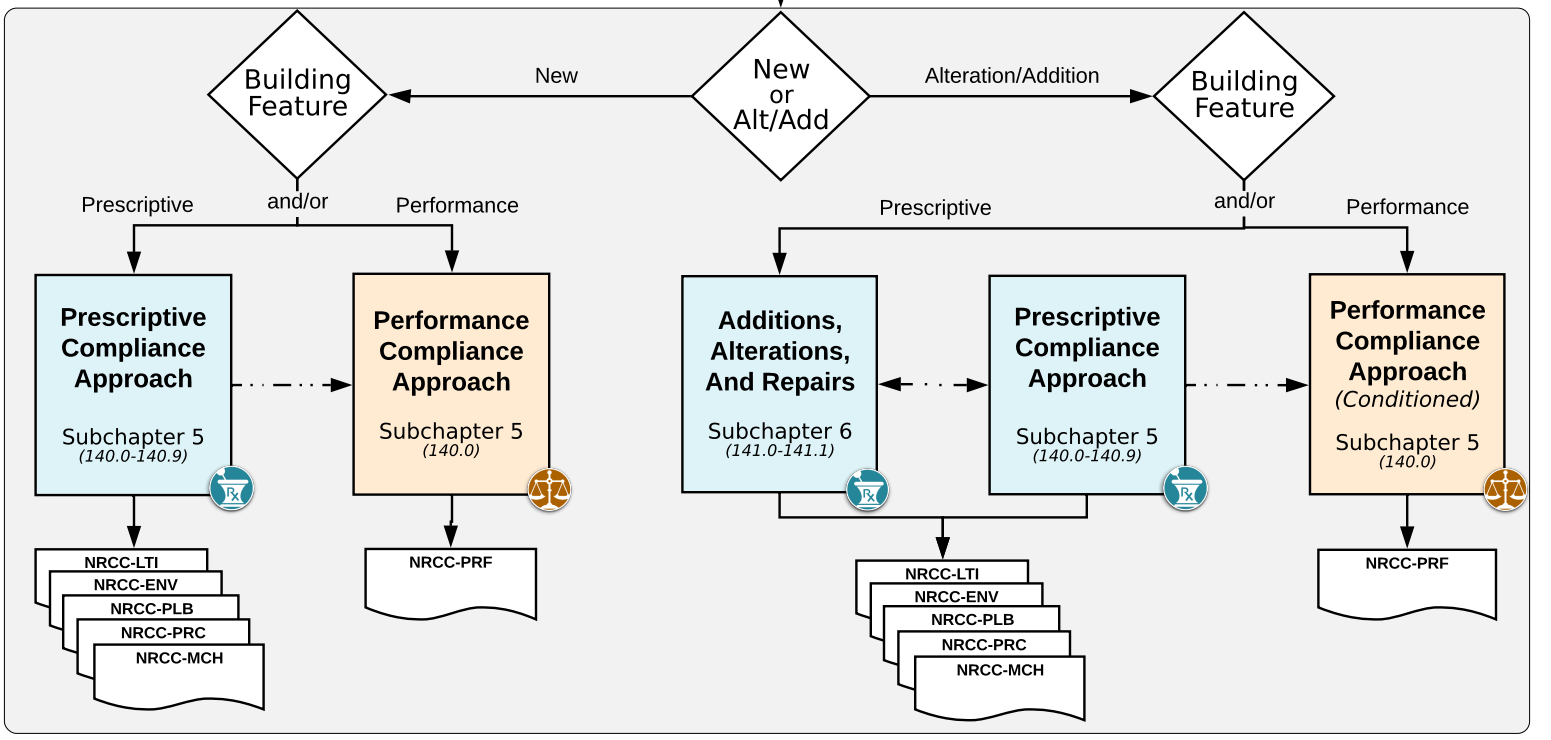
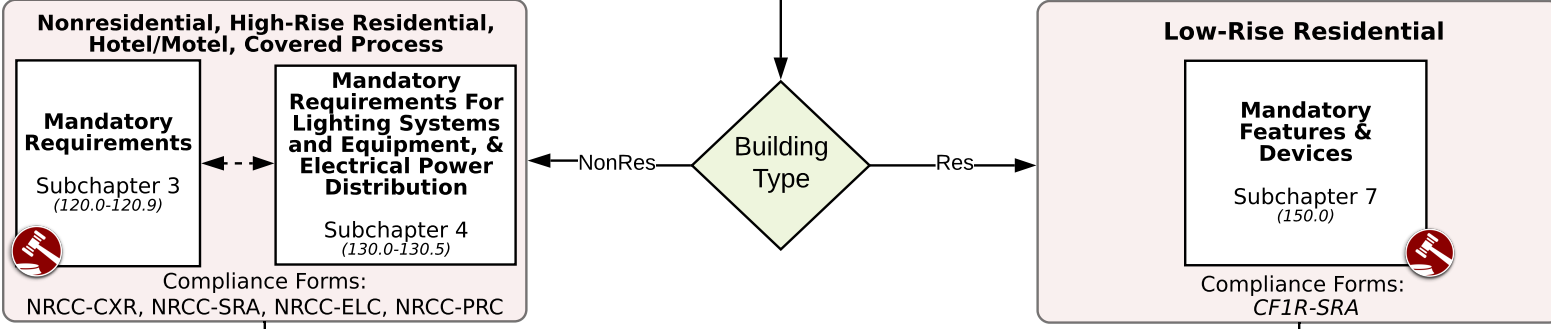
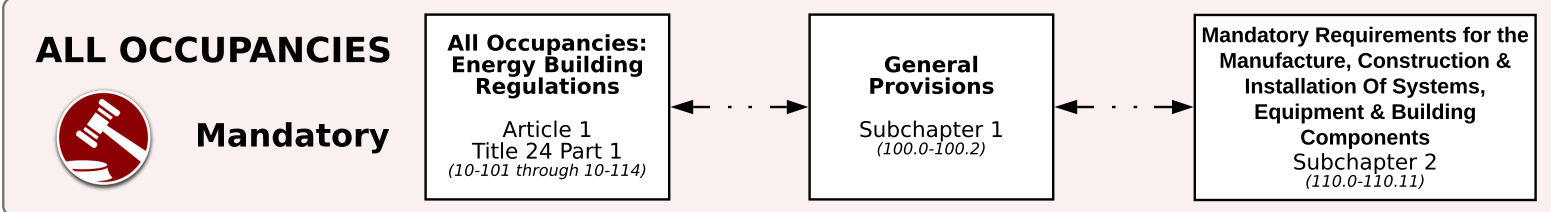
Building Occupancies	Building Application	Mandatory			Prescriptive Subchapter 5 (140.0-140.9)	Performance Subchapter 5 (140.0-140.1)	Additions Alterations Subchapter 6 (141.0-141.1)
		All Occupancy Subchapter 1-2 (100.0-110.11)	Nonresidential Occupancy Subchapter 3 (120.0-120.9)	Nonresidential Lighting/ELP Subchapter 4 (130.0-130.5)			
Nonresidential, High-Rise Residential, and Hotels/Motels	<b>General</b>	100.0, 100.1-2, 110.0, 110.1 <sup>2</sup>	120.0	N.A.	140, 140.2	140.0, 140.1	141.0
	<b>Envelope</b> (conditioned)	110.6, 110.7, 110.8	120.7	N.A.	140.3		
	<b>Envelope</b> (uncond, process spaces)	N.A.			140.3(c)		
	<b>HVAC</b> (conditioned)	110.2, 110.5	120.1, 120.2, 120.3, 120.4, 120.5, 120.8	N.A.	140.4		
	<b>Water Heating</b>	110.3	120.3, 120.8, 120.9	N.A.	140.5		
	<b>Indoor Lighting</b> (conditioned, process spaces)	110.9	120.8	130.0, 130.1, 130.4	140.3(c), 140.6		
	<b>Indoor Lighting</b> (uncond. & parking garages)	110.9	N.A.	130.0, 130.1, 130.4	140.3(c), 140.6		
	<b>Outdoor Lighting</b>	110.9	N.A.	130.0, 130.2, 130.4	140.7		
	<b>Electrical Power Distribution</b>	110.11	N.A.	130.5	N.A.	N.A.	
	<b>Pool and Spa Systems</b>	110.4, 110.5	See Residential 150.0(p)	N.A.	N.A.		
	<b>Solar Ready Buildings</b>	110.10	N.A.	N.A.	N.A.		
Covered Processes <sup>3</sup>	<b>Envelope, Ventilation, Process Loads</b>	110.2	120.6	N.A.	140.9	140.1	140.9, 141.1
Signs	<b>Indoor and Outdoor</b>	110.9	N.A.	130.0, 130.3	140.8	N.A.	141.0, 141.0(b)2H

Building Occupancies	Building Application	Mandatory		Prescriptive Subchapter 8 (150.1)	Performance Subchapter 8 (150.1)	Additions Alterations Subchapter 9 (150.2)
		All Occupancy Subchapter 1-2, 4 (100.0-110.11) & 130.0	Residential Occupancy Subchapter 7 (150.0)			
Low-Rise Residential	<b>General</b>	100.0, 100.1-2, 110.0 110.1 <sup>2</sup>	150.0	150.1(a), 150.1(c)	150.1(a), 150.1(b)	150.2(a), 150.2(b)
	<b>Envelope</b> (conditioned)	110.6, 110.7, 110.8	150.0(a)-(e), 150.0(g), 150.0(q)			
	<b>HVAC</b> (conditioned)	110.2, 110.5	150.0(h)-(j), 150.0(m), 150.0(o)			
	<b>Water Heating</b>	110.3	150.0(j), 150.0(n)			
	<b>Indoor Lighting</b> (cond, uncond. & parking garages)	110.9, 130.0	150.0(k)			
	<b>Outdoor Lighting</b>	110.9, 130.0	150.0(k)			
	<b>Pool and Spa Systems</b>	110.4	150.0(p)	N.A.	N.A.	150.2(a), 150.2(b)
	<b>Solar Ready Buildings</b>	110.10	N.A.	N.A.	N.A.	N.A.

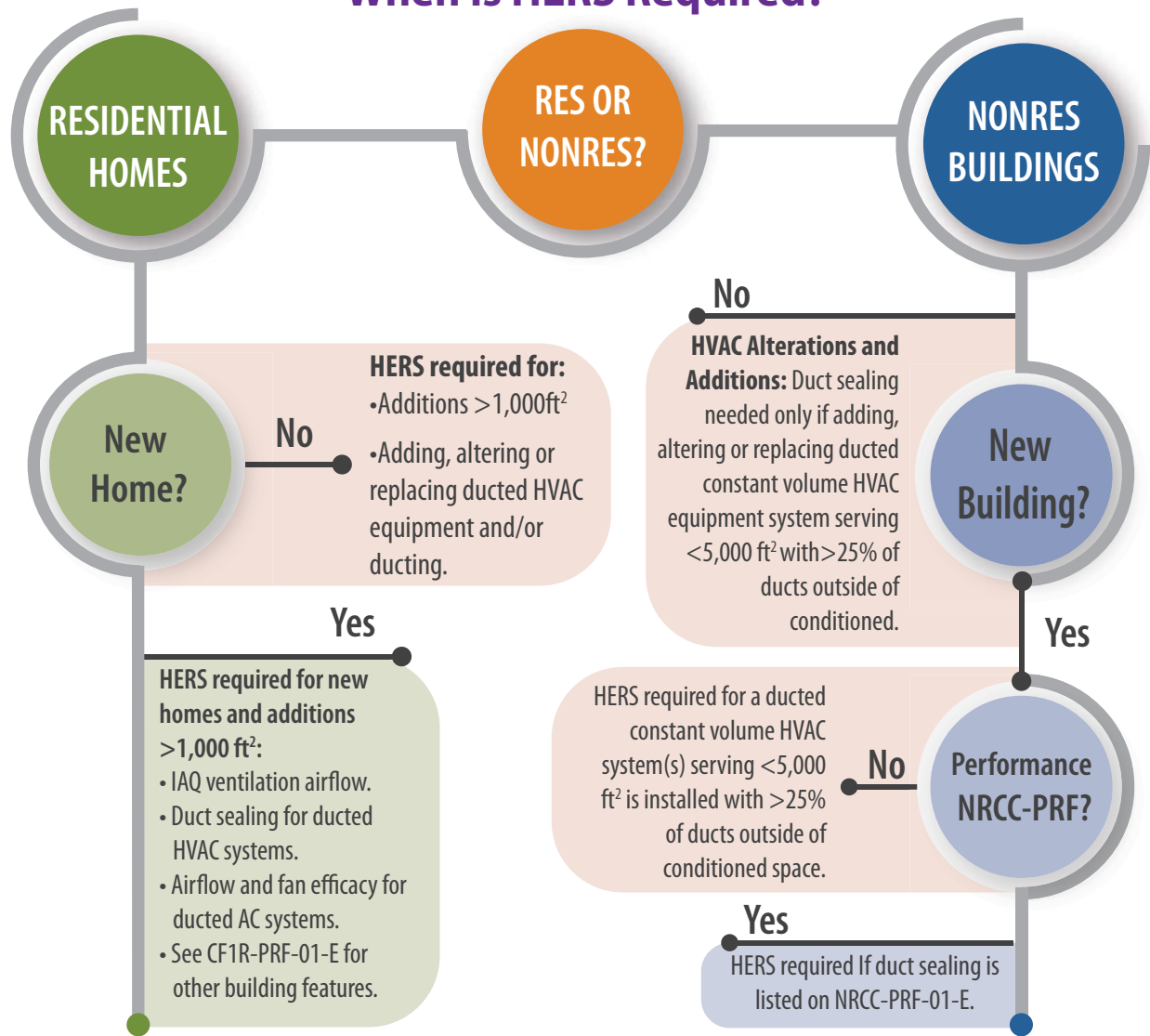
<sup>1</sup> This table is based on Table 100.0-A: [http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037\\_Table100A.pdf](http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037_Table100A.pdf)

<sup>2</sup> Section 110.1 refers to Title 20

<sup>3</sup> Nonresidential, high-rise and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.



## When Is HERS Required?



## When is HERS NOT required for Residential?

### Alterations & Additions ≤ 1,000 ft<sup>2</sup>:

- a) When there are no changes and additions to a ducted HVAC system. Examples include:
  - i) Adding a ductless wall furnace
  - ii) Extending < 40 linear ft. of ducting to an existing HVAC system
  - iii) Changing or adding a water heater
  - iv) Changing or adding lighting
  - v) Changing or replacing envelope features that are NOT to be HERS pre-verified in a performance calculation such as window replacement and reroof(s)

**Note: HERS will always be required for New Construction/Additions > 1,000 ft<sup>2</sup>**






For more information, check out..  
[www.energycodeace.com](http://www.energycodeace.com)

**Trigger Sheet(s):** Residential HVAC Alterations 2016 / Nonresidential New HVAC: Simple and Complex Systems 2016.

**Factsheet:** Just the Basics: HERS for Residential and Nonresidential Projects 2016.

**Application Guide(s):** 2016 Residential HVAC and Plumbing / 2016 Nonresidential HVAC and Plumbing.

Residential HERS Key		APPLICATION		MANDATORY 	PRESCRIPTIVE 	PERFORMANCE 	REFERENCE APPENDICES		
		New	Altered						
<b>DUCT MEASURES</b>						CF1R-PRF-01-E			
<b>DUCT SEALING</b>	<i>Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.</i>	When >10 ft. ducting	Altered HVAC w/>25 ft. ducting outside conditioned space or Adding >40 ft. of ducting	CF2R/CF3R-MCH-20-H \$150.0(m)11			RA3.1.4.3 <b>Single Family:</b> New: 5% Altered: 15% <b>Multifamily:</b> New: 6% Altered: 15%		
<b>RETURN DUCT DESIGN</b>	<i>Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification.</i>	New ducted system	Altered system with >75% new ducting, new HVAC	CF2R/CF3R-MCH-28-H \$150.0(m)13			RA3.1.4.4		
<b>AIR FILTER DEVICE</b>	<i>Confirm that the air filter devices conform §150.0(m)12.</i>			CF2R/CF3R-MCH-28-H \$150.0(m)12			RA3.1.4.5		
<b>ZONALLY CONTROLLED CENTRAL FAU (BYPASS DUCT)</b>	<i>Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.</i>			CF2R/CF3R-MCH-22/23-H \$150.0(m)13			Not Allowed §150.1(c)13	Res ACM 2.4.8.4	RA3.1.4.6
<b>DUCTS IN DIRECTLY CONDITIONED SPACE</b>	<i>Duct system location shall be verified.</i>			Altered system with >75% new ducting, new HVAC when used in a performance calculation (CF1R-PRF-01-E)			CF2R/CF3R-MCH-20/21-H	Res ACM 2.4.6.2	RA3.1.4.3.8
<b>LOW LEAKAGE DUCTS CONDITIONED SPACE</b>	<i>Field Verification for ducts in conditioned space is required. Duct sealing is required.</i>	HPA Option C §150.1(c)9	Res ACM 2.4.6.13						
<b>DUCT SURFACE AREA/ R-VALUE. BURIED DUCTS/ DEEPLY BURIED DUCTS</b>	<i>Duct system installed according to the design, including location, size and length of ducts, duct insulation R-value. For buried ducts measures, Duct Sealing and verification of insulation.</i>	Res ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.41						
<b>LOW LEAKAGE AIR-HANDLING UNITS</b>	<i>Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is required.</i>			Res ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9				
<b>AIR CONDITIONING MEASURES</b>						CF1R-PRF-01-E			
<b>COOLING SYSTEM AIRFLOW</b>	<i>System airflow greater than or equal to a specified criterion, field verification and diagnostic testing required.</i>	New ducted system with AC	Altered system with >75% new ducting, new air handler and new AC.	CF2R/CF3R-MCH-23-H \$150.0(m)13			RA3.3		
<b>COOLING AIR-HANDLING UNIT FAN EFFICACY</b>	<i>Fan efficacy (Watt/cfm) less than or equal to a specified criterion, field verification and diagnostic testing required.</i>			CF2R/CF3R-MCH-22-H \$150.0(m)13			RA3.3		
<b>REFRIGERANT CHARGE</b>	<i>Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge.</i>	New AC System in CZ 2, 8-15	Altered AC System in CZ 2, 8-15		CF2R/CF3R-MCH-25-H	Climate Zone 2,8-15 §150.1(c)7A	RA3.3		
<b>FAULT INDICATOR DISPLAY</b>	<i>Fault Indicator Display can be installed as an alternative to refrigerant charge testing. Field verification is required.</i>						Credit in Climate Zone 1,3-7,16 Res ACM 2.4.5.1	RA3.2 RA1.2 RA3.4.2	

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES		
		New	Altered						
<b>AIR CONDITIONING MEASURES</b>						CF1R-PRF-01-E			
<b>ENERGY EFFICIENCY RATIO (EER)</b>	<i>Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.</i>	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1		
<b>SEASONAL ENERGY EFFICIENCY RATIO (SEER)</b>	<i>Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.</i>					Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1		
<b>EVAPORATIVELY COOLED CONDENSERS</b>	<i>Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.</i>					Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3, 3.2 RA3.4.3/4.1		
<b>MECHANICAL VENTILATION MEASURES</b>									
<b>CONTINUOUS OR INTERMITTENT IAQ</b>	<i>Measurement of whole-building mechanical ventilation. If central fan integrated system used, verification of installation and intermittent controls.</i>	New Homes	Addition over 1,000 sq. ft.	CF2R/CF3R-MCH-27-H §150.0(o)			RA3.7.4.1 RA3.7.4.2		
<b>BUILDING ENVELOPE MEASURES</b>									
<b>BUILDING ENVELOPE AIR LEAKAGE</b>	<i>Compliance credit can be taken for reduced building envelope air leakage.</i>	New Homes	N/A			Res ACM 2.2.5.1	RA3.8		
<b>HIGH QUALITY INSULATION INSTALLATION (QH)</b>	<i>Compliance credit can be taken for quality installation of insulation.</i>		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5		
<b>SPRAY POLYURETHANE FOAM (SPF) INSULATION</b>	<i>Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.</i>		Altered Envelope Features if present in CF1R-PRF			Res ACM 2.3.3.2	RA3.5.6		
						<b>MANDATORY</b>	<b>PRESCRIPTIVE</b>	<b>PERFORMANCE</b>	<b>REFERENCE APPENDICES</b>
<b>SINGLE FAMILY DOMESTIC HOT WATER MEASURES</b>						CF1R-PRF-01-E			
<b>PIPE INSULATION CREDIT</b>	<i>Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.</i>	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3		
<b>PARALLEL PIPING</b>	<i>Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.</i>					Res ACM 2.9	RA3.6.4		

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
<b>SINGLE FAMILY DOMESTIC HOT WATER MEASURES</b>						CF1R-PRF-01-E	
<b>COMPACT HOT WATER DISTRIBUTION SYSTEM</b>	<i>Longest pipe run from the water heater to a HW fixture does not exceed a maximum length per RA3.6.5</i>	New Home	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.5
<b>POINT OF USE</b>	<i>A hot water fixtures in a dwelling unit, except the clothes washer, must be located within a restricted length based on pipe diameter from a water heater.</i>					Res ACM 2.9	RA3.6.6
<b>DEMAND RECIRCULATION: MANUAL CONTROL</b>	<i>Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.</i>					Res ACM 2.9	RA3.6.7
<b>DEMAND RECIRCULATION: SENSOR CONTROL</b>	<i>Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.</i>					Res ACM 2.9	RA3.6.8
<b>LOWRISE AND HIGHRISE MULTIFAMILY DOMESTIC HOT WATER HEATING MEASURES</b>							
<b>MULTIPLE RECIRCULATION LOOP DESIGN FOR DHW SYSTEMS</b>	<i>Performance credit for HERS inspection that a central DHW system serving a building with more than eight dwelling units has at least two recirculation loops, each serving roughly the same number of dwelling units.</i>	New Lowrise and Highrise Multifamily Building	New HW Distribution System			Lowrise CF1R-PRF-01-E Res ACM 2.9.2 Highrise NRCC-PRF-01-E NonRes ACM 5.9.1.4	RA3.6.9 RA4.4
<b>PRE-EXISTING HERS VERIFIED MEASURES</b>							
<b>HERS VERIFIED PRE-EXISTING CONDITIONS</b>	<i>Performance credit for improving an existing building feature beyond "default" per Table 150.2-C, verified by visual inspection.</i>	N/A	Altered Existing Building Feature			Res ACM 2.10.3	Res Manual App. G

Nonresidential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
<b>NONRESIDENTIAL HVAC HERS MEASURES</b>							
<b>DUCT SEALING</b>	<i>Field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria.</i>	New constant volume single zone system serving <5,000 ft <sup>2</sup> , >25% of ducting outside conditioned space.	Altered system or ducting associated with constant volume single zone system serving <5,000 ft <sup>2</sup> , >25% of ducting outside conditioned space.		NRCV-MCH-04-H §140.4(l)	NonRes ACM 5.7.3.6	NA1, NA2.1 New: 6% Altered: 15% or smoke test



# Decoding 2016 Energy Standards: *Let's Talk How to Navigate*



HELPING YOU PLAY YOUR CARDS RIGHT



# Recording For Future Use



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# Who Are We?

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Gina Rodda  
Gabel Energy  
[gina@gabelenergy.com](mailto:gina@gabelenergy.com)



BUILDING ENERGY ANALYSIS +  
ENERGY CODE COMPLIANCE

## 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, starting the *ninth* California building energy code cycle of her career.



# Who Are We?

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Christopher Olvera

California Energy Commission  
Chris.Olvera@energy.ca.gov



## Guest Speaker: Chris Olvera

Christopher Olvera is the supervisor of the California Energy Commission's Outreach and Education Unit. This unit develops tools, presentations, and resources to support enforcement agencies' verification of compliance with the Energy Code.

Chris has over 15 years of experience working at the Energy Commission. He began work as a student on the Energy Standards Hotline fielding questions from designers, builders, and enforcement agencies statewide regarding the Energy Code.



# Decoding 2016 Standards

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- ✦ Be aware of the development process to the Energy Standards;
- ✦ Understand the structure of the Energy Standards and how that can be a road map to find what you are looking for;
- ✦ Know what resources are available through the Energy Commission and Energy Code Ace regarding the Energy Standards.



Why?



HELPING YOU PLAY YOUR CARDS RIGHT



# Handouts

**Decoding 2016 Energy Standards™ ROAD MAP TO TITLE 24, PART 6<sup>1</sup>**

**ALL OCCUPANCIES:**  
Article 1 of Title 24, Part 1 (10-101 through 10-114)

Building Occupancies	Building Application	Mandatory			Prescriptive Subchapter 5 (140.0-140.9)	Performance Subchapter 5 (140.0-140.1)	Additions Alterations Subchapter 6 (141.0-141.1)
		All Occupancy Subchapter 1-2 (100.0-110.11)	Nonresidential Occupancy Subchapter 3 (120.0-120.9)	Nonresidential Lighting/ELP Subchapter 4 (130.0-130.5)			
Nonresidential, High-Rise Residential, and Hotels/Motels	General	100.0, 100.1-2, 110.0, 110.1 <sup>2</sup>	120.0	N.A.	140, 140.2	140.0, 140.1	141.0
	Envelope (conditioned)	110.6, 110.7, 110.8	120.7	N.A.	140.3		
	Envelope (uncond., process spaces)	N.A.			140.3(c)		
	HVAC (conditioned)	110.2, 110.5	120.1, 120.2, 120.3, 120.4, 120.5, 120.8	N.A.	140.4		
	Water Heating	110.3	120.3, 120.8, 120.9	N.A.	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9	120.8	130.0, 130.1, 130.4	140.3(c), 140.6		
	Indoor Lighting (uncond. & parking garages)	110.9	N.A.	130.0, 130.1, 130.4	140.3(c), 140.6		
	Outdoor Lighting	110.9	N.A.	130.0, 130.2, 130.4	140.7		
	Electrical Power Distribution	110.11	N.A.	130.5	N.A.		
	Pool and Spa Systems	110.4, 110.5	See Residential 150.0(p)	N.A.	N.A.		
	Solar Ready Buildings	110.10	N.A.	N.A.	N.A.	141.0(a)	
Covered Processes <sup>3</sup>	Envelope, Ventilation, Process Loads	110.2	120.6	N.A.	140.9	140.9, 141.1	
Signs	Indoor and Outdoor	110.9	N.A.	130.0, 130.3	140.8	141.0, 141.0(b), 2H	

Building Occupancies	Building Application	Mandatory		Prescriptive Subchapter 8 (150.1)	Performance Subchapter 8 (150.1)	Additions Alterations Subchapter 9 (150.2)			
		All Occupancy Subchapter 1-2, 4 (100.0-110.11) & 130.0	Residential Occupancy Subchapter 7 (150.0)						
Low-Rise Residential	General	100.0, 100.1-2, 110.0, 110.1 <sup>2</sup>	150.0	150.1(a), 150.1(c)	150.1(a), 150.1(b)	150.2(a), 150.2(b)			
	Envelope (conditioned)	110.6, 110.7, 110.8	150.0(a)-(e), 150.0(g), 150.0(q)						
	HVAC (conditioned)	110.2, 110.5	150.0(h)-(j), 150.0(m), 150.0(o)						
	Water Heating	110.3	150.0(j), 150.0(n)						
	Indoor Lighting (cond., uncond. & parking garages)	110.9, 130.0	150.0(k)						
	Outdoor Lighting	110.9, 130.0	150.0(k)						
	Pool and Spa Systems	110.4	150.0(p)				N.A.	N.A.	150.2(a), 150.2(b)
	Solar Ready Buildings	110.10	N.A.				N.A.	N.A.	N.A.

<sup>1</sup> This table is based on Table 100.0-A: <http://www.energy.ca.gov/2015publications/CEC-400-2015-017/CEC-400-2015-017-Table100A.pdf>

<sup>2</sup> Section 110.1 refers to Title 20

<sup>3</sup> Nonresidential, high rise and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.

Requirements for the  
culture, Construction &  
Installation Of Systems,  
Equipment & Building  
Components  
Subchapter 2  
(120.0-120.11)

**Residential**

Mandatory  
Approaches &  
Provisions  
Subchapter 7  
(150.0)

Performance  
Forms:  
R-SRA

Residential (Res)

Performance

Performance  
Compliance  
Approach  
(Conditioned)  
Subchapter 5  
(140.0)

NRCC-PRF

Performance

Performance  
Compliance  
Approach  
Subchapter 8  
(150.1)

CFIR PRF

Performance

Performance  
Compliance  
Approach  
Subchapter 8  
(150.1)

CFIR PRF

Performance

Performance  
Compliance  
Approach  
Subchapter 8  
(150.1)

CFIR PRF

Performance

Performance  
Compliance  
Approach  
Subchapter 8  
(150.1)

CFIR PRF

Performance

★ Decoding Talk  
"Road Map to Title  
24, Part 6"

✦ Includes  
Decoding Talk  
handout "HERS  
Key" from  
Decoding 2016  
HERS



# Where to get the Energy Standards

## Online Resource Center

<http://www.energy.ca.gov/title24/orc/>

### Building Energy Efficiency Standards and Forms



2016  
Energy Standards  
& Forms



### Energy Standards Information and Training Materials



Overview



Commissioning



Covered Processes



Electrical Power  
Distribution



Envelope



HVAC



Lighting



Solar Ready



Water Heating

### Acceptance Testing and Home Energy Rating System



Acceptance Test Technician  
Certification Provider  
(ATTCP)



Home Energy Rating System  
(HERS)

### Additional Tools and Information



Approved  
Compliance Software



Blueprint Newsletter



Climate Zones

### External Resources



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External Educational Resources

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Home → title24 → 2016 Standards

## 2016 Building Energy Efficiency Standards

California's Building Energy Efficiency Standards are updated on an approximately three-year cycle. The 2016 Standards will continue to build upon the 2013 Standards for new construction of, and additions and alterations to, residential and nonresidential buildings. The effective date of the 2016 Standards is January 1, 2017.

### 2016 Energy Standards

- » 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. CEC-400-2015-037-CMF. (PDF File, 289 Pages, 2.3 mb)
  - » Table 100.0-A Quick Links to Sections
- » 2016 Reference Appendices. CEC-400-2015-038-CMF. (PDF File, 494 Pages, 8.8 mb)

### Compliance Manuals and Compliance Documents

- » 2016 Residential Compliance Manual and Documents CEC-400-2015-032-CMF
- » 2016 Nonresidential Compliance Manual and Documents CEC-400-2015-033-CMF

### Worksheets

### Compliance Forms

- Residential
- Nonresidential

### Reference Documents

- Rulemaking
- Pre-Rulemaking
- 2016 Standards Post-adoption Documents

### Related Links

- Additional Manufacturer Certified Equipment, Products & Devices
- Appliance Efficiency Database
- California Climate Zone Map
- Online Resource Center



*Helps you navigate the Standards using key word search capabilities, hyperlinked tables and related sections*

**2016 Building and Appliance Efficiency Regulations - Reference Ace v27**

- Contents
- Index
- Search
- 2016 BUILDING ENERGY EFFICIENCY STANDARDS
- REFERENCE APPENDICES
- RESIDENTIAL COMPLIANCE MANUAL
- RESIDENTIAL ACM REFERENCE MANUAL
- NONRESIDENTIAL COMPLIANCE MANUAL
- NONRESIDENTIAL ACM REFERENCE MANUAL
- TITLE 20 APPLIANCE EFFICIENCY REGULATIONS
- TITLE 20 APPLIANCE EFFICIENCY REGULATIONS (Appliance-Specific Sections Only)

**2016 Building Energy Efficiency Standards and Title 20 Appliance Efficiency Regulations Reference Ace Tool**

**2016 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS**  
FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS  
TITLE 24, PART 6, AND ASSOCIATED ADMINISTRATIVE REGULATIONS IN PART 1.

**2016 REFERENCE APPENDICES**  
FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS  
TITLE 24, PART 6, AND ASSOCIATED ADMINISTRATIVE REGULATIONS IN PART 1.

**2016 RESIDENTIAL COMPLIANCE MANUAL**  
FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS  
TITLE 24, PART 6, AND ASSOCIATED ADMINISTRATIVE REGULATIONS IN PART 1.

**2016 NONRESIDENTIAL COMPLIANCE MANUAL**  
FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS  
TITLE 24, PART 6, AND ASSOCIATED ADMINISTRATIVE REGULATIONS IN PART 1.

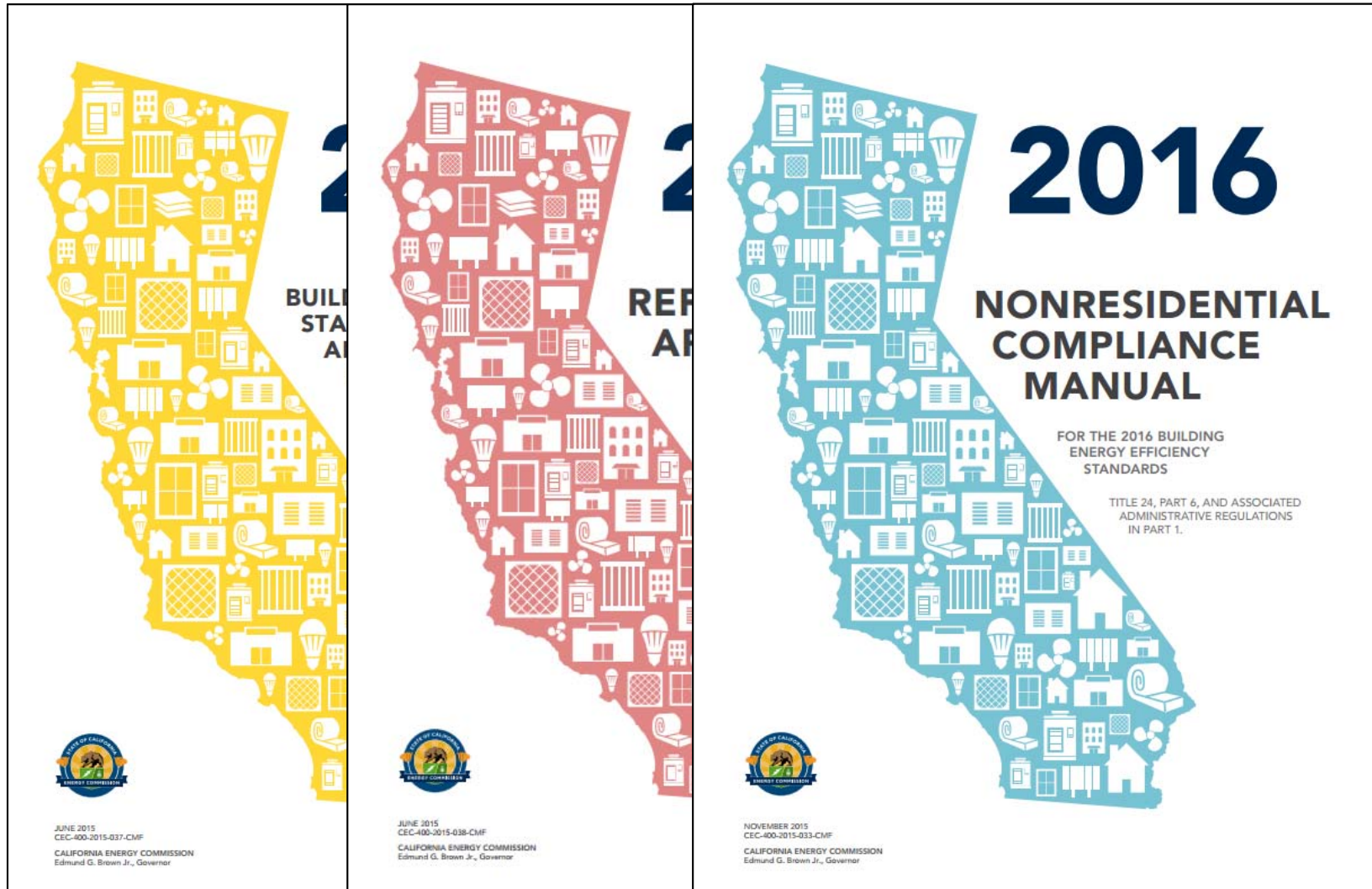
JUNE 2015  
CEC-600-2015-037-CMF  
CALIFORNIA ENERGY COMMISSION  
Edmund G. Brown, Jr., Governor







# What? Title 24 Part 6: Energy Code



<http://www.energy.ca.gov/title24/2016standards/index.html>



# Mandatory, Prescriptive, Performance

1.

## Mandatory Measures



- Must always be met/installed

2.

- Establish minimum level of energy efficiency and/or performance



or

3.

- Set of predefined efficiency requirements that must ALL be met or exceeded
- Applies to various building components



- Requires the use of Energy Commission approved software
- Most flexible approach, allows for trade-offs
- Proposed energy budget  $\leq$  Standard energy budget



## Our Question To You



1. *What is your comfort level in being able to find what you're looking for in the 2016 Energy Standards?*
2. *What are your top 3 concerns regarding the 2016 Energy Standards layout/format?*
3. *What is your advice to a new user of the 2016 Energy Standards on how to find information efficiently?*
4. *If you could wave your magic wand, the 2016 Energy Standards would include \_\_\_\_\_ to further assist the industry?*

1. The standards refer to other sections regularly, making finding an answer a bit difficult.
2. Understanding the code and being able to translate that to the field.
3. Lack of Index

Diagrams and pictures for better understanding

50% Comfortable /  
50% Not Comfortable

Use Energy Code Ace:  
"Reference Ace"  
was the MOST common response 😊



Let's Talk



HELPING YOU PLAY YOUR CARDS RIGHT





# Challenges

---



- ✦ Challenge A:
  - ✦ How the Standards are Developed



- ✦ Challenge B:
  - ✦ Structure Behind the Standards



- ✦ Challenge C:
  - ✦ Review of Subchapters

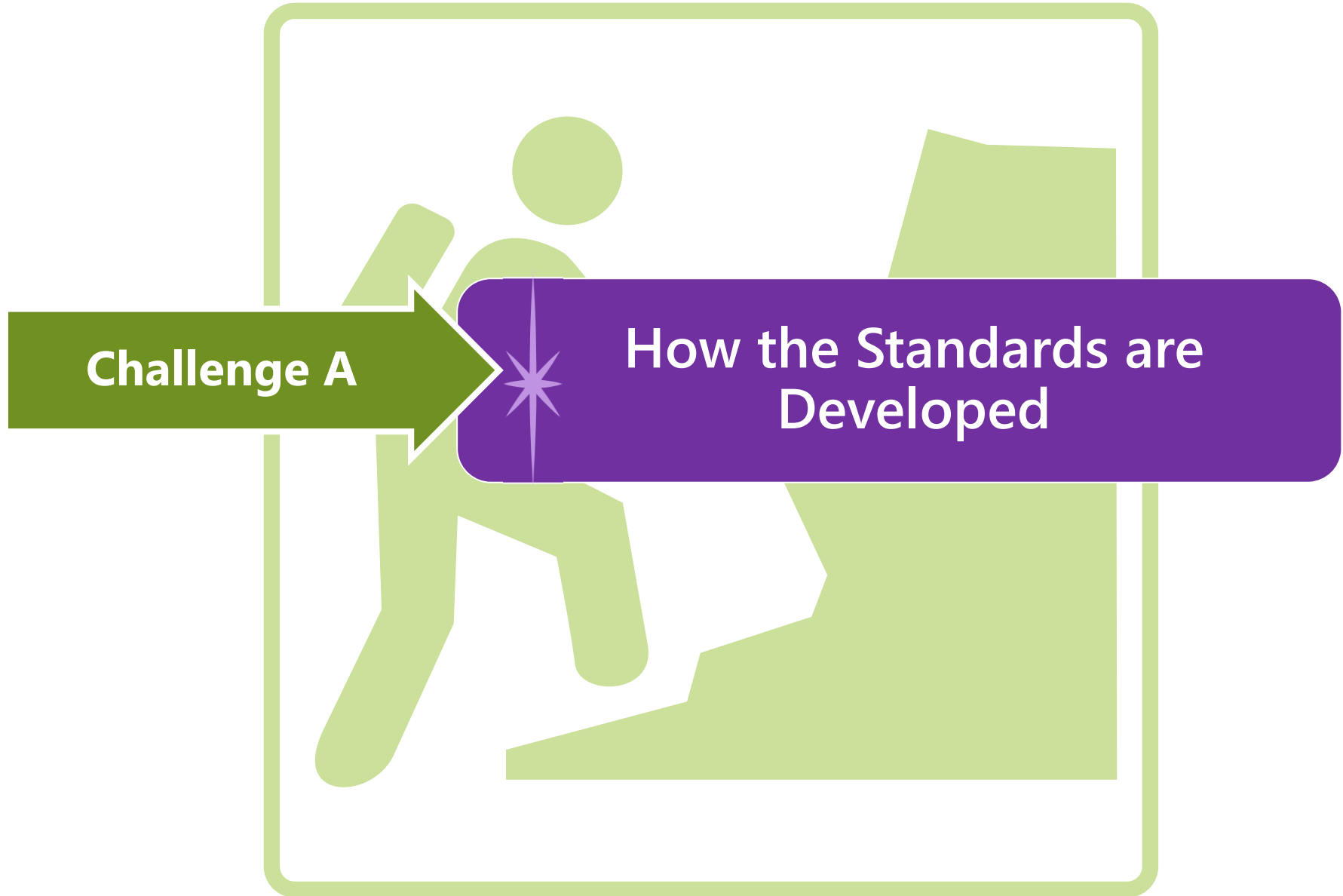


- ✦ Challenge D:
  - ✦ Tricks and Tips



# Challenge A

---





# What is the Process?

---



## Code Adoption Milestones

1. Proposal Development
2. Code Proposals (CASE) submitted to the Energy Commission
3. Public Comments
4. Draft Express Terms
5. 45 Day Public Review
6. 15 Day Language
7. Adopt Final Express Terms

### Subscribe

#### Building Standards List Serve

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# Proposal Development

**BUILDING ENERGY EFFICIENCY MEASURE  
PROPOSAL TO THE  
CALIFORNIA ENERGY COMMISSION**

**FOR THE [REDACTED] UPDATE TO THE  
TITLE 24 PART 6 BUILDING ENERGY EFFICIENCY  
STANDARDS**

**[REDACTED] INSERT MEASURE NAME**

---

**INSERT CATEGORY NAME**  
Use one of these options: Residential Envelope, Residential HVAC, Residential Water Heating, Residential  
Lighting, Nonresidential Envelope, Nonresidential HVAC, Nonresidential Water Heating, Nonresidential  
Lighting, Process Loads

Prepared by: **INSERT NAME of ORGANIZATION**      **Month Year**  
**INSERT ADDITIONAL NAMES of AUTHORS**

## Next Code Cycle: 2022

- ✦ Always had a great idea?
  - ✦ You to can be part of the process 😊





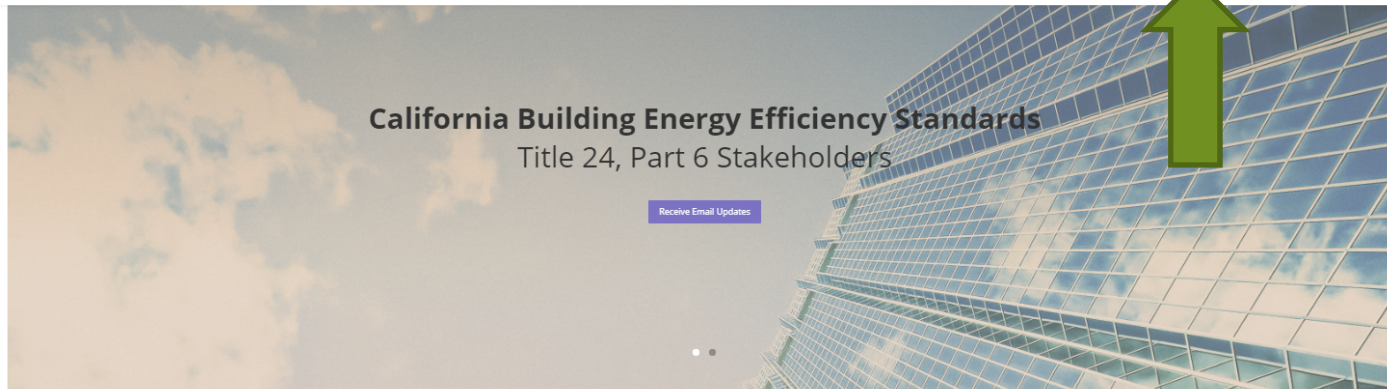
# CASE Reports

## Codes & Standards Enhancement Initiatives (CASE)

<http://title24stakeholders.com/>



Calendar Public Meetings 2019 CASE Topics 2016 Title 24 Advocacy Contact Us



The Statewide Utility Codes and Standards Program actively supports code-setting bodies in developing and revising codes and standards through Codes and Standards Enhancement (CASE) initiatives. The Program's intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code changes.



2019 CASE Measures



Upcoming Public Meetings



California Energy Commission 2019 Code Cycle Website



# How Do Comments Get Collected?

## Docket Log

- ✦ The pre-rulemaking process allows EVERYONE to comments on the proposed measures.

The screenshot shows the header of the California Energy Commission website. It includes the CA.GOV logo, the state seal, and the text "CALIFORNIA ENERGY COMMISSION". A navigation menu contains links for Home, About Us, Analysis & Stats, Efficiency, Funding, Power Plants, Renewables, Research, and Transportation. In the top right corner, there are links for CA.gov, Contact Us, Accessibility, and Quick Links.

### Docket Log

Docket: 17-BSTD-01  
Project Title: 2019 Building Energy Efficiency Standards PreRulemaking  
Generated On: 11/26/2017 1:55:27 PM

Include:  Documents  Comments  Transcripts

↓ TN #	Docketed Date	Document Title	Exhibit #	To	From
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# How is it Tracked?

## SUBCHAPTER 1 ALL OCCUPANCIES—GENERAL PROVISIONS

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### SECTION 100.0 – SCOPE

(a) **Buildings Covered.** The provisions of Part 6 apply to all buildings:

1. That are of Occupancy Group A, B, E, F, H, I, M, R, S, or U; and
2. For which an application for a building permit or renewal of an existing permit is filed (or is required by law to be filed) on or after the effective date of the provisions, or which are constructed by a governmental agency; and
3. That are:
  - A. Unconditioned; or
  - B. Indirectly or directly conditioned ~~by mechanical heating or mechanical cooling~~, or process spaces; ~~or~~
  - C. ~~Low-rise residential buildings that are heated with a non-mechanical heating system.~~

**EXCEPTION 1 to Section 100.0(a):** Qualified historic buildings, as regulated by the California Historic Building Code (Title 24, Part 8). Lighting in qualified historic buildings shall comply with the applicable requirements in Section 140.6(a)3Q.

**EXCEPTION 2 to Section 100.0(a):** Building departments, at their discretion, may exempt temporary buildings, temporary outdoor lighting or temporary lighting in an unconditioned building, or structures erected in response to a natural disaster. Temporary buildings or structures shall be completely removed upon the expiration of the time limit stated in the permit.

**EXCEPTION 3 to Section 100.0(a):** Buildings in Occupancy Group I-3 and I-4.

(b) **Parts of Buildings Regulated.** The provisions of Part 6 apply to the building envelope, space-conditioning systems, water-heating systems, pool and spas, solar ready buildings, indoor lighting systems of buildings, outdoor lighting systems, electrical power distribution systems, and signs located either indoors or outdoors, in buildings that are:

1. Covered by Section 100.0(a); and
2. Set forth in TABLE 100.0-A.

(c) **Habitable Stories.**

1. All conditioned space in a story shall comply with Part 6 whether or not the story is a habitable space.
2. All unconditioned space in a story shall comply with the lighting requirements of Part 6 whether or not the



# Last Step to an Enforceable Code

---



## Building Standards Commission

✦ Adoption

## Local Jurisdictions (AHJ)

✦ Adoption



# Challenge B

---

**Challenge B**

**Structure Behind the Standards**



# Title 24, Part 1













## Article 1

- ✦ Administrative Code
  - ✦ Energy Commission version includes BOTH Title 24 Part 1 and 6
  - ✦ Building Standards Commission version includes Article 1 in Chapter 10



# Title 24, Part 6 Subchapters

All Occupancies			
	<b>SUBCHAPTER 1</b>	Section 100.0-100.2	GENERAL PROVISIONS
	<b>SUBCHAPTER 2</b>	Section 110.0-110.11	MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS
Nonresidential / High-Rise Multifamily Residential / Hotel & Motel / Covered Process Occupancies			
	<b>SUBCHAPTER 3</b>	Section 120.0-120.9	MANDATORY REQUIREMENTS
	<b>SUBCHAPTER 4</b>	Section 130.0-130.5	MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS
 	<b>SUBCHAPTER 5</b>	Section 140.0-140.9	PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY
	<b>SUBCHAPTER 6</b>	Section 141.0-141.1	ADDITIONS, ALTERATIONS, AND REPAIRS
Low-Rise Residential (including single family and low-rise multifamily) Occupancies			
	<b>SUBCHAPTER 7</b>	Section 150.0	MANDATORY FEATURES AND DEVICES
 	<b>SUBCHAPTER 8</b>	Section 150.1	PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES
	<b>SUBCHAPTER 9</b>	Section 150.2	ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS



# Road Map to Se

## Subchapter

### Section #

- (a)(b)(c): *Code Category*
  - 1,2,3: *Building/Design Feature*
  - A,B,C: *Feature Specifics*
    - i,ii,iii: *Sub-category to specifics*
    - a,b,c: *Detailed information*

Exceptions: Exceptions and/or Alternatives

Tables: Summary and/or Alternative Summary

## SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES Subchapter 5

A [building](#) complies with this section by being designed with and having constructed to meet all prescriptive requirements in Subsection (a) and the requirements of Subsection (c) where they apply.

### (a) Envelope Component Requirements



1. **Exterior roofs and ceilings.** Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

A. **Roofing Products.** Shall meet the requirements of [Section 110.8](#) and the applicable requirements of Subsections i through ii:

i. Nonresidential buildings:

a. Low-sloped roofs in [Climate Zones](#) 1 through 16 shall have:

1. A minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75; or
2. A minimum [Solar Reflectance Index \(SRI\)](#) of 75.

**EXCEPTION 1 to Section 140.3(a)1Aia:** Wood-framed roofs in Climate Zones 3 and 5 are exempt from the requirements of Section 140.3(a)1Aia if the roof assembly has a [U-factor](#) of 0.034 or lower.

**EXCEPTION 2 to Section 140.3(a)1Aia:** Roof constructions that have [thermal mass](#) with a weight of at least 25 lb./ft<sup>2</sup> over the roof membrane are exempt from the requirements of Section 140.3(a)1Aia.

**EXCEPTION 3 to SECTION 140.3(a)1Aia:** An aged solar reflectance less than 0.63 is allowed provided the maximum roof/ceiling U-factor in [TABLE 140.3](#) is not exceeded.

b. Steep-sloped roofs in Climate Zones 1 through 16 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

ii. High-rise residential buildings and hotels and motels:

a. Low-sloped roofs in Climate Zones 9, 10, 11, 13, 14 and 15 shall have a minimum aged solar reflectance of 0.55 and a minimum thermal emittance of 0.75, or a minimum SRI of 64.

**EXCEPTION to Section 140.3(a)1Aia:** Roof constructions that have thermal mass with a weight of at least 25 lb./ft<sup>2</sup> over the roof membrane.

b. Steep-sloped roofs in Climate Zones 2 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

**TABLE 140.3 Roof/Ceiling Insulation Tradeoff For Aged Solar Reflectance**

Nonresidential			
Aged Solar Reflectance	Metal <a href="#">Building</a> Climate Zone 1-16	Wood framed and Other Climate Zone 6 & 7	Wood Framed and Other All Other <a href="#">Climate Zones</a>
	U-factor	U-factor	U-factor
0.62-0.58	0.038	0.045	0.032
0.55-0.48	0.035	0.042	0.030
0.45-0.38	0.033	0.039	0.029
0.35-0.25	0.031	0.037	0.028





# Title 24, Part 1: Article 1

---

## Demographics

- 10-103: A good place for the building departments to go for enforcement requirements
- 10-103.1&2: Mechanical and Lighting ATT requirements
- 10-109: How to submit for computer software approval

## Hidden Gems

- 10-103: When compliance paperwork MIGHT be an option
- 10-106: How REACH codes come to be
- 10-111: Fenestration labeling requirements

## Tourist Traps

- This is not a place to find design requirements for buildings.



# Road Map to Article 1

## Article 1: Building Energy Regulations

### **Administrative Regulations, California Code of Regulations Title 24 Part 1**

10-101	SCOPE
10-102	DEFINITIONS
10-103	PERMIT, CERTIFICATE, INFORMATIONAL, AND ENFORCEMENT REQUIREMENTS FOR DESIGNERS, INSTALLERS, BUILDERS, MANUFACTURERS, AND SUPPLIERS
10-104	EXCEPTIONAL DESIGNS
10-105	ENFORCEMENT BY THE COMMISSION
10-106	LOCALLY ADOPTED ENERGY STANDARDS
10-107	INTERPRETATIONS
10-108	EXEMPTION
10-109	COMPLIANCE SOFTWARE, ALTERNATIVE COMPONENT PACKAGES, EXCEPTIONAL METHODS, DATA REGISTRIES AND RELATED DATA INPUT SOFTWARE, ALTERNATIVE RESIDENTIAL FIELD VERIFICATION PROTOCOLS, AND ELECTRONIC DOCUMENT REPOSITORIES
10-110	PROCEDURES FOR CONSIDERATION OF APPLICATIONS UNDER SECTIONS 10-104, 10-106, 10-108, 10-109
10-111	CERTIFICATION AND LABELING OF FENESTRATION PRODUCT U-FACTORS, SOLAR HEAT GAIN COEFFICIENTS, VISIBLE TRANSMITTANCE AND AIR LEAKAGE
10-112	CRITERIA FOR DEFAULT TABLES
10-113	CERTIFICATION AND LABELING OF ROOFING PRODUCT REFLECTANCE AND EMITTANCE
10-114	DETERMINATION OF OUTDOOR LIGHTING ZONES AND ADMINISTRATIVE RULES FOR USE



# Article 1: Example

## Section 10-103

### PERMIT, CERTIFICATE, INFORMATIONAL, AND ENFORCEMENT REQUIREMENTS FOR DESIGNERS, INSTALLERS, BUILDERS, MANUFACTURERS, AND SUPPLIERS



#### (a) Documentation

##### 1. Certificate of Compliance

A. Format

B. HERS registration

C. Residential Alterations: *For alterations to existing residential buildings for which HERS field verification is not required including but not limited to water heater and window replacements, and for additions to existing residential buildings that are less than 300 square feet for which HERS field verification is not required, the enforcement agencies may, at their discretion, not require any Certificate of Compliance documentation, or may develop simplified Certificate of Compliance documentation for demonstrating compliance with the Standards.*

D. Nonresidential Data Registry (when approved)

2. Application for a building permit

3. Certificate of Installation

4. Certificate of Acceptance

5. Certificate of Verification

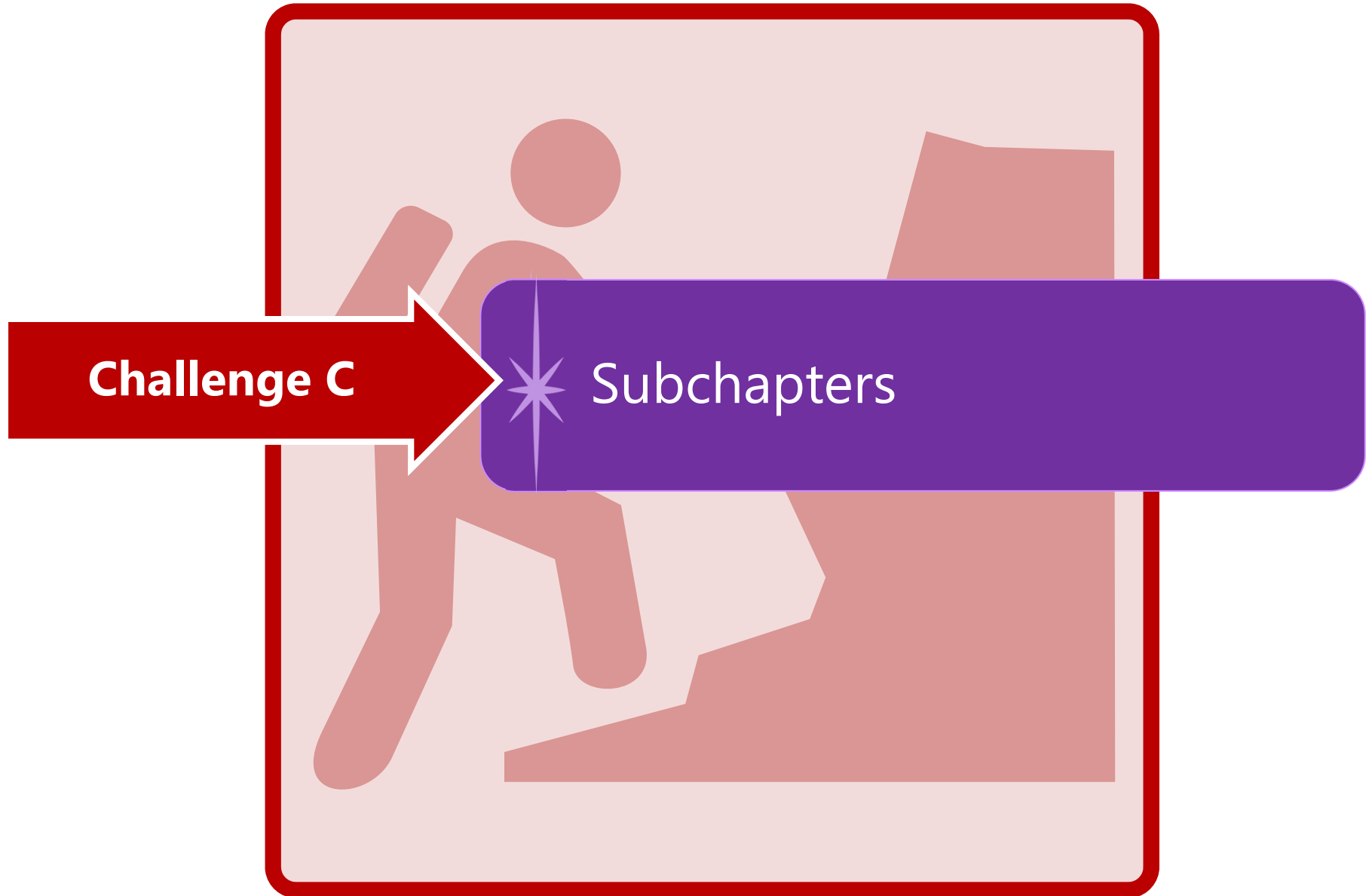
(b)

(c)...



# Challenge C

---





# Title 24, Part 6: Subchapter 1



## All Occupancies

**SUBCHAPTER 1**

Section 100.0-100.2

GENERAL PROVISIONS

### Demographics

- 100.0: Occupancy types covered
- Table 100.0-A: What parts of the building are regulated by what section
- 100.2: What is TDV and how it is used for performance compliance

### Hidden Gems

- 100.1: DEFINITIONS, this really is one of my favorites.
- Table 100.0-A, "map legend" to the standards

### Tourist Traps

- There are a lot of words. This can sometimes cause one to get lost easily.



# Road Map to Subchapter 1

---

## SUBCHAPTER 1: ALL OCCUPANCIES



### **GENERAL PROVISIONS**

100.0	SCOPE
100.1	DEFINITIONS AND RULES OF CONSTRUCTION
100.2	CALCULATION OF TIME DEPENDENT VALUATION (TDV) ENERGY



# Subchapter 1: Example

## Section 100.0

### SCOPE



**(a) Buildings Covered:** The provisions of [Part 6](#) apply to all buildings:

1. That are of Occupancy Group A, B, E, F, H, M, R, S, or U; and
2. For which an application for a [building](#) permit or renewal of an existing permit is filed (or is required by law to be filed) on or after the effective date of the provisions, or which are constructed by a [governmental agency](#); and
3. That are:
  - A. Unconditioned; or
  - B. Indirectly or directly conditioned by [mechanical heating](#) or [mechanical cooling](#), or [process](#) spaces; or
  - C. Low-rise residential buildings that are heated with a non-mechanical heating system.

**EXCEPTION 1 to Section 100.0(a):** [Qualified historic buildings, as regulated by the California Historic Building Code \(Title 24, Part 8\)](#). Lighting in qualified historic buildings shall comply with the applicable requirements in [Section 140.6\(a\)3Q](#).

**EXCEPTION 2 to Section 100.0(a):** Building departments, at their discretion, [may exempt temporary buildings, temporary outdoor lighting or temporary lighting in an unconditioned building, or structures erected in response to a natural disaster](#). Temporary buildings or structures shall be completely removed upon the expiration of the time limit stated in the permit.



# Title 24, Part 6: Subchapter 2



## All Occupancies

### SUBCHAPTER 2

Section 110.0-110.11

MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

## Demographics

- Applies to all building types

## Hidden Gems

- 110.10: Requirements for Solar Ready found here

## Tourist Traps

- It is easy to forget about going here when looking for mandatory requirements
- This is where all manufacturers need to begin their journey to energy compliance regulations





# Road Map to Subchapter 2

## SUBCHAPTER 2: ALL OCCUPANCIES



### **MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS**

110.0	<i>SYSTEMS AND EQUIPMENT—GENERAL</i>
110.1	<i>MANDATORY REQUIREMENTS FOR APPLIANCES</i>
110.2	<i>MANDATORY REQUIREMENTS FOR SPACE-CONDITIONING EQUIPMENT</i>
110.3	<i>MANDATORY REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT</i>
110.4	<i>MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT</i>
110.5	<i>NATURAL GAS CENTRAL FURNACES, COOKING EQUIPMENT, AND POOL AND SPA HEATERS: PILOT LIGHTS PROHIBITED</i>
110.6	<i>MANDATORY REQUIREMENTS FOR FENESTRATION PRODUCTS AND EXTERIOR DOORS</i>
110.7	<i>MANDATORY REQUIREMENTS TO LIMIT AIR LEAKAGE</i>
110.8	<i>MANDATORY REQUIREMENTS FOR INSULATION, ROOFING PRODUCTS AND RADIANT BARRIERS</i>
110.9	<i>MANDATORY REQUIREMENTS FOR LIGHTING CONTROL DEVICES AND SYSTEMS, BALLASTS, AND LUMINAIRES</i>
110.10	<i>MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS</i>
110.11	<i>MANDATORY REQUIREMENTS FOR ELECTRICAL POWER DISTRIBUTION SYSTEM</i>



## Subchapter 2: Example

### Section 110.4

#### MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT



**(a) Certification by Manufacturers.** Any pool or [spa](#) heating system or equipment may be installed only if the manufacturer has certified that the system or equipment has all of the following:

1. Efficiency. A thermal efficiency that complies with the [Appliance Efficiency Regulations](#); and
2. On-off switch. A [readily accessible](#) on-off switch, mounted on the outside of the heater that allows shutting off the heater without adjusting the [thermostat](#) setting; and
3. Instructions. A permanent, easily readable, and weatherproof plate or card that gives instruction for the energy efficient operation of the pool or spa heater and for the proper care of pool or spa water when a cover is used; and
4. Electric resistance heating. No electric resistance heating; and

**EXCEPTION 1 to Section 110.4(a)4:** [Listed](#) package units with fully insulated enclosures, and with tight-fitting covers that are insulated to at least R-6.

**EXCEPTION 2 to Section 110.4(a)4:** Pools or spas deriving at least 60 percent of the annual heating energy from [site solar energy](#) or [recovered energy](#).

**(b) Installation...**



# Title 24, Part 6: Subchapter 3

Nonresidential / High-Rise Multifamily Residential / Hotel & Motel / Covered Process Occupancies



## SUBCHAPTER 3

Section 120.0-120.9

MANDATORY REQUIREMENTS

### Demographics

- Applies to **just** nonresidential occupancies (mostly)
- Don't forget about Covered Processes requirements...

### Tourist Traps

- Not understanding that mandatory insulation sets the lowest possible in a performance calculation

### Hidden Gems

- Many people FORGET about mandatory measures because they are NOT typically documented on the NRCC forms.
- Mandatory Note blocks should be developed using this information



# Road Map to Subchapter 3

## SUBCHAPTER 3: Nonresidential Occupancies\*



### MANDATORY REQUIREMENTS

120.0	<i>GENERAL</i>
120.1	<i>REQUIREMENTS FOR VENTILATION</i>
120.2	<i>REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS</i>
120.3	<i>REQUIREMENTS FOR PIPE INSULATION</i>
120.4	<i>REQUIREMENTS FOR AIR DISTRIBUTION SYSTEM DUCTS AND PLENUMS</i>
120.5	<i>REQUIRED NONRESIDENTIAL MECHANICAL SYSTEM ACCEPTANCE</i>
120.6	<i>MANDATORY REQUIREMENTS FOR COVERED PROCESSES</i>
120.7	<i>MANDATORY INSULATION REQUIREMENTS</i>
120.8	<i>NONRESIDENTIAL BUILDING COMMISSIONING</i>
120.9	<i>MANDATORY REQUIREMENTS FOR COMMERCIAL BOILERS</i>

\*NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES



## Subchapter 3: Example

### Section 120.4

#### REQUIREMENTS FOR AIR DISTRIBUTION SYSTEM DUCTS AND PLENUMS



#### (a) CMC Compliance.

...

Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum installed level of R-8:

1. Outdoors; or
2. In a space between the roof and an insulated ceiling; or
3. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or
4. In an unconditioned crawlspace; or
5. In other unconditioned spaces.

Portions of supply-air ducts that are not in one of these spaces, including ducts buried in concrete slab, shall be insulated to a minimum installed level of R-4.2 (or any higher level required by CMC Section 605.0) or be enclosed in directly conditioned space.

**R-8 if outside or unconditioned space**

**R-4.2 if indirectly conditioned space**

**No insulation if in directly conditioned space**



# Subchapter 3: Example

## Section 120.7

### MANDATORY INSULATION REQUIREMENTS

Allowed for alterations, or “as low as you can go” using a performance approach

**DEMISING PARTITION** is a wall, fenestration, floor, or ceiling that separates conditioned space from enclosed unconditioned space.

Nonresidential, high-rise residential and [hotel/motel](#) buildings shall comply with the applicable requirements in Sections 120.7(a) through 120.7(c).

...

### (b) Wall Insulation.

The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 7 below:

1. **Metal Building**- The weighted average [U-factor](#) of the wall assembly shall not exceed 0.113.
2. **Metal Framed**- The weighted average U-factor of the wall assembly shall not exceed 0.151.
3. **Light Mass Walls**- A 6 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed 0.440.
4. **Heavy Mass Walls**- An 8 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed 0.690.
5. **Wood Framed and Others**- The weighted average U-factor of the wall assembly shall not exceed 0.110.
6. **Spandrel Panels and Opaque Curtain Wall**- The weighted average U-factor of the [spandrel](#) panels and opaque curtain wall assembly shall not exceed 0.280.
7. **Demising Walls**-. The opaque portions of framed demising walls shall meet the requirements of Item A or B below:
  - A. Wood framed walls shall be insulated to meet a U-factor not greater than 0.099.
  - B. Metal Framed walls shall be insulated to meet a U-factor not greater than 0.151.

...



# Title 24, Part 6: Subchapter 4

Nonresidential / High-Rise Multifamily Residential / Hotel & Motel / Covered Process Occupancies



## **SUBCHAPTER 4**

Section 130.0-130.5

**MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS**

## Demographics

- Lighting AND Electrical requirements for nonresidential occupancies

## Tourist Traps

- There is just so much to see that it is easy to forget it all before you even leave
- These are **MANDATORY**

## Hidden Gems

- Lighting Controls
  - Indoor
  - Outdoor
  - Signs
- Electrical requirements



# Road Map to Subchapter 4

## SUBCHAPTER 4: Nonresidential Occupancies\*



### **MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS**

130.0	<i>GENERAL</i>
130.1	<i>MANDATORY INDOOR LIGHTING CONTROLS</i>
130.2	<i>OUTDOOR LIGHTING CONTROLS AND EQUIPMENT</i>
130.3	<i>SIGN LIGHTING CONTROLS</i>
130.4	<i>LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS</i>
130.5	<i>ELECTRICAL POWER DISTRIBUTION SYSTEMS</i>

\*NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES

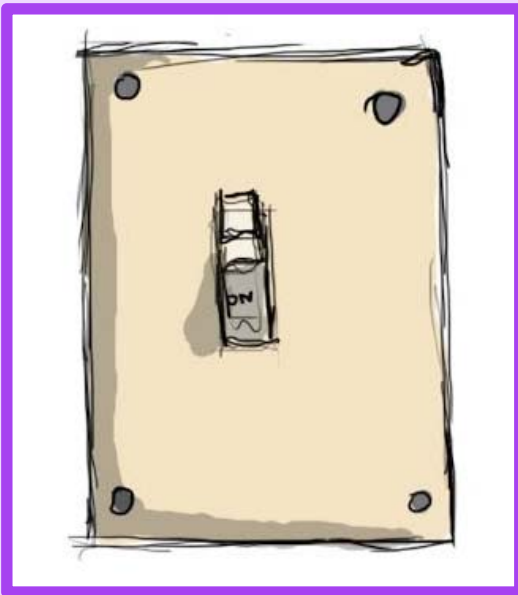




# Subchapter 4: Example

## Section 130.1

### MANDATORY INDOOR LIGHTING CONTROLS



- (a) Area Controls.
- (b) Multi-Level Lighting Controls.
- (c) Shut-OFF Controls
- (d) Automatic Daylighting Controls.
- (e) Demand Responsive Controls.

TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS

Luminaire Type	Minimum Required Control Steps ( percent of full rated power <sup>1</sup> )	Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent	
Low-voltage incandescent systems		
LED luminaires and LED source systems		
GU-24 rated for LED		
GU-24 sockets rated for fluorescent > 20 watts	Continuous dimming 20-100 percent	
Pin-based compact fluorescent > 20 watts <sup>2</sup>		
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30-70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Pin-based compact fluorescent ≤ 20 watts <sup>2</sup>		
Linear fluorescent and U-bent fluorescent ≤ 13 watts		
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
	20-40 %    50-70 %    75-85 %    100 %	
Track Lighting	Minimum one step between 30 – 70 percent	Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts	Minimum one step between 50 - 70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.
Induction > 25 watts		
Other light sources		

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor  
 2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps



# Subchapter 4: Example

## Section 130.2

### OUTDOOR LIGHTING CONTROLS AND EQUIPMENT



...

#### (c) Controls for Outdoor Lighting.

Outdoor lighting controls shall be installed that meet the following requirements as applicable:

...

3. All installed outdoor lighting, where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with automatic lighting controls that meet all of the following requirements:
  - A. Shall be motion sensors or other lighting control systems that automatically controls lighting in accordance with Item B in response to the area being vacated of occupants; and
  - B. Shall be capable of automatically reducing the lighting power of each luminaire by at least 40 percent but not exceeding 90 percent, or provide continuous dimming through a range that includes 40 percent through 90 percent, and
  - C. Shall employ auto-ON functionality when the area becomes occupied; and
  - D. No more than 1,500 watts of lighting power shall be controlled together.

**EXCEPTION 1 to Section 130.2(c)3:** Lighting for Outdoor Sales Frontage complying with Section 130.2(c)4.

**EXCEPTION 2 to Section 130.2(c)3:** Lighting for Building Facades, Ornamental Hardscape and Outdoor Dining complying with Section 130.2(c)5.

**EXCEPTION 3 to Section 130.2(c)3:** Outdoor lighting, where luminaire rated wattage is determined in accordance with Section 130.0(c), and which meet one of the following conditions:

- A. Pole-mounted luminaires each with a maximum rated wattage of 75 watts; or
- B. Non-pole mounted luminaires with a maximum rated wattage of 30 watts each; or
- C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire.

**EXCEPTION 4 to Section 130.2(c)3:** Applications listed as Exceptions to Section 140.7(a) shall not be required to meet the requirements of Section 130.2(c)3.



# Title 24, Part 6: Subchapter 5

Nonresidential / High-Rise Multifamily Residential / Hotel & Motel / Covered Process Occupancies



## SUBCHAPTER 5

Section 140.0-140.9

PERFORMANCE AND PRESCRIPTIVE COMPLIANCE  
APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

### Demographics

- Prescriptive requirements and the performance options for nonresidential buildings

### Tourist Traps

- Be aware of **WHAT** you can trade using the performance approach
  - 140.1: Lighting outside the conditioned space **CANNOT** be used in performance method

### Hidden Gems

- Prescriptive Tables 140.3 based on building type
- Understanding that **ALL** of these measures are required with the prescriptive compliance approach meaning all sections are so important to visit
- Make sure to read the fine print



# Road Map to Subchapter 5

## SUBCHAPTER 5: Nonresidential Occupancies\*



### PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

140.0	<i>PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES</i>
140.1	<i>PERFORMANCE APPROACH: ENERGY BUDGETS</i>
140.2	<i>PRESCRIPTIVE APPROACH</i>
140.3	<i>PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES</i>
140.4	<i>PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS</i>
140.5	<i>PRESCRIPTIVE REQUIREMENTS FOR SERVICE WATER HEATING SYSTEMS</i>
140.6	<i>PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING</i>
140.7	<i>REQUIREMENTS FOR OUTDOOR LIGHTING</i>
140.8	<i>REQUIREMENTS FOR SIGNS</i>
140.9	<i>PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES</i>

\*NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES



# Subchapter 5: Example

**TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)**

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Roofs/ Ceilings	Metal Building		0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
		Wood Framed and Other		0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034

**CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)**

				All Climate Zones			
				Fixed Window	Operable Window	Curtainwall or Storefront	Glazed Doors <sup>2</sup>
Max U-factor				0.26	0.46	0.41	0.45

**TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

				Climate Zone																	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Envelope	Maximum U-factor	Roofs/ Ceilings	Metal Building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041		
			Wood Framed and Other	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	
		Walls	Metal Building	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057		
			Metal-framed	0.069	0.069	0.069	0.069	0.069	0.069	0.105	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.048	0.069	
			Mass Light <sup>1</sup>	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.198	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	
			Mass Heavy <sup>1</sup>	0.180	0.180	0.180	0.184	0.211	0.690	0.690	0.690	0.690	0.690	0.690	0.184	0.253	0.211	0.184	0.184	0.184	0.180
			Wood-framed and Other	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042	0.042
		Floors/ Soffits	Raised Mass	0.045	0.045	0.058	0.058	0.058	0.069	0.062	0.062	0.062	0.069	0.058	0.058	0.058	0.045	0.058	0.037		
			Other	0.034	0.034	0.039	0.039	0.039	0.039	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034	0.034	
		Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	0.55	NR	
				Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR	
			Steep- Sloped	Aged Solar Reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
				Thermal Emittance	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR
		Exterior Doors, Maximum U-factor	Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50		
			Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	

**CONTINUED: TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

		All Climate Zones							
		Vertical		Fixed Window	Operable Window	Curtainwall/ Storefront	Glazed Doors <sup>2</sup>		
Envelope	Fenestration	Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45	
			Area-Weighted Performance Rating	Max RSHGC	0.25	0.22	0.26	0.23	
			Maximum WWR%	Min VT	0.42	0.32	0.46	0.17	
		Skylights	Maximum WWR%	40%					
			Area-Weighted Performance Rating	Glass, Curb Mounted		Glass, Deck Mounted		Plastic, Curb Mounted	
			Area-Weighted Performance Rating	Max U-factor	0.58	0.46	0.88		
Area-Weighted Performance Rating	Max SHGC	0.25	0.25	NR					
Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64					
Area-Weighted Performance Rating	Maximum SRR%	5%							

Notes:

1. Light mass walls are walls with a heat capacity of at least 7.0 Btu/ft<sup>2</sup>-°F and less than 15.0 Btu/ft<sup>2</sup>-°F. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/ft<sup>2</sup>-°F.
2. Glazed Doors applies to both site-built and to factory-assembled glazed doors.



# “What to See” in Subchapter 5

## Section 140.4

### PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS



#### a) Sizing and Equipment Selection

#### b) Calculations

#### c) Power Consumption of Fans

#### d) Space Conditioning Zone Controls

#### e) Economizers

...

#### l) Air Distribution System Duct Leakage Sealing

1. The duct system provides conditioned air to an occupiable space for a **constant volume, single zone, space-conditioning system**; and
2. The space conditioning system serves **less than 5,000 square feet** of conditioned floor area; and
3. The combined surface area of the ducts located in the following spaces is **more than 25 percent of the total surface area of the entire duct system**:
  - A. Outdoors; or
  - B. In a space directly under a roof that
    - i. Has a U-factor greater than the U-factor of the ceiling, or if the roof does not meet the requirements of Section 140.3(a)1B, or
    - ii. Has fixed vents or openings to the outside or unconditioned spaces; or
  - C. In an unconditioned crawlspace; or
  - D. In other unconditioned spaces.

#### m) Fan Control

#### n) Mechanical System Shut-Off



# Title 24, Part 6: Subchapter 6

Nonresidential / High-Rise Multifamily Residential / Hotel & Motel / Covered Process Occupancies



## SUBCHAPTER 6

Section 141.0-141.1

ADDITIONS, ALTERATIONS, AND REPAIRS

### Demographics

- What's different when existing construction is involved?

### Tourist Traps

- It is easy to forget about going here!!
- Getting lost in the many detours (sections numbers reference within section numbers).

### Hidden Gems

- Realizing the important questions that needs to be asked:
  - "Is this new...
  - or ALTERED...
  - OR considered repaired?"
- Addresses change of occupancy
- Only the ALTERED building component needs to meet the energy code requirements



# Road Map to Subchapter 6

## SUBCHAPTER 6: Nonresidential Occupancies\*



### **ADDITIONS, ALTERATIONS, AND REPAIRS**

141.0	<i>ADDITIONS, ALTERATIONS, &amp; REPAIRS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, &amp; HOTEL/MOTEL BUILDINGS, AND TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS</i>
141.1	<i>REQUIREMENTS FOR COVERED PROCESSES IN ADDITIONS, ALTERATIONS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL BUILDINGS</i>

\*NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES





## Subchapter 6: Example

### Section 141.0

#### ALTERATIONS, & REPAIRS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, & HOTEL/MOTEL BUILDINGS, AND TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS



Additions, alterations, and repairs to existing nonresidential, high-rise residential, and [hotel/motel](#) buildings, existing [outdoor lighting](#) for these occupancies, and internally and externally illuminated signs, shall meet the requirements specified in Sections 100.0 through 110.10, and 120.0 through 130.5 that are applicable to the [building](#) project, and either the performance compliance approach (energy budgets) in [Section 141.0\(a\)2](#) (for additions) or [141.0\(b\)3](#) (for alterations), or the prescriptive compliance approach in Section 141.0(a)1 (for additions) or 141.0(b)2 (for alterations), for the Climate Zone in which the building is located. [Climate zones](#) are shown in [FIGURE 100.1-A](#).

Covered [process](#) requirements for additions, alterations and repairs to existing nonresidential, high-rise residential, and hotel/motel buildings are specified in [Section 141.1](#).

**NOTE:** For alterations that change the occupancy classification of the building, the requirements specified in Section 141.0(b) apply to the occupancy after the alterations.

...



# Subchapter 6: Example

## Section 141.0

### ALTERATIONS, & REPAIRS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, & HOTEL/MOTEL BUILDINGS, AND TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS



#### ...(b) Alterations.

Alterations to existing nonresidential, high-rise residential, or [hotel/motel](#) buildings, relocatable public school buildings or alterations in conjunction with a change in [building](#) occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy are not subject to Subsection (a) and shall meet item 1, and either Item 2 or 3 below:

1. **Mandatory Insulation** Requirements for Roofs, Walls, and Floors. Altered components in a nonresidential, high-rise residential, or hotel/motel building shall meet the minimum requirements in this Section.

...

- B. **Wall Insulation.** For the altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal Building.** A minimum of R-13 insulation between framing members, or the weighted average [U-factor](#) of the wall assembly shall not exceed U-0.113.
2. **Metal Framed.** A minimum [of R-13 insulation between framing members](#), or the weighted average U-factor of the wall assembly shall not exceed U-0.217.
3. **Wood Framed and Others.** A minimum [of R-11 insulation between framing](#) members, or the weighted average U-factor of the wall assembly shall not exceed U-0.110.
4. **Spandrel Panels and Glass Curtain Walls.** A [minimum of R-4](#), or the weighted average U-factor of the wall assembly shall not exceed U-0.280.

**EXCEPTION to Section 141.0(b)1B: Light and heavy mass walls.**

- C. **Floor Insulation.** For the altered portion of raised floors that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Raised Framed Floors.** A minimum [of R-11 insulation between framing members](#), or the weighted average U-factor of the floor assembly shall not exceed the U-factor of U-0.071.

...



## Subchapter 6: Example

**SERVICE EQUIPMENT IS THE NECESSARY EQUIPMENT, USUALLY CONSISTING OF A CIRCUIT BREAKER(S) OR SWITCH(ES) AND THEIR ACCESSORIES, CONNECTED TO THE LOAD END OF SERVICE CONDUCTORS TO A BUILDING OR OTHER STRUCTURE, OR AN OTHERWISE DESIGNATED AREA, AND INTENDED TO CONSTITUTE THE MAIN CONTROL AND CUTOFF OF THE SUPPLY.**

...

- P. **Electrical Power Distribution Systems.** Alterations to electrical power distribution systems shall meet the applicable requirements of [Section 130.5](#) as follows:
- i. Service Electrical Metering.  
**New or replacement electrical service equipment** shall meet the requirements of [Section 130.5\(a\)](#) applicable to the electrical power distribution system altered.
  - ii. Separation Of Electrical Circuits For Electrical Energy Monitoring.  
For **entirely new or complete replacement of electrical power distribution systems**, the entire system shall meet the applicable requirements of [Section 130.5\(b\)](#).
  - iii. Voltage Drop. Alterations of feeders and branch circuits where the alteration includes **addition, modification, or replacement of both feeders and branch circuits**, the altered circuits shall meet the requirements of [Section 130.5\(c\)](#).  
**EXCEPTION to Section 141.0(b)2Piii:** Voltage drop permitted by California Electrical Code Sections 647.4, 695.6 and 695.7.
  - iv. Circuit Controls for 120-Volt Receptacles and Controlled Receptacles.  
For **entirely new or complete replacement of electrical power distribution systems**, the entire system shall meet the applicable requirements of [Section 130.5\(d\)](#).



# Title 24, Part 6: Subchapter 7

Low-Rise Residential (including single family and low-rise multifamily) Occupancies



**SUBCHAPTER 7**

Section 150.0

MANDATORY FEATURES AND DEVICES

## Demographics

- All low-rise residential new construction, additions and alterations

## Tourist Traps

- Single family
- Duplex of any height
- Townhomes of any height
- Multifamily 3 habitable stories or lower

## Hidden Gems

- This is where ALL THE LIGHTING information can be found for:
  - Low-Rise Residential
  - Dwelling Units of High-Rise Residential
  - Hotel/Motel rooms



# Road Map to Subchapter 7

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## SUBCHAPTER 7: LOW-RISE RESIDENTIAL BUILDINGS



### **MANDATORY FEATURES AND DEVICES**

150.0

*MANDATORY FEATURES AND DEVICES*



# Subchapter 7: Example

---

## Section 150.0

### MANDATORY FEATURES AND DEVICES



...

#### (k) Residential Lighting.

##### 1. Luminaire Requirements

- A. Luminaire Efficacy:
- B. Blank Electrical Boxes.
- C. Recessed Downlight Luminaires in Ceilings.
- D. Electronic Ballasts.
- E. Night Lights.
- F. Lighting Integral to Exhaust Fans.
- G. Screw based luminaires.
- H. Enclosed Luminaires.

##### 2. Interior Lighting Switching Devices and Controls.

##### 3. Residential [Outdoor Lighting](#).

##### 4. Internally illuminated address signs.

##### 5. Residential Garages for Eight or More Vehicles.

##### 6. Interior Common Areas of Low-rise Multifamily Residential Buildings.

...



# Title 24, Part 6: Subchapter 8

## Low-Rise Residential (including single family and low-rise multifamily) Occupancies



### SUBCHAPTER 8

Section 150.1

PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

### Demographics

- Prescriptive requirements and the performance options for low-rise residential buildings

### Tourist Traps

- Don't forget to look at the code language NOT just the tables
- Performance method uses Table 150.1-A for *most* of the building for "standard" budget.

### Hidden Gems

- U-factors can be so elusive...what IS the R-value associated with them???
- Table 150.1-A



# Road Map to Subchapter 8

---

## SUBCHAPTER 8: LOW-RISE RESIDENTIAL BUILDINGS



### **PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES**

150.1

*PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS*





# Subchapter 8: Example

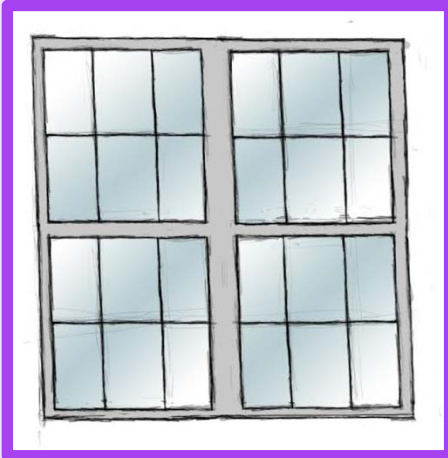
2016 ENERGY CODE								
2016 ENERGY CODE		Title 24, Part 6 Climate Zone Quick Reference				Compliance Baseline (Package A) Low-Rise Residential - §150.1		
Climate Zones 11, 12, 13 & 16		CZ 11	CZ 12	CZ 13	CZ 16	Comments		
Climate Zone		8	9	10	11	12	13	
		8	9	10	11	12	13	
		R 8	R 8	R 8	R 8	R 8	R 8	
Envelope Insulation: Roofs/Ceilings/Walls	<b>Roofing Products</b>	Low-sloped	Aged Solar Reflectance	NR	NR	0.63	NR	or higher
			Thermal Emittance	NR	NR	0.75	NR	or higher
		Steep-sloped	Aged Solar Reflectance	0.20	0.20	0.20	NR	or higher
			Thermal Emittance	0.75	0.75	0.75	NR	or higher
	<b>Fenestration</b>	Maximum U factor <sup>H</sup>		0.32	0.32	0.32	0.32	
		Maximum SHGC <sup>I</sup>		0.25	0.25	0.25	0.25	
		Maximum Total Area		20%	20%	20%	20%	
		Maximum West Facing Area		5%	5%	5%	5%	
	<b>Space Heating</b> <sup>B, C</sup>	Electric-Resistance Allowed		No	No	No	No	
		If gas, AFUE		MIN	MIN	MIN	MIN	Central furnace: • ≥225,000 kBtuh 80% AFUE or higher <sup>N</sup>
If Heat Pump, Heating Seasonal Performance Factor (HSPF)		MIN	MIN	MIN	MIN	Single-phase air source • Split: <65 kBtuh 8.2 HSPF • Packaged: <65 kBtuh 8.0 HSPF or higher <sup>N</sup>		
<b>Space Cooling</b>	SEER		MIN	MIN	MIN	MIN	Central air conditioner or central air source heat pump • Split: <45 kBtuh 14.0 SEER/12.2 EER ≥45 but <65 kBtuh 14 SEER/11.7 EER • Packaged: <65 kBtuh 14 SEER/ 11 EER or higher <sup>N</sup>	
	Refrigerant Charge Verification or Charge Indicator Display		REQ	REQ	REQ	NR		
	Whole House Fan <sup>J</sup>		REQ	REQ	REQ	NR		
<b>Central System Air Handlers</b>	Central Fan Integrated Ventilation System Fan Efficacy		REQ	REQ	REQ	REQ		
<b>Ducts</b> <sup>D</sup>	Duct Insulation		R-6 or R-8 <sup>M</sup>	R-6 or R-8 <sup>M</sup>	R-6 or R-8 <sup>M</sup>	R-6 or R-8 <sup>M</sup>	or higher	
<b>Water Heating</b>	All Buildings		Gas Storage ≤ 55 gallons; ≤ 105 kBtuh Tankless Instantaneous ≤ 200 kBtuh		Apr 16, 2015: 0.675-(0.0015*V) <sup>O</sup> EF or higher			



# Subchapter 8: Example

## Section 150.1

### PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW RISE RESIDENTIAL BUILDINGS



...

### 3. Fenestration.

- A. Installed fenestration products shall have an area weighted average U-factor and SHGC no greater than the applicable value in TABLE 150.1-A and shall be determined in accordance with Sections [110.6\(a\)2](#) and [110.6\(a\)3](#).

**EXCEPTION 1 to Section 150.1(c)3A:** For each [dwelling unit](#), up to 3 square feet of new [glazing](#) area installed in doors and up to 3 square feet of new tubular skylights area with dual-pane diffusers shall not be required to meet the U-factor and SHGC requirements of TABLE 150.1-A.

**EXCEPTION 2 to Section 150.1(c)3A:** For each [dwelling unit](#) up to 16 square feet of new [skylight area](#) with a maximum U-factor of 0.55 and a maximum SHGC of 0.30.

**EXCEPTION 3 to Section 150.1(c)3A** For fenestration containing chromogenic type glazing:

- i. the lower-rated labeled U-factor and SHGC shall be used with [automatic](#) controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;
- ii. chromogenic glazing shall be considered separately from other fenestration; and
- iii. area-weighted averaging with other fenestration that is not chromatic shall not be permitted and shall be determined in accordance with Section [110.6\(a\)](#).

**EXCEPTION 4 to Section 150.1(c)3A:** For dwelling units containing unrated [site-built](#) fenestration that meets the maximum area restriction, the U-factor and SHGC can be determined in accordance with the Nonresidential Reference [Appendix NA6](#) or use default values in [TABLE 110.6-A](#) and [TABLE 110.6-B](#).

...



# Title 24, Part 6: Subchapter 9

## Low-Rise Residential (including single family and low-rise multifamily) Occupancies



**SUBCHAPTER 9**

Section 150.2

ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS

### Demographics

- Prescriptive requirements for **additions & alterations** for low-rise residential buildings

### Tourist Traps

- The rules **CHANGE** when associated with existing infrastructure because of the cost effectiveness rules associated with Title 24, Part 6

### Hidden Gems

- Prescriptive addition approach!
- Huh?! Extended walls?
- *WHEN* are HERS measures required?
- Remember, repairs are **NOT** code triggers (but....what is a repair?)



# Road Map to Subchapter 9

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## SUBCHAPTER 9: LOW-RISE RESIDENTIAL BUILDINGS



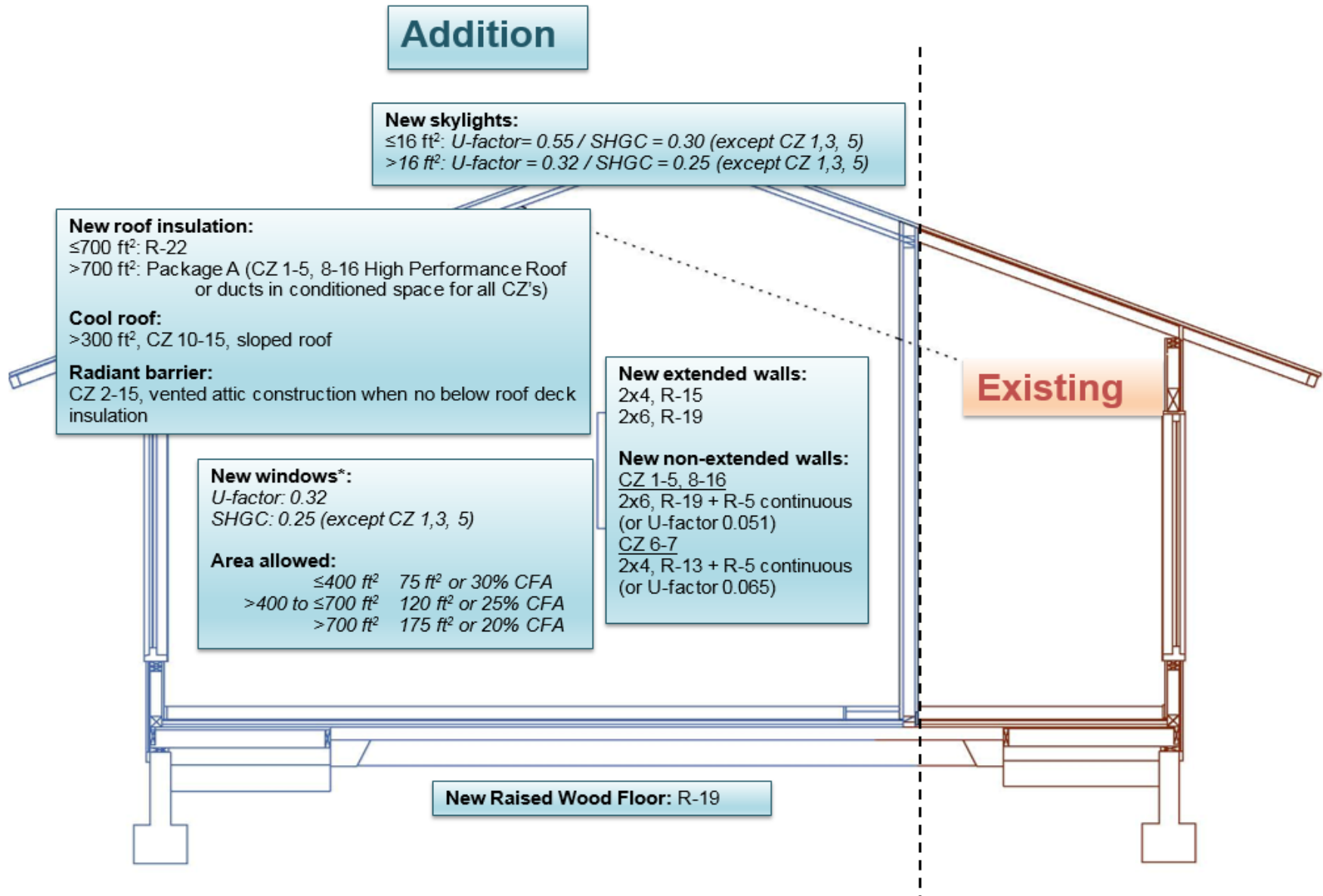
### **ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS**

150.2

*ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS*



# Subchapter 9: Example



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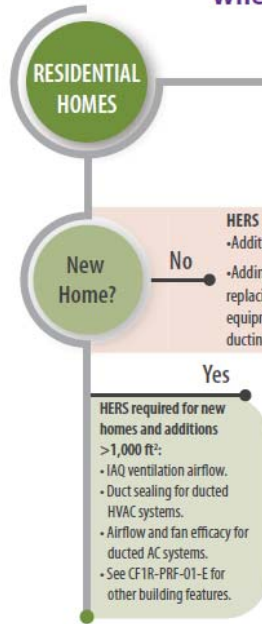
# Subchapter 9: Example

## Section 150.2

### ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS



When



**When is HERS**

**Alterations & Additions ≤ 1,000 ft²**

- When there are no changes and:
  - Adding a ductless wall furnace
  - Extending < 40 linear ft. of duct
  - Changing or adding a water heater
  - Changing or adding lighting
  - Changing or replacing envelope such as window replacement

**Note: HERS will always be required for**

**EnergyCode Ace™** For more information visit [www.energycodeace.com](http://www.energycodeace.com)

Helping you play your cards right

**Trigger Sheet(s):** Residential HVAC Alterations

**Factsheet:** Just the Basics: HERS for Residential

**Application Guide(s):** 2016 Residential HVAC

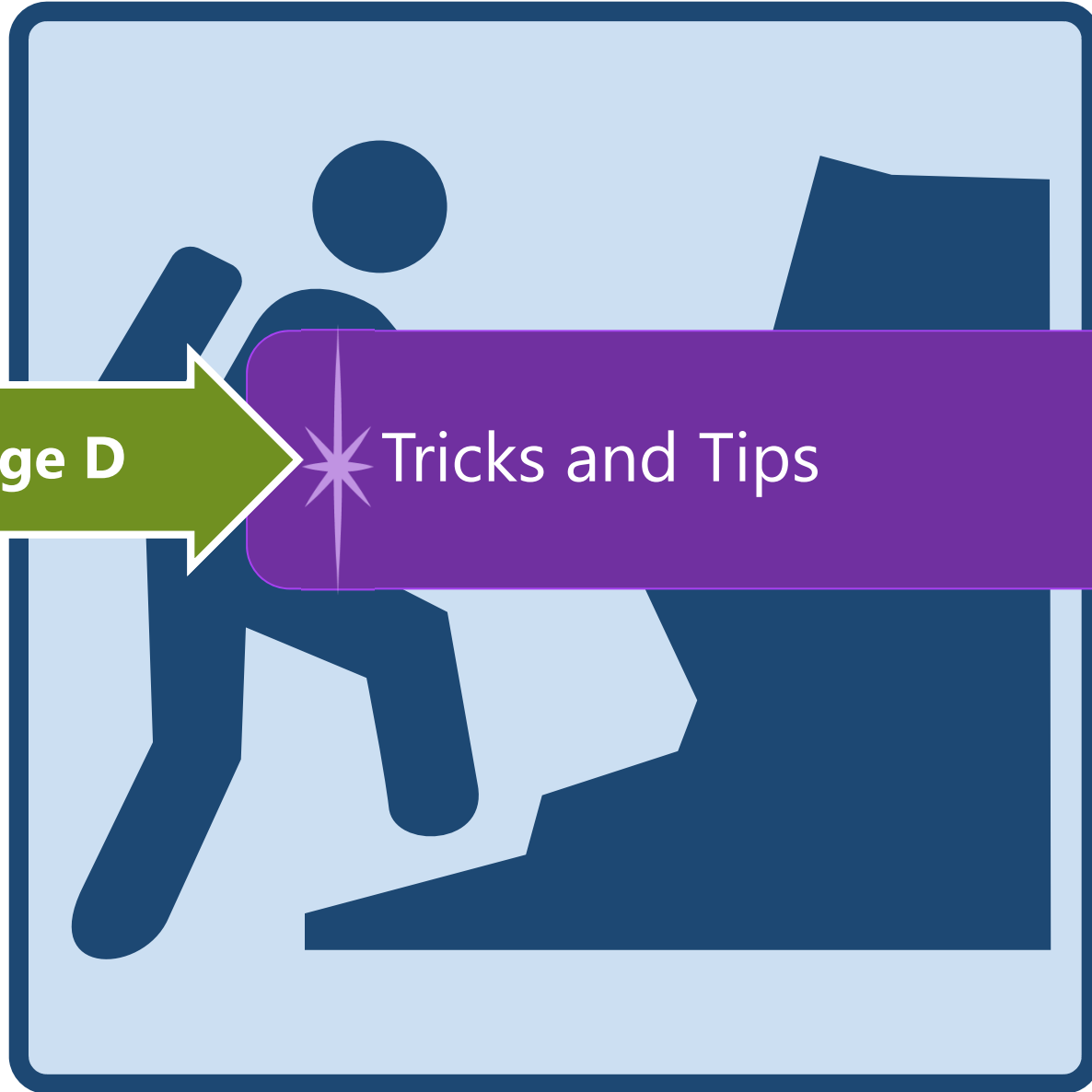


Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
<b>DUCT MEASURES</b>							
CF1R-PRF-01-E							
DUCT SEALING	Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.	When > 10 ft. ducting	Altered HVAC w/ > 25 ft. ducting outside conditioned space, or Adding > 40 ft. of ducting	CF2R/CF3R-MCH-20-H §150.0(m)11			RA3.1.4.3 Single Family: New: 5% Altered: 15% Multifamily: New: 6% Altered: 15%
RETURN DUCT DESIGN	Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification.		Altered system with > 75% new ducting, new HVAC	CF2R/CF3R-MCH-28-H §150.0(m)13			RA3.1.4.4
AIR FILTER DEVICE	Confirm that the air filter devices conform §150.0(m)12.		Altered system with > 75% new ducting, new HVAC	CF2R/CF3R-MCH-28-H §150.0(m)12			RA3.1.4.5
ZONALLY CONTROLLED CENTRAL FAU (BYPASS DUCT)	Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.		New ducted system	CF2R/CF3R-MCH-22/23-H §150.0(m)13	Not Allowed §150.1(c)13	Res ACM 2.4.8.4	RA3.1.4.6
DUCTS IN DIRECTLY CONDITIONED SPACE	Duct system location shall be verified.		Altered system with > 75% new ducting, new HVAC when used in a performance calculation (CF1R-PRF-01-E)		CF2R/CF3R-MCH-20/21-H	Res ACM 2.4.6.2	RA3.1.4.3.8
LOW LEAKAGE DUCTS CONDITIONED SPACE	Field Verification for ducts in conditioned space is required. Duct sealing is required.				HPA Option C §150.1(c)9	2.4.6.13	
DUCT SURFACE AREA/ R-VALUE, BURIED DUCTS/ DEEPLY BURIED DUCTS	Duct system installed according to the design, including location, size and length of ducts, duct insulation R-value. For buried ducts measures, Duct Sealing and verification of insulation.					Res ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.4.1
LOW LEAKAGE AIR-HANDLING UNITS	Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is required.					Res ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9
<b>AIR CONDITIONING MEASURES</b>							
CF1R-PRF-01-E							
COOLING SYSTEM AIRFLOW	System airflow greater than or equal to a specified criterion, field verification and diagnostic testing required.	New ducted system with AC	Altered system with > 75% new ducting, new air handler and new AC.	CF2R/CF3R-MCH-23-H §150.0(m)13			RA3.3
COOLING AIR-HANDLING UNIT FAN EFFICACY	Fan efficacy (Watt/CFM) less than or equal to a specified criterion, field verification and diagnostic testing required.			CF2R/CF3R-MCH-22-H §150.0(m)13			RA3.3
REFRIGERANT CHARGE	Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge.	New AC System in CZ2, 8-15	Altered AC System in CZ2, 8-15		CF2R/CF3R-MCH-25-H	Credit in Climate Zone 1, 3-7, 16	RA3.3 RA3.2
FAULT INDICATOR DISPLAY	Fault Indicator Display can be installed as an alternative to refrigerant charge testing. Field verification is required.				Climate Zone 2, 8-15 §150.1(c)7A	Res ACM 2.4.5.1	RA3.4.2



# Challenge D

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**Challenge D**

**Tricks and Tips**



# Exceptions



## Keep Reading

### ✦ Exceptions

- ✦ Typically found at the END of the applicable section, and read through them ALL before deciding your course of action.

## 130.1(c) Shut-OFF Controls

1. In addition to lighting controls installed to comply with Sections 130.1(a) and (b), all installed indoor lighting shall be equipped with controls that meet the following requirements:
  - A. Shall be controlled with an occupant sensing control, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and
  - B. Separate controls for the lighting on each floor, other than lighting in stairwells; and
  - C. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet; and  
**EXCEPTION to Section 130.1(c)1C:** In the following function areas the area controlled may not exceed 20,000 square feet: Malls, auditoriums, single tenant retail, industrial, convention centers, and arenas,
  - D. Separate controls for general, display, ornamental, and display case lighting.





# What's Not Mentioned

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## Each Word Counts

- ✦ If it is not mentioned, it is not required

### SECTION 120.8 – **NONRESIDENTIAL** BUILDING COMMISSIONING

Nonresidential buildings with [conditioned space](#) of 10,000 square feet or more shall comply with the applicable requirements of Sections 120.8(a) through 120.8(i) in the [building](#) design and construction processes. All building systems and components covered by [Sections 110.0, 120.0, 130.0, and 140.0](#) shall be included in the scope of the commissioning requirements in this Section, excluding those related solely to covered processes.

**NOT Hotel/motel**  
**Not High-Rise Residential**



# Importance of Tables



## Go To The End

- ✦ The Tables are *typically* at the end of the subsection, are so important to understanding how code applies (when they are provided).

**TABLE 141.0-E Control Requirements for Entire Luminaire Alterations**

Control requirements that shall be met when 10% or more of existing luminaires in an <u>enclosed space</u> are altered	Resulting lighting power, compared to the lighting power allowance specified in <u>Section 140.6(c)2</u> , Area Category Method	
	Lighting power is ≤ 85% of allowance	Lighting power is > 85% to 100% of allowance
<u>Section 130.1(a)1</u> , 2, and 3 Area Controls	Yes	Yes
<u>Section 130.1(b)</u> Multi-Level Lighting Controls – only for alterations to general lighting of enclosed spaces 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per square foot	For each enclosed space, minimum one step between 30-70 percent of lighting power regardless of luminaire type, or meet <u>Section 130.1(b)</u>	Yes
<u>Section 130.1(c)</u> Shut-Off Controls	Yes	Yes
<u>Section 130.1(d)</u> Automatic Daylight Controls	Not Required	Yes
<u>Section 130.1(e)</u> Demand Responsive Controls – only for alterations > 10,000 ft <sup>2</sup> in a single <u>building</u> , where the <u>alteration</u> also changes the area of the space, or changes the occupancy type of the space, or increases the lighting power	Not Required	Yes



# Duplication



Issue 116 September – October 2016

## What if also in another code?

✦ Section 1.1.7.3 of the California Building Code states:

✦ “When the requirements of this code conflict with the requirements of any other part of the California Building Standards Code, Title 24, the most restrictive requirements shall prevail.”

### Example:

### **Overlapping Requirements for Residential Hot Water Pipe Insulation**

*The 2016 Energy Standards and California Plumbing Code both have requirements for insulating residential domestic hot water pipes. These requirements differ slightly.*



# Who Signs What?



*California*  
LEGISLATIVE INFORMATION

<http://leginfo.legislature.ca.gov/>

## Business & Professions Code



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[DIVISION 8.6. CIGARETTE AND TOBACCO PRODUCTS LICENSING ACT OF 2003 \[22970 - 22991\]](#)

[DIVISION 9. ALCOHOLIC BEVERAGES \[23000 - 25762\]](#)

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# Next Steps



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Issue 113 | March - April 2016

## BLUEPRINT

California Energy Commission  
Efficiency Division

**In This Issue**

- > New Mechanical Acceptance Test Technician Certification Provider
- > Small Duct High Velocity Space Conditioning Systems
- > Demand Responsive Controls for Additions and Alterations
- > Residential Water Heating Options
- > EnergyPro Version 7.0
- > Alternative Path for Complying with Lighting Alteration Requirements
- > Lighting Standards to Save Californians More Than \$4 Billion in Electricity Costs
- > OMA
  - \* Illuminated Areas
  - \* Track Lighting Alterations
  - \* Compliance Documents
  - \* Townhouses and Duplexes
  - \* Commissioning
- > Energy Code Ace Training Schedule

**New Mechanical Acceptance Test Technician Certification Provider**

On January 13, 2016, the California Energy Commission (Energy Commission) approved the National Environmental Balancing Bureau (NEBB), as a mechanical Acceptance Test Technician Certification Provider (ATCP).

This gives NEBB the authority to train, certify, and oversee acceptance test technicians (ATTs) and their employers. NEBB will train and certify ATTs to perform all 17 mechanical acceptance tests required in the 2013 Building Energy Efficiency Standards (Energy Standards).

The Conditions of Approval are available for review in the **Executive Director's recommendation**.

For more information, please visit <http://energy.ca.gov/title24/atcp/>.

**Small Duct High Velocity Space Conditioning Systems**

Small duct high velocity (SDHV) systems may be used to comply with the Energy Standards. The following is a list of requirements with direction on how SDHV systems can comply with the low-rise residential requirements of the Energy Standards.

**Mandatory Requirements**

United States Department of Energy Standards: SDHV systems manufactured on or after January 23, 2006, and before January 1, 2015, must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 11, and a minimum Heating Seasonal Performance Factor (HSPF) of 6.8.

SDHV systems manufactured on or after January 1, 2015, must have a minimum SEER of 12, and a minimum HSPF of 7.2.

Energy Standards:

**Section 150.0(m)13B** - Single zone systems that use forced air ducts to supply cooled air to an occupiable space must either meet minimum airflow and fan efficacy requirements, or meet the return duct and grille sizing requirements of TABLES 150.0-C or 150.0-D.

**Section 150.0(m)15** - Specific to systems with multiple thermostatically controlled zones, this section requires the same mandatory airflow and fan efficacy requirements as **Section 150.0(m)13B**. However, it does not have the same duct and grille sizing alternative. If such systems cannot satisfy the airflow and fan efficacy requirements of this section, compliance must be demonstrated via the performance approach.

The duct leakage and insulation requirements apply as with any other system.

**Prescriptive Requirements**

The refrigerant charge and duct insulation requirements apply as with any other system.

## Blueprint

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- ✦ Clarifications on frequently asked questions

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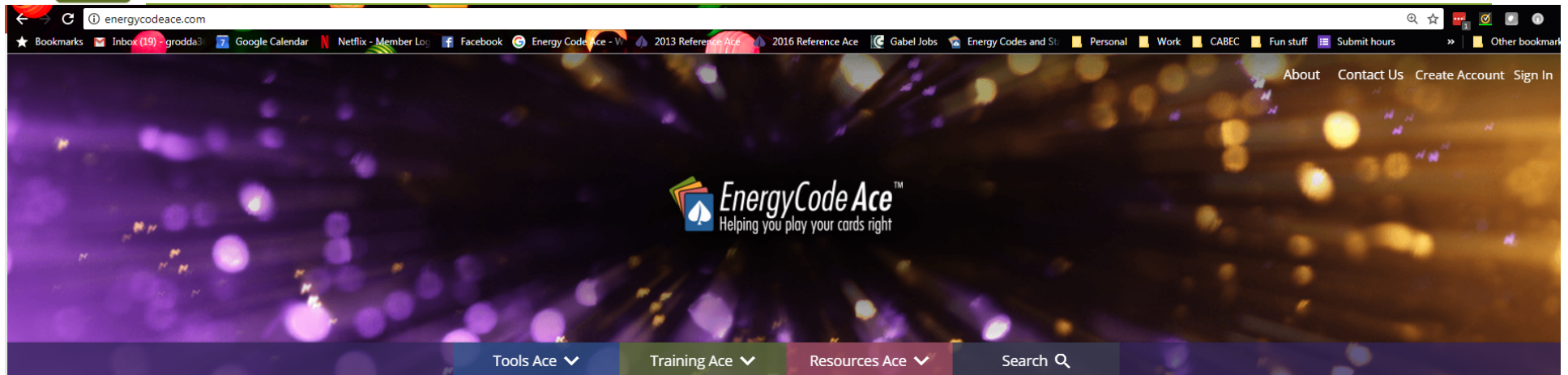
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# Other ECA Resources



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



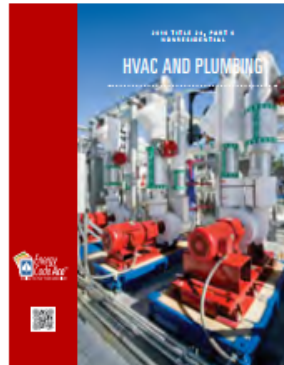
Short manuals including compliance requirements and recommendations for implementing Title 24, Part 6 in new construction, addition and renovation projects.



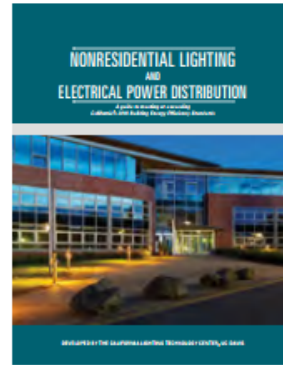
Nonresidential Process Equipment and Systems



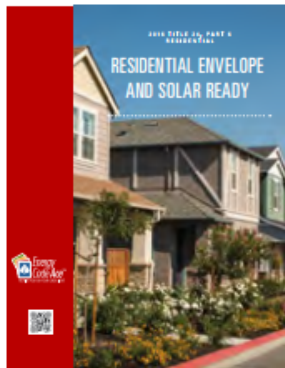
Nonresidential Envelope and Solar Ready



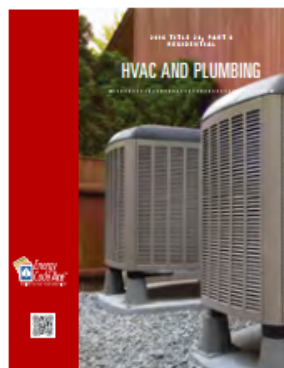
Nonresidential HVAC and Plumbing



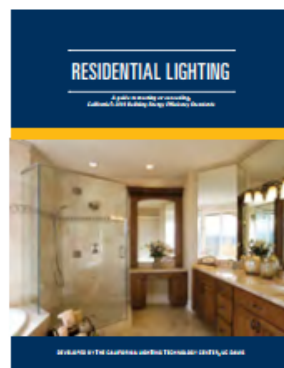
Nonresidential Lighting and Electrical Power Distribution



Residential Envelope and Solar Ready



Residential HVAC and Plumbing



Residential Lighting

**Application Guides:**  
*Short manuals including compliance requirements and recommendations for implementing Title 24, Part 6 in new construction, addition and renovation projects.*

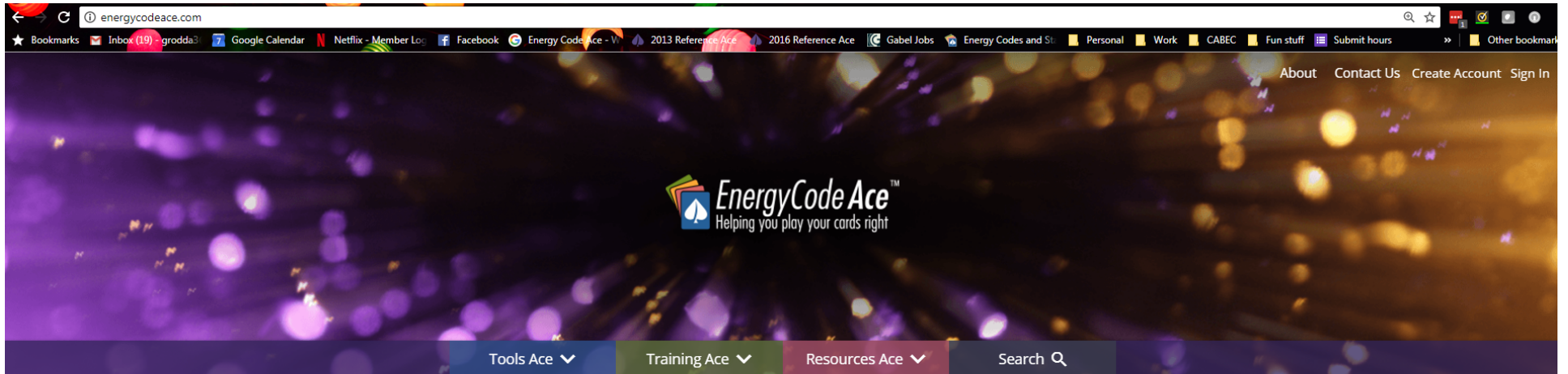
**Also Available through Amazon**







# Other ECA Resources



In-Person Class - Available via utility training centers or we'll bring them to you at your and schedule at your convenience



Online, On-demand Training - Take them whenever and wherever you like, at your own pace



Facilitated Online Discussion – Experts lead peer-to-peer conversations on key code topics



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# Coming Soon!

March 2018

Decoding Recovery:  
Let's Talk Residential Rebuilding  
w/Ted Tiffany

April 2018

Decoding Training: Energy Code Ace  
w/Brian Selby

