Environmental Protective Coatings, Inc.

2035 Regency Road, Suite5, Lexington, Kentucky,40503
Phone: (859) 277-0014 Fax: (859) 278-4973 Email: homerhartepc@aol.com

Product Information:

THERM-A-SHIELD ®

General Introduction

Thanks to Environmental Coating Systems Improved Research Technology, we are able to introduce a much-improved elastomeric acrylic coating to roof owner users. We have incorporated our superior acrylic polymers to produce the best elastomeric base that, coupled with ceramic hollow pressured spheres, makes the ultimate insulation believed to be far superior to any other conventional coatings now available. Although acrylic latex polymers are known for their exterior durability and ultraviolet resistance, early roofing applications were occasionally problematic because the polymers were designed for applications other than roofing. The new acrylics for roofing, however, are internally plasticized to maintain elastomeric properties, such as high and low-temperature flexibility. In addition, they are combined with unique chemistries that provide both long-term dirt pick-up resistance and outstanding adhesion to many roofing substrates.

The durable 100% acrylic-based coatings can be easily applied over a variety of roofing substrates including aged built-up, polyurethane foam, asbestos, galvanized steel, asphalt shingles, or cured concrete, and offer the following benefits:

- Superior exterior durability and UV light resistance
- High temperature stability
- Low-temperature flexibility down to -15 degrees
- Dirt pick-up resistance
- Excellent adhesion to polyurethane foam and many other substrates
- High reflectivity which reduces roof surface temperatures, thereby prolonging roof life and reducing interior temperatures and energy costs
- Easy 'application by spray, brush, or roller - thus lowering application costs
- Low toxicity and odor
- Simple water cleanup for manufacturers and contractors

THERM-A-SHIELD ®

THERM-A-SHIELD ® latex was specifically designed for superior wet and dry adhesion to low and high-density foam. **THERM-A SHIELD ®** also exhibits excellent adhesion to a variety of other construction substrates.

Typical Performance properties of THERM-A-SHIELD ® Elastomeric Roof Coating

Listed below are the individual properties inherent in THERM-A-SHIELD technology. ***It is important to remember that it is the balance of these properties that is unique to this chemistry***. Although coatings based upon other technologies may exhibit excellence in one or two performance properties, it is the combination of all the properties that is required for a successful elastomeric roof coating.

Durability
Since the advent of Plexiglas acrylic plastic sheet during World War II, acrylics have been known for their exceptional durability, offering unequaled resistance to degradation by sunlight and moisture. It was the UV resistance of the acrylic polymer the lack of which is the major cause of failure in conventional roof systems - that first led manufacturers to consider acrylic polymers for elastomeric roof coatings. Through **THERM-A-SHIELD®** technology these acrylic polymers have been tailored specifically for elastomeric roofing applications, although T**HERM-A-SHIELD®** affords many more hi-tech and practical uses, such as hot and cold industrial plant pipes.
High-Temperature Advantages of Conventional Coatings
THERM-A-SHIELD®' s formulation of ceramic-filled product allows increased insulation over the more conventional coatings now available.
Tensile Strength and Elongation
Thermal movement of a roof requires high tensile strength and elongation as well. The tolerance for movement of these coatings is essential due to the dynamic nature of a roofing substrate which expands and contracts due to climatic conditions and the shifting and settling of the foundation.
These properties also give properly formulated elastomeric roof coatings the needed flexibility and elasticity to withstand impact from foot traffic and other abuse without rupturing.

Low Temperature Flexibility
Coatings for dimensionally unstable roofing substrates must have long-term low-temperature flexibility. This is necessary to accommodate thermal expansion and contraction of the substrate, so that coatings will not fail over an extended period of time or with extreme weather conditions.

> **It should be remembered that the effects of extreme weather conditions are not restricted to cold climates. Evaporation of water after a sudden thunderstorm on a hot day in any geographic location can rapidly drop the roof temperature as much as 100 degrees, causing severe thermal stress on the roof surface.**

Roof coatings based on **THERM-A-SHIELD®** technology can withstand a 180 degree flexibility bend at -15 degrees without cracking. Since there is no plasticizer to migrate from the system, this flexibility is retained over time. Long term resistance to cracking extends the life of the roof. It is important to note that elastomeric roof coatings should exhibit good mechanical properties at room and low temperatures before and after exterior exposure.
Stop Leaks
THERM-A-SHIELD® stops most small holes by application directly to surface substrate.
Dirt Pickup Resistance
Polymers designed for **THERM-A-SHIELD®** elastomeric roof coatings combine the inherent flexibility of pliable, low Tg polymers with long-term resistance to dirt pickup. Without dirt pickup resistance, the roof coatings would quickly darken with age. Because dark materials tend to absorb heat, dirt pickup can significantly increase roof surface temperatures which, in turn, increases interior temperatures and energy costs.
THERM-A-SHIELD®-based coatings, however, resist dirt pickup and retain their white, reflective appearance.
Test roofs have shown that after five years of exposure, the surface temperature of the THERM-A-SHIELD®-based acrylic coating was 35 degrees cooler that that of a conventional caulk polymer coating and 85 degrees cooler than a black uncoated roof.

THERM-A-SHIELD® Elastomeric Coatings

Although designed specifically for superior wet and dry adhesion to high and low density polyurethane foam. elastomeric roof coatings properly formulated with THERM-A-SHIELD® latex polymer exhibit excellent adhesion to other typical roofing substrates. A variety of ceramics, color chips and metal oxide pigments can be used to produce tinted roofs. **THERM-A-SHIELD®**-based elastomeric roof coating formulations can vary due to different climates.

Actual Performance Properties of
THERM-A-SHIELD® Ceramic Elastomeric Roof Coating
Tensile Strength and Elongation

THERM-A-SHIELD® ceramic insulating coatings expand and contract along the roofing substrate to which they are applied because of their excellent tensile strength, elongation and recovery properties. Resistance to cracking will be maintained upon long-term exterior exposure because **THERM-A-SHIELD®** acrylic does not require a plasticizer. Typical tensile strength, elongation and recovery properties of **THERM-A-SHIELD®** ceramic elastomeric roof coating are shown in Table 1.

Table 1-Typical Mechanical Properties of **THERM-A-SHIELD®** Ceramic Elastomeric Roof Coatings

	Mechanical Properties After Two-Week Cure 70°/50% Relative Humidity		
Property	**74 Degrees F**	**32 Degrees F**	**0 Degrees F**
Percent Recovery	**65(65)**	**54 (65)**	**63 (52)**
Percent Elongation			
Maximum Stress	**240 (140)**	**120 (110)**	**80(70)**
Break	**245 (230)**	**215 (180)**	**130(120)**
Tensile Strength (psi)			
Maximum Stress	**173 (242)**	**245 (394)**	**728 (699)**
Break	**167 (232)**	**220 (385)**	**659 (699)**

Note: The numbers In parenthesis are alter an additional 50 hours Weather-Ometer exposure. These numbers show noticeably lower elongation and higher tensile strength than alter only a two-week cure. The additional Weather-Ometer exposure ensures complete cure of the mastic and also leaches out the water-sensitive components of the formulation, e.g. ethylene glycol, HEC thickener and dispersants which act to hydroplasticize the roof mastic film. The use of 50-hour Weather-Ometer exposure or a "zero-point" is recommended for monitoring changes that occur in accelerated or real-world exposure studies.

Other Performance Properties

Mechanical Properties

Room Temperature Tensile Strength	**670 psi**
Room Temperature Elongation	**460%**
0° F Tensile Strength	**2100 psi**
0° F Elongation	**100%**
Low Temperature Flexibility @ 180° Bend	**Passes @ -25°F**
Clear track Firm	**Low**
Adhesion to PUF(3)	
Dry (pound/inch)	**5 A/C**
Wet (pound/inch) 2A	
Perms 14	
Water Swelling (30 days)	**8%**

(1) Mechanical properties measures using a 2 in/mm. crosshead speed
(2) Lowest temperature at which It passes a 1/8 Inch mandrel bend.
(3)A= adhesive failure.
C= Cohesive failure of the substrate.

Dirt Pickup-Resistance and Low-Temperature Flexibility

The combination of dirt pickup resistance and low-temperature flexibility is unique to **THERM-A-SHIELD®** based on acrylic polymers formulated in **THERM-A-SHIELD®**. Surfaces coated with these formulations retain the initial white, reflective color, thereby decreasing the exterior surface temperature of the roof and further reducing interior building temperatures. This could mean a savings in air conditioning costs.

It is necessary for roof mastics to have low-temperature flexibility because they must accommodate the thermal expansion and contraction of the roof substrate. In addition, they must resist the impact of hailstones prevalent in most climates. Our **THERM-A-SHIELD®** ceramic formulation can be bent over 180 degrees over a 1/8 inch mandrel at 15 degrees without breaking.

Superior Adhesion to Polyurethane Foam

Formulations based on **THERM-A-SHIELD®** technology acrylics exhibit superior adhesion to polyurethane foam. The standard 180 degree peel adhesion test measures the wet and dry adhesion properties of an elastomeric roof coating formulation.

Samples of **THERM-A-SHIELD®** acrylic were tested on an Inston Unit. According to test results, the weakest point was found to be in the cohesive strength of the foam rather than the bond between the roof mastic and the foam. The adhesion data reveal that formulation of **THERM-A-SHIELD®** ceramic elastomeric actually tore the adhesion during the test, This type of failure is referred to as cohesive failure in the substrate. The conventional acrylic roof mastic failed adhesively in the same test, and the value were significantly lower than those recorded for our **THERM-A-SHIELD®** formulation.

The excellent peel adhesion data obtained in the laboratory were also found in the tests run under the exterior exposure conditions. Results appear in Tables 2 and 3.

Table 2- Adhesion to Polyurethane Foam

Formulation Binder	THERM-A-SHIELD®		Conventional Acrylic Roof mastic Latex	
	Peel Adhesion (lb./in.)		Peel Adhesion (lb./in.)	
Foam Density (lb./ft)	Dry1	Wet2	Dry1	Wet2
2.5[3]	5.OC	3.OC	1.OA	< 0.2A
3.5[3]	3.5C	2.OC	1.OA	< 0.2A
4.0[4]	3.6C	3.5C	1.OA	<0.2A

A = Adhesive Interfacial Failure
C= Cohesive Failure In Substrate

1 Sample cured two weeks at 750F/250C and 50% relative humidity and tested.
2 Sample cured two weeks at 750Ffl?C and 50% relative humidity and then immersed in water for one week and tested while wet.
3 Smooth Surface texture.
4 Orange peel surface texture.

Table 3 - Adhesion of THERM-A-SHIELD® Acrylic to Polyurethane Foam after Exterior Exposure

Cure Time	Adhesion	Failure
One week dry[1]	4.8 lb/in.	Cohesive
One week dry plus one week water soak[2]	4.1 lb/in.	Cohesive
Eight Weeks exterior[3]	4.4 lb./in.	Cohesive
Twenty-eight weeks exterior[3]	4.0 lb./in.	Cohesive
Two years exterior	5.0 lb./in.	Cohesive

1 Sample cured two weeks at 750F/25C and 50% relative humidity and tested one week and tested while wet.
2 Sample cured two weeks at 750F1250C and 50% relative humidity and then Immersed In water for
3 samples exposed horizontal face up, Southeastern Pennsylvania. Samples not cured in the laboratory.

Long Term Exterior Roofing Exposure

Early prototypes of **THERM-A-SHIELD®** ceramic based coatings have been on exposure since the late 1980's and in actual roofing applications since 1989. These exposures continue to demonstrate excellent performance.

THERM-A-SHIELD® ceramic elastomeric roof coating formulation also has excellent adhesion to many common construction substrates. Some examples are in Table 4.

Table 4 - Adhesion of THERM-A-SHIELD® Ceramic Elastomeric to Common Construction Substrates

	Peel Adhesion (lb./in.)	
Substrate	Dry1	Wet2
Polyurethane Foam	5.0 cp	3.5 cp
Galvanized Steel	5.0 cp	2.0 cp
White Pine	6.0 cp	0.5 A
APP Modified Bitumen	1.3	0.4 A
Asphalt Shingles	1.5 A	0.5 A

A= Adhesive Failure
C = Cohesive PEAK Failure

1 Sample cured two weeks at 750F1250C and 50% relative humidity and tested.

2 Sample cured two weeks at 750F/250C and 50% relative humidity and then immersed In water for one week and tested while wet.

Safe Handling Information

Based on final composition, **THERM-A-SHIELD®** elastomeric acrylics are not expected to be acutely toxic. There may be a slight moderate skin, eye, or respiratory irritant.
THERM-A-SHIELD® Material Safety Data Sheets (MSDS) contain pertinent data that you may need to protect your employees and customers against any known health or safety hazards associated with our products.

MSDS SHEET:

Under the OSHA Hazard Communication standard, workers must have access to and understand MSDS on all hazardous substances to which they are exposed. Thus, it is important that you provide appropriate training and information to your employees and make sure they have available to them MSDS on any hazardous products in their workplace.
Environmental Coating Systems sends MSDS on non-OSHA hazardous as well as OSHA-hazardous products to both the "bill to" and "ship to" locations of all our customers upon initial shipment (including samples) of all of our products (whether or not they are considered OSHA-hazardous). If you do not have access to one of these MSDS, please contact your local Environmental Coating Systems representative for an additional copy. Updated MSDS are sent on an annual basis to all customers on record.
MSDS should be obtained from the suppliers of other materials recommended in this bulletin.

LIGHTWEIGHT CERAMIC

Form	**Hollow Spheres**
Composition	**Silica-Alumina Ceramic Alloy**
Color	**White**
Specific Gravity	**.7- .9 g/cc**
Particle Size Range	**10 - 300 microns**
Ph in Water	**6-8**
Specific Conductance in 1% Slurry	**Maximum 25 Micro Mohs/cm**
Softening Point	**22000 F**
Hardness Mohs Scale	**5**
Compressive Strength	**5,000 psi**
Free Moisture	**0.2% Maximum by Weight**
Thermal Conductivity	**0.69 Btu/hr/SL2/F/in**
Coefficient of Thermal Expansion	**$d=8 X 10^{-6}$**
Electrical Resistance	**10^{15} ohm cm**
Dielectric Constant	**1.608 @1000 KH**