CALIFORNIA ENERGY COMMISSION

Cool Roofs in California's Title 24 Building Energy Efficiency Code (2008 Standards)

Cool Roof Rating Council
Las Vegas, NV
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What We Will Cover Today

- Some Basics, Background
- How Title 24 Works
- Current requirements for Cool Roof Regulations(2005)
- Upcoming Cool Roof Regulations (2008)
- Contact Information/Resources

History of Building Standards

- California Legislature, through the Warren-Alquist Act, created the foundation for the CEC.
- Gov. Reagan signed the legislation that created the CEC in 1974.
- Gov. Brown funded it in 1975.
- WAA required Building Energy Efficiency Standards, updates to Standards, and required building departments to enforce them through the permit process.

How Standards Are Updated

- Standards operate under the Efficiency Committee, which currently consists of Chairman Jackalyne Pfannenstiel and Commissioner Arthur Rosenfeld.
- Staff, its consultants, and the utility partners write Triennial Standards update.
- The updates are presented to the public in staff workshops and committee hearings.
- All public comments are processed and responded to.

Support and Outreach

- Residential and Nonresidential Compliance Manuals development and distribution which interpret the Standards.

- Title 24 Hotline for questions on Standards:
  Toll Free (in CA): **800-772-3300**.
  Toll Phone: **916-654-5106**

- Facilitates training sponsored by utilities (usually starting about 3-6 months before the new effective date of Standards).

Standards Compliance

- Building Standards are enforced by the local building officials.

- Enforcement may involve third party verifications by a HERS Rater for particular measures such as duct sealing and TXVs.

- Compliance Methods: Buildings must comply with mandatory measures and with either the prescriptive or performance compliance approaches (basically an energy "budget" for each building referenced to specific climate zone – 1 of 16 zones).

Standards Compliance – Cont'd

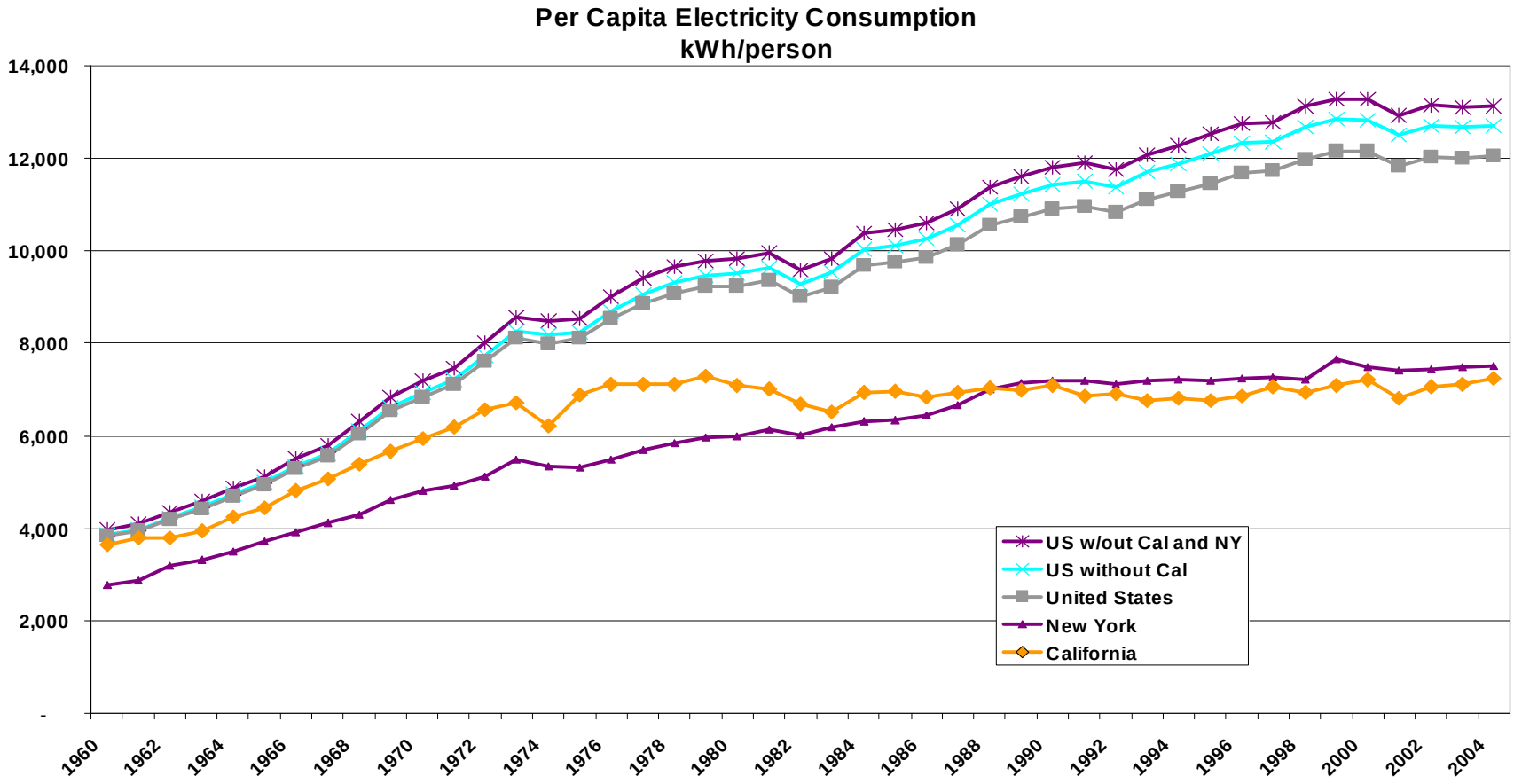
- **Mandatory Measures** – All buildings must comply with mandatory measure regardless of compliance path.

- **Prescriptive Compliance** – Compliance through prescriptive packages which varies with climate zones – no tradeoffs allowed.

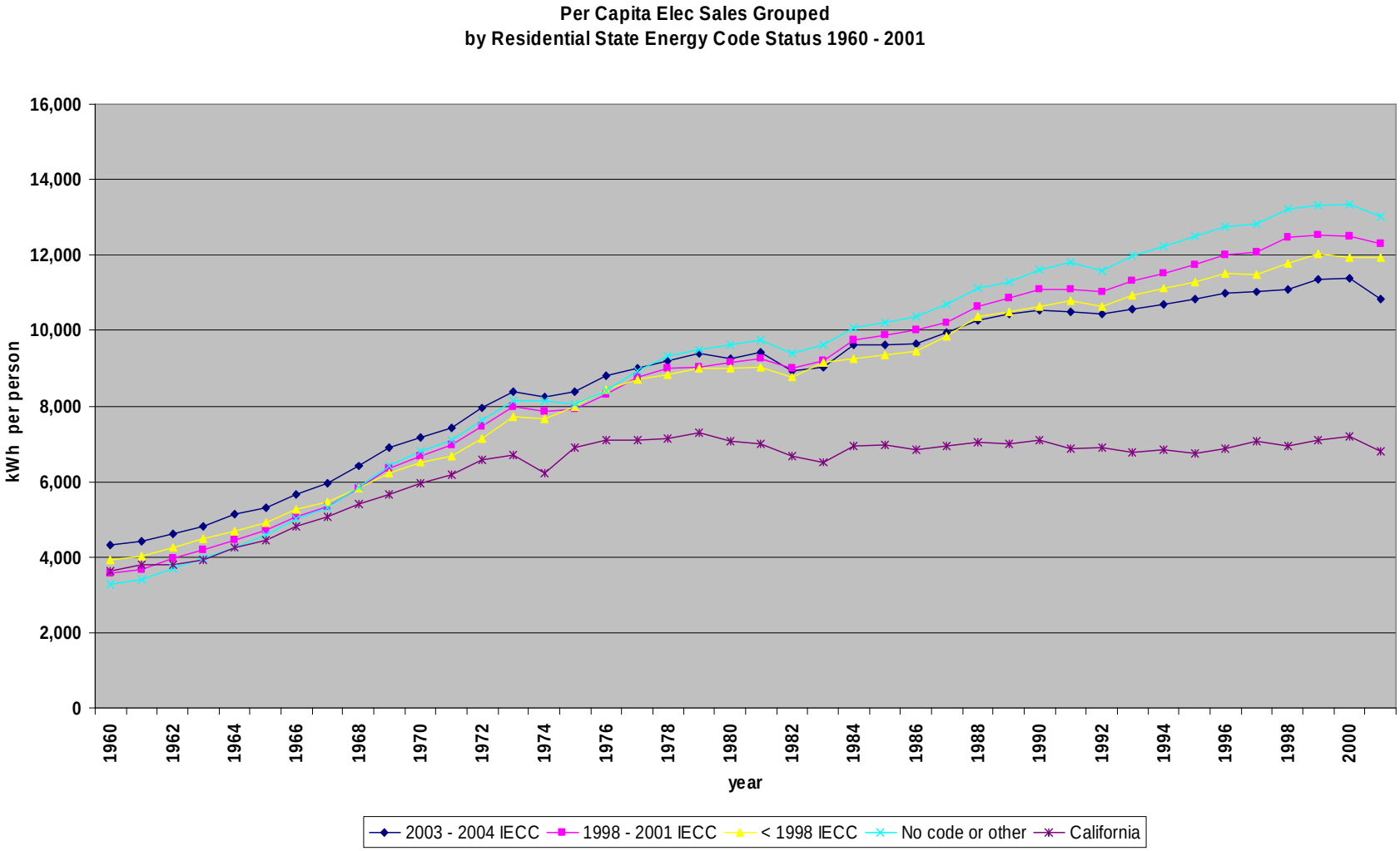
- **Performance Compliance** – Use an approved compliance software to demonstrate compliance for the entire building – allows tradeoffs.

- **Compliance Options** – Measures that are not required prescriptively but can result in a compliance credit if installed, such as high EER air conditioning and buried ducts.

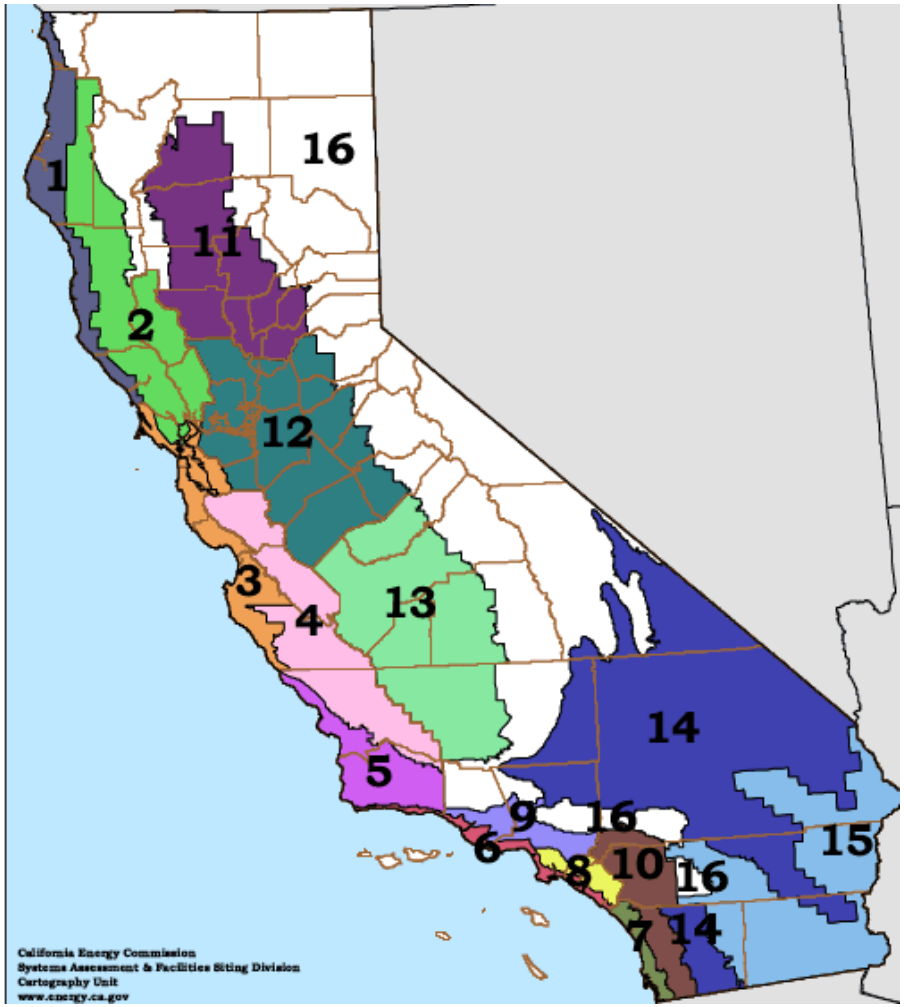
Per Capita Energy Consumption



Per Capita Energy Consumption



California Climate Zones



Current 2005 requirements for Cool Roof

2005 requirements for Cool Roof

- **Cool Roof Requirements apply to nonresidential low-sloped roofs directly over conditioned (heated or cooled) spaces in all California climate zones.**
  - **Low-Slope = 2:12 or less**

- **Cool Roof is a prescriptive requirement.**

Types of buildings subject to cool roof requirements:

- Group A-ASSEMBLY
- Group B-Business
- Group E-Educational (through 12th grade)
- Group F-Factory
- Group H-Hazardous facilities
- Group M-Mercantile
- Group S- Storage facilities
- Group U-Utility facilities

Cool Roofs 2005 – Mandatory Measures

To be considered Cool Roof in CA, the roof must:

- Be certified by CRRC (Title 24, Part 1, §10-113)
- Meet labeling requirements (Title 24, Part 1, §10-113)
- Meet reflectance and emittance requirements (≥ 0.70 and ≥ 0.75 respectively, or go by the formula) [Part 6, §118(i) 1 and 2]
- For coatings liquid-applied in the field, meet performance requirements [Part 6, Table 118-C]

Cool Roofs 2005 – Liquid Applied Roof Coatings Be Considered A Cool Roof

- Shall be applied across the entire roof surface to meet the dry mil thickness or coverage recommended by the coating manufacturer, taking in to consideration the substrate on which the coating is applied.
- Meet the minimum performance requirements listed in the table on the next page or the minimum performance requirements of ASTM C836, D3468, D6083, D6694, whichever are appropriate to the coating material.

Cool Roofs 2005 – Minimum Performance Requirements For Liquid Applied Roof Coatings For Low-Sloped Roofs

Physical Property	ASTM Test Procedure	Requirement
Initial percent elongation (break)	D 2370	Minimum 200% 73 ºF (23 ºC)
Initial percent elongation (break) OR Initial Flexibility	D 2370 D522, Test B	Minimum 60% 0ºF (-18 ºC) Minimum pass 1" mandrel 0ºF (-18 ºC)
Initial tensile strength (maximum stress)	D 2370	Minimum 100 psi (1.38 Mpa) 73ºF (23 ºC)
Initial tensile strength (maximum stress) OR Initial Flexibility	D 2370 D522, Test B	Minimum 200 psi (2.76 Mpa) 0ºF (-18 ºC) Minimum pass 1" mandrel 0ºF (-18 ºC)
Final percent elongation (break) after accelerated weathering 1000 h	D 2370	Minimum 100% 73ºF (23 ºC)
Final percent elongation (break) after accelerated weathering 1000 h OR Flexibility after accelerated weathering 1000h	D2370	Minimum 40% 0ºF (-18 ºC) Minimum pass 1" mandrel 0ºF (-18 ºC)
Permeance	D 1653	Maximum 50 perms
Accelerated weathering 1000 h	D 4798	No cracking or checking[1]

[1] Any cracking or checking visible to the eye fails the test procedure.

Cool Roofs 2005 –(EXCEPTION) Minimum Performance Requirements For Liquid Applied Roof Table

- Aluminum-pigmented asphalt roof coatings shall meet the requirements of ASTM D2824 or ASTM D6848 and be installed as specified by ASTM D3805.
- Cement-based roof coatings shall contain a minimum of 20% cement and shall meet the requirements of ASTM C1583, ASTM D822 and ASTM D5870.

Cool Roof Regulations for 2005 – Residential

- Cool roofs are only a compliance option

- Note: for residential buildings, concrete tile (as defined in ASTM C55) and clay tile (as defined in ASTM C1167) roofing products shall have a minimum initial thermal emittance of 0.75 and a minimum initial solar reflectance of 0.40 when CRRC tested (this cannot be used as credit if a Radiant Barrier is installed).

WHAT IS IN THE WORKS FOR 2008

Residential Low-Rise Steep-Slope New Construction Roofs For 2008

PRESCRIPTIVE			
New Construction	**Climate Zones**	**Aged Reflectance/ Emittance**	**Equivalence To Prescriptive Requirements**
5 lb/ft^2 or More	1-16	0.15/0.75	SRI= 10
Less than 5 lb/ft^2	10-15	0.20/0.75	SRI= 16

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Residential Low-Rise Steep-Slope Alterations For 2008

PRESCRIPTIVE

Alterations	Climate Zones	Aged Reflectance/Emittance	Equivalence To Prescriptive Requirements
5 lb/ft^2 or More	1-16	0.15/0.75 SRI= 10	1. No Ducts in Attic 2. R-30Ceiling Insulation 3. R-0.85 or greater above roof deck thermal resistance over a vented attic. 4. Ducts sealed and tested to altered existing duct requirements. 5. Radiant barrier 6. In CZ 10,12 and 13, 1/150 Attic ventilation with 30% of vent area high
Less than 5 lb/ft^2	10-15	0.20/0.75 SRI= 16	

Residential Low-Rise Steep-Slope Performance For 2008

PERFORMANCE			
New Construction/ Alterations	**Climate Zones**	**Aged Reflectance/Emittance**	**Equivalence To Prescriptive Requirements**
5 lb/sf or More	10-16	0.15/0.85	SRI= 10
Less than 5 lb/sf	10-15	0.20/0.85	SRI= 16
	All other Zones Default	0.08/0.85	

Residential Low-Rise Low-Slope Prescriptive Requirement For 2008

PRESCRIPTIVE			
	Climate Zones	**Aged Reflectance/ Emittance**	**Equivalence To Prescriptive Requirements**
New Construction	13 & 15	0.55/0.75	SRI= 64
Alterations	13 & 15	0.55/0.75	1. SRI =64 2. No Duct in Attic

Nonresidential Low-Slope New Construction Prescriptive Requirement For 2008

PRESCRIPTIVE

	Climate Zones	Aged Reflectance/Emittance	EXCEPTIONS
	2-15	0.55/0.75 SRI=64	1. Wood framed roofs in CZ 3 and 5 are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI if the roof assembly has a U-factor of 0.039 or lower. 2. Metal framed roofs in CZ 3 and 5 are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI if the roof assembly has a U-factor of 0.048 or lower.

Nonresidential Steep-Slope New Construction Prescriptive Requirement For 2008

PRESCRIPTIVE			
New Construction	**Climate Zones**	**Aged Reflectance/ Emittance**	**Equivalence To Prescriptive Requirements**
5 lb/sf or more	1-16	0.15/0.75	SRI= 10
Less than 5 lb/sf	2-16	0.20/0.75	SRI= 16

High-Rise Residential & Hotel & Motels Low-Slope Roofs Prescriptive Requirement For 2008

Climate Zones	Aged Reflectance/Emittance SRI
10, 11, 13, 14 and 15	0.55/0.75 SRI = 64

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—ADDITIONS, ALTERATIONS, AND REPAIRS Requirements For 2008

- If >50% or >2,000 ft^2 of low-sloped roof, whichever is less, is being replaced, recovered, or recoated, prescriptive cool roof "requirements" kick in [§149(b)1B]

  [Can use Performance Approach to avoid Cool Roof but ONLY if other highly efficient energy features are being changed at the same time allowing for trade-offs]

OR

- Building envelope meets heat gain requirements [§149(b)1Bii and 143(b)]

ALTERATIONS AND REPAIRS Requirements For 2008 – Cont'd 1

	Condition	Climate Zones	Aged Reflectance/Emittance SRI
Nonresidential	Low-slope	2-15	0.55/0.75 SRI = 64
Less than 5 lb/ft^2	Steep-slope	2-16	0.20/0.75 SRI = 16
5 lb/ft^{2}or More	Steep-slope	1-16	0.15/0.75 SRI = 10

ALTERATIONS AND REPAIRS

Requirements For 2008 – Cont'd 2

	Condition	Climate Zones	Aged Reflectance/Emittance SRI
High-rise Residential, Hotels & Motels	Low-slope	10, 11, 13, 14, and 15	0.55/0.75 SRI = 64

ALTERATIONS AND REPAIRS

Requirements For 2008 – Cont'd 3

- When the roof deck or the recover boards are exposed in nonresidential, high-rise residential and hotel/motel, it shall be insulated to the levels on the next slide

Insulation Requirements for Alterations

	Roof			
Climate Zone	Nonresidential		High-rise Residential and Guest Rooms of Hotel/Motel Buildings	
	Continuous Insulation R-value	U-factor]	Continuous Insulation R-value	U-factor
1	R-8	0.081	R-14	0.055
2	R-14	0.055	R-14	0.055
3	R-8	0.081	R-14	0.055
4	R-8	0.081	R-14	0.055
5	R-8	0.081	R-14	0.055
6	R-8	0.081	R-14	0.055
7	R-8	0.081	R-14	0.055
8	R-8	0.081	R-14	0.055
9	R-8	0.081	R-14	0.055
10	R-14	0.055	R-14	0.055
11	R-14	0.055	R-14	0.055
12	R-14	0.055	R-14	0.055
13	R-14	0.055	R-14	0.055
14	R-14	0.055	R-14	0.055
15	R-14	0.055	R-14	0.055
16	R-14	0.055	R-14	0.055

Exceptions to the requirements of the table

1. The existing roof is insulated with at least R-7 insulation or it has a U-factor lower than 0.089.
2. If mechanical equipment is located on the roof and it will not be disconnected and lifted as part of the roof replacement, insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches (203 mm) from the roof membrane surface to the top of the base flashing.
3. If adding the required insulation will reduce the base flashing height to less than 8 inches (203 mm) at penthouse or parapet walls, the insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches (203 mm) from the roof membrane surface to the top of the base flashing, provided that the conditions in subsections i through iv apply:

Exception to 3 of the previous slide

i. The penthouse or parapet walls are finished with an exterior cladding material other than the roofing covering membrane material; and

ii. The penthouse or parapet walls have exterior cladding material that must be removed to install the new roof covering membrane to maintain a base flashing height of 8 inches (203 mm); and

iii. For nonresidential buildings, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for climate zones 2 and 10 through 16, and less than 100 square feet per linear foot for climate zones 1 and 3 though 9; and

iv. For high-rise residential buildings, hotels or motels, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for all climate zones

Exception 4 To The Insulation Table

Tapered insulation may be used which has a thermal resistance less than that prescribed in Table 149-A at the drains other low points, provided that the thickness of insulation is increased at the high points of the thickness of insulation is increased at the high points of the roof so that the average thermal resistance equals or exceeds the value that is specified in Table 149-A

Exception to the Replacement, Recovering or Recoating

Roof recoverings allowed by the CBC are not required to meet Section 149(b)1B when all of the following occurs:

1. The existing roof has a rock or gravel surface, and
2. The new roof has a rock or gravel surface, and
3. There is no removal of existing layers of roof coverings of more than fifty percent of the roof or more than 2,000 square feet of roof, whichever is less; and
4. There is no recoating with a liquid applied coating; and
5. There is no installation of a recover board, rigid insulation or other rigid, smooth substrate to separate and protect the new roof recovering from the existing roof.

Equation to obtain an aged value if the product does not have an aged Value listed in the CRRC Directory and only has the current value.

- $REFLECTANCE_{AGED}=(0.2+0.7[\rho_{in}-0.2])$
- ρ_{in}= Initial Reflectance listed with CRRC

Title 24 Energy Code Documents – available at www.energy.ca.gov/title24

- 2005 Building Energy Efficiency Standards (Title 24, Parts 1 and 6).
- Residential and Nonresidential Manuals (interpretative) – **INCLUDES THE FORMS** for submitting to Building Department.
- Joint Appendices – appendices containing definitions, climate data, construction assemblies.
- Residential and Nonresidential Alternative Calculation Methods (ACM) Manuals – details for designing modeling software.

Resources (1)

- Title 24 Website – **www.energy.ca.gov/title24** (Title 24 Energy Standards and support documents)

- Title 24 Energy Hotline

  (800)772-3300 (within CA)

  (916)654-5106 (outside CA)

  title24@energy.state.ca.us

- Title 24 Office – (916)654-4064
  - Payam Bozorgchami – (916)654-4618, pbozorgc@energy.state.ca.us

Resources (2)

- Cool Roof Rating Council www.coolroofs.org
  (866) 465-2523

- CABEC (Calif. Assoc. of Building Energy Consultants)
  www.cabec.org
  (866)360-4002

- Title 24 Energy Information Videos (free) -
  www.energyvideos.com

Thank You

Any Questions???