FLUID-APPLIED ROOF COATINGS

SUBSTRATES, SELECTION, AND APPLICATION

Presented by:

covestro

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LEARNING OBJECTIVES

At the end of this program, participants will be able to:

1. Identify the different types of fluid-applied roof coatings.
2. Explore the advantages and applications of fluid-applied roof coatings.
3. Examine appropriate substrates and surface preparation techniques for fluid-applied roof coatings.
4. Describe reflective roofing requirements and how fluid-applied roof coatings can be used to achieve a reflective roof.

CONTINUING EDUCATION

CREDIT: 1 LU

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By Paige Lozier and Steven Reinstadtler

INTRODUCTION TO FLUID-APPLIED ROOF COATINGS

Note: The terms liquid-applied and fluid-applied roof coatings are often used interchangeably.

Though there are many different types of liquid roofing products on the market, this course is going to focus on those products that qualify as a roof coating. It is important to note that a liquid-applied roofing membrane or coating can itself be the exterior weathering surface, or it may be coated with another UV and weather stable layer.

The National Roofing Contractors Association (NRCA) draws a distinction between what is considered a coating and a liquid-applied roof membrane. According to *The NRCA Roofing Manual: Membrane Roof Systems—2015:*

> *Liquid-applied roof membranes are constructed in place from a liquid resin and reinforcing material. The liquid resin is available as a one- or two-component product and is typically applied in two coats. Depending on resin chemistry, a catalyst or hardener may be added to induce the curing process. In most instances, a primer is required. Liquid-applied roof membranes typically are reinforced with polyester fleece or fiberglass mat. Reinforcement typically is set into the resin base coat. The reinforcing material provides the membrane's crack-bridging ability and much of its mechanical strength. Liquid-applied roof membranes may be surfaced with aggregate (e.g., sand, mineral, ceramic granules), coatings or sealers. The liquid material cures to form a monolithic weatherproof membrane. Single-component resin eliminates the need for combining products at the job site. Two component materials require proper mixing at the job site and have a limited pot life after mixing.*

The NRCA Roofing Manual also says:

> *Liquid-applied roof membranes are more widely known to be used as waterproofing systems but have gained in popularity as roof systems, especially in reroofing situations. However, if a liquid-applied roof membrane does not have reinforcement, it typically is considered a coating system. A reinforced liquid-applied roof membrane is considered by NRCA to be a roof system.*

Therefore, a one or two coat liquid-applied roof membrane or a roof membrane with a weatherable topcoat can both be considered a roof system. A liquid roofing product with reinforcement such as fleece or other geotextile material is considered a membrane; if there is no reinforcement it is considered a coating. While reinforcement can be important to a roof system, it is worthwhile to consider the physical properties of liquid-applied roof coatings with and without reinforcement, as the physical properties can help determine what products are best suited to a specific application.

Reflective coatings are often applied over darker colored or aged reflective existing roofs to help reduce energy costs.

Benefits of Fluid-Applied Roof Coatings

Fluid-applied roof coatings can be applied as a new roof system on a new roof deck or in a maintenance situation as a re-roofing system over an existing deck. They have many benefits, but they are most commonly used to prolong the life of an existing roofing system whether it is an EPDM or TPO sheet membrane or another fluid-applied roofing system.

These systems contribute to the sustainability of the building structure by extending the life of the existing roof surface and preventing unnecessary roof tear off's, which contribute a great deal of waste to landfills. If properly maintained, you may never have to tear off the existing roof membrane and a renewable coating can be reapplied every 5 to 15 years.

In addition, reflective coatings are often applied over darker colored or aged reflective existing roofs to help reduce energy costs. Fluid-applied coatings provide a seamless, monolithic surface that is fully adhered so that water cannot migrate beneath the surface. These coatings are lightweight, often less than 1/3 pounds per square foot, are self-flashing, and may qualify for immediate tax advantages based on prevailing tax code in your region related to energy saving building upgrades.

Liquid-applied coatings can be installed over virtually any type of existing roof substrate.

Potential Substrates

When choosing a liquid-applied coating for your project, it is important to consider the existing substrate. Liquid-applied coatings can be installed over virtually any type of surface, from thermoplastic single-ply membranes such as PVC or thermoplastic polyolefin (TPO), to thermoset single-ply membranes such as ethylene propylene diene terpolymer (EPDM), or chlorosulfonated polyethylene (CSPE-Hypalon). They can also be installed over metal, concrete, built-up roof (BUR), modified bitumen (MB), or spray polyurethane foam (SPF).

SURFACE PREPARATION FOR SUCCESSFUL APPLICATION

While fluid-applied coatings can be applied over almost any substrate, it is important to note that surface preparation is critical for their success and longevity. Fluid-applied coatings are not to be installed over failed or failing roofs. Deficiencies such as blisters, wrinkles and ponded water conditions must be repaired, as a clean, dry, sound, and secure surface is required prior to the installation of a fluid-applied coating.

An infra-red (IR) roof scan or core cuts can help to determine if the roof is a good candidate for a fluid-applied coating, as they can identify problems that are not readily visible to the naked eye. Wet and/or damaged areas identified by an IR scan or core cuts must be removed and replaced with like insulation and coating. Each substrate should be washed with a bio-degradable detergent and appropriate power washing or scrubbing equipment. Be sure to consult the manufacturer of the sheet goods to determine how long you should wait to install a fluid-applied coating over new sheet goods.

Primers can be used to darken substrates to reduce small amounts of residual moisture, as the darker surface will absorb more heat and dry faster.

Priming Substrates

While priming is not required on all surfaces, it can be a critical component to a successful fluid-applied coating installation. Primers are often used to enhance adhesion between the fluid applied coating and the substrate, as well as bind small amounts of dirt, seal porous substrates, and inhibit corrosion of metal substrates. Finally, primers are used to darken substrates to reduce small amounts of residual moisture, as the darker surface will absorb more heat and dry faster. Be sure to consult the manufacturer to determine whether or not a primer is required.

Seam Treatment

For granulated cap sheets and some single-ply membranes, it is good practice, and sometimes even required, to pre-treat the seams with a

layer of base coat and a reinforcement fabric before the liquid-applied system is installed. An additional flood coat may also be required to encapsulate the granules on the roof before building the liquid-applied system.

Self-adhered flashing tapes may also be used for detailing penetrations and seams. Whether to use a self-adhered tape or extra base coat and reinforcement is typically the contractor's choice.

There are many different types of liquid-applied roof coatings and choosing the right product for a project deserves careful consideration to avoid problems or premature failures.

SYSTEM SELECTION CRITERIA

System selection criteria is probably the most important discussion for a specifier, as there are many different types of liquid-applied roof coatings and choosing the right product for a project deserves careful consideration to avoid problems or premature failures. The liquid-applied coatings that we will cover here include aluminum, acrylic, asphalt emulsion, polyurea, silicone, SEBS, and polyurethane.

Aluminum Coatings

Aluminum roof coatings are typically formulated with asphalt, aluminum paste, moisture scavenger, fillers, hydrocarbon solvents, and in some cases, fibers. The overall quality of aluminum roof coatings can be judged by the total quantity of leafing aluminum pigment content per gallon. While aluminum roof coatings are relatively easy to install and provide good sun protection to the existing roof membrane, they come with very limited warranties, no real waterproofing capacity, minimal solar reflectance, and must be regularly maintained every two to three years in order to function properly.

Acrylic Coatings

Acrylic coating systems are based on acrylic resin and are generally a latex-based system that cures by air drying. Acrylic coatings are amongst the easiest to apply. They are low odor, low cost, and have excellent color retention, as well as UV and weather resistance with very good initial solar reflectance.

Multiple coats can be applied on hot days, but on the down side, they cannot be applied below 32 degrees or if rain or dew are imminent. Acrylic coating systems have low tensile strength and are not appropriate for high traffic areas or where ponding water is a problem. They are also not chemical resistant, cannot be applied in heavy mils, and have extended cross linking time. However, when used appropriately, acrylics can greatly enhance the appearance of a roof.

Asphalt Emulsion

According to the *Handbook of Accepted Roofing Knowledge (HARK) Manual*, asphalt emulsion is, "A mixture of asphalt particles and an emulsifying agent such as bentonite clay and water. These components are combined by using a chemical or clay emulsifying agent and mixing or blending machinery."

Emulsions are user friendly and provide good water resistance. However, they are also temperature dependent, cannot resist the high movement of modern buildings, have somewhat of an odor and require protection and reinforcement for superior longevity. They are also dark in color so they will cause the roof to heat up when exposed to sunshine.

Polyurea Snap Cure Systems

Polyurea coatings are either solvent based or 100% solids, depending on the formulation, are typically two-component, and cure to form films with limited elongation and high tensile strength.

Polyurea coatings can be applied in heavier single passes up to 40 mils thick and can be applied to vertical surfaces with significant film build. Spray-applied base and top coats can be applied the same day, providing quick return to service with very durable physical properties and low VOCs. These coatings can be rained on or walked on often within minutes of application.

However, polyureas can have adhesion issues and suffer significant loss of physical properties over time due to UV degradation. Plural component equipment is very expensive and a good application is heavily dependent on the applicator, more than with other fluid-applied coatings. There is potential for an off-ratio mix if the equipment experiences issues, and there is significant overspray risk.

Silicone Inorganic Coatings

Silicone is an inorganic coating derived from silicone polymer that is available in single or plural components. Silicone inorganic coatings have high moisture vapor permeability and are classified as breathable coatings.

Silicones provide excellent weathering ability and UV resistance and retain their physical properties well. The biggest issue with silicone is compatibility with other coatings, as it will only stick to silicone and is therefore not a good candidate for re-coats. Granules may be added for abrasion resistance, mechanical activity and aesthetics. Silicones have good initial solar reflectance, but due to their surface tackiness can pick up dirt from the atmosphere relatively quickly and lose reflectance.

Styrene Ethylbutylene Styrene (SEBS)

Styrene ethylbutylene styrene (SEBS) is a single component elastomeric coating made from rubber polymer that cures when the solvent evaporates and leaves a rubber film. They offer excellent adhesion, high elongation at 600 to 800 percent, and are good in ponding water conditions. SEBS may be applied on a variety of substrates, but primer is only required on modified bituminous and BUR roofs.

SEBS are limited by low solids content in the 50 to 60 percent solids range, meaning they have a high concentration of solvents, which is required to reduce viscosity to a workable level. Additionally, they have a strong odor, high cost, and are difficult to apply in low temperatures or high humidity.

Polyurethanes have faster curing times, allowing for increased productivity and driving their widespread acceptance across the protective markets.

POLYURETHANE COATINGS OVERVIEW

During the late 1930's, Otto Bayer pioneered the chemistry of polyisocyanates, a technology

that led to the advent of polyurethanes for a variety of applications. Due to their ability to vary physical properties such as hardness, elongation, abrasion resistance, and modulus, polyurethanes are widely used in a variety of materials such as foams for building insulation and seating, adhesives for construction and specialty applications, textile fibers for clothing and consumer products, thermoplastics for automotive and general industrial parts, and coatings for a variety of substrates and applications. Polyurethane coatings used in the building, infrastructure, and architectural markets, which we are discussing here, fall under this category.

Polyurethane Performance Attributes

Polyurethanes are one of the most durable coatings on the market today and have found application in the corrosion and construction protection markets because they provide a unique combination of flexibility, weatherability, as well as chemical, abrasion, and corrosion resistance. These coatings also provide reduced VOC emissions, superior coating thickness, and edge retention. A well formulated coating provides the advantage of fewer required coats, reducing cost per application by reducing labor, and the higher level of performance requires less surface preparation and the ability to self-prime. Furthermore, polyurethanes have faster curing times, allowing for increased productivity and driving their widespread acceptance across the protective markets.

Polyurethane coatings come in both single component (moisture cure) and plural component (chemical cure) systems with different speeds of reactivity. Single component polyurethanes are moisture cured and offer longer working life, while plural component products have a standard-to-fast cure time, limiting the window of opportunity when installing. However, the faster cure time provides a faster finish, which limits defects due to rain or environmental contaminants such as leaves or insects.

The solids content of polyurethane coatings is typically medium to high. High solids coatings have little to no solvent in their composition and were first introduced to comply with increasingly stringent VOC regulations. Due to this increased solids content and lack of solvent, these coatings needed to be formulated differently than those coatings with low solids. The removal of solvents, which are used in traditional coatings to compensate for viscosity, flow and curing, require the new coatings to have different characteristics and methods of handling.

In many cases, catalysts as well as other modifiers such as flow and leveling agents, solvents, and anti-corrosion and extender pigments may also be used to formulate a complete commercial coating. Raw material suppliers have developed lower viscosity resins and methods for coating formulators to employ to allow for user-friendly roof coating systems.

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QUIZ

1. True or False: A liquid-applied roof coating that does not have reinforcement is typically considered a coating system.

2. True or False: A liquid roofing product with reinforcement such as fleece or other geotextile material is considered a membrane.

3. Which of the following is a characteristic of fluid-applied roof coating?
   a. Provide a seamless, monolithic surface
   b. Self-flashing
   c. Can be a reflective roof
   d. Lightweight
   e. All of the above

4. Which type of coating can be applied in heavier single passes up to 40 mils thick and can be applied to vertical surfaces with significant film build?
   a. Aluminum
   b. Acrylic
   c. Polyurea
   d. Polyurethane

5. Which type of coating has found application in the corrosion and construction protection markets because they provide a unique combination of flexibility, weatherability, as well as chemical, abrasion, and corrosion resistance?
   a. Aluminum
   b. Silicone inorganic
   c. Asphalt emulsion
   d. Polyurethane

6. True or False: Polyurethane coatings only come in single component (moisture cure) systems.

7. Which polyurethane system has a faster cure time?
   a. One-component
   b. Two-component

8. The solids content of polyurethane coatings is typically _____.
   a. Medium to high
   b. Low to medium

9. Which of the following is more light stable and therefore offers excellent UV resistance?
   a. Aliphatic coatings
   b. Aromatic coatings

10. True or False: Reflective colored roofs typically have an initial solar reflectance 0.30 to 0.55, compared with around 0.10 for conventional dark steep-sloped roofs.

SPONSOR INFORMATION

Aliphatic coatings are light stable and therefore exhibit excellent UV resistance, and also have excellent color retention.

Polyurethanes—Aromatic vs. Aliphatic

Polyurethane roof coatings can be grouped into two broad categories, aromatic or aliphatic. Either type can be a single or two-component system. Aromatics have moderate-to-high tensile strength and elongation with medium-to-high solids. They are typically used as a base coat (primer), although some formulations can be used for top coats.

Aliphatic coatings have similar properties as aromatic coatings, but their solids content is generally not as high. Aliphatics are light stable and therefore exhibit excellent UV resistance, and also have excellent color retention. These attributes, along with the coatings' inherent dirt resistance, allows the coating to have excellent initial and long term solar reflectance. Because of these superior aesthetic properties, aliphatics are typically used as a top coat but are sometimes employed as a vapor retarder or breathable membrane.

Polyurethanes—Single Component vs. Two Component

Single-component polyurethanes are moisture cured, meaning they react with atmospheric water in the form of humidity to form a polyurethane/polyurea coating. They have medium-to-high solids, can be aromatic or aliphatic, and are also often used as a vapor retarder or breathable membrane depending on the specific formulation.

Two-component polyurethanes are a mixture of polyol and isocyanate, which react with each other and then cure. The cure is standard to fast and therefore requires care in mixing due to their limited pot life. Some coatings may only be sprayed through two-component equipment. Two-component polyurethanes have high tensile strength and resist mechanical damage. They can be either aromatic or aliphatic.

One-component and two-component aromatic and aliphatic polyurethane roof coatings have excellent initial as well as long term elongation. Some elastomeric roof coatings use plasticizers for flexibility but these can migrate out of the coating after repeated exposure to rain and heat. The long term elastomeric properties of polyurethane based roof coatings are achieved by the use of reactive resin components that do not leach out over time. This is a key attribute to retain the waterproofing and crack bridging capabilities of a roof coating system.

There are two keys to any successful liquid-applied coating application, surface preparation and dry film thickness; if the right amount of product is not put down, and if the surface is not properly prepared, it can lead to premature roof failure.

One-Component Moisture Cure Roof Coatings

One-component moisture cure roof coatings are one of the most common polyurethane based liquid applied roofing systems. They are popular since they have a good price and performance balance versus other liquid coating technologies. They are easier to apply than two component polyurea or polyurethane systems since most of the reaction has already taken place in the supplier's reaction vessels.

A moisture cure coating is made in the coating supplier's facility by combining the two polyurethane components—a resin blend and an aromatic or aliphatic isocyanate—under controlled conditions in a reaction vessel. The selection of resin components contributes to their resistance to water, and a range of physical properties such as elongation and hardness can be obtained by varying the resin selection. The finished product is technically called a pre-polymer and is a one-component product that can be applied by the roofing contractor in the field using conventional methods rather than specialized plural component spray equipment.

Moisture cure coatings based on aliphatic isocyanates are a relatively new class of coatings compared to other technologies and represent a significant step up in long term durability, weatherability, and waterproofing. The aliphatic polyurethane technology is similar to the exterior clearcoats used in the automotive industry for excellent long term color and gloss retention as well as UV and weather resistance. While slightly higher cost than aromatic based coatings, they offer a higher level of in-service performance and longer service life.

APPLICATION OF FLUID-APPLIED COATINGS

Fluid-applied coatings can often be tinted to add color to a roof, while aggregate can be added to provide additional protection and texture for slip resistance. Sometimes aggregate and color are used in tandem to create a slip-resistant walkway on the roof. If there are multiple penetrations in a roof a fluid-applied coating can be a great choice, as the product is easily applied around the penetrations to form a seamless monolithic waterproofing barrier.

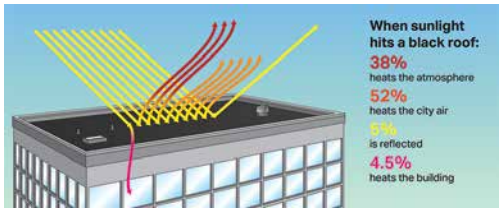
Determining the best application method for the material is critical. Fluid-applied coatings can be spray applied, roll applied, or brush applied and each has its pros and cons. Often times two or more methods are combined (spray and backroll) which help to provide the best coverage. Rolling is often used if over spray is a problem or wind conditions prevail. A crosshatch technique should be used when spraying for better productivity and more uniform dry film thickness. Brushing is used when trimming out penetrations or architectural details such as parapets, HVAC units, and stacks.

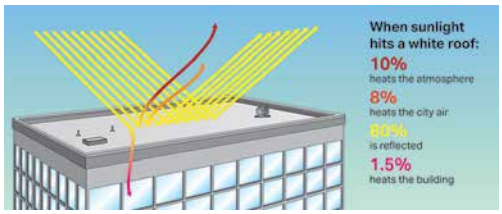
FACTORS AFFECTING PROPER SELECTION OF LIQUID-APPLIED ROOFING COATING

There are several factors to consider in selecting the proper liquid-applied coating including the time of year of application, which will determine the weather, temperature and humidity. Geography, expected longevity, and use of the roof including mechanical equipment and foot traffic are also important, as are aesthetic considerations. Some may think of roof aesthetics as secondary, but consider

that higher buildings surrounding the project will have a clear view of the roof. Flammability and code requirements, cost (life cycle), the mil thickness and slope are also important considerations.

In summary, there are two keys to any successful liquid-applied coating application, surface preparation and dry film thickness. The surface must be exceedingly clean, and seams and penetrations must be properly prepared. The dry film thickness (DFT) can determine the longevity of the roof, as more mils equate to a longer life expectancy. If the right amount of product is not put down, and if the surface is not properly prepared, it can lead to premature roof failure.





INTRODUCTION TO REFLECTIVE ROOF REQUIREMENTS

We briefly discussed how fluid-applied polyurethane roofing systems can be used as a "cool roof coating" to reduce a building's energy load and extend the life of the roof, but let's talk a bit more about reflective roofs and their benefits.

Cool colored roofing products are simply conventional roofing materials produced in pigments that have a high solar reflectivity and are minimally heated by the sun. Reflective roofs keep buildings and their surroundings cooler by reducing the fraction of incident sunlight that is converted to heat by the roof. They reduce electricity use in air-conditioned buildings, increase thermal comfort in unconditioned buildings, and reduce the urban heat island effect.

The urban heat island effect is increased air temperature in urban areas in contrast to cooler surrounding rural areas. The main causes of the urban heat island effect are vegetation that has been replaced by urban development and surfaces that have low solar reflectance, high impermeability, and thermal properties that favor energy storage and heat release. According to the EPA, the annual mean air temperature of a city with 1 million people or more can be 1.8 to 5.4°F warmer than its surroundings. In the evening, the difference can be as high as 22°F.

White and tinted roof coatings contain transparent polymeric materials, such as polyurethane or acrylic, and a white pigment, to make them opaque and reflective. These coatings typically reflect 70 to 90 percent of the sun's energy. The solar reflectance of colored coatings is generally lower than white coatings, but can still reach reflectance as high as 85 percent, particularly lighter colored coatings such as light gray. This is made possible by specific IR reflective pigments which are available in several colors other than white.

The cool roof options available to a building owner depend in large part on the building and roof type they are working with. That said, there is a cool option for nearly every type of roof and they are relatively easy to implement for commercial buildings. The roofs of most commercial and high-rise residential buildings are low-sloped and are generally not visible from the street. As a consequence, there is little resistance or cost to changing the color of these roofs during routine retrofits or when waterproofing.

That being said, cool roofs must be considered in the context of their surroundings. A bright white roof could reflect into the higher windows of taller neighboring buildings, which may cause uncomfortable glare and heat for those building occupants. Building owners can opt for a cool colored roof with lower reflectivity to provide some improvement in reflectance without significantly affecting neighboring buildings.

In addition, the success of cool roofs depends on latitude, altitude, annual heating load, annual cooling load, peak energy demands, and sun blockage by trees, buildings, and hills for the particular building. Cool roofs on buildings in some of the northern latitudes may not be appropriate. That said, whether or not a cool roof is appropriate in any climate depends on the building, its energy usage pattern, existing needs, and costs.

White and tinted roof coatings typically reflect 70 to 90 percent of the sun's energy.

Cool Colors

White is the "coolest" color, but there are cool versions of a wide variety of popular colors. Highly reflective roofs can come in many colors such as red, green, and gray. Surfaces that are more reflective tend to remain cooler than those that are less reflective. Both solar reflectance and surface temperature rise should be considered when assessing a cool surface material.

Highly reflective colored roofs typically have an initial solar reflectance 0.30 to 0.55, compared with around 0.10 for conventional dark steep-sloped roofs. With a liquid applied coating system, the life expectancy is 5 to 20 years and they can be applied on low- or steep-sloped roofs. As a comparison, a non-cool smooth black coating would have a solar reflectance of 0.05 while a smooth white cool roof would have a solar reflectance of 0.70 to 0.85.

Codes and Standards

Any shift along the solar reflectance continuum towards more reflective materials will create benefits from an energy savings, as well as local and global cooling perspective. However, for codes and standards to be effective and useful, there needs to be a threshold for compliance.

There are a variety of ways that cool roofs and pavements may be incorporated into building and energy codes, which range from mandatory measures to prescriptive compliance and performance compliance. Cool roof requirements have been included in a number of mandatory and voluntary standards. These include ASHRAE 90.1 (U.S. national model code for commercial and high-rise residential buildings), ASHRAE 90.2 (low-rise residential buildings) and ASHRAE 189.1 (voluntary, "advanced" code for commercial and high-rise residential buildings.) California Title 24 is a residential and non-residential energy efficiency standard that has cool roof requirements that vary by region. Other local codes such as those in Chicago, Florida, Hawaii, New York and Washington DC set requirements for reflective

roofs in those locations. IECC Chapter 5, the U.S. national model code for commercial and high-rise residential buildings, requires low-sloped roofs above air-conditioned space to have cool roofs in certain climate zones.

DOE Cool Roof Calculator

Now that we've discussed various fluid-applied roof coatings and how they can contribute to reflective roof requirements, take a minute to explore The Department of Energy Cool Roof Calculator. The DOE Cool Roof Calculator estimates cooling and heating savings for flat roofs with non-black surfaces. It was developed by the U.S. Department of Energy's Oak Ridge National Laboratory (Version 1.2). This version of the calculator is for small and medium-sized facilities that purchase electricity without a demand charge based on peak monthly load. If you have a large facility that purchases electricity without a demand charge, run the CoolCalcPeak version in order to include the savings in peak demand charges from using solar radiation control.

What you get out of this calculator is only as good as what you put in. There are resources to help you figure out the best input value. Some things, such as the weathering of the solar radiation control properties and the effects of a plenum, are especially important. You'll also find help in figuring out your heating and cooling system efficiencies and proper fuel prices.

To compare two non-black roofs, print out results of separate estimates for each versus a black roof. Manually compute the difference in savings to compare the two non-black roofs.

If your energy costs are determined by on-peak and off-peak rates, print out results of separate estimates with on-peak and off-peak rates for the same roof. Judge what fraction of the savings with on-peak rates is appropriate.

Copy and paste this link to enter your own project's parameters into the DOE Calculator: http://web.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm

FLUID-APPLIED COATINGS AS REFLECTIVE ROOF SYSTEMS

An example of a fluid applied coating that can also qualify as a reflective roof system would be a one or two component polyurethane coating. These coatings are formulated with flow and leveling aids, solvents to reduce the working viscosity, and pigments. In the case of roof coatings, the pigment package often utilizes white or light pigments such as titanium dioxide in order to reflect the heat generating infrared (IR) wavelengths of sunlight off of the roof surface.

The benefit of this is two-fold. First, reducing the temperature of the roof reduces the building cooling system energy load, which is why this type of coating is often referred to as a "cool roof coating." Second, by reducing the temperature fluctuations of the roof, the expansion and contraction of the roof components and infrastructure are lessened, extending the life of the roof and reducing future leakage points. Additionally, some aromatic polyurethane based roof coatings are ablative as they weather in the sun, which is claimed to be beneficial because the IR absorbing dirt that builds up on the surface can wash off when it rains, therefore keeping the roof lighter in color and more reflective.

This class of coatings is the topcoat and usually is applied by roller or spray with the latter more common due to the large areas to be coated.

Government and Industry Standards for Low Slope Reflective Roofs	Minimum Solar Reflectance Value		
	Climate Zone	Initial	3-Year Aged
ASHRAE 90.1 Energy Standard for Buildings 2013	1-3	-	0.55
California Title 24 Building Energy Efficiency Standard 2013	All Zones	-	0.63
Energy Star Program for Roof Products 2013	N/A	0.65	0.50
International Energy Conservation Code 2012	1-3	0.70 (with TE of 0.75)	0.55

Cool roof requirements have been included in a number of mandatory and voluntary standards.

Substrates include aged single ply membranes such as EPDM and TPO, metal, concrete, built up roof (BUR), and spray polyurethane foam (SPF). Typical thickness is 15 to 20 wet mils per coat, and two coats are commonly applied. The material cure time is dependent on atmospheric moisture and ambient temperature, with lower temperature and/or humidity lengthening the cure time. For this reason, the cure time can vary from 4 to 16 hours. Some manufacturers offer catalysts that can aid the cure in lower temperature or humidity situations.

Some application areas where this class of coating is used include low-slope standing seam metal and spray foam insulated roofs.

CASE STUDIES

Fountainbleu High School, St. Tammany Parish, LA

A high performance aliphatic polyurethane coating was selected to protect, preserve and extend the life of the Fountainblue High School's extensive metal roofs.

Fontainebleau High School, located in the heart of St. Tammany Parish, was opened in 1994 with 775 ninth and tenth grade students. Fontainebleau presently serves a student population of 1,950 and is ranked as a top Louisiana public school when compared with schools of equivalent size.

In 2014, the school district was looking for different options from the acrylic roof coatings they had been using on Fontainebleau High School's 115,000 square feet of factory-coated metal roofs. The design team, consisting of architects from KVS Architecture and Sizeler, Thompson, Brown Architects, reached out to a leader in urethane roof coating technologies, Neogard, for a coating solution.

A high performance aliphatic polyurethane coating was selected to protect, preserve and extend the life of the school's extensive metal roofs. The single-component solution delivered an easy application process, allowing the design team to meet the project's demanding time constraints while the topcoat's greater tensile strength provided better weather resistance and durability than experienced with previous coatings.

Fontainebleau High School's mission is to provide their students, "with the ability and tools necessary to function successfully in an advancing society,"

and the manufacturer was proud to play a part by providing a metal roof coating solution that would minimize disruptions due to a leaky roof and allow the student's to achieve their goals undisturbed.

The design team and applicators were faced with a short time frame of 60 days to complete the 115,000 square foot job while also having to work around summer events held at the school.

Application

The design team and applicators were faced with a short time frame of 60 days to complete the 115,000 square foot job while also having to work around summer events held at the school.

Coupled with frequent afternoon thunderstorms and dew in the mornings, the contractor was also challenged with moisture concerns throughout the work.

Brazos Urethane utilized a biodegradable cleaner to properly prepare the metal substrate; seams were detailed with urethane and TieTex fabric and all fastener heads detailed with urethane sealant.

A primer was applied followed by a base coat of Elasta-Gard 70630 urethane. A reflective topcoat of Elasta-gard 7490 aliphatic urethane completed the system and adhesion tests were performed throughout the jobsite to confirm integrity of the coating application.

Holiday Isle Condominiums, Dauphin Island, AL

Holiday Isle is the largest condominium in Dauphin Island, AL. The existing roof coating was an aromatic urethane based coating applied over a concrete roof that had been installed for approximately 7 years. The contractor had adhesion test challenges with areas of the existing roof and had to mechanically abrade the problems to get to a sound substrate. The contractor prepared the substrate by removing the old aromatic coating down to either sound coating or to bare concrete. Once the contractor had a suitable substrate and adhesion tests were successful, they installed an aliphatic urethane topcoat system.

The decision to use an aliphatic urethane system was made because of the harsh UV exposure along Alabama's Gulf Coast

The system consisted of a base coat of Elasta-Gard 70620 polyurethane and an intermediate coat of Elasta-Gard 70630 polyurethane. A reflective topcoat of Elasta-gard 7490 aliphatic polyurethane topcoat finished the system off and provided the reflective and weatherable top layer. An elastomeric, 100% acrylic, anti-carbonation coating was utilized on all of the parapet walls. The decision to use an aliphatic urethane system was also made because of the harsh UV exposure along Alabama's Gulf Coast, and as we've discussed aliphatics have superior UV resistance and color retention. ■