Biobased Roof Coatings and Membranes

U.S. Capitol Roof Project

Prepared by BioPreferred®
USDA–Department of Management
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Washington, D.C. 20250
202-205-4008

June 21, 2011
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## Roof Membranes

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Roof Coatings

Introduction

Hundreds of roof coating products are on the market today, and several of their manufacturers have developed more sustainable biobased options. Many of these products are fire, impact, mold, mildew, and rust resistant, in addition to being solar reflective. Solar-reflective roof coatings help to lower the temperature of the roof, saving money and energy that would be used to cool the building. They are also used to seal roofs to prevent leaking and other water damage to the building. Roof coating products can be applied by being brushed, rolled, or sprayed onto the roofing surface. Biobased roof coatings can be used on almost any roofing substrate, including asphalt built-up roofs, concrete, metal, fiberglass, wood, gypsum board, ethylene propylene diene monomer rubber, gravel, polyurethane foam, and others. Several roof coating manufacturers are members of the U.S. Green Building Council and the Cool Roof Rating Council. Many of the products listed in this document are ENERGY STAR qualified, and some may also earn credits in the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) Green Building Rating System™.

Additional product information can be attained through the manufacturers directly or by contacting Steve Devlin with BioPreferred℠, sdevlin@iastate.edu, 641-613-3298.
<table>
<thead>
<tr>
<th>Company</th>
<th>Product Description</th>
</tr>
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<tbody>
<tr>
<td><strong>G. Cole Corporation</strong></td>
<td>L55 Roof Coating is a biobased white roof coating that is nonbreathing, does not allow water or vapor transmission, and sets within 68 hours. L55 enhances the efficiency of the existing cooling system by reducing the surface temperature of the roof by up to 30%.</td>
</tr>
<tr>
<td><strong>Green Products, LLC</strong></td>
<td>ELMS® PLATINUM Liquid Membrane™ is a solar reflective, urethane roof coating to be applied over various low-slope roofing substrates. It provides many benefits including superior elongation, tensile strength, and adhesion to substrate. It is 100% waterproof and has low VOC and excellent UV, stain, mildew, and mold resistance. It can be applied with a brush or roller or can be sprayed on.</td>
</tr>
<tr>
<td><strong>NEOGARD® division of JonesBlair</strong></td>
<td>ELMS® 50 is a solar-reflective roof coating that can be used for various waterproofing applications including the restoration and repair of low-slope roofing assemblies and other applications where moisture or ponding water may exist. ELMS 50 is environmentally friendly, meets EPA requirements, and is stain, mildew, and mold resistant. It can be applied with a brush or roller or can be sprayed on.</td>
</tr>
<tr>
<td><strong>TKO Waterproof Coatings, LLP</strong></td>
<td>PERMATHANE II FR-BIO is a complete roofing system designed for low-slope new or existing commercial and industrial roof applications. The system consists of 1&quot; minimum polyurethane foam, 70620Bio base coat, and 70613Bio top coat. It has superior resistance to impact, fire, and mildew as well as excellent adhesion and flexibility. Urethane foam is spray applied; coatings can be sprayed or rolled. The system increases energy efficiency. Customer must specify biobased.</td>
</tr>
<tr>
<td><strong>U.S. Ply, Inc.</strong></td>
<td>Roof-kote seals and waterproofs to withstand ponding water and stop flat roof leaks. Its bright white color serves to reflect UV rays and lower cooling costs. Its high-build, nonsagging formula has outstanding strength, adhesion, and flexibility. It is resistant to mold, mildew, and UV light. It can be applied with a brush, roller, or squeegee and can also be sprayed on.</td>
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<td><strong>TKO Waterproof Coatings, LLP</strong></td>
<td>Metal 1-kote is 100% waterproof, stops rust, never needs priming, and seals and waterproofs in just one coat. It is formulated for all metal roofs. Metal 1-kote's high-build, nonsag formula has excellent adhesion and flexibility, with built-in resistance to mold, mildew, rust, and UV attacks. It can be applied with a brush or roller or can be sprayed on.</td>
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<tr>
<td><strong>U.S. Ply, Inc.</strong></td>
<td>ALL SEASON BIO KOTE is ideal for odor-sensitive environments. It provides a nonbreathing, reflective, high-tensile strength, and highly elastic membrane and gives the advantages of cold weather flexibility as well as chemical and water resistance. Its bright white finish helps to reduce surface temperatures, minimizing thermal expansion while providing long-term solutions for the renewal and maintenance of many roof types.</td>
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<tr>
<td><strong>Volatile Free, Inc.</strong></td>
<td>VFI-540 Aluminum Polyurea Hybrid Roof Coating is a liquid-applied, fast-set coating. It is made using both polyurethane and polyurea chemistry. The result is an extremely tough elastomeric coating. It is spray-applied to make a seamless membrane. It conforms to the shape of the roof, creating a watertight, reflective, longlasting roof.</td>
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<tr>
<td><strong>Volatile Free, Inc.</strong></td>
<td>VFI-540/FR Aluminum is a plural component, UL-rated fire-retardant, polyurea hybrid roof coating for use over polyurethane foam insulation.</td>
</tr>
<tr>
<td><strong>Volatile Free, Inc.</strong></td>
<td>VFI-540R is made of 100% solid materials. It is a two-component, one-to-one by volume, general purpose polyurea hybrid elastomer coating.</td>
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<td><strong>Volatile Free, Inc.</strong></td>
<td>VFI-540US is a 1:1 by volume, fire-retardant polyurea hybrid coating.</td>
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Prepared by BioPreferred - 6/21/2011
Dear Reader:
The United Soybean Board (USB) is pleased to expand our work in sharing the good news about biobased products to government officials across the nation. In recent weeks, USB enrolled as the first associate sponsor of the National Association of Counties (NACO) Green Government Initiative as well as joined as an associate member of the National Association of Local Government Environmental Professionals (NALGEP).

Government representatives have two new resources to assist them in greening efforts. First, the United Soybean Board (USB) has updated its Biobased Products Best Practices Guide as a resource for government purchasing decision makers. The Guide is designed to support the work of government agencies that are implementing the biobased products procurement program first launched in the 2002 Farm Bill. It is also an excellent tool for states, counties, cities and local government agencies to use for their green procurement programs.

“This Guide will aid government employees in making the switch to biobased products, which are good for America’s environment, economy and energy security,” said United Soybean Board (USB) New Uses Committee Chairman Todd Allen, a soybean farmer from West Memphis, Arkansas. “Soybean farmers support this effort through their national checkoff program because biobased products, ranging from carpet backing to lubricants to cleaning supplies, can be made from U.S. soybeans to reduce their petroleum content.”

We are delighted that NACO and NALGEP members are interested in incorporating biobased products into their greening efforts. Many of our newsletter readers are federal employees who often interact with government professionals from the state and local levels. We hope that you will help spread the word that USB’s resources, like the Biobased Best Practices Guide and Profiles in Biobased Success, are available to them as well. You can go to our website at www.soybiobased.org. Also, if you know of a state or local success with biobased products, we would love to hear from you as well.

Sincerely, Todd Allen,
New Uses Committee Chair

Two New Guides for Biobased Procurement Available

Midwestern States Launch Biobased Procurement Initiative
The Midwestern Governors Association took action in November to promote biobased products in their Energy Security and Climate Stewardship Summit agreement. The agreement includes a resolution to jointly establish a Midwestern Biobased Product Procurement System to support the growth of the region's bioeconomy. The System goal is to create a common approach to listing biobased products consistent with the federal Biopreferred® program, with System members listing biobased products based on their own procurement rules.

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A typical, 10-story, brick 1940s office building used by the General Service Administration (GSA) in Chicago’s Loop has added a 21st Century roof that features living green plants and a white biobased roof coating, both of which help the environment and reduce urban heat. (The project, completed in October, was first reported on in Biobased Solutions for Government Winter 2007 issue available at www.soybiobased.org.)

The soy-based products are white Environmental Liquid Membrane System® (ELMS) Liquid membranes and ELMS Masonry Jacket in a tan color are now installed on more than 6,500 square feet of masonry. More than 15,000 plants specific to the geographic region were also planted.

Architect Will Wagner, GSA Office of Tenant Operations in Chicago, was the “visionary” who conceived and executed the project to add to the city of Chicago’s cutting edge efforts to improve its urban environment.

Director of Business Development for Roofing Resources, Erich Poch, points out that his firm’s GSA contract GS-07F-5624P now includes ELMS products and Roofscapes Green roof systems. Detailed information is available at the GSA Advantage Website www.gsaadvantage.gov/advgsa/advantage/search/search.do?contract=GS-07F-5624P&sin=563+4.

Two New Guides for Biobased Procurement Available continued from page 1

Available online at www.soybiobased.org as well as in print and CD formats, the Guide offers a list of the products officially designated as “biobased” by the U.S. Department of Agriculture as well as the law and regulations, relevant Executive Orders, factual information, descriptions of actual practices, and examples of procurement of biobased products by government employees. The online version is continually updated to include all new product categories designated as biobased by the USDA, any changes in various regulations pertaining to preferred procurement program implementation and case histories as they become available. The Guide also has sample language for government service contracts to encourage the use of biobased products.

The second resource is the amendment to the Federal Acquisition Regulation (FAR). On November 7, 2007, the federal government amended the FAR to add procurement preference provisions for biobased products. This is an important step in the implementation of the BioPreferredSM program because the FAR contains the uniform policies and procedures used by federal agencies when purchasing products and services. The new biobased provisions in the FAR include requirements that agencies consider the “maximum practicable use” of biobased products and services:

- when developing or revising their specifications, product descriptions and standards;
- in describing government requirements for products and services; and
- in developing source-selection factors.

The new provisions also require agencies to establish affirmative procurement programs for biobased products and sets procedures for contracting officers when purchasing biobased products or services using biobased products, including requirements for solicitation and contract clauses. FAR amendments are online at www.soybiobased.org/resources/FARBiobasedProcurement-2007-11-07FR.pdf.
Success Story

GPO uses biobased roofing materials to fulfill Federal procurement needs and reduce operating costs

The U.S Government Printing Office (GPO), comprised of four buildings totaling approximately 1.5 million square feet, was in dire need of a new roof system for three of its historic buildings.

“Maintenance and repairs were becoming a common occurrence and reliability of our old system was lost,” says Mike Brady, GPO’s Strategic Environmental Programs Manager. “GPO needed an entirely new roof due to the failure and continued deterioration of the old roof.”

GPO saw the failing roof as an opportunity to increase the energy efficiency and reduce the environmental impact of buildings.

Choosing a roofing system

GPO decided to open the solicitation only to roof contractors on the General Services Administration (GSA) schedule due to their experience selling to the Federal government. In addition, utilizing the GSA schedule allows for an expedited procurement process.

A request for proposal (RFP) was issued and proposals were scored based upon the following criteria: environmental requirements, warranty, project management and safety, technical requirements, references and past performance.

“In addition, the RFP also stated that each proposal would receive a higher rating in the applicable category based upon their ability to recycle existing materials and use materials with recycled and biobased content,” says GPO’s contracting officer, Bryan Cook.

Cook says the contractors had to prove their products were

History of GPO

GPO has been providing the American public with access to digital and printed copies of the nation’s most important documents for nearly 150 years.

“GPO opened its doors the same day President Lincoln was sworn into office - March 4, 1861,” says Gary Somerset, GPO Media and Public Relations Manager.

Created by an act of Congress in 1860, GPO was founded to print government documents such as the: Congressional Record, Federal Register, congressional bills, hearings and reports, official inaugural materials of the President and many more important government documents.

Today, GPO employs 2,300 people and is the largest manufacturing facility in Washington D.C. GPO is now comprised of four historic buildings, with the oldest building being opened in 1901.
environmentally friendly by showing they could meet or qualify for one or more of the following: Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines, GSA’s Environmental Products and Services Guide, U.S. Department of Agriculture’s BioPreferred program, Energy Star rating and/or Cool Roof Council listing.

The roof
After reviewing all of the RFPs, GPO decided to use Roofing Resources, Inc. (RRI) to build the new roofs. RRI was able to provide GPO with a biobased roof coating that met the content requirement (20% or more) for BioPreferred and provided a roof that had a Energy Star rating and qualified for the Cool Roof Council listing.

To ensure the roof would meet expectations, GPO created a pilot project.

“Basically we tested small portions of the roof to make sure it would work for GPO’s buildings,” Brady says. “The pilot project proved the roof would be effective and we have decided to move ahead with the completion of the roof.”

RRI put new roofs on three of the four GPO buildings using a Build-Up Roofing (BUR) system, which utilizes many biobased materials. In addition a biobased roof coating was put on each roof during the pilot project to prolong the life of the roof.

“We chose the BUR system because it doubles the life expectancy of our roof and allows our rooftop equipment to run at a higher efficiency during the summer months,” Brady says. “In addition, the biobased roof coating added immediate environmental benefits to our facility.”

The biobased roof coating GPO chose is highly reflective, which reduces the temperature of the roof. The roof coating not only helped GPO reduce its environmental impact, but also fulfilled GPO’s procurement requirement to purchase biobased products.

“We have been very pleased with the pilot project and are looking forward to discovering what benefits the completed project will bring,” Brady says.

GPO plans to finish the roofing project during Fall 2010. This success story will be updated in 2011 to include any energy-saving benefits noticed during the first year.
ARC
Product Data Sheet

PRODUCT INFORMATION: ARC’s BIO ROOF COAT (L-55) has a “Biobased Content” of 48% plus and engineered for industrial roofing and waterproofing use. Product is friendly user and may be applied using roller, brush or airless spray equipment. Product should be heated if choice of application is airless sprayer. The viscosity mean is 11,000 cps. +/- 3K Brookfield, with 70% solids by weight +/- 5%, pigmentation Titanium White or Aluminum Glaze, and designed for use as a sealant or reflectant to seal metal, metal gutters, and protect and extend existing roofing systems such as EPDM, TPO, PVC, Hypalon, Modified Asphalt Plies (smooth or granulated), Hot BUR and PUF’s. Product carries a low citrus odor and sets by evaporation of oils. Product separation in container is not measurable but it is recommended to mix well before use. Bio Roof Coating (L-55) forms a water-repellent surface after application. Must be applied over a dry surface. To maintain 91% reflectivity apply ARC’s DynaSHIELD Asphlat Stain Blocker coating first. Allow 24 to 48 hours cure time between Base Coat and finish coat.

RECOMMENDED USES:
- As a sealant over galvanized metal, existing metal roof coatings and metal gutters.
- Contact U.S. Ply, Inc. for uses over EPDM, TPO, PVC, Hypalon, Modified Asphalt Plies, BUR, PUF and other uses.

PRODUCT CHARACTERISTICS:

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<thead>
<tr>
<th>Physical Property</th>
<th>Typical Value</th>
<th>Test Method</th>
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</thead>
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<tr>
<td>Solids Content By Weight</td>
<td>70% ± 5%</td>
<td>ASTM-D-1353</td>
</tr>
<tr>
<td>Solids Content By Volume</td>
<td>60% ± 5%</td>
<td>ASTM-D-2697</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>1700 psi ± 25%</td>
<td>ASTM-D-2370</td>
</tr>
<tr>
<td>Elongation</td>
<td>500% ± 25%</td>
<td>ASTM-D-2370</td>
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</tbody>
</table>

Recommended Spread Rate Depends On Substrate Surface: Primer: 30 – 50 sq. ft./gal (nominal)

PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Procedure</th>
<th>Result</th>
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<tbody>
<tr>
<td>Permeability</td>
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<td>Non-breathing</td>
</tr>
</tbody>
</table>

All values given are approximate and are subject to change without notice. There is no implied or express warranty given through these values or statements, nor are there any assertions that the product purchased has been individually tested to conform to these standards. Testing is performed on a random basis by “in-house” and independent “third party” evaluation for the purpose of classification and or approval. Acceptance, purchase and selection of these products are the sole responsibility of the buyer or buyer’s representative. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of the product. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY ARC EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.
APPLICATION PROCEDURES

ARC’s Bio Roof Coat “L-55”

TEMPERATURE
Air and Surface: 40°F Minimum/140°F Maximum
Spray Application: 110°F Minimum/140°F Maximum
Brush/Roll Apply: 75°F Minimum/140°F Maximum

DEW POINT
Do not apply product when temperatures are within 5 degrees of dew point. Surface must pass tissue test before L-55 can be applied.

BRUSH/ROLLER: Apply with a soft brush or roller in a uniform pattern. Avoid excessive brushing which may cause streaking. A ½” to 1½” synthetic nap roller is recommended or nylon/polyester brush.

AIRLESS SPRAY-VOLUME:
Output: 2 – 3 gal. per min.
Pressure: 4,000 to 7,000 psi
Spray Equip: Graco, Speedflow or Tecknicator
Fan/Tip: 12/31 – 12/37 reversible
Extension: 12” – 36” gun extension recommended

APPLICATION INSTRUCTIONS
• Mix contents thoroughly before using. Protect hands with rubber gloves when applying this product. Product works best if kept above 110°F.
• Surface to be treated must be clean, dry, and structurally sound. All dirt, grease, asphalt, loose particles, grime and film should be removed before applying.
• Over new or galvanized metal apply ARC’s Bio Roof Coat “L-55” at the rate of 50 square feet per gallon per pass with a complete two pass application using a brush, roller, or airless spray equipment.
• Do not apply over Kynar coated metal without first performing an adhesion test to the metal. If results are unsuccessful, apply ARC’s HP Primer at the rate of 200 to 300 square feet per gallon using a brush, roller, or airless spray equipment.
• Do not apply over an existing metal roof coating without first performing an adhesion test to the coated substrate. If results are unsuccessful, apply ARC’s HP Primer at the rate of 200 to 300 square feet per gallon using a brush, roller, or airless spray equipment.
• Over masonry surfaces, apply ARC’s HP Primer in two coats at the rate of 200 square feet per gallon per coat using a brush, roller, or airless spray equipment before applying ARC’s Bio Roof Coat “L-55.”

Airless Application Equipment: This product may be brushed, rolled or sprayed. When using spray equipment, it is important that the following criteria are met: When using a spray pump, a 45:1 fluid to air ratio capable of delivering 2-1/2 gallons or more per minute continuous is needed, as well as a filter screen of 30 mesh or smaller. If a fluid spray hose is used, it should be high pressure with designed working pressure to handle maximum pressure delivered by the spray pump. Inside lining or tube should be of such a material so it is unaffected by the coating and any solvents used for clean up. Additionally, the following criteria should be used for hoses: 3/8” minimum I.D. up to 200 feet; and 3/4” minimum I.D. over 200 feet. The larger I.D. sections of hose should be used from the pump out in all circumstances with additional hose size reductions as necessary. Material temperature should be 70°F or higher. In colder temperatures, material may require thermal assistance, such as heated hoses or band heaters to maintain the minimum temperature of 70°F.

If a gun hose whip is used, high pressure with adequate W.P.S.I. 3/8” I.D. X 6 feet with an appropriate lining or tube is recommended. When using a spray gun, we recommend the listed spray equipment on this page that is commercial grade. High-pressure gun swivels are available and can reduce operator fatigue. Any spray tip should be a reversible self-cleaning type with an orifice size of .021 to .027 with a fan angle of 40 to 50 degrees. Always use components rated for pump pressures.

Cleanup Instructions: Clean up spills and spatters immediately with biodegradable citrus turpentine. After cleaning, flush spray equipment with water followed by propylene glycol to prevent unit from rusting. A substitution cleaner may be odorless mineral spirits, baby oil or ARC’s equipment cleaner.

SAFETY PRECAUTIONS: Do not get on skin or in eyes. Can cause severe burns. Wear protective eye and skin coverings. Avoid breathing fumes and prolonged contact with skin. Do not ingest. Keep containers covered when not in use. When using, provide proper ventilation. Refer to the MSDS sheet before use. For Chemical emergencies, spills, leaks, exposure, or accidents CALL: CHEMTREC DAY/NIGHT 1-800-424-9300.
Biobased Urethane Waterproofing Membrane for Low Slope Roofing Assemblies

DESCRIPTION

ELMS® PLATINUM Liquid Membrane™ is a solar reflective, biobased urethane roof coating to be applied as a liquid waterproofing membrane over various low slope roofing substrates such as smooth asphalt built up roofs; granular and smooth modified bitumen; single-ply membranes such as TPO, aged Hypalon and aged PVC membranes; EPDM; metal roofing assemblies; Polyurethane Foam and more where ponding water conditions may exist. ELMS® PLATINUM Liquid Membrane™ provides many outstanding benefits including: superior elongation, tensile and adhesion to substrate; 100% waterproof even under ponding water conditions; low VOC; environmentally friendly; excellent UV resistance; and stain, mildew, and mold resistance.

Each roof application has unique requirements and as such may require a specific system configuration and application. It is recommended that you contact Green Products, LLC. for technical services to assess the proper use of any product within a roof system configuration or for roof systems approvals.

TYPICAL PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUE</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>18,000 cps</td>
<td>ASTM D 2196</td>
</tr>
<tr>
<td>Elongation @ 77°F</td>
<td>1446.12%</td>
<td>ASTM D 6083</td>
</tr>
<tr>
<td>Tensile @ 77°F</td>
<td>106.3 psi</td>
<td>ASTM D 6083</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>0.9053%</td>
<td>ASTM D 6083</td>
</tr>
<tr>
<td>Permeability</td>
<td>0.2401 perms (&gt;1 perm)</td>
<td>ASTM D 6083</td>
</tr>
<tr>
<td>Low temperature flexibility</td>
<td>No loss of adhesion or cracking. Unaffected</td>
<td>ASTM C 734</td>
</tr>
<tr>
<td>Ultraviolet Exposure</td>
<td>No cracking, checking, loss of flexibility or discoloration</td>
<td>ASTM 822</td>
</tr>
<tr>
<td>10,000 hrs UV and Moisture</td>
<td>100% Resistant</td>
<td>ASTM D 3273</td>
</tr>
<tr>
<td>Mold, Mildew, Bacteria, Algae Resistance</td>
<td>100% Resistant</td>
<td>ASTM D 3273</td>
</tr>
<tr>
<td>Solar Reflectance</td>
<td>.84</td>
<td>ASTM E 903</td>
</tr>
<tr>
<td>Emittance</td>
<td>.68</td>
<td>ASTM E 408</td>
</tr>
<tr>
<td>Solar Reflectance Index (SRI)</td>
<td>104.53</td>
<td>ASTM E 1980</td>
</tr>
<tr>
<td>V.O.C.</td>
<td>140 g/l</td>
<td></td>
</tr>
<tr>
<td>Solids Content</td>
<td>61%</td>
<td></td>
</tr>
</tbody>
</table>

PRODUCT USES

ELMS® PLATINUM Liquid Membrane™ is recommended to be applied as a liquid waterproofing membrane over various low slope roofing substrates such as smooth asphalt built up roofs; granular and smooth modified bitumen; single-ply membranes such as TPO, aged Hypalon and aged PVC membranes; EPDM; metal roofing assemblies; Polyurethane Foam and more where ponding water conditions may exist.

COVERAGE

Coverage rates required to qualify for extended warranties range from 2 - 4 gal/sq (0.8 - 1.6 l/sq/m).

When applied at a rate of 2-gal/sq (0.8 l/m), the theoretical wet film thickness should be 30 mils of thickness and a dry film thickness should be 21 mils.
COLOR  
Standard colors are U.S. EPA Energy Star® and CRRC rated highly solar reflective white, light gray, light tan. Custom colors are available upon request for a nominal fee. All colors must be mixed prior to application to assure that pigments have not settled.

STORAGE STABILITY  
One-year minimum when stored in unopened containers at 45° F - 90° F

CLEAN UP  
Mineral Spirits (California Rule 66 MS recommended); aMAIZEing™ Biobased Solvent & Stripper.

PRIMER  
None necessary.

CURE TIMES  
When applied at 30 wet mils, coating thickness and at conditions of 75° F (24° C) and 50% relative humidity, ELMS® PLATINUM Liquid Membrane™ will dry to the touch in 1 to 2 hours and should reach final cure in 24 hours. Colder weather and/or higher humidity will retard curing whereas warmer weather and/or lower humidity will accelerate curing.

APPLICATION INSTRUCTIONS  
ELMS® PLATINUM Liquid Membrane™ is a high solids biobased urethane that requires an ideal product temperature range for proper application. Thorough mixing of each container is mandatory. After mixing, please allow product to sit for 5-10 minutes to allow trapped air to evacuate container to protect against product pinholes when applied. Electric pail and drum warmers are highly recommended to maintain ideal working temperatures. A physical product temperature of 65°F-70°F is the lowest ideal working temperature. The coating has flow and a good working viscosity for even mil coverage. Smooth modified can be covered at 2.0 gal/sq and granulated or alligatored surfaces can be applied at 2.5 gal/sq at this temperature range. A physical product temperature of 85°F-90°F has a much lower viscosity (similar to ELMS® 50) and is highly recommended to ease application. This temperature range gives an even coverage of the roller when dipped and rolls out easily.

Note: It is important that the material’s temperature is above 65°F and not just the ambient air temperature. This 65°F minimum temperature range will guarantee the best working conditions for applying the product.

Brush, roller, or conventional airless spray equipment may be used to apply ELMS® PLATINUM Liquid Membrane™. Though cold weather applications do not deter the usage of the ELMS® PLATINUM Liquid Membrane™ product on a properly prepared and dry surface, application lower then 30° F may deter the use of spray equipment due to viscosity changes at lower temperatures.

For airless spray application, ELMS® PLATINUM Liquid Membrane™ can be sprayed at pressures above 3000 psi. A “typical” airless spray unit would consist of the following:

• A material transfer pump for air motor driven sprayers: 1:1-5:1 compression ratios or a drum siphon for self-contained gas-hydraulic sprayers.
• Basic spray pump capable of developing a minimum of 3000 psi working pressure.
• 200 - 300 ft. of 1/2” high-pressure hose, 3/8” whip optional. Please consult equipment manufacturer for proper tip size for your application.

NOTE: Any airless spray gun designed to operate in the same working spray unit contemplated for use with Green Products, LLC coatings should be used only by experienced professional spray mechanics trained in the safe operation of the high-pressure airless equipment. All equipment should conform to the most recent OSHA safety standard. Contact Green Products, LLC regarding specific application criteria and instruction.
**ELMS® 50**

Natural Oil Based Waterproofing Membrane for Low Slope Roofing Applications

**DESCRIPTION**

*The ELMS® 50* is a natural agricultural oil based, solar reflective roof coating that can be applied in a one coat application for various waterproofing applications for low slope roofing assemblies, masonry, structural steel/metals, and other industrial applications where latent moisture or ponding water may exist. *ELMS® 50* provides many outstanding benefits including: low VOC; environmentally friendly; meets current and future EPA requirements; outstanding UV resistance; permanent stain, mildew, and mold resistance and can be applied over aged and unaged asphalt substrates.

*Each roof application has unique requirements and as such may require a specific system configuration and application. It is recommended that you contact Green Products for technical services to assess the proper use of any product within a roof system configuration or for roof systems approvals.*

**TYPICAL PHYSICAL PROPERTIES**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUE</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>18,000 cps</td>
<td>ASTM D 2697 (86)</td>
</tr>
<tr>
<td>Solids Content, min.</td>
<td>81%</td>
<td>ASTM D 2370</td>
</tr>
<tr>
<td>Initial Elongation at 77° F</td>
<td>488%</td>
<td>ASTM D 2370</td>
</tr>
<tr>
<td>Initial Elongation and Tensil at 0° F</td>
<td>685.1 psi</td>
<td>ASTM C 2370</td>
</tr>
<tr>
<td>Low temperature flexibility</td>
<td>No loss of adhesion or cracking. Unaffected</td>
<td>ASTM C 734</td>
</tr>
<tr>
<td>Solar Reflectance</td>
<td>85%</td>
<td>ASTM C 1549</td>
</tr>
<tr>
<td>Emittance</td>
<td>.88</td>
<td>ASTM C 1371</td>
</tr>
<tr>
<td>UL Flame Spread</td>
<td>UL Class A Rating</td>
<td>UL 790</td>
</tr>
<tr>
<td>Permeability</td>
<td>&lt;1 Perms</td>
<td>ASTM E 96</td>
</tr>
<tr>
<td>Water Swelling</td>
<td>0.4956%</td>
<td>ASTM D 471</td>
</tr>
<tr>
<td>Fungi Resistance</td>
<td>100%</td>
<td>ASTM D 3273</td>
</tr>
<tr>
<td>Biobased Content</td>
<td>23% Certified</td>
<td>USDA FB4P</td>
</tr>
</tbody>
</table>

**PRODUCT USES**

*ELMS® 50* is recommended as an Energy Star® approved solar reflective waterproofing system for restoration and repair of numerous low slope roofing assemblies such as Modified Bitumen, Asphalt BUR, EPDM, TPO, Capsheet,
galvalume roof panels, concrete, and numerous other substrates. Additionally, **ELMS® 50** is specially formulated for waterproofing low slope roofing applications where ponding water may exist.

**COVERAGE**
Coverage rates required to qualify for extended warranties range from 2 - 4 gal/sq (0.8 - 1.6 l/sq/m).

When applied at a rate of 2-gal/sq (0.8 l/m), theoretical wet film thickness should be 30 mils of thickness and a dry film thickness should be 25 mils.

**COLOR**
Standard color is highly reflective Energy Star® and CRRC Listed solar white. Custom colors are available upon request for a nominal fee.

**STORAGE STABILITY**
One-year minimum when stored in unopened containers at 30° - 80° F

**CLEAN UP**
Mineral Spirits – Rule 66

**PRIMER**
None.

**CURE TIMES**
When applied at 30 wet mils (762 microns) coating thickness and at conditions of 75° F (24° C) and 50% relative humidity, **ELMS® 50** dry to the touch in 2 hours and should reach final cure in 72 to 120 hours. Colder weather and/or higher humidity will retard curing whereas warmer weather and/or lower humidity will accelerate curing.

**APPLICATION INSTRUCTIONS**
**ELMS® 50** is supplied ready to use. Onsite product mixing is not necessary if used within 4 months of manufacture date. All special colors must be mixed prior to application to assure that pigments have not settled. **ELMS® 50** may be applied by brush, roller, or conventional or airless spray equipment. Though cold weather applications do not deter the usage of the **ELMS® 50** product on a properly prepared and dry surface, application lower then 30° F may deter the use of spray equipment due to viscosity changes at lower temperatures.

For airless spray application, **ELMS® 50** can be sprayed at pressures from 2500 - 4000 psi. A "typical" airless spray unit would consist of the following:

- A material transfer pump for air motor driven sprayers: 1:1-5:1 compression ratios or a drum siphon for self-contained gas-hydraulic sprayers.
- Basic spray pump capable of developing a minimum of 1500 psi working pressure.
- 200 - 300 ft. of 1/2" high-pressure hose, 3/8" whip optional.

**NOTE:** Any airless spray gun designed to operate in the same working spray unit contemplated for use with Green Products coatings should be used only by experienced professional spray mechanics trained in the safe operation of the high-pressure airless equipment. All equipment should conform to the most recent OSHA safety standard. Contact Green Products regarding specific application criteria and instruction.

The information contain herein is believed to be reliable. All recommendations or suggestions are made without guarantee in as much as conditions and methods of commercial use are beyond our control. Properties given are typical values and are not specifications unless otherwise stated.

**ELMS® 50**
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Revised 02/22/007
PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools and equipment necessary for the application of a new sprayed-in-place, polyurethane foam and coating system (PERMATHANE™ II FR BIO), including accessory items, as specified herein.

B. All existing HVAC and other equipment shall be protected from any damage that could be caused by roofing demolition, foam over spray, coating, and mishandling.

C. Raising, re-setting, and protection of air conditioning equipment, ventilators, and exhaust fans may be required.

D. Related Sections:
   1. Section 03 03 00 - Cast-in-Place Concrete
   2. Section 05 30 00 - Metal Decking
   3. Section 06 10 00 - Rough Carpentry
   4. Section 07 20 00 - Thermal Protection
   5. Section 07 50 00 - Membrane Roofing
   6. Section 07 60 00 - Flashing and Sheet Metal
   7. Section 07 70 00 - Roof and Wall Specialties and Accessories
   8. Section 08 60 00 - Roof Windows and Skylights

1.2 SYSTEM DESCRIPTION

A. PERMATHANE™ II FR BIO shall be a complete system of compatible materials to create a seamless waterproof roofing membrane to comply with the warranty requirements of this specification.

B. PERMATHANE™ II FR BIO shall be designated for application on the specific type of deck as indicated on the drawings and specifications.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers’ literature, technical data, material safety data sheets (MSDS) and installation instructions for primers (if required), polyurethane foam and protective coatings. Submit letter of certification that their products comply with the materials specified.

B. Samples: Submit samples of PERMATHANE™ II FR BIO roofing system. Samples shall be construed as examples of finished color and texture of the system only.

C. Applicator Approval: Submit letter from manufacturer stating applicator is approved to install the PERMATHANE™ II FR BIO roofing system.

D. Warranty: Submit specimen copy of manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Supplier Qualifications: PERMATHANE™ II FR BIO, as supplied by NEOGARD®, is approved for use on this project.

B. Applicator Qualifications: The applicator shall be approved to install specified roofing system. Manufacturer’s written verification of applicator approval is required.

C. Regulatory Requirements:
   1. The PERMATHANE™ II FR BIO roofing system shall be rated Class A in accordance with the spread of flame test requirements of ASTM E108.
   2. Materials used in the PERMATHANE™ II FR BIO roofing system shall meet Federal, State and local VOC regulations.

1.5 DELIVERY, STORAGE AND HANDLING

A. Containers and Packaging: Materials shall be delivered in original, tightly sealed containers, clearly labeled with the manufacturer’s name, brand name, type of material and batch number(s).

B. Storage and Handling: It is recommended to store materials at 75°F (23.8°C) with careful handling to prevent damage to products. All materials shall be stored in compliance with local fire and safety requirements. Do not store at high temperature or in direct sunlight.

1.6 PROJECT CONDITIONS

A. The sprayed polyurethane foam applications shall not proceed during periods of inclement weather. Do not apply the sprayed polyurethane foam below the temperature and/or above humidity specified by the manufacturer for ambient air and substrate.

B. Do not apply protective coatings when surface temperature is less than 40°F (4.4°C). Do not apply if there is ice, frost, surface moisture or visible dampness present on the surface to be coated. Prior to applying the protective coatings, check the polyurethane foam to insure that the surface is dry. Apply protective coatings in accordance with the coating manufacturer’s application instructions.

C. Wind barriers may be used if wind conditions could affect the quality of the polyurethane foam or protective coating installation.
1.7 WARRANTY

A. Upon request, NEOGARD shall offer its standard warranty upon receipt of a properly executed warranty request form.

PART 2 PRODUCTS

2.1 POLYURETHANE FOAM

A. The polyurethane foam system must be installed per manufacturer's current published recommendations.

B. The foam to be applied shall be a two-component, sprayed-in-place, rigid-class polyurethane foam, having a nominal density of 3 lbs per cubic foot and a thermal conductance ("K" Factor) of .16 btu/hr/sqft/oF/in at 70°F.

C. Typical performance requirements of cured foam used on this project are:

<table>
<thead>
<tr>
<th>Performance Requirements for Cured Foam</th>
<th>Test Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D1623</td>
<td>50 psi min.</td>
</tr>
<tr>
<td>Density</td>
<td>ASTM D1622</td>
<td>2.7 to 3.2 pcf</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM D1621</td>
<td>40 - 60 psi</td>
</tr>
<tr>
<td>Closed Cell Content</td>
<td>ASTM D1940</td>
<td>90% min.</td>
</tr>
<tr>
<td>Dimensional Stability 158°F, 100% RH, 28 Day</td>
<td>ASTM D2126</td>
<td>15% max.</td>
</tr>
<tr>
<td>K Factor (aged)</td>
<td>ASTM C518</td>
<td>0.14 - 0.16</td>
</tr>
<tr>
<td>Flame Spread</td>
<td>ASTM E84</td>
<td>75 max.</td>
</tr>
</tbody>
</table>

2.2 ELASTOMERIC COATING SYSTEM

A. The PERMATHANE™ II FR BIO coating system shall be manufactured by NEOGARD®, a division of JONES-BLAIR® Company, P.O. Box 35286, Dallas, TX 75235, Toll Free (800) 321-6588, Fax (214) 357-7532, www.neo-gard.com.

B. Protective Coating Materials (The following products qualify as a USDA BioPreferred product for Federal preferred procurement. Each product contains at least 20% of its carbon from a sustainable, renewable, biological resource):
   1. Liquid Flashing: 70600-BIO series polyurethane coating, gray or white in color.
   2. Base Coat: 70620-BIO polyurethane coating, gray in color.

C. Typical performance requirements for the cured protective coatings used on this project are:

<table>
<thead>
<tr>
<th>Performance Requirements of Cured Film</th>
<th>Test Method</th>
<th>Base Coat</th>
<th>Top Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Properties</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
<td>800 psi</td>
<td>1200 psi</td>
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<tr>
<td>Elongation</td>
<td>ASTM D412</td>
<td>190%</td>
<td>200%</td>
</tr>
<tr>
<td>Permanent Set</td>
<td>ASTM D412</td>
<td>3.1%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Tear Resistance</td>
<td>ASTM D1004</td>
<td>130 lbf/in</td>
<td>140 lbf/in</td>
</tr>
<tr>
<td>Water Resistance</td>
<td>ASTM D471</td>
<td>1.2% @ 7 days</td>
<td>&lt;1% @ 7 days</td>
</tr>
<tr>
<td>MVT @ 9 mils</td>
<td>ASTM E96</td>
<td>1.8 English</td>
<td>2.7 English</td>
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<tr>
<td>Taber Abrasion</td>
<td>ASTM D4060</td>
<td>N/A</td>
<td>14.6 mg</td>
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<tr>
<td>Shore A</td>
<td>ASTM D2240</td>
<td>83</td>
<td>73</td>
</tr>
<tr>
<td>Adhesion</td>
<td>ASTM D903</td>
<td>3.1 psi to Polyurethane Foam</td>
<td>8.6 psi to 70620-BIO Base Coat</td>
</tr>
<tr>
<td>Weathering Resistance</td>
<td>ASTM D822</td>
<td>N/A</td>
<td>Physical Properties Retained</td>
</tr>
<tr>
<td>Xenon Arc (1,000 hrs, Cycle A)</td>
<td>ASTM D4798</td>
<td>N/A</td>
<td>No Visible Blistering, Cracking, Crazing or Checking</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>Alternate Heat/Cold</td>
<td>No Loss of Adhesion</td>
<td>No Loss of Adhesion</td>
</tr>
</tbody>
</table>

2.3 ACCESSORIES

A. Flashings and waterproof coverings for expansion joints shall be compatible with specified PERMATHANE™ II FR BIO roofing system.

B. Miscellaneous materials such as primers, adhesives, elastomeric caulk compounds, metal, vents and drains shall be a composite part of the roof system and shall be compatible with specified PERMATHANE™ II FR BIO roofing system.

C. Granules (Optional): When used, shall be of the size and type recommended by NEOGARD and broadcast into an additional topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect surfaces, which will receive the PERMATHANE™ II FR BIO roofing system to make sure they are clean, smooth, sound, properly prepared, and free of moisture, dirt, debris, or other contaminants.

B. Verify that all roof penetrations, mechanical equipment, cants, edge metal, and other on-roof items are in place and secure.

C. Verify that all critical areas around the immediate vicinity of the spray area are suitably protected.

D. Verify that roof deck has sufficient slope for water to drain and that all drains and drain lines are clean and in working order.

E. Verify that all air conditioning and air intake vents are suitably protected or closed.
3.2 PROTECTION

A. The overspray and/or solvents from sprayed polyurethane foam and protective coating materials can carry considerable distances and care should be taken to do the following:
   1. Post warning signs noting potential overspray hazard within 100’ of work area.
   2. Mask off or cover all air intakes near the work area to prevent odors from entering occupied areas of the building or structure.
   
B. All surfaces not to receive system specified shall be protected from overspray hazard i.e. windows, doors, exterior and vehicles. Protective coverings shall be secured against wind.

3.3 SURFACE PREPARATION

A. Built-Up Roof
   1. All loose gravel, dust and residue shall be removed using power vacuum equipment, power sweeper, air blowing, or other suitable means.
   2. The roof shall be thoroughly inspected or tested to determine if moisture is present within the roof assembly. Saturated insulation must be removed and replaced with compatible materials.
   3. The existing roof shall be thoroughly inspected for adhesion between felts, insulation, and deck. Areas of poor adhesion should be fastened. Blisters, buckles, wrinkles and fishmouths shall be cut out and/or fastened.
   4. All soft mastic or other materials that impede polyurethane foam adhesion shall be removed.
   5. Remove or refasten all loose base flashing, counter flashing and gravel stops as required.
   6. Existing expansion joints should be inspected and repaired as necessary.
   7. Electrical and mechanical conduits should be relocated or raised above the finished roof surface.

B. Metal Deck
   1. Metal surfaces to be foamed shall be free of rust, loose scale, dust, dirt, grease, oil or other contaminants.
   2. Grease, oil or other obvious contaminants must be removed by tri-sodium phosphate and water or other solutions as required by job conditions. Remove all cleaning solutions with plenty of fresh water.
   3. Metal surfaces having loose scale or rust must be cleaned and primed with metal primer prior to polyurethane foam application as job conditions dictate. Contact NEOGARD for primer recommendations.
   4. Fluted metal decks require a suitable method of covering or filling the flutes prior to polyurethane foam application. Flutes may be covered with mechanically fastened board stock or filled with precut board stock or spray applied polyurethane foam.

C. Concrete
   1. Remove loose dirt, dust and debris by using compressed air, vacuum equipment or brooming. Oil, grease, form release agents or other contaminants shall be removed with proper cleaning solutions.

   2. Priming is required on concrete surfaces, and it is recommended that poured concrete decks be permitted to cure for twenty-eight (28) days prior to the application of primer or sprayed polyurethane foam. Consult polyurethane foam manufacturer for primer recommendations.
   3. All joint openings in concrete decks that exceed 1/4 inch shall be grouted or caulked and allowed to thoroughly cure prior to application of primer or sprayed polyurethane foam.
   4. The PERMATHANE™ II FR BIO roofing system is not recommended for lightweight or insulating concretes unless tests have been made to determine that adequate adhesion can be obtained or unless an overlayment is installed.

D. Wood
   1. Plywood shall be exterior grade not less than 1/2 inch thick, nailed firmly in place. Attachment must meet building code requirements for resistance to wind uplift.
   2. Plywood shall contain no more than 18% water, as measured in accordance with ASTM D4444, or ASTM D4442.
   3. Deck shall be free of loose dirt, grease, oil or other contaminants prior to priming or foam application. Remove loose dirt or debris by use of compressed air, vacuum or brooming. No washing shall be permitted.
   4. All untreated and unpainted surfaces shall be primed with an exterior grade primer. Priming is required to minimize moisture absorption and eliminate potential polyurethane foam adhesion problems. Contact polyurethane foam manufacturer for primer recommendations.
   5. Plywood joints in excess of 1/4 inch shall be taped or filled with a suitable sealant material. If sealant material is used, allow to thoroughly cure prior to application of primer or sprayed polyurethane foam.
   6. Tongue & Groove, Sheathing, Planking: Due to the frequency of joints, possibility of variable openings and effects of aging and shrinking, these surfaces must be overlaid with a minimum of ⅛ inch thick exterior grade plywood or suitable covering.

E. Other Surfaces (i.e. Gypsum Board, Isocyanurate Board)
   1. These materials are generally used over fluted metal decks and must be fastened to achieve necessary wind uplift requirements.
   2. Boards shall be firmly butted together along all edges without gaps or openings. Joints exceeding ¼ inch shall be caulked with a suitable sealant material. Allow sealant to thoroughly cure prior to application of primer or sprayed polyurethane foam.
   3. Special care must be taken to prevent these materials from getting wet in storage on the job site and after installation prior to being protected by polyurethane foam. Moisture exposure will damage these materials and may be a cause for replacement.
   4. Remove loose dirt and debris by using compressed air, vacuum or light brooming. No power brooming is permitted due to possibility of damage.
5. The installed materials shall be protected from spills of contaminants such as oil, grease, solvents, etc., as these materials cause soiling that cannot be readily removed from the board surfaces.

### 3.4 SPRAYED POLYURETHANE FOAM APPLICATION

A. Application Techniques: Techniques used to apply polyurethane foam to roof assembly shall be those recommended by the manufacturer of the polyurethane foam system.

B. Equipment: Equipment used shall be recommended by the manufacturer of the polyurethane foam system.

C. Tolerance: A multiple pass application of polyurethane foam is to be made in accordance with the polyurethane foam manufacturer's specifications and application procedures to reach the specified thickness. A tolerance of $+1/4'' - 0''$ per 1" thickness is acceptable.

D. Texture of Surface: Polyurethane foam surface texture may range from smooth orange peel to verge of popcorn and be acceptable. "Popcorn" surfaces are unacceptable and must be reworked. Note: Texture of polyurethane foam surfaces directly affects coating coverage rates.

E. Details: Use of sprayed polyurethane foam at cant lines is recommended.

F. Polyurethane foam application shall be limited to an area which can be completed to full foam thickness in one day and base coat applied the same day. Consult the foam manufacturer for minimum curing time before application of the base coat.

G. If polyurethane foam is not coated within 72 hours, surface shall be examined for surface oxidation and moisture contamination. If oxidation or contamination exists, contact polyurethane foam manufacturer for recommendations.

H. The polyurethane foam surface shall be free of moisture, frost, dust, debris, oils, tars, grease or other materials that will impair adhesion of the protective coating.

### 3.5 PROTECTIVE COATING APPLICATION

A. Base Coat: The base coat shall be applied the same day as the polyurethane foam application when possible. Apply 70620-BIO base coat in a uniform thickness at the rate of 2 gallons per 100 square feet in a minimum of 2 coats to yield an average thickness of 24 dry mils in strict accordance with procedures outlined by NEOGARD and allow to cure.

B. Topcoat: Apply 70613-BIO topcoat in a uniform thickness at the rate of 2 gallons per 100 square feet in a minimum of 2 coats to yield an average thickness of 24 dry mils in strict accordance with application procedures outlined by NEOGARD. Note: The above application rates are theoretical, calculated for glass-smooth surfaces with no allowances made for loss, job or surface conditions. Therefore, published coverage rates should only be used as a guide for estimating material requirements for a given job.

C. Granules: If a granule finish is desired, they shall be of the size and type recommended by NEOGARD and immediately broadcast into additional topcoat at the rate of 30 - 40 pounds per 100 square feet and allow to cure.

### 3.6 FIELD QUALITY CONTROL

A. The contractor shall maintain a system to verify compliance with this specification. Thickness of polyurethane foam and applied coating shall be measured and recorded for each coat and the total protective coating system.

B. Any variations from specified limits found by contractor shall be corrected by the contractor.

C. Total coating system thickness shall average 48 dry mils with a minimum coating thickness of the system, at any point on the roof, to be 30 dry mils exclusive of granules.

### 3.7 CLEANING

A. Remove debris, resulting from completion of coating operation, from the project site.

### 3.8 PROTECTION

A. After completion of application, do not allow traffic on the PERMATHANE™ II FR BIO roofing system for a period of at least 48 hours at 75°F (23.8°C) and 50% R.H., or until completely cured.
Product Benefits

Roof-kote is a natural agricultural oil-based, single application roof coating. Roof-kote’s biobased formula is VOC compliant, has built-in resistance to mold, mildew, and ultraviolet light attack. The high-build, non-sagging formula has excellent adhesion and flexibility and is 100% waterproof in just one coat. Roof-kote’s environmentally friendly formula stops flat roof leaks and offers permanent ponding resistance.

Product Certifications

- ENERGY STAR® qualified roof coating (white).
- Listed in the USDA BioPreferred™ product catalog.
- Roof-kote White is rated by the Cool Roof Rating Council (CRRC).
- LEED™ Certification: Roof-kote White can help contribute to earning Sustainable Sites -- Credit 7.2: Heat Island Reduction: Roof and Materials & Resources -- Credits 1.1, 1.2 or 1.3: Building Reuse: Maintain 25%, 50% or 75%, of Existing Walls, Floors & Roof.

Product Features


Application

Recommended for:

Roof-kote can be used over many roof surfaces, including concrete, foam, well adhered water-based coatings, weathered tar and gravel, weathered asphalt, rolled roofing, compatible single-ply membranes, slate and tile. When used with Primer-kote, Roof-kote can be used on new concrete and new or unsealed asphalt. Do not use Roof-kote on rubber, EPDM or any questionable roof surface. Do not use Roof-kote on new concrete or new or unsealed asphalt unless surface is primed with Primer-kote. Before coating ANY roof, always do a test patch to check for compatibility, adhesion and soundness.

Tools

- Airless spray: 4000 psi min. ½” hose min. 0.025 to 0.039 inch orifice reversible tip
- Reduction: Do not reduce
- Squeegee: Rubber squeegee
- Brush: Natural, nylon or polyester bristle
- Roller: Smooth foam roller

Approximate Coverage Rates per Gallon

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Coverage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slate, Tile, Concrete</td>
<td>30-40 sq. ft.</td>
</tr>
<tr>
<td>Foam/Membranes</td>
<td>30-40 sq. ft.</td>
</tr>
<tr>
<td>Rolled Roofing</td>
<td>25-35 sq. ft.</td>
</tr>
<tr>
<td>Alligatored Asphalt</td>
<td>20-30 sq. ft.</td>
</tr>
<tr>
<td>Tar &amp; Gravel</td>
<td>15-25 sq. ft.</td>
</tr>
</tbody>
</table>

(*will vary with extent of gravel removal)

Coverage rates are given in good faith by TKO Waterproof Coatings and should be used as an estimate only. Actual coverage rates will vary due to the individual nature of each application. Therefore, TKO Waterproof Coatings is not responsible for any variance between estimated and actual coverage rates.

General Application Guidelines

Preparation: Surface should be sound, clean and dry. Remove flaking, peeling and loose material. If mold and mildew are present, they must be removed before coating with Roof-kote. Use a suitable fungicide cleaner or liquid bleach solution. Once the mold and mildew has been completely removed, rinse the surface with water and allow it to dry thoroughly before coating with Roof-kote. For proper maintenance, the roof can be power-washed with up to 3000 psi to remove mold and mildew as well as other dirt and air-borne contaminants.

Patching: Patch all seams, breaks, leaks and problem areas with Tuff-kote and Tuffglass Fabric before coating.

Priming: Some substrates may require priming of the surface with Primer-kote prior to coating (including tar and asphalt and new concrete). Allow Primer-kote to cure for 24 hours before coating with Roof-kote. Refer to the Primer-kote product specification sheet for more information.

Application: Mix product thoroughly before using. Do not thin. Product warranty is voided if product is altered in any way. Keep lid tightly sealed after opening to prevent skin formation, stir again before each use. If skin forms, remove completely prior to mixing. Apply one thick coat at 40 wet mils (cures to dry film thickness of 32 mils). Always use a wet film gauge to ensure the proper mil thickness has been applied. Temperature range
for application: 40° F to 100° F for air, surface and material with a maximum humidity of 85%. Keep material at 72° F to 100° F for best spread rate. Forms immediate watertight barrier on all surfaces.

**Cure time:** Initial skin forms in six to eight hours; develops thicker set skin in 24 to 48 hours in good drying conditions (72° F and 50% humidity).

<table>
<thead>
<tr>
<th>Conditions</th>
<th>To Touch</th>
<th>To Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>40° F @ 50% humidity</td>
<td>72 hours</td>
<td>30 days</td>
</tr>
<tr>
<td>72° F @ 50% humidity</td>
<td>48 hours</td>
<td>14 days</td>
</tr>
<tr>
<td>100° F @ 50% humidity</td>
<td>24 hours</td>
<td>7 days</td>
</tr>
</tbody>
</table>

Final dry time will vary based on ambient temperature, weather conditions, relative humidity, application thickness, air movement and precipitation. Avoid all foot traffic until fully cured. **Suitable for occasional / maintenance foot traffic only. Do not use on decks or high traffic areas.** Roof-kote dries slowly, stays flexible and pliable under skin, never dries hard; cures to a tough, leathery finish.

**Clean-up:** Clean tools with mineral spirits. Dispose of contain-ers properly.

**Application Guidelines for Specific Roof Types**

**Concrete:** New concrete surfaces should be tested for alkalinity prior to the application of Roof-kote. Treat alkaline concrete and concrete patches with a Muriatic acid and water solution or seal with Primer-kote. Apply one coat of Roof-kote at 40 wet mils.

**Slate and Tile:** Remove efflorescence. Treat alkaline stucco surfaces with a Muriatic acid and water solution or seal with Primer-kote. Apply one coat of Roof-kote at 40 wet mils. Make sure Roof-kote is applied evenly on all overlaps, with no voids or gaps in the coating.

**Acrylic Elastomeric Coatings:** Remove all failed coatings completely. Apply one coat of Roof-kote to secured surface at 40 wet mils.

**Asphalt:** Seal new asphalt and unsealed asphalt with Primer-kote to prevent bleed-through. Apply one coat of Roof-kote at 40 wet mils. Allow extra material when coating granulated or rough surfaces.

**Rolled Roofing:** Check and repair blisters, patch all seams and joints. Remove all loose granules to ensure good adhesion, allow for extra material on rough or graveled surfaces. Seal with Primer-kote before applying Roof-kote.

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### Technical Information

- **Biobased content:** minimum 49% (ASTM D 6866-04)
- **Mold, algae, bacteria resistance:** No growth.
- **Flash point greater than 140° F.**
- **Non-toxic when cured.**
- **VOC compliant, less than 250 grams per liter.**
- **No hazardous disposal requirements.** Check with all local, state and federal regulations before disposing.
- **Shelf life:** two years in unopened can. Store at 40° to 85° F for maximum in-can stability.
- **Solids contents:** 80%.
- **Weight per gallon:** 9.5#.
- **Fire rating:** Class A over non-combustible substrate (ASTM E-84-04).
- **Non-ozone producing.** Non-ozone depleting.
- **Biodegradable.**

### Cautions

Combustible - keep away from heat and flame. Contains mineral spirits. Do not smoke when using product. Keep of out reach of children. Avoid prolonged exposure with skin and breathing of vapor or spray mist. Do not take internally. Before smoking or eating and after using, cleanse hands thoroughly. Close container tightly after each use. Use only with adequate ventilation. See the Material Safety Data Sheet (MSDS) for additional safety information.

### Warranty

Information is given in good faith, to be used as a guide only and does not assure product suitability for an intended purpose or application. Product is guaranteed to be free of defect. Warranty is limited to replacement of that portion of product proven to be defective. For complete warranty information, contact manufacturer.

---

**Listed in the USDA BioPreferredSM product catalog.**
Product Benefits

Metal 1-kote is a natural agricultural oil-based, rustproof, single application direct-to-metal coating. Metal 1-kote’s biobased formula is VOC compliant, has built-in resistance to mold, mildew and ultraviolet light attack. The high build, non-sagging formula has excellent adhesion and flexibility and fast surface drying characteristics.

Product Certifications

- ENERGY STAR® qualified roof coating (white).
- Listed in the USDA BioPreferred™ product catalog.
- Metal 1-kote White is rated by the Cool Roof Rating Council (CRRC).
- LEED™ Certification: Metal 1-kote White can help contribute to earning Sustainable Sites -- Credit 7.2: Heat Island Reduction: Roof and Materials & Resources -- Credits 1.1, 1.2 or 1.3: Building Reuse: Maintain 25%, 50% or 75%, of Existing Walls, Floors & Roof.

Product Features


Application

**Recommended for:**
Galvanized steel, Galvalume, weathered pre-painted metal, tin, copper, aluminum, carbon steel, acrylic coatings in good condition, aged fiberglass, weathered EPDM, weathered plastic. Do not use on TPO, Kynar metal panels, fresh tar and asphalt or any unsound surface. Before coating ANY roof, always do a test patch to check for compatibility, adhesion and soundness.

**Tools:**
- Airless spray: 4000 psi min, ½” hose min. 0.025 - 0.039 inch orifice reversible tip
- Reduction: Do not reduce

**Approximate Coverage Rates per Gallon**

Recommended Spreading Rate: 30-40 mils wet
Coverage: 30-40 sq. ft. per gallon

When estimating amount needed, always allow for roof stretch factor (square footage + corrugation/seam profile footage). Allow extra material when coating rusted surfaces.

Coverage rates are given in good faith by TKO Waterproof Coatings and should be used as an estimate only. Actual coverage rates will vary due to the individual nature of each application. Therefore, TKO Waterproof Coatings is not responsible for any variance between estimated and actual coverage rates.

**General Application Guidelines**

**Preparation:** Mix product thoroughly before using. If skin forms on surface of coating, cut skin carefully and remove completely before stirring and using product. DO NOT THIN. Product warranty is voided if product is altered in any way. Keep tightly sealed after opening to prevent skin formation, stir again before each use. Store at 40°F to 85°F. Can be factory-tinted or painted to match surrounding surfaces. Power-wash surface with a water pressure washer up to 3000 psi. Insure that the surface is clean and free of dirt, grease, oil and debris. Remove all mold and mildew. Remove all loose or poorly adhered coatings. If roof was previously coated or patched with an aluminum or asphaltic coating, prime surface with Primer-kote prior to applying Metal 1-kote. Make sure previous coating is firmly adhered before applying Metal 1-kote.

**Patching:** Patch all seams, breaks, leaks and problem areas with Metal1-patch and Tuffglass Fabric before coating. Replace worn or rusted fasteners.

**Priming:** Some substrates may require priming of the surface with Primer-kote prior to coating. Allow Primer-kote to cure for 24 hours before coating with Metal 1-kote. Refer to the Primer-kote product specification sheet for more information.

**Application:** Mix product thoroughly before using. Do not thin. Product warranty is voided if product is altered in any way. Keep lid tightly sealed after opening to prevent skin formation, stir again before each use. If skin forms, remove completely prior to mixing. Apply one thick coat at 30 to 40 wet mils (cures to dry film thickness of 24 to 32 mils). **Always use a wet film gauge to ensure the proper mil thickness has been applied.** Temperature range for application: 40°F to 100°F for air, surface and material with a maximum humidity of 85%. Keep material at 72°F to 100°F for best spread rate.
**Cure time:** Initial skin forms in two to four hours; develops thicker set skin in 24 to 48 hours in good drying conditions (72°F and 50% humidity).

<table>
<thead>
<tr>
<th>Conditions</th>
<th>To Touch</th>
<th>To Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F @ 50% humidity</td>
<td>24 hours</td>
<td>7 days</td>
</tr>
<tr>
<td>72°F @ 50% humidity</td>
<td>2 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>100°F @ 50% humidity</td>
<td>2 hours</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

Final dry time will vary based on ambient temperature, weather conditions, relative humidity, application thickness, air movement and precipitation. Avoid all foot traffic until fully cured. **Suitable for occasional/maintenance foot traffic only. Do not use on decks or high traffic areas.**

**Clean-up:** Clean tools with mineral spirits. Dispose of containers properly.

**Technical Information**
- Biobased content: minimum 31% (ASTM D 6866-04)
- Mold, algae, bacteria resistance: No growth
- Flash point greater than 140°F.
- Non-toxic when cured.
- VOC compliant, less than 250 grams per liter.
- No hazardous disposal requirements. Check with all local, state and federal regulations before disposing.
- Shelf life: two years in unopened can. Store at 40°F to 85°F for maximum in-can stability.
- Solids contents: 80%.
- Weight per gallon: 10.5#
- Fire rating: Class A over non-combustible substrate (ASTM E-84-04).
- Biodegradable.

**Cautions**
Combustible - keep away from heat and flame. Contains mineral spirits. Do not smoke when using product. Keep of out reach of children. Avoid prolonged exposure with skin and breathing of vapor or spray mist. Do not take internally. Before smoking or eating and after using, cleanse hands thoroughly. Close container tightly after each use. Use only with adequate ventilation. See the Material Safety Data Sheet (MSDS) for additional safety information.

**Warranty**
Information is given in good faith, to be used as a guide only and does not assure product suitability for an intended purpose or application. Product is guaranteed to be free of defect. Warranty is limited to replacement of that portion of product proven to be defective. For complete warranty information, contact manufacturer.

**Listed in the USDA BioPreferred® product catalog.**
ALL SEASON™ BIO KOTE
Product Data Sheet

PRODUCT INFORMATION: ALL SEASON™ BIO KOTE is a high performance, 71% solids, bio-based copolymer elastomeric fluid applied coating that is specially formulated from bio oils derived from agricultural products. ALL SEASON™ BIO KOTE is ideal for odor sensitive environments and provides a non-breathing, reflective, high tensile and highly elastic membrane with cold weather flexibility, chemical, weather and water resistance. Its bright white finish helps reduce surface temperatures thereby minimizing thermal expansion and contraction while providing long-lasting and preventative solutions for the renewal and maintenance of many roof types.

RECOMMENDED USES:
• As an intermediate coat and/or top coat over asphaltic materials, modified bitumen, metal, EPDM, aged TPO and select aged PVC.
• 48% Certified Bio Based Content – USDA FB4P
• SRI Index = 107.1 exceeding criteria for LEED Credit: SS Credit 7.2: Heat Island Effect: Roof 1 Point, Option 1.
• Always use in conjunction with the appropriate USP ALL SEASON base coats.
• Contact U.S. Ply, Inc. for specific uses.

PRODUCT CHARACTERISTICS:
Finish: Satin
Color: White
Reflectivity: .86 (ASTM C1549)
Emissivity: .84 (ASTM C1371)
Viscosity: 12,000 – 18,000 cps @ 77°F (nominal)
Weight: 11.98 lbs./gal.
VOC: < 213 grams/liter
Recommended Spread Rate: 1.5 gal – 2.00 gal per square per coat (nominal)

Drying Schedule: At 12.0 mils wet @ 50% RH

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Touch Dry</th>
<th>Recoat</th>
<th>Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>2 hr.</td>
<td>8 hrs.</td>
<td>72 hrs.</td>
</tr>
<tr>
<td>70°F</td>
<td>30 min.</td>
<td>4 hrs.</td>
<td>48 hrs.</td>
</tr>
<tr>
<td>110°F</td>
<td></td>
<td>2 hrs.</td>
<td>24 hrs.</td>
</tr>
</tbody>
</table>

Note: Drying time is temperature, humidity, and film thickness dependent.

Shelf Life: (Unopened) – 18 months from date of shipment
Flammability: Non-Flammable

Shipping Information:

<table>
<thead>
<tr>
<th>Container Size</th>
<th>Gross Weight</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Gal.</td>
<td>60 Lbs.</td>
<td>55</td>
</tr>
<tr>
<td>55 Gal.</td>
<td>680 Lbs.</td>
<td>55</td>
</tr>
</tbody>
</table>

D.O.T. Classification: Roof Coating, Not Regulated

HMIS:
- Health: 1
- Flammability: 0
- Reactivity: 0
- Protection: X

PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTY</th>
<th>TYPICAL VALUE</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids Content By Weight:</td>
<td>71% ± 2%</td>
<td>ASTM D-1353</td>
</tr>
<tr>
<td>Solids Content By Volume:</td>
<td>62% ± 2%</td>
<td>ASTM D-2697</td>
</tr>
<tr>
<td>Peel/Adhesion</td>
<td>Pass</td>
<td>ASTM C794</td>
</tr>
<tr>
<td>Tensile Strength 20 mil, 21 day cure @ 0F:</td>
<td>1400 psi ± 25</td>
<td>ASTM D-2370</td>
</tr>
<tr>
<td>Tensile Strength 20 mil, 21 day cure @ 77F:</td>
<td>250 psi ± 25</td>
<td>ASTM D-2370</td>
</tr>
<tr>
<td>Tear Strength</td>
<td>120 psi ± 25</td>
<td>ASTM D-624</td>
</tr>
<tr>
<td>Elongation, 20 mil, 21 day cure @ 0F:</td>
<td>345%</td>
<td>ASTM D-2370</td>
</tr>
<tr>
<td>Elongation, 20 mil, 21 day cure @ 77F:</td>
<td>560%</td>
<td>ASTM D-2370</td>
</tr>
<tr>
<td>Ultimate Elongation @ 23C (after 1000 hrs Accelerated Weathering)</td>
<td>250%</td>
<td>ASTM D-2370</td>
</tr>
<tr>
<td>Low Temperature Flexibility, @ -26C (after 1000 hrs Accelerated Weathering)</td>
<td>Pass (0.5 in mandrel, No cracking or Breaking)</td>
<td>ASTM D-522</td>
</tr>
<tr>
<td>Low Temperature Flexibility @ -17C (after 500 hrs Accelerated Weathering)</td>
<td>Pass (1 in mandrel, No cracking or Breaking)</td>
<td>ASTM D-522</td>
</tr>
<tr>
<td>Accelerated Weathering: No degradation after 1,000 hours</td>
<td>ASTM D-4798</td>
<td></td>
</tr>
<tr>
<td>Permeability: &lt; 0.5 Perms (Non-breathing)</td>
<td>ASTM D-1653</td>
<td></td>
</tr>
<tr>
<td>Water Swelling % after 1 week/ 4 weeks</td>
<td>&lt; 1% / &lt; 1.1%</td>
<td>ASTM D-471</td>
</tr>
<tr>
<td>Blistering on Mod Bit after 14 days under water</td>
<td>No Blistering</td>
<td></td>
</tr>
<tr>
<td>Fungi Resistance</td>
<td>Pass – 0 Rating</td>
<td>ASTM G21/Dade</td>
</tr>
<tr>
<td>Sag Resistance</td>
<td>0.3 inch</td>
<td>ASTM D-4400</td>
</tr>
</tbody>
</table>
APPLICATION PROCEDURES

ALL SEASON™ BIO-KOTE

TEMPERATURE
Air and Surface: 40°F Minimum/140°F Maximum
Material (spray): 100°F Minimum/140°F Maximum
Material (Non-spray): 80°F Minimum/140°F Maximum

RELATIVE HUMIDITY
Can be applied at relative humidity up to 90%

DO NOT APPLY WHEN THE TEMPERATURE CAN FALL TO WITHIN 5°F OF THE DEW POINT WITHIN 6 HOURS.

This product cures by flashing solvents. It is very important that this product is not used when weather conditions are below 20°F or when there is a chance that the temperature could fall below 20°F within a 24 hour period after application. Do not apply this product if rain or dew is likely to occur before drying of product. Late afternoon application is not recommended if high humidity conditions exist, which could cause high moisture concentration of the surface overnight.

BRUSH: No reduction necessary. Use nylon/polyester brush. Do not over-brush as material may start to pull.

ROLLER: No reduction necessary. Use 1/2” to 1-1/2” nap synthetic rollers. Keep a wet edge to avoid ripping which may change appearance. If ripping is a problem, extend lap time to after materials have skinned. Avoid rapid rolling which causes bubbling.

AIRLESS SPRAY-VOLUME:
Output: 2.5 – 3 gal. per min.
Pressure: 4,000 – 7,250 psi
Spray Gun: Graco – Contractor rated for pressure
Fan/Tip: 12/.031 -12/.037 reversible
Extension: 12” – 36” gun extension recommended

SPECIAL CONDITIONS
This product should only be applied with a working material temperature of at least 80°F when roller or squeegee application and at least 100°F when spraying. For best results, keep material temperature at a range of 120°F – 135°F. A heating band is recommended at all times to maintain optimum spray ability.

Mildew:
• Must be removed by power washing and broom scrubbing with a solution of bleach or detergent and water. Rinse clean and dry.

Ponding Water:
• U.S. Ply, Inc.’s Warranties do not cover damage due to ponding water.
• Coatings should not be applied on roofs collecting ponding water which stands longer than 48 hours. The National Roofing Contractors Association considers ponding water on any roof unacceptable. (See the NRCA Roofing and Waterproofing Manual).
• Please consult U.S. Ply, Inc.’s Technical Department for any specific questions regarding the application of this product.

Surface Preparation: All surfaces to be coated must be clean, dry, and paintable. It may be necessary to power wash and/or prime to enhance adhesion. See application specification for more details.

Mixing Procedures: No thinning or reducing is necessary. Product may separate after shipping and storage, though it may still look mixed. When mixing becomes necessary we recommend the use of a 3/4 horsepower or larger electric or air operated mixer with a blade capable of uniformly mixing the entire container. When product is in 5-gallon pails, use a 3” minimum diameter mixing blade. When product is in drums, use a 6” minimum diameter mixing blade.

Application Equipment: This product may be sprayed, squeegeed, or rolled. When using spray equipment, it is important that the following criteria are met: When using a spray pump, an air assisted pump 40:1 or greater fluid to air ratio capable of delivering 2-1/2 gallons or more per minute continuous is needed, the aluminum window screen should be removed. For best results when using a fluid spray hose, it should be high pressure with designed working pressure to handle maximum pressure delivered by the spray pump. Inside lining or tube should be of such a material so it is unaffectted by the coating and any solvents used for clean up. Additionally, the following criteria should be used for hoses: 3/8” ID whip connected to the gun followed by a 1/2” - 3/4” minimum I.D. up to 200 feet. The larger I.D. sections of hose should be used from the pump out in all circumstances with additional hose size reductions as necessary. Material temperature should be a minimum of 100°F or higher when spraying. In all conditions, material requires thermal assistance, such as heated hoses or band heaters to maintain the minimum material temperature and proper yields.

When using a spray gun, high-pressure gun swivels are available and can reduce operator fatigue. Any spray tip should be a reversible self-cleaning type with an orifice size of .031 to .037 with a fan angle of 40 to 50 degrees. Always use components rated for pump pressures.

Cleanup Instructions: Clean up spills and spatters immediately with biodegradable citrus cleaning products. After cleaning, flush spray equipment with USP All Season Cleaning Solvent.

SAFETY PRECAUTIONS: Refer to the MSDS sheet before use. For Chemical emergencies, spills, leaks, exposure, or accidents CALL: CHEMTREC DAY/NIGHT 1-800-424-9300.

All values given are approximate and are subject to change without notice. There is no implied or express warranty given through these values or statements, nor are there any assertions that the product purchased has been individually tested to conform to these standards. Testing is performed on a random basis by “in-house” and independent “third party” evaluation for the purpose of classification and or approval. Acceptance, purchase and selection of these products are the sole responsibility of the buyer or buyer’s representative. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of the product. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY U.S. PLY, INC.

EXPRESSED OR IMPLIED; STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.
VFI-540 Aluminum is a one-to-one by volume polyurea hybrid elastomeric roof coating. For specific ratings and approvals contact Volatile Free, Inc.

**Usage**

VFI-540 Aluminum is intended for use as a spray applied protective roof coating for use over concrete, metal, polyurethane foam and smooth built-up roofs. VFI-540 Aluminum should not be used directly over rough built-up roofs unless polyurethane foam is used to create a smooth surface. VFI-540 Aluminum can also be used over various single-ply membranes. Contact Volatile Free, Inc. on fire retardant systems or other information regarding this product.

**Color**

Aluminum. Note: Aluminum color is dispersed in the isocyanate component.

**Physical Properties**

**Weatherability**

Q.U.V. Weatherometer exposure equivalent to 15 years with no visible deterioration or change in physical properties.

**Chemical Resistance**

Good hydrolytic stability to 180°F. Good resistance to inorganic bases, acids, and hydrocarbon solvents. Fair resistance to oxygenated and chlorinated solvents.

**Ponding Water**

Resistant to ponding water.

**Tensile**

ASTM D-412

Strength: 1752 psi
Elongation: 200-300%
Permanent Set: 10% max.

**Hardness**

ASTM D-2240
Shore A 85 ± 3

**Tear Resistance**

ASTM D-624
Die C 199 pli

**Abrasion Resistance**

Excellent

**Water Vapor Permeability**

ASTM E-96
Method B 0.34 perm @ 44 mil thickness @ 68°F

**Water Absorption**

ASTM D-471
24 hours @ room temp. 1.3%

**Liquid Component Properties**

**Solids**

Weight: 97%
Volume: 96%

**Viscosity**

Poly Component: 550 ± 75 cps @ 77°F
Iso Component: 550 ± 75 cps @ 77°F

**Density**

Poly Component: 8.40 ± .2 lbs./gal. (S.G. 1.01)
Iso Component: 9.80 ± .2 lbs./gal. (S.G. 1.175)

**V. O. C**

27 grams/liter

**Flash Point**

ASTM D-56 (TCC)
Greater than 200°F.

**Toxicity**

Iso component contains polymeric isocyanate requiring fresh air supply respirator, gloves, and protective clothing during application.

**Storage**

VFI-540 Aluminum is sensitive to moisture. Store in a dry place between 45° and 85°F. Shelf life is six months for the "A" Side (Iso) and one year for the "B" Side (Poly) in original unopened containers. All containers must be sealed when not in use. Containers that have been opened should be used within one week. To prolong the shelf life of opened containers, it is recommended that a blanket of nitrogen be applied to the container or desiccant cartridge inserted into the container opening.
Storage When High Humidity Is Present

Upon opening of the “A” Side, one of the following procedures must be followed:

Desiccant Cartridge

Upon opening of the “A” Side for use, a desiccant cartridge should be inserted into one of the bung openings and the transfer pump tightly sealed in the other. To store unused portion of material, remove transfer pump and reseal drum plug. Leave desiccant cartridge in the drum during storage.

Application

Mixing

Care should be taken to ensure proper mixing of VFI-540 Aluminum. Drums must be power mixed. Mix all “A” Side (Iso) drums with a 1 ½ horsepower air driven mixer (do not use auger type mixer) for a minimum of 15 to 45 minutes depending upon the temperature of the product on the day of application. The shaft must have collapsible blades to fit through the bung opening in the drum and should be long enough to reach the bottom of the drum. Three or four drums of the “A” Side (Iso) can be mixed in an hour when you start up in the morning. The ultra violet protection in VFI-540 Aluminum coating is aluminum paste. The aluminum paste settles to the bottom of the drum during shipment and storage. Therefore, the “A” Side (Iso) drum must be thoroughly mixed before spraying; otherwise the aluminum paste will be left on the bottom of the drum. Product sprayed with aluminum paste still on the bottom of the drum will not perform as designed and the coating will not last as long. The coating finish may also appear streaky if all drums are not mixed properly.

Thinning

Do not thin.

Equipment

Plural component spray equipment capable of maintaining a constant temperature of 140° - 160°F, 1500 psi minimum pressure and a 1:1 volume mix ratio. Through testing, it has been determined that installation at the proper temperature of 150° to 160°F, 2000 psi minimum pressure at the gun will produce the optimum membrane.

Reactivity

Tack free time is 10-30 seconds when sprayed with hot plural component airless spray equipment.

When contents of the drum have been used, the desiccant cartridge can be used on another drum. You can continue to transfer the cartridge from drum to drum until the color indicates replacement.

Nitrogen Blanket

Nitrogen being heavier than air, can be put into a partially filled drum of the “A” Side forming a protective layer which will prevent any moisture from reaching the material in the drum. It takes only a small quantity of the nitrogen to form this layer and it will not mix with or contaminate the Iso.

Cure Time

Applied coating will set in 2-10 minutes at 70°F, depending on the film thickness and substrate temperature. Product can be placed into service after four hours of cure time at 70°F minimum.

Surface Preparation

Please refer to VFI Roofing Specifications relating to your particular project.

Surface Preparation for Asphalt Contamination

Material applied over thick uncured asphalt will cause bleed through and possible delamination. We even find “black jack” type products on metal roofs, where repairs were attempted around stacks, units and even on seams and fasteners to be a problem. Whether the asphalt is totally cured or not has to be the contractor’s determination, NOT Volatile Free, Inc.’s. If the asphalt product is old, hard and totally cured out, there is no problem going right over it with VFI-540 Aluminum. If the asphalt is soft and you can move it with your finger, it is not totally cured. This means that there still might be oil present that could leach out and cause discoloration and/or delamination. If the asphalt is not too thick and you see no signs of oil, we have found it extremely helpful to coat those areas with 1 to 1 ½ gallons per 100 sq. ft. of our VFI-550 Aluminum Single Component Moisture Cured Urethane. Let the VFI-550 Aluminum cure and then recoat with VFI-540 Aluminum. This forms a barrier between the asphalt and VFI-540 Aluminum. If the asphalt is too thick or uncured, it must be removed.

Corporate Office: P.O. Box 344 / Brookfield, WI 53008 / 800-307-9218 / 262-787-0400 / Fax: 262-787-0500

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DESCRIPTION:
VFI-540 FR Aluminum is a plural component, UL rated fire retardant (ASTM E-108/UL-790 Class A) polyurea hybrid roof coating for over VFI-730 Polyurethane Foam Roof Insulation.

USAGE:
VFI-540/FR is intended for use as a waterproofing; spray applied, fire retardant coating over VFI-730 Polyurethane Spray Roofing Foam applied over multiple substrates. This product has Dade County Approval.

- Protective fire rated coating over VFI-730 Urethane Foam Insulation.
- Protective coating for waterproofing metal, single-ply and built-up roofs over VFI-730 Polyurethane Foam.
- Protective coating over polystyrene insulation.

COLOR:
Aluminum.

PHYSICAL PROPERTIES

WEATHERABILITY:
ASTM 26 Xenon Accelerated Weathering at 3000 hours shows no cracking or checking. ASTM G-53 Weatherometer exposure: Tests equivalent to 15 years with no visible deterioration or change in physical properties.

FIRE RESISTANCE:
UL Rated ASTM E-108 /Class A over VFI-730 polyurethane foam roof insulation.

CHEMICAL RESISTANCE:
Good hydrolytic stability to 180°F. Good resistance to inorganic bases, acids and hydrocarbon solvents. Fair resistance to oxygenated and chlorinated solvents.

TENSILE:
ASTM D-412
Strength: 1500 psi
Elongation: 200-300%
Permanent Set: 10% max.

HARDNESS:
ASTM D-2240
Shore A 85 ± 3

TEAR RESISTANCE:
ASTM D-624
Die C 125 pli

ABRASION RESISTANCE:
Excellent.

WATER ABSORPTION:
ASTM G-471 1.0% max.

LOW TEMP FLEX
30°F, ½” mandrel PASS

LIQUID COMPONENT PROPERTIES

SOLIDS:
Weight: 97%
Volume: 96%

VISCOITY:
Poly Component: 400-600 cps @ 77°F
Iso Component: 550-750 cps @ 77°F

DENSITY:
Poly Component: 9.35 lbs./gal. (S.G. 1.122)

Iso Component: 11.49 lbs./gal. (S.G. 1.379)

FLASH POINT:
ASTM D-56 (TCC)
Greater than 200°F.

TOXICITY:
Iso component contains polymeric isocyanate requiring fresh air supply respirator, gloves, and protective clothing during application.

STORAGE STABILITY:
WARNING:
VFI-540 Aluminum is sensitive to moisture. Store in a dry place between 45° and 85°F. Shelf life is six months for the “A” Side (Iso) and one year for the “B” Side (Poly) in original unopened containers. All containers must be sealed when not in use. Containers that have been
VFI-540/FR ALUMINUM
UL RATED POLYUREA HYBRID ROOFING ELASTOMER

open any moisture from reaching the material in the drum. It takes only a small quantity of the nitrogen to form this layer and it will not mix with or contaminate the Iso.

APPLICATION

MATERIAL PREPARATION:
MIXING: Care should be taken to ensure proper mixing of VFI-540 FR Aluminum. ALL DRUMS MUST BE POWER MIXED! Mix all "A" side (ISO) drums and "B" side (POLY) drums with a 1½ horsepower air driven mixer (do not use auger type mixer) for a minimum of 30 to 45 minutes depending upon the temperature of the product on the day of application. (Minimum product temp 70°F). The shaft must have two sets of 3" long collapsible blades to fit through the bung opening in the drum and should be long enough to reach the bottom of the drum. The ultra violet protection in VFI-540 FR Aluminum coating is aluminum paste. The aluminum paste settles to the bottom of the drum during shipment and storage. Therefore, the "A" side (ISO) drum has to be thoroughly mixed before spraying; otherwise the aluminum paste will be left on the bottom of the drum. Product sprayed with aluminum paste still on the bottom of the drum will not perform as designed and the coating will not last as long. The "B" side (POLY) contains fire retardants that must be mix thoroughly to achieve proper physical properties.Product sprayed with fire retardants not completely mix will not perform as designed and the coating will not last as long. The coating finish may also appear streaky and can also clump up in sprayer causing off-ratio spraying, if ALL drums are not properly and completely mixed.

EQUIPMENT:
Plural component airless spray equipment capable of maintaining temperatures of 130° - 160°F, 2500 psi minimum pressure and a 1:1 volume mix ratio. Contact Volatile Free, Inc. for specific instructions and spray equipment needed.

REACTIVITY:
Tack free time is 10-30 seconds when sprayed with hot plural component airless spray equipment.

CURE TIME:
Applied coating will set in 2-10 minutes at 70°F, depending on film thickness and the substrate temperature. Product can be placed into service after four hours of cure time at 70°F minimum.
**General Purpose Polyurea Hybrid Elastomer**

**Description**
VFI-540R is a 100% solids, two component one to one by volume polyurea hybrid coating.

**Usage**
VFI-540R is intended for use as a spray applied coating for a variety of applications including but not limited to the following:
- Protective coating for metal and smooth asphalt roofs.
- Secondary containment when applied over concrete, wood or geotextiles.
- Protective coating for decorative products.
- Wearing and waterproofing membrane.

**Color**
Black and Gray
Custom colors are also available. Please contact Volatile Free, Inc. for more information.

**Physical Properties**

**Chemical Resistance**
Good hydrolytic stability to 180°F. Good resistance to inorganic bases, acids and hydrocarbon solvents. Fair resistance to oxygenated and chlorinated solvents.

**Tensile**
ASTM D-412
- Strength: 2852 psi
- Elongation: 314%
- Permanent Set: 25% max.
- Yield Strength: 602 psi
- Elastic Modulus: 4715 psi

**Adhesion**
ASTM D-4541
Adhesion to unprimed concrete.
475 lb./in.² with concrete failure

**Hardness**
ASTM D-2240
- Shore A: 94 - 96
- Shore D: 47 - 51

**Tear Resistance**
ASTM D-624
- Die C: 311 pli

**Abrasion Resistance**
Excellent.

**Permeability**
ASTM E-96
- Method BW: .03 perm In.

**Liquid Component Properties**

**Solids**
- Weight: 100%
- Volume: 100%

**Viscosity**
- Poly Component: 3268 ± 500 cps @ 77°F
- Range: 3900 ± 1000
- Iso Component: 624 C 50 cps @ 77°F
- Range: 600 ± 200

**Density**
- Poly Component: 10.7-11.4 lbs./gal. (S.G. 1.28-1.37)
- Depending on color.
- Iso Component: 9.41 lbs./gal. (S.G. 1.13)

**Specific Gravity**
- Poly Component: 1.285 g/ml.
- Iso Component: 1.369 g/ml.

**V. O. C.**
Conforms to all Air Pollution regulations. Contains no Volatile Organic Compounds.

**Flash Point**
ASTM D-56 (TCC)
Greater than 200°F

**Toxicity**
Iso component contains polymeric isocyanate requiring fresh air supply respirator, gloves, and protective clothing during application.

**Storage Stability**
One year in unopened containers at 50° - 90°F.
**Application**

- **Material Preparation**
  Thoroughly power mix Poly and Iso component before beginning to apply. Usually this takes a minimum of 15 minutes per drum with proper mixing equipment. For specific mixers, blade and shaft length contact V.F.I. A hand mixer is not adequate.

- **Equipment**
  Plural component airless spray equipment capable of maintaining temperatures of 130° - 140°F, 1500 to 2000 psi minimum pressure and a 1:1 volume mix ratio. Contact Volatile Free, Inc. for specific instructions and spray equipment needed.

- **Reactivity**
  Tack free time is 15-40 seconds when sprayed with hot plural component airless spray equipment.

- **Cure Time**
  Applied coating will set in 3-15 minutes at 70°F, depending on film thickness and the substrate temperature. Product can be placed into service after four hours of cure time at 70°F minimum.
U.L. RATED POLYUREA HYBRID ROOFING ELASTOMER

- **Description**
  VFI-540US Aluminum is a 1:1 polyurea hybrid coating designed for fire retardance over noncombustible surfaces.

- **Usage**
  VFI-540US can also be used on a variety of applications including:
  - Protective coating for waterproofing metal and built-up roofs.
  - Protective coating for urethane and expanded polystyrene insulation.
  - Secondary containment when applied over concrete, wood or geotextiles.
  - Protective coating for corrosion resistance on steel.

- **Color**
  Standard colors are aluminum, copper or gray.

### Physical Properties

- **Tensile Properties**
  - **ASTM D-412**
    - Strength: 1616 psi
    - Elongation: 325-350%
    - Permanent Set: 10% max

- **Tear Strength**
  - **ASTM D-624**
    - Strength: 150 pli

### Weather & Environmental Performance

- **Weatherability**
  - **ASTM G-53**
    Weatherometer exposure equivalent to 15 years with no visible deterioration or change in physical properties.

- **Chemical Resistance**
  Good hydrolytic stability to 180°F. Good resistance to inorganic bases, acids and hydrocarbon solvents. Fair resistance to oxygenated and chlorinated solvents.

- **Ponding Water Resistance**
  Resistant to ponding water.

- **Hydrolytic Properties**
  - **Water Absorption**
    - **ASTM G-471**
      - Water Vapor Permeability: 0.23 perms
  - **At 50 mils**

### Liquid Component Properties

- **Solids**
  - **Aluminum**
    - Weight: 97%
    - Volume: 96%
  - **Copper & Gray**
    - Weight: 100%
    - Volume: 100%

### Viscosity

- **Aluminum“A” side**
  - 600±200 cps @ 77°F
- **Aluminum “B” side**
  - 500±200 cps @ 77°F
- **Copper “A” side:**
  - 600±200 cps @ 77°F
- **Copper “B” side:**
  - 500±200 cps @ 77°F
- **Gray “A” side:**
  - 700±200 cps @ 77°F
- **Gray “B” side:**
  - 600±200 cps @ 77°F
Liquid Material Density
Aluminum "A" side 10.5±0.2 lbs/gal (SG 1.26 g/ml)
Aluminum "B" side 8.4±0.1 lbs/gal (SG 1.01 g/ml)
Copper "A" side 10.8±0.2 lbs/gal (SG 1.296 g/ml)

Storage

Warning
VFI-540US products are sensitive to moisture. All containers must be sealed when not in use. Containers that have been opened should be used within one week. To prolong the shelf life of opened containers, apply a blanket of nitrogen to the container or insert a desiccant cartridge into the container opening.

Storage Stability
"A" side 6 months in unopened containers @ 50-90°F.
"B" side 12 months in unopened containers @ 50-90°F.
Do not preheat over 100°F maximum without mixing. Do not store in direct sunlight.

Storage When High Humidity is Present
Upon opening of the "A" side, the following procedures must be followed:

Application

Mixing
Care should be taken to ensure proper mixing of VFI-540US product. The aluminum and copper is pigmented on the Iso side and the Gray product is pigmented on the Poly side. Pigmented drums must be power mixed. Mix all pigmented drums with a 1 ½ horsepower air driven mixer for a minimum 15-45 minutes depending on the temperature of the day of application. The shaft must have collapsible blades to fit through the opening on the drum and should be long enough to reach the bottom of the drum.

The ultra violet protection in VFI-540US Aluminum or copper coating is aluminum or copper paste that settles to the bottom of the drum during shipment and storage. Therefore, the "A" side (ISO) drum has to be thoroughly mixed before spraying or the colored paste will remain on the bottom of the drum. Product sprayed with paste on the bottom of the drum will not perform as designed and the coating will not last as long. The coating finish may also appear streaky as if the drums were not mixed properly.

Material Preparation
Thoroughly power mix Iso component before beginning to apply for a minimum of 15 minutes per drum with the proper mixing equipment. For specific mixers, blade and shaft length, contact VFI. A hand mixer is not adequate.

Equipment
Plural component spray equipment capable of maintaining a constant temperature of 150-160°F., with 2200 psi minimum static pressure and 2000 psi dynamic pressure with a 1:1 volume mix ratio. Testing has determined that installation at the proper temperature and minimum pressure will produce an optimum membrane.

Reactivity
Tack free time is 10-30 seconds when sprayed with proper spray equipment and temperature.

Cure Time
The applied coating will set in 2-10 minutes @ 70°F, depending on the film thickness and substrate temperature. The coated surface can be placed into service after four hours of cure time at 70°F minimum.

Desiccant Cartridge: Upon opening of the "A" side for use, a desiccant cartridge should be inserted into one of the bung openings and the transfer pump tightly sealed in the other. To store an unused portion of material, remove transfer pump and reseal the drum plug. Leave the desiccant cartridge in the drum during storage. When the contents of the drum have been used, the desiccant cartridge can be used on another drum. You can continue to transfer the cartridge from drum to drum until the color indicates replacement.

Nitrogen Blanket: Nitrogen, being heavier than air, can be put into partially filled drum of "A" side forming a protective layer that will prevent any moisture from reaching the material in the drum. It takes only a small quantity of the nitrogen to form this layer and it will not mix with or contaminate the ISO.
Roof Membranes

Introduction

In addition to the multiple roof coating choices, there is also the option of applying a biobased roofing membrane. Membranes serve the same purpose as the roof coatings—they seal out water and lower the temperature of the building. The main difference is that membranes are a dry sheet that can be applied to the roof with adhesive rather than being rolled or sprayed onto the roof. Like the roof coatings, many of these products are fire, impact, mold, mildew, and rust resistant. These products are designed to be durable and are highly tear resistant, which helps keep maintenance to a minimum. Different membranes have different roofing substrates to which they can be applied, but as a whole, membranes can be applied to almost any surface given the proper adhesive or polyurethane foam application. Some of these products are designed to be cap sheets, which are the top layers of a membrane roofing system, while others are base sheets and need to have other roofing materials applied over them.

Additional product information can be attained through the manufacturers directly or by contacting Steve Devlin with BioPreferred\textsuperscript{SM}, sdevlin@iastate.edu, 641-613-3298.
<table>
<thead>
<tr>
<th>Company</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Garland Company</td>
<td><strong>StressPly E (Environmental)</strong> membranes feature a unique combination of rubber-modified asphalt together with selected reinforcement layers. The result is a high-strength, puncture- and fatigue-resistant, rubber-modified membrane designed for application as the waterproofing and reinforcement layer of a modified built-up roofing system. It provides long-term performance in all types of new or retrofit construction uses.</td>
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<tr>
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<td><strong>StressPly E FR Mineral</strong> membranes feature a unique combination of rubber-modified asphalt together with selected reinforcement layers. The result is a high-strength, puncture- and fatigue-resistant, rubber-modified membrane designed for application as the waterproofing and reinforcement layer of a modified built-up roofing system. These rubber-modified membranes utilize Kevlar® fibers and a dual polyester and fiberglass combination reinforcement that offers the inherent strength and heat stability of fiberglass along with the ability of polyester to conform.</td>
</tr>
<tr>
<td>U.S. Ply, Inc.</td>
<td><strong>DuraFlex™ 190FR BIO SBS</strong> is a fire-resistant, granule-surfaced, premium SBS (Styrene-Butadiene-Styrene) mop- or cold-applied membrane. Manufactured with a nonwoven polyester mat for high tear strength and puncture resistance, DuraFlex™ 190FR BIO SBS is formulated with premium quality, asphaltic bitumen, SBS elastomers and 3% USDA Certified Bio material for a highly durable, flexible, and easily maintainable membrane. It is designed for use as a cap sheet in modified bitumen and hybrid built-up roof systems.</td>
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<td><strong>DuraFlex™ 190S BIO SBS</strong> is a smooth-surfaced, premium SBS mop- or cold-applied membrane. Manufactured with a nonwoven polyester mat for high tear strength and puncture resistance, it is formulated with premium quality, asphaltic bitumen, SBS elastomers and 3% USDA Certified Bio material for a highly durable, flexible, and easily maintainable membrane. It is designed for use as a base sheet in modified bitumen and built-up roof systems or as a cap sheet when surfaced with a coat of asphalt and gravel.</td>
</tr>
<tr>
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<td><strong>DuraFlex™ 250FR BIO SBS</strong> is a fire-resistant, granule-surfaced, premium SBS mop- or cold-applied membrane. Manufactured with a heavy-duty, high-performance nonwoven polyester mat with a high tensile strength and puncture resistance, it is formulated with premium quality, asphaltic bitumen, SBS elastomers and 7% USDA Certified Bio material for a highly durable, flexible, and easily maintainable membrane. It is designed for use as a cap sheet in modified bitumen and hybrid built-up roof systems.</td>
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<tr>
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<td><strong>DuraFlex™ 250S BIO SBS</strong> is a smooth-surfaced, premium SBS mop- or cold-applied membrane. Manufactured with a heavy-duty, high-performance nonwoven polyester mat for higher tear strength and puncture resistance, it is formulated with premium quality, asphaltic bitumen, SBS elastomers and 3% USDA Certified Bio material for a highly durable, flexible, and easily maintainable membrane. It is designed for use as a base sheet in modified bitumen and built-up roof systems or as a cap sheet when surfaced with a coat of asphalt and gravel.</td>
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## Roof Membrane Product List

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<td>ASTM D6162</td>
<td>UL Certified Biobased</td>
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<tr>
<td>Modified BURs</td>
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<tr>
<td>Modified Bitumen BURs</td>
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<tr>
<td>Modified Bitumen Built-up Roof Systems</td>
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StressPly® E (Environmental) Membranes

**PRODUCT DESCRIPTION**

StressPly E membranes feature a unique combination of rubber-modified asphalt together with selected reinforcement layers. The result is a high strength, puncture and fatigue resistant, rubber-modified membrane designed for application as the waterproofing and reinforcement layer of a modified built-up roofing system. It provides long-term performance in all types of new or retrofit construction uses.

StressPly membranes are made up of Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene (SBS+SIS). These rubber-modified membranes utilize Kevlar® fibers and a dual polyester and fiberglass combination reinforcement that offers the inherent strength and heat stability of fiberglass along with the ability of polyester to conform.

**PRODUCT ADVANTAGES**

**Environmentally Friendly** - Waste tire disposal is a serious environmental problem. StressPly E membranes benefit everyone by utilizing post-consumer scrap from tires in the roofing compound. In addition, StressPly E utilizes recycled boiler slag as the surfacing in non-mineral membranes diverting materials away from landfills. With absolutely no sacrifice in quality, StressPly E membranes maintain Garland’s reputation as a manufacturer of high-performance roofing systems while benefiting the environment.

**Soy-Based Technology** - StressPly E reduces our reliance on traditional petroleum-based technologies by incorporating soy-based products flexibility and performance. The incorporation of soy in StressPly E introduces a rapidly renewable resource, further enhancing the sustainability of the membrane.

**Unmatched Rubber Technology** - StressPly E membranes provide unmatched durability. The SBS rubber affords superior low temperature flexibility and long-term weathering characteristics. The SIS rubber dramatically increases the overall life expectancy of the modified membrane. When SBS and SIS are combined, the result is a superior high-performance roof membrane.

**Security in Multi-Ply Construction** - StressPly E membranes function as the top component in a multi-ply roof system. It combines the proven performance of a multi-ply configuration together with the strength, flexibility and elongation of an elastomeric roof system. This high-performance roofing system represents a concerted development effort by Garland researchers combined with years of practical problem-solving field experience.

**Superior Strength** - The StressPly E membranes are reinforced with one layer of fiberglass and one layer of polyester. The superior strength provided by the Kevlar fibers and the dual fiberglass and polyester combination resists the movement created by today’s modern buildings. In addition, StressPly E membranes provide tensile strength in excess of 500 pounds per inch in the machine and cross machine direction. This translates to long-term resistance to splits and tears in the completed StressPly E membrane roof system.

**Superior Fire Resistance** - StressPly E FR Mineral contains a fire retardant that is added to the compound during the manufacturing process. As a result, it will maintain its fire rating for the life of the membrane. StressPly E FR Mineral has a Class A fire rating over a combustible roof deck.

**USES**

StressPly E membranes are designed for use as the top component in a roofing system where fire retardancy is required. It can also be used in conjunction with other HPR® products, as well as with conventional glass base sheets or fiberglass roofing felts. Specifications are available for either hot or cold-applied systems. In addition, StressPly E membranes can be used as the top ply in a two-ply flashing system. It can also be used to repair splits, cracks, and other deteriorated areas in existing asphalt-based roofing systems.

**APPLICATION**

StressPly E membranes can be used with ASTM D 312, Type III or IV asphalt, Garland’s HPR All-Temp Asphalt or modified asphalt. One or two plies of ASTM D 2178, Type IV or VI fiberglass felt are solidly bonded to the approved substrate. The StressPly E membrane is then solidly bonded to these base layers with mopping asphalt.

StressPly E membranes can also be applied in Garland’s cold-applied Weatherking® and Green-Lock® membrane adhesive. One or two layers of Garland approved base sheets are applied in Weatherking or Green-Lock membrane adhesive to the approved substrate. The StressPly E membrane is then adhered to these base layers with Weatherking or Green-Lock membrane adhesive.
**StressPly E (Environmental) Membranes**

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<tr>
<th>Technical Data</th>
<th>StressPly E</th>
<th>StressPly E FR Mineral</th>
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<tbody>
<tr>
<td><strong>Tensile Strength</strong></td>
<td>*MD 500 lbf./in. (87.5 kN/m)</td>
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<td></td>
<td>*XD 550 lbf./in. (96.25 kN/m)</td>
<td>*XD 550 lbf./in. (96.25 kN/m)</td>
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<tr>
<td><strong>Tear Strength</strong></td>
<td>**MD 650 lbf./in. (114 kN/m)</td>
<td>**MD 650 lbf./in. (114 kN/m)</td>
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<td></td>
<td>**XD 750 lbf./in. (132 kN/m)</td>
<td>**XD 750 lbf./in. (132 kN/m)</td>
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<tr>
<td><strong>Elongation</strong></td>
<td>MD 900 lbf. (4003 N)</td>
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<td></td>
<td>XD 950 lbf. (4226 N)</td>
<td>XD 950 lbf. (4226 N)</td>
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<td><strong>Low Temperature Flex.</strong></td>
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<td>XD 6.0%</td>
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<tr>
<td></td>
<td>-30°F (-34°C)</td>
<td>-30°F (-34°C)</td>
</tr>
</tbody>
</table>

Finished membrane meets and/or exceeds ASTM D 6162, TYPE III Test Method ASTM D 5147 is tested at:

* 2 in./min @ 73.4 ± 3.6°F
  (50 mm/min @ 23 ± 2°C)
* 0.08 in./min @ 0 ± 3.6°F
  (2.0 mm/min @ -18 ± 3°C)

<table>
<thead>
<tr>
<th>Roll Dimensions</th>
<th>StressPly E</th>
<th>StressPly E FR Mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>3 ft. 3 in. (1 m)</td>
<td>3 ft. 3 in. (1 m)</td>
</tr>
<tr>
<td>Length</td>
<td>34 ft. 8 in. (10.57 m)</td>
<td>26 ft. 2 in. (7.98 m)</td>
</tr>
<tr>
<td>Weight</td>
<td>85 lbs. (39 kg)</td>
<td>85 lbs. (39 kg)</td>
</tr>
<tr>
<td>Nominal Thickness</td>
<td>115 mils (2,921 microns)</td>
<td>160 mils (4,064 microns)</td>
</tr>
<tr>
<td>Net Coverage</td>
<td>100 sq. ft. (9.29 m²)</td>
<td>75 sq. ft. (6.97 m²)</td>
</tr>
<tr>
<td>Packaging</td>
<td>25 rolls/pallet</td>
<td>25 rolls/pallet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eco-Facts</th>
<th>StressPly E</th>
<th>StressPly E FR Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycled Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Consumer</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>Post-Consumer</td>
<td>26%</td>
<td>2%</td>
</tr>
<tr>
<td>LEED® Material Resources Contribution</td>
<td>25%</td>
<td>11%</td>
</tr>
<tr>
<td>Rapidly Renewable Content</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

For specific application recommendations, please contact your local Garland Representative or Garland Technical Service Department.