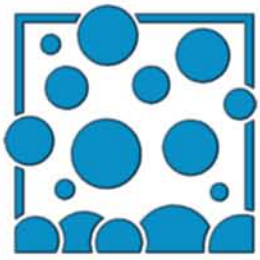
Johns Manville

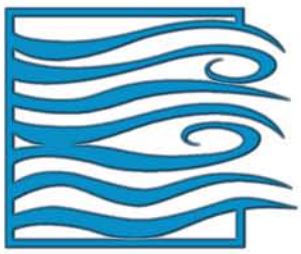
Defy the Elements

WATER

FIRE



HAIL



WIND

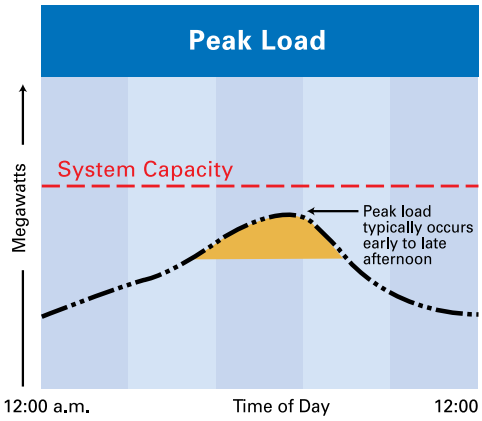
Cool Roof Solutions

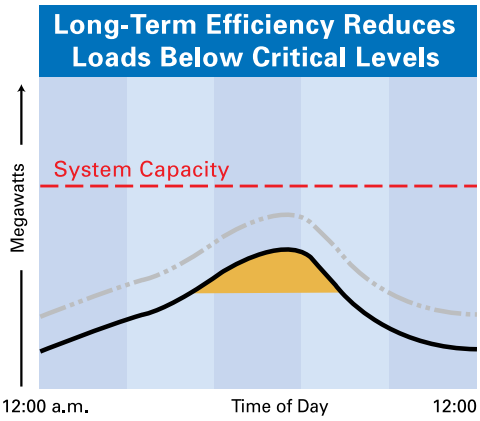
Energy, Environment and Roofing Engineering

Think of JM when you think of sustainable building – creating structures that preserve the natural environment, use less energy, last longer and are more comfortable to be in and around.

Many factors affect the indoor temperature of a building and ultimately our comfort as building occupants. Environmental factors such as sunshine, clouds, humidity and wind speed all impact the building envelope, causing a temperature change. The first line of defense for a building is the material selection and placement in the building envelope.

Highly infrared emissive and solar reflective roofing surfaces can help save money in air-conditioning costs because less heat is transferred into the building. Increased insulation also can mitigate this heat transfer, translating into less cooling to keep people comfortable. This is especially true on hot afternoons in peak energy periods, such as 3 p.m. in the middle of July on a 90°F (32°C) day. Lower peak usage helps to reduce the chance of rolling power outages, which means businesses stay up and running.





1 Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory, a DOE national laboratory, DOE/GO-102002-1613, September 2001.

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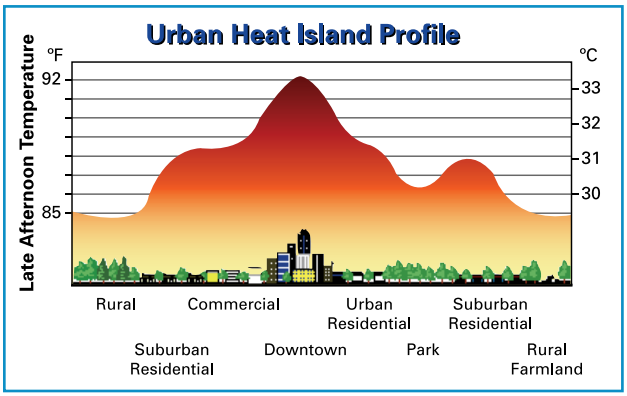
Cool roofs also help mitigate the "urban heat island effect." Heat islands occur when many buildings and paved surfaces in close proximity are designed with dark materials that absorb heat from the sun. Research indicates that this can cause cities to become 2°F (-17°C) to 8°F (-13°C) warmer than the surrounding countryside, as shown in the illustration below.



Source: Illustration is a composite drawing of data obtained from Southern California Edison Company, Greg Sharp, AIA, IES.

WATER FIRE HAIL WIND

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The Role of Reflectivity and Emissivity in Cool Roofs

To better understand the concept of cool roofs, we need to understand reflectivity and emissivity. Conceptually, Figure 1 below demonstrates how the sun's solar radiation affects a product's reflective and emissive properties.

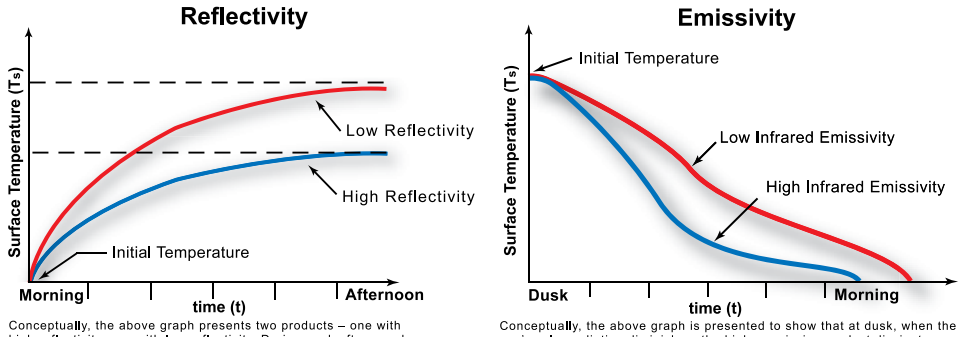
Energy-efficient material selection will impact indoor environmental comfort, which results in lower energy consumption and reduced demand during peak periods.

Reflectivity
Solar reflectivity (or reflectance) is the fraction of the solar energy that is reflected by the surface (i.e., roofing membrane) back to the sky. White membranes have the highest solar reflectivity, while black membranes have the lowest.

Emissivity
Infrared emissivity (or emittance) is a measure of the ability of a surface to shed some of its heat (in the form of infrared radiation) away from it (i.e., roofing membrane). High infrared emissivity helps keep surfaces cool. This property can make a significant difference in controlling the "urban heat island effect." Metallic surfaces have a low infrared emissivity.

Solar Reflective Index (SRI)
The Solar Reflective Index is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. SRI combines reflectance and emittance into one number.

Figure 1. Illustrating Reflectivity and Emissivity



Conceptually, the above graph presents two products – one with high reflectivity, one with low reflectivity. During peak afternoon hours, the product with the higher reflectivity delivers a cooler rooftop surface.

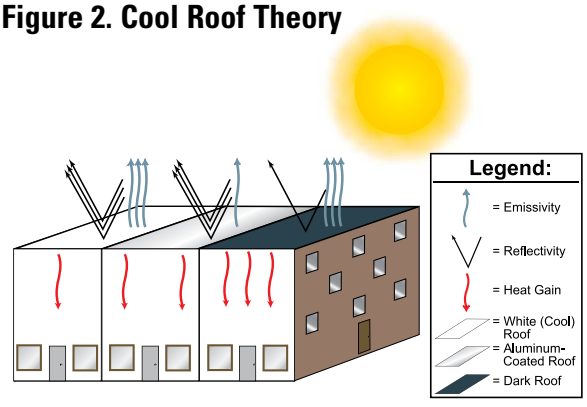
Conceptually, the above graph is presented to show that at dusk, when the sun's solar radiation diminishes, the higher emissive product dissipates stored heat at a faster rate than the lower emissive product.

Figure 2 compares properties from three types of roofing products:

- White (cool) roof
- Aluminum-coated roof
- Dark roof

Highly reflective and highly emissive products, such as the white membrane, combined with the proper amount of roof insulation, offer a system that significantly reduces heat gain into a building.

Figure 2. Cool Roof Theory



This simple graphic illustrates the theory of cool roofs. There are many complex and related variables to consider when selecting the correct roofing product for these applications.

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Cool Roof Rating Systems Set Standards for Reflectivity and Emissivity

Title 24 / ENERGY STAR / LEED

How the Energy and Environmental Standards Compare

Below are key points to help distinguish the unique requirements of each of these programs. For the roofing industry in particular, all of these rating systems have one thing in common: they all set standards for cool roof reflectivity and/or emissivity. Some standards are voluntary, while others are mandatory.

- Title 24 is mandatory in California.
- LEED (Leadership in Energy and Environmental Design) is highly encouraged among a growing list of city, state and federal agencies.
- ENERGY STAR is generally voluntary. However, meeting the ENERGY STAR standards for roofing reflectivity can help earn points in the LEED rating system.

Program	Requirement	Initial Reflectivity	3-Yr Aged Reflectivity	Emissivity	SRI***
Title 24 (for climate zones 2-15)	Mandatory	N/A	0.55	0.75	64≥
ENERGY STAR	Voluntary*	0.65	0.50	N/A**	N/A
LEED	Voluntary*	N/A	N/A	N/A	78≥

Note: Cool Roof Rating Council (CRRC) lists product emissivity information according to ASTM C 1371. LEED accepts products tested for emissivity according to ASTM E 1980. Results may vary between test methods.

** Although voluntary, some local and state authorities are requiring designers to adhere to these guidelines for specific building types (i.e., government or state-funded projects).*

*** ENERGY STAR emissivity levels are not required at this time; however, manufacturers are required to test and report emissivity levels following appropriate test procedures.*

**** SRI is determined by using the reflectivity values, emissivity values and the steady state temperature equations defined in ASTM E 1980-01.*

Johns Manville's Product Offering for Cool Roofs

Reduce Energy Costs and Mitigate the "Heat Island" Effect of Development

Recommended roof systems include:

PVC

Johns Manville offers white JM PVC with DuPont™ Elvaloy® KEE (Ketone Ethylene Ester) membranes including JM PVC-50, JM PVC-60, JM PVC-80 as well as JM PVC-50 Fleece Backed, JM PVC-60 Fleece Backed and JM PVC-80 Fleece Backed single ply systems, either mechanically attached or fully adhered.

TPO

Johns Manville markets white JM TPO single ply systems either mechanically attached or fully adhered.

Bituminous Built-Up Roofing (BUR) and SBS

CR cap sheets have white minerals and are factory-coated with one coat of TopGard® Base and one coat of TopGard® 5000 to meet cool roof standards.

As another option for bituminous systems, several non-CR BUR and SBS cap sheets may be coated with TopGard Base and TopGard 4000 or TopGard 5000.

Product	Reflectivity** (ASTM C 1549)	Emissivity** (ASTM C 1371)	SRI* (ASTM 1980-01)
JM PVC	0.86	0.86	109
JM TPO	0.77	0.87	101
GlasKap CR	0.76	0.85	93
TopGard® 4000	0.83	0.88	102
TopGard 5000	0.83	0.88	102
SBS CR Membranes	0.76	0.85	92

* LEED's Solar Reflective Index.

** Test Methods used by CRRC.

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The LEED Green Building Rating System™*

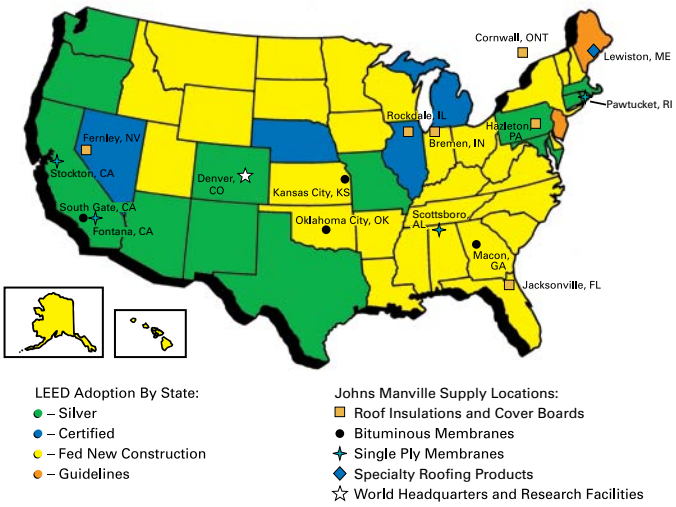
The U.S. Green Building Council (USGBC) is a non-profit coalition of building professionals working to promote the design and development of environmentally and economically responsible buildings. Leadership in Energy and Environmental Design (LEED) is its Green Building Point Rating System. LEED points recognize the design and construction of energy-efficient and environmentally responsible buildings. The USGBC developed LEED to further the expansion of its mission.

The objective of LEED is to decrease the energy consumption and environmental impact of buildings. There are specific point designations for new construction (NC), core and shells (CS) and schools (S).

Where LEED Is Encouraged

While LEED is voluntary, a number of state and local authorities require it for municipal construction projects as shown in Figure 1 below. An increasing number of cities, counties and states across the nation are adopting LEED certification for certain projects. In addition, branches of the federal government (including the Department of Defense, General Services and the Environmental Protection Agency [EPA]) also are encouraging LEED certification for their projects. Please visit www.usgbc.org for the most current information.

Figure 1. LEED Adoption By State and Johns Manville Supply Locations



* LEED and Green Building Rating System are trademarks of the U.S. Green Building Council.

How the LEED Rating System Works

LEED is a points-based system with four levels of certification: LEED Certified, Silver, Gold and Platinum (see Table 1). The majority of points are allocated to five of the seven LEED categories (see Table 2) and roofing materials can impact four of these: Sustainable Sites, Energy and Atmosphere, Materials and Resources and Indoor Environmental Air Quality.

Four additional innovation points may be awarded to buildings or products that exhibit exceptional performance above the standard LEED requirements (see Table 2 for specific points).

Table 1

LEED Certification	Points
LEED Certified	40-49 points
Silver Level	50-59 points
Gold Level	60-79 points
Platinum Level	80 points or more

Table 2

Category	Points
Sustainable Sites	26
Water Efficiency	10
Energy and Atmosphere	35
Materials and Resources	14
Indoor Environmental Air Quality	15
Sub-total	**100**
Innovation in Design	6
Regional Priority	4
Total Potential Points	**110**

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Who's Responsible for What, in What Sequence

Responsible Party	Their Responsibility
Owner and Design Team	• **Register** the project during design phase; document green building technologies • **Select** qualified/certified products; document • **Submit** documentation at or near building occupancy
USGBC	• Project registration, technical support and building certification
Roofing Manufacturers	• Provide products that have been tested by accredited testing facilities and label accordingly

LEED Requirements for Cool Roofing

Reflective membranes reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirements:

SSc7.1

OPTION 2 – Place a minimum of 50 percent of parking spaces under cover (defined as underground, under deck, under roof or under a building); any roof used to shade or cover parking must have an SRI of at least 29.

SSc7.2

OPTION 1 – Use roofing materials with a Solar Reflectance Index (SRI) of 78 for low-sloped roofs and 29 for steep-sloped roofs.

OPTION 2 – Install a vegetated roof over 50 percent of the roof area

OPTION 3 – Install a combination of high albedo (reflective) and vegetated roof surfaces that meet the following criteria.

$$\frac{\text{(Area of Roof Meeting Minimum SRI)}}{0.75} + \frac{\text{(Area of Vegetated Roof)}}{0.5} \geq \text{Total Roof Area}$$

Required SRI Values

Roof type	Slope	SRI
Low-Sloped Roof	< 2:12	78
Steep-Sloped Roof	> 2:12	29

An Emerging Opportunity for the Roofing Industry

Selecting the right roofing product is one of the easiest ways to generate LEED points. JM roofing systems will give your company a competitive edge when working with corporations, universities and government agencies that are working to provide green buildings for better work environments and buildings that cost less to operate.

How JM Can Help Get Your Project LEED Certified

JM offers a wide range of products and expertise to help you attain LEED certification. Please visit the JM Web sites (www.jmbuildgreen.com or www.specjm.com), or contact your local JM sales representative for a copy of JM's LEED brochure detailing JM systems that contribute to LEED certification (HIG-1231).

A list of our cool roof products include:

- TopGard 4000 and TopGard 5000 acrylic coatings secure energy-performance credits for LEED points.
- JM PVC with Elvaloy KEE and JM TPO white single ply roofing systems also secure energy-performance credits for LEED points.
- GlasKap CR and SBS CR white mineral-surfaced, white acrylic-coated cap sheets for use in bituminous roofing systems. The unique surfacing protects the underlying asphalt and membrane, as well as provides a reflective, emissive surface.
- Fesco® Boards include low thermal, perlite roof insulation boards and general-purpose cover boards for use over closed-cell foam insulation boards in BUR, modified bitumen and some single ply roofing systems. These products contain 25 percent recycled post-consumer content by weight. JM insulation boards with recycled content include Fesco Board, DuraBoard®, ½" Retro-Fit™ Board, and Fesco® Foam rigid insulation boards.

LEED points can also be earned if at least 10 percent of the total value of the building materials and products are manufactured within a 500-mile radius of the project. JM has manufacturing facilities throughout the U.S. Depending on the project location, JM membrane, insulation and/or accessories may be eligible. (See Figure 1 on the previous page.)

Additional Benefits of LEED Certification

Not only do you receive recognition for quality buildings and environmental stewardship, but you gain the ability to compete in a growing market among corporations, universities and government agencies that have discovered green buildings provide better work environments and cost less to operate. For LEED-certified facilities, specifiers, designers and building owners can gain marketing exposure through the Web site of the U.S. Green Building Council, the organization that developed the LEED system and administers the certification program. In addition, you can qualify for state and local government incentives in states where they are offered (reference www.usgbc.org).

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The Basics of California's Title 24 Regulations

Title 24 is the Building Standards Section of the California Code of Regulations and is the latest revision of the Warren Alquist Act passed in 1978 to reduce energy consumption in California, particularly the kind of peak energy demand that contributed to the rolling blackouts of 2000 and 2001.

Part 6 of Title 24 is the Energy Code. The law is updated every three years to take advantage of new energy-efficiency technologies and methods. As of October 1, 2005, it now regulates – for the first time – energy-efficiency for roofs in California. And these cool roofs are now the default requirement under the prescriptive method.

Standards for Cool Roofing
To qualify as a cool roof under the new Title 24 standards, roofing products must be tested and rated according to the system developed by the CRRC, which is the only rating system recognized for Title 24 compliance. In California, a cool roof is defined as a roof system that has a minimum 3-year aged reflectivity of 0.55, emissivity of 0.75 and SRI of 64. Although a cool roof is required under the prescriptive approach, designers can select a non-cool roof by following specific steps in the Performance or Trade-off compliance methods.

How Title 24 Works
For each proposed new building, the California Energy Commission (CEC) establishes an energy "budget" based on a computer simulation of the building's one-year energy use (kBtu/ft^2/yr). The energy budget is used to establish component requirements outlined in the prescriptive approach. Designers for the proposed building can either follow the same prescription of energy features to comply with Title 24, or they have the option to select alternate components, as long as the new design meets or exceeds the energy savings outlined in the energy budget. Additional calculations are needed to validate compliance with the new design.

Two Prescriptive Approaches for Meeting the "Budget"

- *Standard Prescriptive Approach (Envelope Component Method):* This is the simplest, but least flexible approach. An applicant need only show that each building component meets or exceeds the prescriptive requirement for that climate zone. No calculations are needed to demonstrate compliance; however, there is no flexibility to trade off components that have a lower energy savings than the prescribed values. Within the prescriptive approach, cool roofs are a default requirement to comply with Title 24. A cool roof can, however, be traded for another component of equal or greater energy efficiency using the building envelope approach detailed below.
- *Prescriptive "Trade-Off" Approach for the Building Envelope (Overall Envelope):* A subset of the Prescriptive method, the overall envelope approach allows for some flexibility in component selection where a nonmandatory component can be "traded" for one of equal or greater energy performance. For example, an owner can elect to install a non-cool roof if enough roof or ceiling insulation is added to meet or exceed the prescribed energy budget. The energy performance of the substituted component must be assessed and documented using the calculation under this approach.

For low-sloped nonresidential roofs over conditioned space, cool roofs are one of the required features in the standard prescriptive approach.

However, a designer can install a non-cool roof if other components in the building design compensate for the increased solar heat gain caused by not having a cool roof.

Whole Building Performance Approach

- This approach provides the greatest flexibility in the building design, but requires the most documentation. Using this approach, a detailed calculation must be performed using CEC-approved software where the energy efficiency of the entire building is calculated with the desired components, and compared to the prescribed energy budget. Just as before, the new design must meet or beat the prescribed energy budget. Energy consultants are often utilized in this approach due to the complexity.

The performance approach is most commonly used with new construction or during a major remodel, when multiple components of the building envelope are being altered.

Building and Project Types Subject to Compliance
Title 24 applies to all mechanically heated or cooled, newly constructed, renovated or remodeled buildings (including re-roofing projects). Any building permit issued on or after October 1, 2005, must meet the cool roof provisions of Title 24. The law requires compliance whether a permit is applied for or not. Building owners are bound by California law to ensure their buildings meet the California Code of Regulations. Permits issued prior to that date were held to the previous 2001 standards.

If a building is considered nonresidential, has a low-sloped roof (slope less than 2:12) and is mechanically air-conditioned or heated, it will need to be in compliance with Title 24.

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Roof Replacements Guidelines

Low-sloped nonresidential roofs must meet the new requirement when half of the roof, or 2,000 square feet (whichever is less), is being re-roofed. There is one exception: for certain conditions when gravel on a built-up roof is removed down to the membrane and new gravel is added as a replacement. This does not include removing the entire membrane – just the gravel surfacing.

Simple guidelines for insulation:

If the building requires a cool roof....

Roof Installed		Existing Insulation		Insulation Re-roof Requirement
Cool Roof	+	Existing insulation is **disturbed**	=	Replace the insulation at the **same level** or greater
Cool Roof	+	Existing insulation is **not disturbed**	=	**No additional** insulation is required
Cool Roof	+	**None**	=	**No additional** insulation is required
Non-Cool Roof	+	Yes	=	**Calculate** and install **additional insulation***
Non-Cool Roof	+	None	=	**Calculate** and install **additional insulation***

** Must use overall envelope trade-off or the performance approach*

Other Requirements That Could Impact Roofing

Laying insulation batts on top of suspended ceilings is no longer sufficient, except in air-conditioned spaces with a combined floor area not greater than 2,000 square feet in an otherwise unconditioned building, and when the average space between the ceiling and roof is greater than 12 feet. Otherwise, to achieve the appropriate R-value, insulation must be installed directly under the deck, or roof insulation must be installed on top of the deck.

Who's Responsible for What

Responsible Party	Their Responsibility
Owner	• Provide code-compliant building (even if permit is not required).
Owner's Architect or Construction Manager	• Project coordination including building permits.
Energy Consultant	• Handle all Title 24 calculations and documentation.
Roofing Contractor	• Install systems that meet Title 24. If a permit is required, furnish appropriate documentation to the Building Department.
Roofing Products Manufacturers	• Provide products that meet code. Products should be properly labeled with Title 24 standards; test with supervisory entity (CRRC); affix CRRC label.
Permitting Agency / Building Official	• Inspect and enforce Title 24 compliance. Ensure all plans comply with the California Code of Regulations and furnish appropriate documentation.

JM Can Help You Comply with Title 24

Designers can specify and use the following JM roofing membranes or coatings, which are Title 24 compliant:

- *BUR and SBS CR* white mineral-surfaced, white acrylic-coated cap sheets. The unique surfacing provides protection to the underlying asphalt and membrane, as well as the benefit of a reflective, emissive surface.
- *JM PVC with Elvaloy* white, single ply roofing membranes.
- *JM TPO* white, single ply membrane systems.
- *TopGard 4000 and TopGard 5000* white acrylic coatings: These coatings may be applied directly over BUR, SBS and APP membranes. They must be applied at a rate to achieve a minimum dry mil thickness of 20 (0.02 in.). The physical properties of these JM coatings meet all ASTM minimum performance requirements, as specified by the CRRC.

Further Questions Regarding Title 24

How do I know products meet the Title 24 standards?
Title 24 requires that roofing products be tested through the CRRC and labeled accordingly. However, the label alone does not mean the product is compliant. Look for the actual minimum 3-year aged reflectivity and emissivity values listed on the label. Products must meet minimum 3-year aged reflectivity of 0.55, 0.75 emissivity and SRI of 64 to be compliant under the Prescriptive Approach. If there is no 3-year aged reflectivity value, the Title 24 formula can be used. This applies to low-slope nonresidential (climate zones 1-15), low-slope guest rooms of hotel/motels (climate zones 10-11, 13-15) and low-slope relocatable public school buildings. Or, use the SRI calculator on the Title 24 Web site.

What products already meet the standard?
Some single ply products including PVC and TPO roofing membranes and BUR-type bituminous roofs that have white coatings applied meet the standard. It is important to note that just because a product is white, it does not mean it meets the standard. It must have been tested by the CRRC and have appropriate labeling. The label must indicate that the emissivity and 3-year aged reflectivity of that particular product meet the standard.

Can roof coatings be used to meet the emissivity and reflectivity standards?
Yes, look for the label with the tested values.

How will customers know if a roof meets these standards?
Every roofing product must have a product label that lists the 3-year aged reflectivity, emissivity and SRI testing results for the product.

Are there any exempt roofing products?
Exceptions to Prescriptive Requirements for low-sloped, nonresidential:

- Wood-framed roof assemblies in climate zones 3-5, exempt if roof assembly has a u-factor of 0.039 or lower
- Metal framed in climate zones 3-5, exempt if u-factor 0.048 or lower
- Roof covered by building-integrated PV panels
- Thermal mass has weight of at least 25 lb/ft^2

What alternatives are there to installing a roof that meets these standards?
Nonmandatory design features can be substituted as long as the overall building energy budget results are the same or better energy savings than the proposed budget. Depending on what is being altered, the overall envelope approach under the prescriptive method or the performance approach may be used. Remember, proof of compliance is required for all methods.

Building owners, architects or contractors may prepare building-specific designs that save equal or greater energy and include roofs that do not meet the standards. However, they must submit the proposed designs, as well as use certified software to model the changes, for Code Official Review. If the Code Official agrees that the proposed designs are more energy efficient than mandatory requirements, the building can be built following those plans.

Does the product on my roof have to be maintained to meet the reflectivity and emissivity ratings?
No. There is no requirement in Title 24 mandating that building owners maintain the initial reflectivity and emissivity ratings. However, JM recommends routine maintenance as part of good roofing practices.

What if the roofing product I want to use does not have the CRRC designation on the packaging?
If a product is not listed with the CRRC, Title 24 requires that default values of 0.10 for 3-year reflectivity and 0.75 for thermal emissivity be used.

What are my energy savings going to be?
Savings will vary on a number of factors, such as your building type, number of stories, windows used, insulation products used, etc. There are calculators available that can help building owners understand potential savings, including the U.S. Department of Energy (DOE), Oak Ridge National Laboratory and EPA Lawrence Berkeley National Laboratory calculators. See the "Helpful Web Sites" Section for more information.

Can I use "Green Roofs"?
Vegetative roofs are currently not written into the legislation specifically. Depending on the situation, the overall envelope approach under the prescriptive method or the performance method could be used to compensate for this design.

Do current white granule cap sheets meet the requirement?
Most do not, but there are factory-coated granulated cap sheets that comply.

Is there a significant difference in reflectivity and emissivity between PVC, TPO and coated roofs?
No. Reflectivity and emissivity are surface properties, unrelated to what is underneath.

Is there a significant difference in similar product categories between manufacturers?
The CRRC posts all manufacturers' test results on its Web site. Generally speaking, white membranes or surfaces have results that meet the Title 24 requirement.

Does the emissivity vary a great deal between coated BUR, coated SBS and coated APP?
No. Reflectivity and emissivity are surface properties, unrelated to what is underneath.

Do thermoplastics retain their reflectivity and emissivity qualities longer than the coating?
It depends on the durability of the thermoplastics and of the coating.

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A Close Look at ENERGY STAR

What It Is and Why It's Important to Roofing
The EPA's ENERGY STAR program, created in 1992, is helping to conserve energy in countless ways. ENERGY STAR is a voluntary labeling program designed to identify and promote energy-efficient products – including roofing products.

Energy savings is critical to preserving the environment. The less energy we consume, the less fossil fuel we must burn to create the energy. The less fossil fuel we burn, the less smog we produce, the less acid rain falls and the less adverse environmental effects we cause. Additionally, as businesses and government agencies everywhere have discovered, saving energy saves money.

Products that have qualified for ENERGY STAR will bear its label on both packaging and in advertising. To earn the ENERGY STAR label, products must meet strict energy-efficiency criteria set by the EPA or the U.S. Department of Energy. ENERGY STAR-labeled roofing products must be very efficient at reflecting the sun's rays. In so doing, they contribute to lower rooftop surface temperatures. Lower temperatures will decrease the amount of heat transferred into a building and reduce membrane surface temperatures by as much as 100˚F (www.energystar.gov). If you are installing a new roof or replacing an old roof on a commercial building, be sure to ask your roofing contractor or manufacturer about ENERGY STAR.

To bear the ENERGY STAR label, roofing products for low-slope roofs must have an initial reflectivity greater than or equal to 0.65. After three years of exposure, the reflectivity must still be greater than or equal to 0.50.

ENERGY STAR emissivity levels are not required at this time; however, manufacturers are required to test and report emissivity levels following appropriate test procedures.

How ENERGY STAR Benefits the Roofing Industry
By specifying and installing roofing products with the ENERGY STAR label, owners and design teams can reap many benefits. Most obvious are the cost savings that can be achieved by reducing the amount of energy needed for cooling. According to the EPA, approximately $40 billion is spent annually in the U.S. to air-condition buildings, which is one-sixth of all electricity generated in a year. ENERGY STAR roofing products reduce the amount of air conditioning needed and can reduce energy bills.

The level of savings will depend on the geographic location and climate. Buildings located in hot, sunny climates will realize the greatest reduction in cooling cost. Savings also depend on existing insulation levels in the building, the type of roof being replaced, the type of roof installed, and how well the roof is kept clean and maintained.

It also increases roof product life. Roofing products that qualify for ENERGY STAR maintain a more constant temperature and help prevent thermal shock that occurs when cool rain hits a hot roof. With such sudden temperature changes, roofing materials can expand and contract, causing stress and degradation of the roof.

Due to a roof's normal wear and tear, some degradation of roof reflectivity can be expected, particularly within the first few years. Low-slope roofs may accumulate more dirt and debris because they're not as easily washed by rain. Ongoing roof maintenance can minimize degradation and maximize energy savings.

Finally, roofing products that meet ENERGY STAR requirements and carry the ENERGY STAR label are helping owners and design teams comply with mandatory standards and/or rating systems that are now becoming commonplace in states and cities across the nation.

How JM Can Help You with Your ENERGY STAR Project
JM roofing systems can help give your company a competitive edge when working with corporations, universities and government agencies that are working to provide green buildings for better work environments and that cost less to operate.

With their high reflective properties that help improve the energy efficiency of buildings, the following JM roofing products have earned the ENERGY STAR label:

- TopGard 4000 and TopGard 5000 acrylic coatings: to secure heat-island and energy-performance credits with systems that have ENERGY STAR ratings and high emissivity ratings.
- JM PVC with Elvaloy KEE white single ply roofing systems help secure heat-island and energy-performance credits with systems that have ENERGY STAR ratings and high emissivity ratings.
- BUR and SBS CR white mineral-surfaced, white acrylic-coated cap sheets that have ENERGY STAR ratings and high emissitivity ratings.

The Role of Roof Insulation
ENERGY STAR energy-efficiency criteria do not include a specification for roof insulation. However, roof insulation plays an important role in any building's energy consumption – both for heating and cooling. By using polyisocyanurate foam roofing insulation, such as ENRGY 3®, in combination with highly reflective and emissive surface products, significant energy savings can be achieved.

JM Single Ply Roofing Systems

JM EPDM, JM PVC and JM TPO
Often called "single ply," JM EPDM, JM PVC and JM TPO membranes are actually made of two plies laminated together. These products are available in several thicknesses. JM EPDM, JM TPO and JM PVC membranes can be installed via various methods: ballasted, fully adhered or mechanically fastened. See manufacturers' recommendations.

Energy and the Environment
JM PVC and JM TPO are generally white – though ENERGY STAR Sandstone and Grey are now available – and deliver high reflectivity and emissivity without a coating. Thus, JM PVC and JM TPO can help keep buildings cool and cut energy consumption, thereby reducing power bills and minimizing the "urban heat island effect."

In regions of the U.S. that mandate cool roofs, black JM EPDM must be coated. JM offers white acrylic coatings to meet this need.

JM EPDM

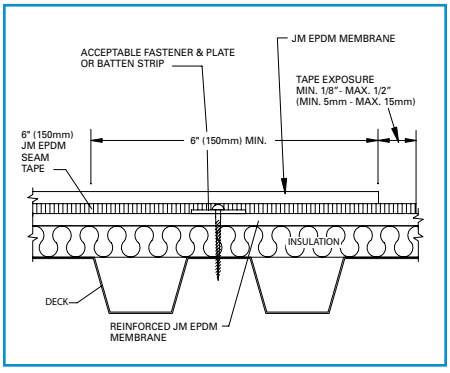
- Highly flexible
- Dimensionally stable
- Available in reinforced product
- High UV resistance
- Relatively low cost
- Butyl tapes or adhesives used for seaming
- Generally black in color – can be coated for reflectivity

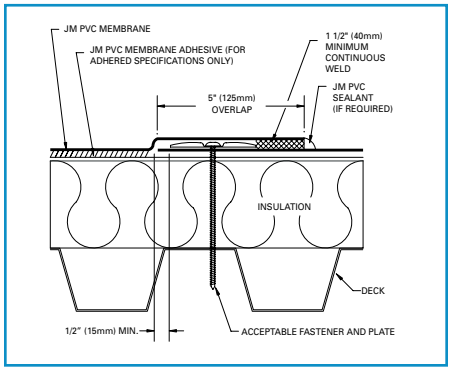
JM PVC with Elvaloy KEE

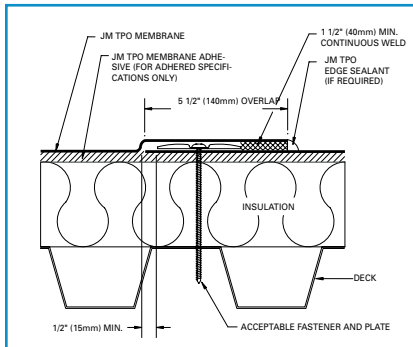
- Uses Elvaloy KEE from DuPont for added long-term flexibility
- Inherently fire-resistant
- High puncture and tear resistance
- Energy-efficient white color for reflectivity
- Strong heat-welded seams
- Resistant to chemicals and grease
- Solid phase, non-migrating polymer extends roof's life

JM TPO

- Fire-resistant
- Energy-efficient white color for reflectivity
- UV inhibitors increase longevity
- Polyester-reinforced
- Strong heat-welded seams
- Flexible without containing plasticizers
- Resistant to chemicals and grease







Johns Manville

Bituminous Products

BUR - GlasKap CR, GlasBase™ Plus, GlasKap®, GlasPly® IV, GlasPly® Premier and Ventsulation® Felt
A BUR system is made of multiple plies of reinforcement laminated together with bitumen (hot asphalt), a highly reliable waterproofing method.

SBS – DynaBase®, DynaClad™, DynaKap™, DynaFlex™, DynaGlas®, DynaGrip™, DynaLastic®, *JM*CleanBond® DynaFlex® CR, DynaGlas® FR CR, DynaKap® FR CR, DynaLastic® 180 FR CR, DynaLastic® 250 FR CR, DynaWeld® Cap FR CR
SBS membranes are made of SBS rubber-polymer modifiers combined with a premium asphalt flux. This asphalt-blended coating produces a highly durable roof in an extreme environment.

APP – APPeX®, BICOR™, TRICOR™ and TRICOR™ M FR CR
APP membranes are made of plastic-polymer modifiers combined with asphalt to provide a tough material with good weathering properties and are ideal for hot, desert climates.

Energy and the Environment
In regions that mandate cool roofs, multiple-ply roofing products can be used. CR cap sheets are factory-coated and cool roof compliant. Other asphaltic systems can be used with a coating; JM's TopGard 4000 and TopGard 5000 acrylic coatings are ideal for these applications.

BUR

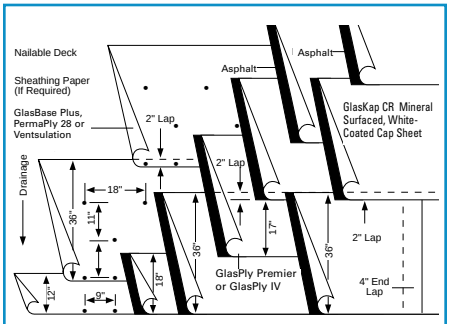
- Multi-ply application
- Widespread and long-term use
- Reliable waterproofing through multiple layers
- Field-fabricated waterproofing

SBS

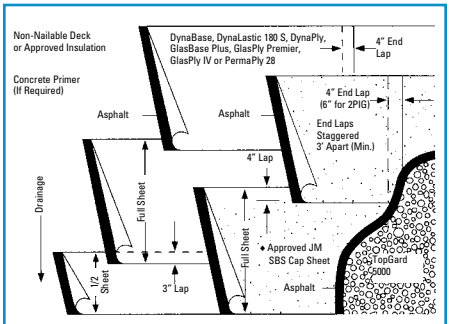
- Durable under extremes in high and low temperature extremes
- Self-adhering, heat-welded, cold-applied or hot-mopped installation
- Heat-welded products have applicator-friendly, burn-off films for proper adhesion to substrate
- Waterproofed in the manufacturing process

APP

- Heat-welded application for sites with rooftop obstacles
- Can be applied with cold adhesive
- Applicator-friendly burn-off films for proper adhesion to substrate
- Waterproofed in the manufacturing process



4GNC-CR



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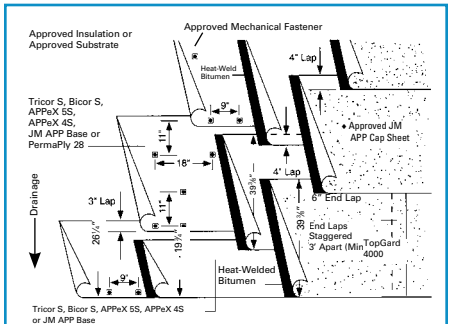


3CBN-W/3PBN-W

WATER FIRE NAIL WIND

Johns Manville

CR Cool Roof Cap Sheets – the Easiest Way to Title 24 Compliance

When compliance with California's Title 24 regulations is required, and a bituminous roofing system is preferred, there is no easier solution than JM's CR sheets.

CR cap sheets are white mineral-surfaced, and white acrylic-coated. They are used as the uppermost finish ply in a variety of built-up and SBS roofing systems. The unique, UV-resistant coating provides extra protection to the membrane and underlying asphalt. It provides a reflective, emissive surface that meets California's Title 24 and LEED requirements.

With reflectivity rated at 0.76 and emissivity rated at 0.85, CR cap sheets meet all requirements for compliance with California's Title 24 regulations and qualifies for LEED points. CR cap sheets have strong UL and FM ratings for both fire and wind uplift.

Title 24
This product meets California Title 24 reflectivity & emissivity requirements.

CRRC COOL ROOF RATING COUNCIL MEMBER

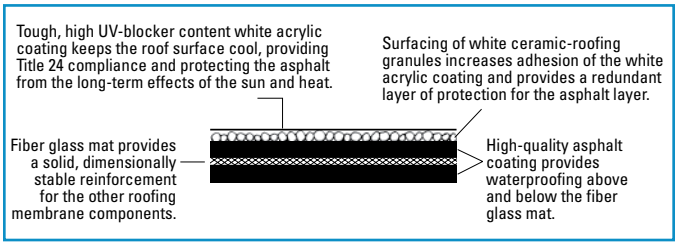
FM APPROVED

CLASSIFIED UL US

ENERGY STAR

Before CR cap sheets, the options for achieving Title 24 compliance included applying a field coating over an asphalt system, or switching to a TPO or PVC single ply system. Now with CR cap sheets, you have a sheet that is manufactured by Johns Manville with full Title 24 compliance and installs like standard BUR and SBS cap sheets.

CR cap sheets meet Title 24 requirements through the standard prescriptive approach, which means a specifier, contractor or building owner need only show that each building product meets or exceeds the prescriptive requirement. JM provides the product and the documentation.

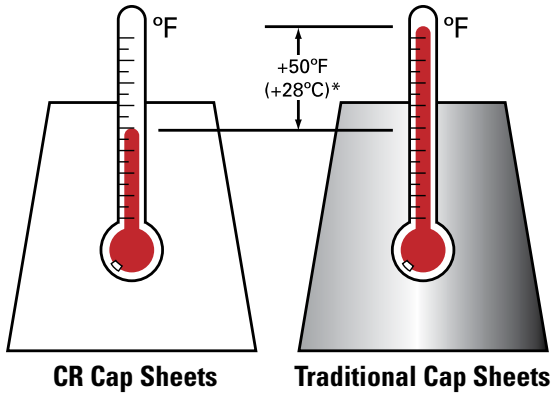


The peace of mind that comes with the long, solid history of bituminous roof systems
The relatively recent development of single ply, self-adhering and other roofing systems has brought many benefits to the building and roofing industries. Many owners, specifiers and contractors are still most comfortable with the multi-ply redundancy of an asphalt bituminous roofing system.

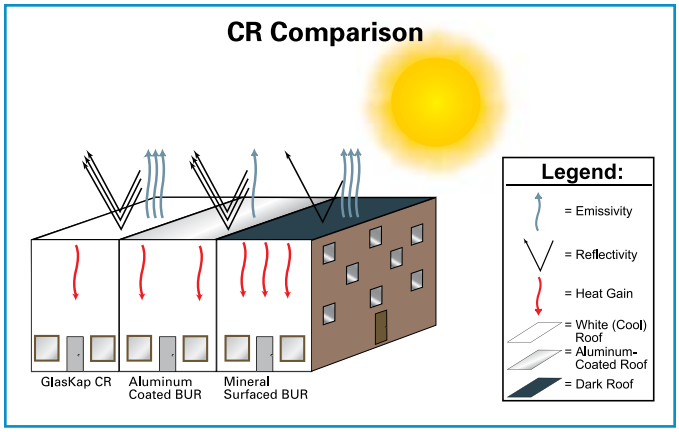
CR cap sheets have an enhanced top surface for added toughness and are Title 24-compliant. The white acrylic coating is factory-applied over the mineral granules, increasing the coatings adhesion while retaining the granules' protective benefits.

Brighter and Whiter – To Keep the Roof Cooler
The greater reflectivity and emissivity of GlasKap CR means the roof stays cooler, consumes less energy and reduces demand during peak periods. The more solar energy reflected back to the sky and heat shed from the surface causes less heat to be transferred into the building.

CR Cap Sheets vs. Traditional Cap Sheets



* Estimate, California Energy Commission Consumer Energy Center Web site
Graphic is representative of potential range/drop using reflective/emissive surface products.



Combining highly reflective and emissive roof surfacing with the proper amount of roof insulation can significantly reduce heat gains inside the building. Keeping the roof cooler also has other advantages, as well. It helps prevent thermal shock: the sudden, drastic change in roof temperature that can cause membrane fatigue.

More Consistent Quality Than Field-Applied Coating
With CR cap sheets, the quality is built in during the production process. A computer-controlled machine meters the application rate. The coating is evenly applied to the proper thickness over every square inch of the membrane. During manufacture, the coating is dried under controlled conditions, whereas field-applied coating may be exposed to adverse temperature, humidity or moisture before curing.

In addition, the factory-applied coating has 300 percent of the UV blockers of a regular field-applied white coating. It simply does a better job protecting the membrane, slowing oil exudation from the plies and helping the roof perform like new longer.

Lower Installed Cost Than Field Coating
Labor costs are lower because it doesn't take as long to install CR cap sheets as it takes to apply two layers or 3 to 4 gallons of coating. When you install CR cap sheets, the job is done. Expensive spray equipment is no longer necessary. And you don't have to return 30 to 60 days later to apply the coating, as with many field-applied coatings.

Additionally, the consistent quality of the factory-applied coating means fewer costly call-backs. And, with CR cap sheets, the life of your bituminous system is extended due to greater UV protection and the reduced frequency of problems caused by thermal shock.

Simple Touch-Up and Repair
CR cap sheets comply with Title 24 and LEED even if there is some bleed-out or tracking during installation. To ensure a more aesthetically pleasing roof, end laps and side laps can be touched-up easily using JM CR Seam Coating. If there is any damage to the roof after installation, repairs can be made easily with standard methods.

Availability
CR cap sheets are readily available in full truck quantities nationwide. It is manufactured by Johns Manville in our Oklahoma City plant, and are stocked at both our South Gate (Los Angeles) and Stockton locations. They are available from JM distributors throughout the United States.

Energy and the Environment

CA Title 24 (CRRC) Compliant	Reflectivity 0.76	Emissivity 0.85
ENERGY STAR	Initial Reflectivity 0.76	3-yr. Aged Reflectivity 0.61
LEED	Recycled Content: 0%	SRI 92
	Producing Locations: Oklahoma City, OK	

* Three-year reflectance still pending

Precautions
Refer to the material safety data sheet and product label prior to using these products.

Johns Manville's Peak Advantage® Guarantee
- Up to 20-Year No Dollar Limit (NDL) Guarantee available
  - Same systems as 10, 15 or 20-Year NDL with standard cap sheets
  - Use CR series of details or other approved JM details

WATER FIRE NAIL WIND

Johns Manville

Spotlight on JM TopGard Acrylic Coatings

These highly reflective, water-based acrylic coatings have been carefully designed to meet the toughest requirements in the growing list of energy and environment-related regulations and standards.

JM's TopGard coatings qualify for the ENERGY STAR label, and meet all requirements for compliance to California's Title 24 regulations and the USGBC's LEED (Leadership in Energy and Environmental Design) program.

In addition to significant energy savings, particularly in the reduction of peak demand for cooling, TopGard's high emissivity helps combat the "urban heat island effect," which can cause city temperatures to be 2°F (-17°C) to 8°F (-13°C) higher than the surrounding countryside.

TopGard coatings may be used over any bituminous roofing system, smooth or granulated, to help provide seamless waterproofing, long-term energy savings and prolonged roof life.

TopGard coatings meet or exceed all performance standards contained in ASTM D 6083. Carefully formulated with high-quality, 100 percent acrylic polymer, TopGard coatings have the high strength, elongation and adhesion properties that cannot be found among products composed of copolymers or those weakened by high pigment volume content. And they offer excellent protection against premature weathering due to ultraviolet rays from the sun.

Installing TopGard Coatings for Superior Results Over Modified Bitumen or BUR Systems

With proper installation, TopGard coatings will provide excellent performance. Installation should not be performed without following the complete guide specifications. For best results, some of the most important considerations are listed as follows:

Storage and Handling. Coatings must be stored between 40°F (4°C) and 100°F (38°C). If conditions exceed these ranges, special precautions must be taken to avoid damage. Do not store at high temperatures in direct sunlight.

Project Conditions. Surface must be clean, dry and free of any dirt, grease, oil or other debris that may interfere with proper adhesion. Temperatures must be 50°F (10°C) and rising during time of application. Do not apply within 24 hours of anticipated rain, dew or freezing temperatures.

Preparation. Ensure that surface is clean, sound, dry and free of any materials that could inhibit adhesion. Achieving this condition may require the use of an industrial cleaner such as TSP (trisodium phosphate), scraping, power brooming, vacuuming or other means performed by observing responsible trade practices. If a cleaner is used, scrub the entire surface vigorously with a stiff-bristled broom, paying particular attention to low areas. Allow the solution to stand approximately 5 minutes. Before it dries, wash thoroughly with clean water and repeat as necessary to remove all traces of the cleaning solution. Please note: any existence of talc or other separator agents on the bitumen is not acceptable.

If a roof has been previously coated with an aluminized asphalt, check for proper adhesion after cleaning. To test proper adhesion, apply a piece of masking tape to the cleaned membrane and peel it back up. If any of the aluminized coating comes up, the roof must be re-cleaned prior to installing TopGard products.

All roof penetrations, mechanical equipment, cants, edge metal and other on-roof items must be in place and secure. All drains must be clean and in working order. All air-conditioning and air intake vents must be closed or suitably protected. All cracks, voids, holes or other surface imperfections must be repaired with at least 24 hours of drying time.

Equipment. TopGard products may be installed with a roller or airless spray equipment, with spray equipment being preferred. JM recommends the Graco® GH-5030 pump or Graco® GM-7000 pump, with a Reverse-A-Clean® tip, sized between .033 inch to .045 inch (Registered trademarks of Graco, Inc., Minneapolis, MN.)

Application. Apply two coats of TopGard product, both at the rate of 1.5 gallons per 100 square feet. TopGard Base is used as the base coat when the roofing system is new and/or if ponding water is an issue. TopGard 4000 is used as the base when a new roofing system has had at least 90 days to cure. After thorough drying of the first coat (normally 12 hours), the second coat is applied using a cross-hatch technique. *TopGard Base must always be used as the first coat when applying TopGard products over APP (Atactic Polypropylene) membranes.*

Inspection. Inspection by a JM representative must be made to verify the proper installation of the system. Any areas that do not meet the minimum standards for application as specified shall be corrected at the contractor's expense. Heavy puddles of the coating are not acceptable.

Extending Roof Life Through Sound Maintenance and TopGard Re-coating

It's important to inspect your coated roofing system every spring and fall, after storms, and after HVAC servicemen or other tradesmen have been on the roof. Make sure all drains and scuppers are clean and free of debris. Repair any HVAC leaks that may be discharging condensate or water onto the roof. Inform a JM technical representative and engage an approved roofing contractor to provide proper repairs and sealing of any damage, new penetrations, openings or new equipment.

As the coating system approaches 7 years old, assess its condition. As needed, schedule a thorough roof cleaning, consisting of water, a mild soap solution and a soft-bristle broom. Then, apply a full re-coat with the desired TopGard product.

These procedures will not only extend the life of your roofing system, but also help preserve its energy-saving properties.

Availability
TopGard 4000, 5000 and Base are available in 5-gallon pails, 55-gallon drums and 275-gallon totes. The product is currently stocked in southern California. If shipping to the East Coast in spring or fall, additional shipping precautions may be required resulting in increased freight charges.

TopGard 4000 Technical Data

Type of Roof	Coverage Rate (per coat) (100 sq ft)
Fiber glass felts	1 - 1½ gal (3.8 - 5.7 l)
Smooth-surface modified sheets	1 - 1½ gal (3.8 - 5.7 l)
Granulated-surface BUR/modified sheets	1½ - 2 gal (5.7 - 7.6 l)

Note: When TopGard 4000 is applied as a two-coat process, total cured coating thickness will be approximately 20 mil.

Packaging

5-gallon pails (approximate weight: 60 lb [27.2 kg])
55-gallon drums (approximate weight: 689 lb [312.5 kg])
275-gallon totes (approximate weight: 3,370 lb [1,528.6 kg])

Tested in Accordance to ASTM D 6083 Physical Properties

Physical Property	Result
Initial Tensile Strength (psi)	270
Initial Elongation (%)	260
Dry Adhesion (pli)	6.5
Wet Adhesion (pli)	5.0
Tear Resistance (lbf/in.)	100
1,000-hr Accelerated Weathering	No Cracking or Checking
Elongation After Accelerated Weathering (%)	220
Permeance (perms)	12
Water Swelling (%)	26
Fungi Resistance (Zero = No Growth)	Zero
Volume Solids (%)	52 ± 1
Weight Solids (%)	66 ± 1
Viscosity (KU)	110 ± 10
Density (lb/gal)	11.9
Nonvolatiles (%)	66 ± 1

TopGard 5000 Technical Data

Type of Roof	Coverage Rate (per coat) (100 sq ft)
Fiber glass felts	1 - 1½ gal (3.8 - 5.7 l)
Smooth-surface modified sheets	1 - 1½ gal (3.8 - 5.7 l)
Granulated-surface BUR/modified sheets	1½ - 2 gal (5.7 - 7.6 l)
SPF/Metal	1½ - 2 gal (5.7 - 7.6 l)

Note: When TopGard Base is used in conjunction with TopGard 5000 as a two-coat process, total cured coating thickness will be approximately 20 mil.

Packaging

5-gallon pails (approximate weight: 60 lb [27.2 kg])
55-gallon drums (approximate weight: 673 lb [305.3 kg])
275-gallon totes (approximate weight: 3,290 lb [1,492.3 kg])

Tested in Accordance to ASTM D 6083

Physical Property	Result
Initial Tensile Strength (psi)	235
Initial Elongation (%)	245
Dry Adhesion (pli)	8.5
Wet Adhesion (pli)	3.5
Tear Resistance (lbf/in.)	80
1,000-hr Accelerated Weathering	No Cracking or Checking
Elongation After Accelerated Weathering (%)	230
Low-Temperature Flexibility After Accelerated Weathering	Pass
Permeance (perms)	15
Water Swelling (%)	10
Fungi Resistance (Zero = No Growth)	Zero
Volume Solids (%)	55 ± 1
Weight Solids (%)	69 ± 1
Viscosity (KU)	120 ± 10
Density (lb/gal)	11.8
Nonvolatiles (%)	69 ± 1

Johns Manville

Appendix

Glossary of Terms

Addition
Any change to a building that increases conditioned floor area and conditioned volume. See also, "Newly Conditioned Space."

Albedo
Albedo is another word for reflectivity. A roofing product that has high reflectivity has high albedo.

Alteration
Any change to a building's water heating system, space conditioning system, lighting system or envelope that is not an addition. See also, "Addition."

Alternative Calculation Method (ACM)
Different approved techniques for calculating a building's energy performance including: The California Energy Commission's public domain computer programs, one of the Commission's simplified calculation methods or any other calculation method approved by the Commission.

APP (Atactic Polypropylene)
A group of high molecular-weight polymers formed by the polymerization of propylene. APP is used as a modifier to asphalt flux to improve performance qualities of the asphalt.

ASHRAE
The American Society of Heating, Refrigerating and Air-Conditioning Engineers.

ASTM
The American Society for Testing and Materials.

Building Envelope
The exterior and demising partitions of a building that enclose the conditioned space; sometimes called just "Envelope."

Btu
British thermal unit. The amount of heat required to raise the temperature of one pound of liquid water by one degree on the Fahrenheit scale.

BUR (Built-Up Roofing)
A roof membrane consisting of layers of bitumen, which serves as the waterproofing component, with plies of reinforcement fabric installed between each layer. The reinforcement material can consist of bitumen-saturated felt, coated felt, polyester felt or other fabrics. A surfacing is generally applied and can be asphalt, aggregate, emulsion or a granule-surfaced cap sheet.

CABEC
The California Association of Building Energy Consultants.

CEC
The California Energy Commission.

Climate Zones
The 16 geographic areas of California for which the CEC has established typical weather data, prescriptive packages and energy budgets. Climate zone boundary descriptions are in the document, "California Climate Zone Descriptions," July 1995.

Coatings
Products, such as water-based acrylic, soy, etc., that can be field-applied with a brush, roller or spray equipment over a roofing system for purposes of weatherproofing and/or increasing reflectivity and emissivity.

Condition
To equip (as a building) with an apparatus for washing air and controlling its humidity and temperature.

Conditioned Floor Area (CFA)
The floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

Conditioned Space
Space in a building that is directly conditioned, indirectly conditioned or semi-conditioned.

Conditioned Volume
The total volume (in cubic feet) of the conditioned space within a building.

Cool Roofs
A roof with reflective and emissive properties that help improve the energy efficiency of the building and/or mitigate the "urban heat island effect."

CRRC
The Cool Roof Rating Council is the sole supervising entity for the standards and testing of Title 24-compliant roofing products. It is responsible for administering the certification program relating to reflectivity and emissivity ratings for those roofing products.

Design Heat Gain Rate
The total calculated heat gain through the building envelope under design conditions.

Design Heat Loss Rate
The total calculated heat loss through the building envelope under design conditions.

Directly Conditioned Space
An enclosed space that is provided with wood heating or mechanical heating that has a capacity exceeding 10 Btu/(hr•ft^2), or mechanical cooling that has a capacity exceeding 5 Btu/(hr•ft^2).

Elvaloy KEE
Elvaloy KEE (ketone ethylene ester) from DuPont is an advanced, solid phase, non-migrating thermoplastic polymer. When used in a roofing membrane, it enables the membrane to stay flexible and easy to maintain.

Emissivity
Infrared emissivity (or emittance) is a measure of the ability of a surface to shed some of its heat (in the form of infrared radiation) away from the surface (i.e., roofing membrane). High infrared emissivity helps keep surfaces cool. Metallic surfaces have a low infrared emissivity.

Energy Efficiency Ratio (EER)
The ratio of net cooling capacity (in Btu/hr) to total rate of electrical energy (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the California Appliance Efficiency Regulations.

Energy Factor (EF)
The ratio of energy output to energy consumption of a water heater, expressed in equivalent units, under designated operating conditions over a 24-hour-use cycle, as determined using the applicable test method in the California Appliance Efficiency Regulations.

ENERGY STAR
A voluntary labeling program developed by the Environmental Protection Agency to identify and promote energy-efficient products, including roofing products.

EPDM (Ethylene-propylene-diene monomer)
Commonly known as a thermoplastic rubber membrane with high tear strength that can be cross-linked by both peroxides and sulfur, EPDM falls into the category of single ply roofing.

Gross Exterior Roof Area
The sum of the skylight area and the exterior roof/ceiling area.

Heat Flux
The amount of energy flowing through any surface of one square meter per second.

Infiltration
Uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and holes, around windows and doors, and through any other exterior or demising partition, pipe or duct penetration.

LEED
Leadership in Energy and Environmental Design is the U.S. Green Building Council's (USGBC) green building rating system. The objective of LEED is to decrease the energy consumption and environmental impact of buildings.

Low-e Coatings
Low emissivity metallic coatings for roofs.

Newly Conditioned Space
Any space being converted to directly conditioned or indirectly conditioned space. Newly conditioned space must comply with the requirements for an "Addition" in the California Title 24 regulations.

Nonresidential Building
A building is considered nonresidential when it has a low-sloped roof (slope less than 2:12), and is mechanically air-conditioned or heated. Some examples of nonresidential buildings include: office buildings, grocery stores, restaurants, assembly/conference areas, commercial/industrial warehouses, schools, churches, theaters, hotels and motels. Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Part 6.

Nonresidential Manual
The manual developed by the California Energy Commission, under Section 25402.1(c) of the Public Resources Code, to aid designers, builders and contractors in meeting the energy-efficiency requirements for nonresidential, high-rise residential and hotel/motel buildings.

PVC (Polyvinyl Chloride)
A thermoplastic polymer that can be compounded into flexible and rigid forms through the use of plasticizers, stabilizers, fillers and other modifiers. Rigid forms are used in pipes, and flexible forms are used in the manufacture of sheeting and roof membrane materials. PVC falls into the category of single ply roofing.

Reflectivity
Solar reflectivity (or reflectance) is the fraction of the solar energy that is reflected by the surface (i.e., roofing membrane) back to the sky. White membranes have the highest solar reflectivity, while black has the lowest.

SBS (Styrene-Butadiene-Styrene)
A group of high-molecular-weight polymers. SBS is used as a modifier to asphalt flux to improve performance qualities of the asphalt.

Semi-Conditioned Space
An enclosed nonresidential space that is provided with wood heating, cooling by direct or indirect evaporation of water, mechanical heating that has a capacity of 10 Btu/(hr•ft^2) or less, mechanical cooling that has a capacity of 5 Btu/(hr•ft^2) or less, or is maintained for a process environment as set forth in the definition of "Directly Conditioned Space."

Solar Heat Gain Coefficient (SHGC)
The ratio of the solar heat gain entering the space through the window area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted or convected into the space.

Solar Reflective Index (SRI)
The Solar Reflective Index is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. SRI combines reflectance and emittance into one number.

SpecRight
The SpecRight Program was developed by NRCA and other industry partners with the ultimate goal of providing useful and consistent information about roofs, energy and the environment to building owners, designers and consultants.

Title 24
The California regulations that set energy-efficiency design and construction standards for residential and nonresidential buildings in California.

TPO (Thermoplastic Olefin)
A synthetic that becomes soft and pliable when heated, without changing its intrinsic properties. TPO falls into the category of single ply roofing.

Urban Heat Island Effect
Building and pavement construction materials and high-density structures that cause cities to actually become 2ºF (-17°C) to 8ºF (-13°C) warmer than the surrounding countryside.

U-Value
The overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr•ft^2•°F), including air-film resistance at both surfaces.

Web Sites

Helpful Information Web Sites

American Institute of Architects (AIA) ..... www.aia.org
California Association of Building Energy Consultants (CABEC) .... www.cabec.org
California Energy Commission (CEC) ..... www.energy.ca.gov
Construction Specifications Institute (CSI) ..... www.csinet.org
Cool Roof Rating Council (CRRC) ..... www.coolroofs.org
Cool Roof Solutions ..... www.jmcoolroofs.com
Lawrence-Berkeley National Laboratory. ..... www.lbl.gov
National Roofing Contractors Association (NRCA) ..... www.nrca.net
Oak Ridge National Laboratory. ..... www.ornl.gov
Roof Consultants Institute (RCI) ..... www.rci-online.org
U.S. Green Building Council (USGBC). ..... www.usgbc.org

Cool Roof Information

BOMA International and Real Win-Win Partner
on Energy Rebate and Efficiency Programs ..... www.energyvortex.com
Database of State Incentives for Renewable Energy (DSIRE) .... www.dsireusa.org
PositivEnergy - Community Energy Conservation ..... www.pstvnrg.com
State of California: California Energy Commission -
Programs & Funding ..... www.energy.ca.gov
State of California Consumer Energy ..... www.consumerenergycenter.org
Energy Star ..... www.energystar.gov

Sustainable Design, Energy-Efficient Products and General "Green" Information

Building Industry Professionals for
Environmental Responsibility ..... www.biperusa.org
Environmental Building News. ..... www.buildinggreen.com
Green Building Concepts ..... www.greenconcepts.com
Green Building Council ..... www.usgbc.org
Green Building Links ..... www.ciwmb.ca.gov
Oikos: Green Building Source ..... www.oikos.com
Residential Environmental Design ..... www.reddawn.com
The EcoGateway - Green Design and Building Links ..... www.ecoiq.com

Building Codes, Research and General Information

Building Operating Management ..... www.facilitiesnet.com
California Energy Commission ..... www.energy.ca.gov
California State Rebate Program ..... www.coolroofs.info
Cool Roof Rating Council ..... www.coolroofs.org
Florida Solar Energy Center ..... www.fsec.ucf.edu
National Institute of Standards and Technology ..... www.bfrl.nist.gov
PositivEnergy - Community Energy Conservation ..... www.pstvnrg.com
Rocky Mountain Institute ..... www.rmi.org
San Diego Regional Energy Office ..... www.sdenergy.com
Single Ply Roofing Institute ..... www.spri.org
State of California Consumer Energy ..... www.consumerenergycenter.org
The Architectural Catalog ..... www.arcat.com

PRODUCT WARRANTIES

Johns Manville designs roofing products that work together to provide a one-source comprehensive roofing system solution. Total roofing system guarantees are available under the JM Peak Advantage® Guarantee program. To learn more about our standard guarantee terms and conditions, visit our Web site at www.jm.com or talk to your local JM sales representative.

JM Peak Advantage Guarantees are available only on qualified JM roofing systems containing JM roofing products. JM standard product terms and conditions will apply to include a one-year limited product warranty. Limited product warranty information is available at www.jm.com/About Us/US Terms and Conditions.

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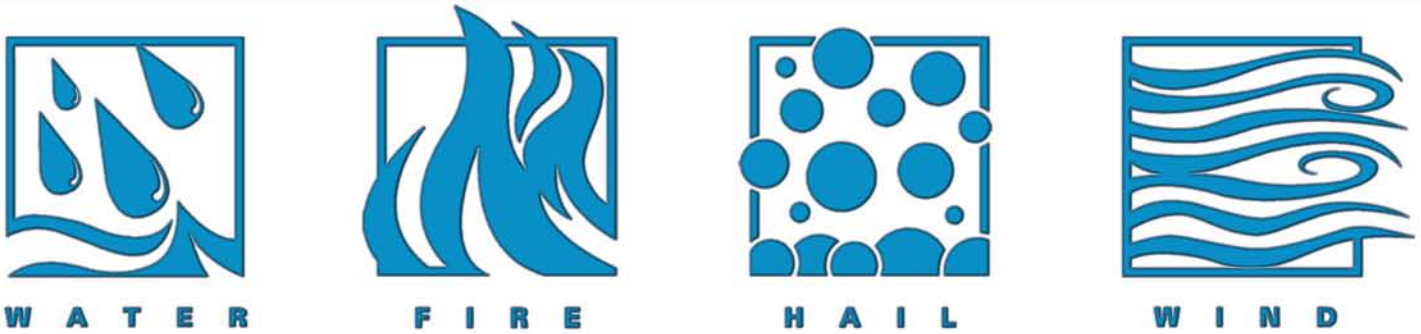

Johns Manville

717 17th St.
Denver, CO 80202
(800) 922-5922
www.jm.com/roofing

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