

Firestone Building Products
Title 24
California Energy Commission
2005 Building Energy Efficiency Standards

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Title 24 and Firestone Building Products

The following guide gives a brief summary of the 2005 Building Energy Efficiency Standards (Title 24) produced by the California Energy Commission. Specifically, it gives an overview of the standard put forth by title 24, Part 6, of the California Code of Regulation and how Firestone Building Products adheres to these mandatory guidelines. For additional information, or to download a copy of the entire compliance manual, please refer to <http://www.energy.ca.gov/title24/>, or contact Firestone Roofing Solutions at 1-800-428-4511.

WHAT IS TITLE 24?

The Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods.

Title 24 was created to establish mandatory standards that would help prevent the depletion of energy, land, and water resources that impact California's environment. The October 1st, 2005 version of title 24 (current standard), set mandates that cover building types, including components such as roofing, lighting, windows, insulation, etc. The current code applies to all parts of California, and its compliance is mandatory in order to receive a proper building permit.

According to the state of California, California's building efficiency standards (along with those for energy efficient appliances) have saved more than \$56 billion in electricity and natural gas costs since 1978. It is estimated the standards will save an additional \$23 billion by 2013.

WHY WAS TITLE 24 CREATED?

The California Energy Commission adopted the 2005 Building Energy Efficiency Standards for a number of reasons. These include:

1. To respond to California's energy crisis to reduce consumer energy bills, increase energy delivery system reliability, and contribute to an improved economic condition for the state;
2. To respond to the AB 970 (statutes of 2000) urgency legislation to adopt and implement updated and cost-effective building energy efficiency standards;
3. To respond to the SB 5X (statutes of 2001) urgency legislation to adopt energy building standards for outdoor lighting; and
4. To emphasize energy efficiency measures that save energy at peak periods and seasons, improve the quality of installation of energy efficiency measures, incorporate recent publicly funded building science research, and collaborate with California utilities to incorporate results of appropriate market incentives programs for specific technologies.

WHAT TYPE OF BUILDING CONSTRUCTION DOES TITLE 24 INCLUDE?

Title 24 covers residential and non-residential structures including:

1. New Construction
2. Existing Construction / Renovation
3. Additions to Existing Buildings



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HOW ARE BUILDINGS DEEMED TITLE 24 COMPLIANT?

There are multiple methods in order to determine whether or not a specific structure is compliant with Title 24. These include:

1. **Prescriptive Method:** The prescriptive method is the easiest of the methods to use to determine if the structure in question is code compliant. This method simply states to make a line item list of Title 24 requirements and simply match those requirements to the building's structure. This procedure is seen as more of a Check List where the components proposed are matched against the requirements to determine whether or not compliance has been satisfied.
2. **Building Envelope Method:** The Building Envelope Method allows for the entire building to be examined. In this process calculations can be made to determine whether or not trade-offs can be attained. Simply put should one component be highly efficiency, it can be used to offset the lower energy efficiency of another component.
3. **Performance Method:** The Performance Method is by far the most difficult approach in determining Title 24 compliance. This method requires an entire building energy assessment compared to the local standard energy load. Typically, an engineer is required to calculate the energy performance of the building and prove that it uses less energy than that of a standard building.

HOW DO FIRESTONE ROOFING PRODUCTS RELATE TO TITLE 24 COMPLIANT ROOF SYSTEMS?

Firestone Building Products Roof Systems play a significant part in the successful completion of a Title 24 compliant non-residential building. Specifically, Firestone Polyisocyanurate ISO 95+ roofing insulation and numerous Firestone TPO and EPDM roofing membranes play a pivotal role in the overall compliance to chapter 3, Building Envelope, Title 24 compliance.

INSULATION:

Section 3.3.1 of the Non-residential Compliance Manual refers specifically to the certification and use of Insulation Materials. These standards for insulation materials ensure that insulation sold or installed in the state performs according to the stated R-Value and meets minimum quality, health, and safety standards.

Exterior roofs can meet prescriptive requirements by having the required R-Value of insulation. For most non-residential buildings, an R-Value of 11 is required in the south coast climates, and an R-Value of 19 is required in other locations. These requirements for R-Value can be seen in the following chart:

Table 3-10 – Roof/Ceiling Requirements

Summary from Standards Tables 143-A and 143-B

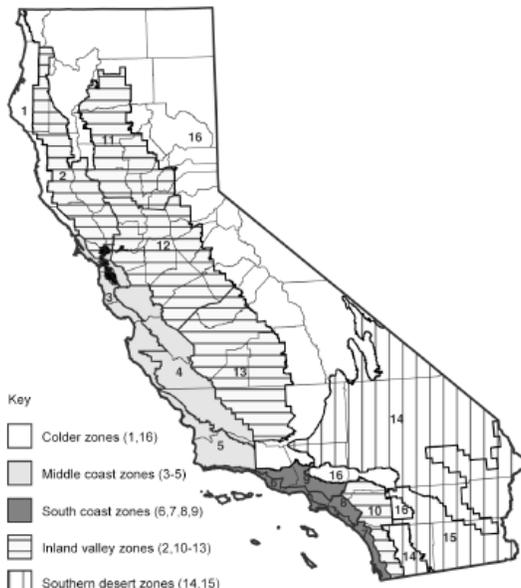
| Roof/Ceiling | | Climate Zones | | | | |
|-------------------------------------|------------|---------------|-------|-------|---------|--------|
| Space Type | Criterion* | 1,16 | 3-5 | 6-9 | 2,10-13 | 14, 15 |
| Nonresidential | U-factor | 0.051 | 0.051 | 0.076 | 0.051 | 0.051 |
| | R-value | 19 | 19 | 11 | 19 | 19 |
| Residential High-rise | U-factor | 0.036 | 0.051 | 0.051 | 0.036 | 0.036 |
| | R-value | 30 | 19 | 19 | 30 | 30 |
| Relocatable Public School Buildings | U-factor | 0.051 | 0.051 | 0.051 | 0.051 | 0.051 |
| | R-value | 19 | 19 | 19 | 19 | 19 |

*U-factors are the actual conductance of the entire assembly. R-values refer to the nominal R-value of the insulation within the framing.

NOTE: R-value cannot be used for compliance when the roof has metal framing members or a metal deck unless additional rigid insulation is installed. See §143 (a) 1 C.



The Climate Zones mentioned in the above chart can be outlined in Figure 3-1 found on page 67 of the 2005 Non-residential Compliance Manual.



Source: California Energy Commission

Figure 3-1 – Nonresidential Climate Regions

Firestone ISO 95+ LTTR Values

| Insulation Thickness | | LTTR* R-Value |
|----------------------|-------|---------------|
| (Inches) | (mm) | |
| 1.00 | 25.4 | 6.0 |
| 1.25 | 31.7 | 7.5 |
| 1.50 | 38.1 | 9.0 |
| 1.75 | 44.5 | 10.5 |
| 2.00 | 50.8 | 12.1 |
| 2.30 | 58.4 | 14.0 |
| 2.50 | 63.5 | 15.3 |
| 2.80 | 71.1 | 17.2 |
| 3.00 | 76.2 | 18.5 |
| 3.25 | 82.6 | 20.1 |
| 3.50 | 88.9 | 21.7 |
| 3.75 | 95.3 | 23.4 |
| 4.00 | 101.6 | 25.0 |

*Long Term Thermal Resistance (LTTR) values provide a 15-year time-weighted average in accordance with CAN/ULC-S770.

“COOL ROOFING” MEMBRANES:

According to Title 24, Section 3.4, the term “cool roof” refers to an outer layer or exterior surface of a roof that has a high solar reflectance and high emittance and reduces heat gain into a building. As the term implies, the temperature of a cool roof is lower on hot sunny days than darker roofs, therefore reducing the cooling loads and the energy required to provide air conditioning.

Section 3.4.1 Mandatory Measures:

The Mandatory measures require that cool roofs be tested and labeled by the Cool Roof Rating Council. The CRRC is the sole supervisory entity responsible for the certifying of cool roofing products. The CRRC test procedure is a documented procedure that includes tests for both reflectance and emittance. Please be aware that Energy Star Rated Roofs do not automatically qualify as cool roofs under title 24. Due to this strict regulation only CRRC labeled product can be used to comply with Title 24.

Firestone ECOWhite RubberGard EPDM

| | | | |
|--|-------------------|------------------------|-----------------------------|
|  | Solar Reflectance | <u>Initial</u> 0.80 | <u>Weathered</u> Pending |
| | Thermal Emittance | 0.84 | Pending |
| Rated Product ID | | 0027 | |
| Licensed Manufacturer ID | | 0608 | |
| Classification | | Production Line | |
| <p>Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.</p> <p>Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.</p> | | | |



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Section 3.4.2 calls for a cool roof in all low-slope applications for non-residential buildings. A low slope roof is defined as a surface with a pitch less than or equal to 2:12.

A qualify cool roof must have an initial reflectance of .070 or greater and an initial emittance of 0.75 or greater. However, the emittance may be lower and the reflectance higher such that equivalent performance is achieved. For products with lower emittance values, the following calculation can be used:

$$\text{Reflectance} = 0.70 + 0.34 * (0.75 - \text{Emittance})$$

For tradeoffs between Roof Reflectance and Emittance, see the following figure (3-17 from Title 24).

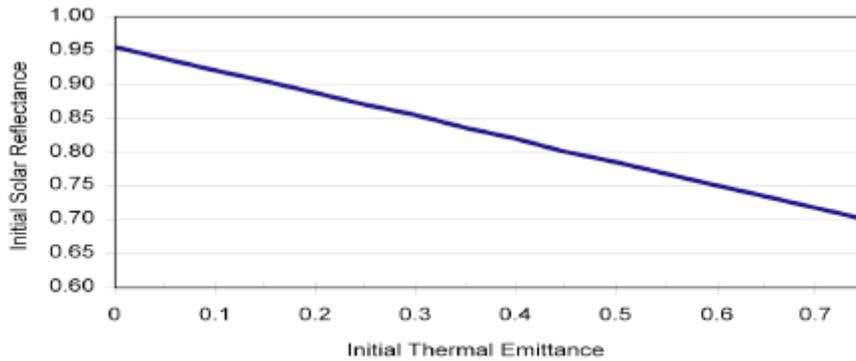


Figure 3-17 – Tradeoffs between Cool Roof Reflectance and Emittance
A cool roof may comply with an emittance lower than 0.75 as long as the reflectance is higher. This graph shows the relationship.

Solar Reflectance and Thermal Emittance Values:

Please refer to the following table for a listing of Firestone Roofing products that have been tested by the Cool Roof Rating Council:

| Product Name and Product ID* | Solar Reflectance | Thermal Emittance |
|--------------------------------------|-------------------|-------------------|
| ReflexEON TPO White (0608-0014) | 0.84 | 0.83 |
| UltraPly TPO White (0608-0008) | 0.79 | 0.85 |
| UltraPly TPO Tan (0608-0015) | 0.60 | 0.81 |
| UltraPly TPO XR White (0608-0016) | 0.79 | 0.78 |
| Acrylitop PC-100 White (0608-0003) | 0.82 | 0.87 |
| Acrylitop PC-100 Tan (0608-0002) | 0.53 | 0.88 |
| Acrylitop PC-100 Gray (0608-0001) | 0.32 | 0.88 |
| Acrylitop PC-100 Base (0608-0006) | 0.60 | 0.88 |
| SBS Metal Flash AL (0608-0009) | 0.81 | 0.44 |
| Aluminum Fibered Coating (0608-0013) | 0.67 | 0.38 |



| | | |
|---|------|------|
| APP 180 White (0608-0011) | 0.31 | 0.87 |
| APP 180 FR White (0608-0019) | 0.31 | 0.89 |
| APP 180 COOL White (0608-0020) | 0.30 | 0.88 |
| APP 180 FR COOL White (0608-0018) | 0.32 | 0.87 |
| APP Premium White (0608-0017) | 0.32 | 0.88 |
| SBS Granule White (0608-0012) | 0.31 | 0.88 |
| SBS FR Cap (0608-0026) | 0.31 | 0.89 |
| SBS Premium White (0608-0024) | 0.30 | 0.88 |
| SBS Premium FR White (0608-0023) | 0.29 | 0.88 |
| SBS Torch White (0608-0022) | 0.31 | 0.88 |
| SBS FR Torch White (0608-0021) | 0.31 | 0.88 |
| SBS Premium FR Torch (0608-0025) | 0.32 | 0.88 |
| Fluropon Classic Silver Roof Panel (954-318-2600) | 0.56 | 0.76 |
| Fluropon Bone White Roof Panel (954-318-2600) | 0.70 | 0.84 |
| Fluropon L/S Regal White Roof Panel (954-318-2600) | 0.70 | 0.85 |
| Fluropon L/S/ Solar White Roof Panel (915-318-2600) | 0.70 | .085 |
| Weather X Solar White Roof Panel (954-318-2600) | 0.70 | 0.85 |
| Dynapon reflective White Roof Panel (954-318-2600) | 0.70 | 0.86 |
| Fluropon Sandstone Roof Panel (954-318-2600) | 0.51 | 0.84 |
| Fluropon Cityscape Roof Panel (954-318-2600) | 0.35 | 0.84 |

For further information please refer to the following links:

www.firestonebpco.com
<http://manual.fsbp.com/technicalresources>
www.coolroofs.org
<http://www.energy.ca.gov/title24/>

Firestone Building Products Main page
Firestone Building Products Technical Database
Cool Roof Rating Council
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