

Raising the Roof (Performance)

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Highly reflective, field-applied roof coatings have demonstrated the ability to protect the roof surface from the ravages of weather and extend the roof's performance life by reflecting ultraviolet (UV) light that starts the weathering process, reflecting infrared (IR) light that heats up the roof system and accelerates weathering, and shedding water, keeping it away from the original roof membrane so it cannot contribute to weathering.

Focus on energy

Increasingly, highly reflective white roof coatings also play a role in energy management of institutional and commercial buildings. They have been shown to reduce the temperature of a building's black roof surface by 50-70 degrees. Lower roof-surface temperatures can reduce the need for cooling energy in a number of ways.

Lower surface temperatures mean roof insulation conducts less heat into the building, so the demand on chillers drops accordingly. They also translate into lower insulation temperature and increased effective R-value of the insulation.

Coatings can increase the efficiency of heating, ventilation, and air conditioning (HVAC) units mounted on the roof. And, cumulatively in mass in urban locations, they can contribute to lower air temperatures in the immediate vicinity of a building.

For example, rooftops on an entire city block in Philadelphia were coated with highly reflective white coatings, and the surrounding air temperature dropped about 1 degree during periods of summer heat.

Coating chemistry

Reflective roof coatings often are composed of a variety of synthetic elastomers — polymers with the ability to stretch and retain their original configuration — including acrylic, polyurethane, silicone, epoxy, and specialty polymers, such as fluoropolymers. Workers can apply these coatings over a range of common roof surfaces, including metal, asphalt, modified bitumen, plastic membranes such as polyvinylchloride (PVC) and thermoplastic polyolefin (TPO), and rubber materials, such as Hypalon.

When it comes to metal roof systems, an elastomeric reflective coating can reduce the summertime surface temperature from about 160 degrees or higher when uncoated to a surface temperature of about 110 degrees when coated. This 30 percent reduction is

significant because it reduces the thermal shock.

Thermal shock is responsible for premature aging in metal roof systems, as it results in slight separations between panels and around vent pipes and other roof penetrations. If a metal roof system has exposed fasteners, these also will back out as a result of thermal shock. Typically, workers sealed these areas during detail work before installing an elastomeric coating. The coating seals areas of potential water penetration, reflect heat, cool the surface and extend the service life of the metal roof system.

Application issues

Managers must carefully consider several factors in applying highly reflective roof coatings to an existing roof, and applicators must follow good roofing practices. The roof should drain properly, wet insulation should be removed as part of the restoration process, weaknesses or limitations of the original roof system should be corrected, and the roof should be made watertight before the application of the reflective coating.

The coating should be part of a system that specifically supports compatibility and adhesion to the specific, original roof membrane in place. For example, one coating and system specification might be recommended for restoring an EPDM rubber membrane, and another might be designed for restoring a metal roof with a factory applied Kynar coating.

The long-term performance of a reflective coating also might depend on:

- the adhesion and compatibility of the coating with the roof substrate; field adhesion tests might be required.
- proper preparation and cleaning of the roof substrate surface before applying the coating.
- proper application of the coating.

Membrane restoration

For many years, manufacturers touted asphalt resaturants as replenishing the light fractions of asphalt into the bitumen roof membrane. These fractions in the original roof leech out of the membrane during natural weathering and cause the membrane to become brittle and less tolerant of movement associated with the roof.

From a practical perspective, chemical components that leech out during weathering and can be readily reinfused into the membrane via a maintenance coating probably will migrate out in a similar or shorter time frame. So from a practical standpoint, the ideal coating at least would prevent further loss of plasticizers and other key components from the membrane. But if the coating could block UV light, reduce water contact with the membrane and keep the membrane cooler, the roof would last longer.

Roof maintenance

One common question is whether all roofs are maintainable with coatings. They are, if the coating provides some performance property inherent in the roofing membrane that has deteriorated during normal weathering. For example, the coating on a metal roof

might erode during weathering and can be recoated using the appropriate maintenance coating. Even uncoated metal subject to galvanic corrosion can be coated with a corrosion-inhibiting coating to prolong the roof life.

Built-up and modified bitumen roofs subject to surface degradation can be coated to provide additional protection in the form of high-film thickness over weathered and worn areas. If the coating has additional reflective properties, as in the case of aluminized or white coatings, the roof-membrane temperature can be reduced and the membrane's life extended.

As single-ply roofs weather, causing chalking, crazing and checking, technicians also can maintain them with coatings. This coating would be specifically formulated to adhere to the membrane, tolerate the dynamics associated with the installation method — fully adhered or mechanically attached — and have excellent weathering characteristics equal or superior to the membrane chemistry.

A white or light-colored reflective coating applied to a black single-ply membrane will reduce the membrane temperature and, thus, reduce the thermally induced elongation and contraction of the membrane. This process also will reduce the stresses imposed on the mechanical attachments of the roof membrane.

Life-cycle costs

Life-cycle costing is an excellent vehicle for demonstrating that low first cost actually might be more expensive than a premium system when studied over the life of the roof.

Using coatings to prolong the roof has been shown to reduce a roof's life-cycle costs. The longer a roof can remain in place without the need for costly tear off, disposal and disruption of occupants during re-roofing, the lower its long-term cost. Coating and subsequent recoating offer several additional benefits in terms of life-cycle cost.

First, periodic maintenance and recoating gives technicians an opportunity to inspect the roof and determine its condition. The technician then can make necessary repairs while the problems are still relatively small.

Second, coating and recoating — unlike reproofing - adds relatively little dead load to the structural demands of the roof. The typical elastomeric coating applied at 3 gallons per 100 square feet adds merely 24 pounds per 100 square feet when dry. So workers can apply many coats without concern for structural-load issues.

Reflective roof coatings are a useful and complimentary tool in maintaining and sustaining roofs. From the early use of asphalt cutback resaturants to today's high-performance elastomeric coatings, which both protect and provide air conditioning energy savings through solar reflectivity, these coatings have demonstrated significant added value to building managers and owners. •

This special report is provided by the Reflective Roof Coatings Institute, www.reflectivecoatings.org.

Underlying Issue: When To Coat

The subject of applying roof coatings sometimes arises during the design phase of a roofing project, but all too often, the building owner dismisses the application as unnecessary to achieve the immediate need of a watertight building. This decision is generally cost-driven when the owner sees the proposal for the new roof.

If a manager decides to apply a coating during the roof life, the question becomes, “When is the appropriate time to coat the roof?” The obvious answer is, “While it is still possible for the coating to be effective.”

If the roof has significant water entrapped below the membrane, the prudent decision is to tear off that section and replace it with a new membrane. But if the mechanical and structural integrity of the roof membrane is viable, the roof would be a suitable candidate for coating.

The mechanical and structural integrity of the roof membrane refers to its ability to tolerate the mechanical stresses associated with a specific roof under specific design and environmental factors. If the reinforcing mat or scrim in a single-ply roof has deteriorated substantially due to excessive weathering, managers cannot expect an unreinforced coating to have the tensile strength required to maintain the roofing membrane.

Similarly, if the glass or polyester mat of a conventional built-up or modified bitumen roof has deteriorated significantly, the roof might not be suitable for coating. Today’s coatings, without scrim reinforcement, are not capable of providing the tensile strength normally associated with glass and polyester mats.

— *Reflective Roof Coatings Institute*

Spotlight: RRCI

The Reflective Roof Coatings Institute (RRCI) is an organization of elastomeric roof coating manufacturers who promote the highest standards in product performance, application training and product promotion. The institute is involved in the development and research of data through ongoing field-study programs. These programs are focused on the application, performance and value-added benefits roof coatings provide over a variety of roof substrates. For more information, visit www.reflectivecoatings.org.