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The ABCs of PVC roof membranes

PVC membranes offer a wide variety of features, including heat weldability, reflectivity and fire resistance

By the Thermoplastic Subcommittee of SPRI

PVC (polyvinyl chloride) roof membranes have the longest track record of any thermoplastic membrane, with the first PVC-based systems installed in Europe in the early 1960s.

Despite the dramatic growth of TPO membranes, use of PVC roofs continues to grow in the U.S., according to RSI's 2001 State of the Industry Report. More than 10% of the average roofing contactor's volume last year was PVC—up a significant 3% from 1999.

Reinforced PVC roof membranes have many important attributes that complement their proven track record and have spurred additional growth. Besides the important feature of heat-welded seam technology, PVC or vinyl roof membranes offer many other inherent features.

These additional features include:

- a comprehensive history of product testing,
- an ability to be made in a spectrum of colors including reflective white,
- a high resistance to puncture and impact, an excellent resistance to flame exposure and subsequent fire propagation,
- proven durability against rooftop soiling and contamination, and
- good low-temperature flexibility and high-temperature tolerance.

Vinyl roof membranes are very user-friendly and are installed by a variety of attachment methods. Vinyl roof membranes are aesthetically appealing and they provide excellent visual feedback of workmanship for the applicator during and after installation.

PVC: A history of performance

Specifically, vinyl is "polyvinyl chloride." PVC is a molecule comprised of carbon, hydrogen and chlorine (taken from salt).

As mentioned above, today's reinforced vinyl membranes have a long history of installations worldwide; many that were installed over 20 years ago are still performing today. Vinyl membranes for roof applications were first developed in Germany and Switzerland in the 1960s and arrived in North America in the 1970s. The use of vinyl membranes in low-slope roofing has grown significantly and rapidly in North America ever since then.

Vinyl membranes were the first single-ply roof products to obtain a standard designation, D4434, from the American Society for Testing and Materials (ASTM). ASTM D4434 was published in 1985 and has been updated several times since then.

Vinyl is the best known thermoplastic roof membrane. "Thermoplastic" means that when heated sufficiently, the material tem-

A PVC roof system being fully adhered. *(Photo courtesy of Sarnafil Inc., Canton, MA.)*

PVC membranes have a long history of installations worldwide. *(Photo courtesy of Sarnafil Inc., Canton, MA.)*

porarily changes from a solid to a semi-solid state enabling the sheets or panels that are overlapped to be fused together and return to a solid upon cooling, yielding one continuous membrane. It is this feature that enables the seam overlaps of vinyl roof membranes to be fused or heat-welded together.

To accomplish the welding, specialized, electrically-powered welding equipment that is either self-propelled or hand-held is used. These units operate on electricity and inject heated air into the seam area, softening the membrane surfaces. A roller that is either hand-held or part of the self propelled unit, presses the seam overlap together. As the welder moves away from a given seam location, the membrane quickly cools down to ambient temperature and the heat weld is made, providing a watertight bond.

Vinyl roof membranes are manufactured by various methods, including extrusion, calendering, laminating, extrusion-coating, spread-coating or a combination of the above.

In all cases, however, the finished vinyl roof membrane contains polyester or fiber glass reinforcement, vinyl resins, ultra-violet light inhibitors, heat-stabilizers, biocides, pigments and plasticizers. Polyester reinforcement imparts high tearing and breaking strengths needed for mechanically-fastened roofing systems.

Attachment methods

Fiber glass reinforcement imparts a greater degree of dimensional stability beneficial for adhered methods of roofing systems. Depending upon the approach to plasticizer chemistry by the membrane manufacturer, vinyl membranes can be referred to as CPA (copolymer alloy), EIP (ethylene interpolymer) or NBP (acrylonitrile butadiene polymer), etc. The versatility of vinyl affords the membrane manufacturer many options when formulating for enhanced chemical resistance, flexibility and/or tensile strength.

Vinyl roof membranes have great versatility of application. Vinyl roof membranes are usually mechanically-attached, adhered to the insulation or other substrate or held in place with stone or concrete as ballast. Some vinyl roof membranes are also offered in large prefabricated panels intended to reduce rooftop installation time.

In addition, vinyl membrane can be readily produced with "fleece cushion" backing (typically polyester) that enables it to be installed over slightly rough surfaces and/or to be adhered with a variety of adhesives.

In order to complement this versatility of application, vinyl roof membranes can be manufactured in a variety of colors. This feature allows for the application of rooftop logos or multiple-color roofs.

The look of steep slope metal can also be simulated with a colored vinyl membrane. Standard production vinyl membranes generally have a light- colored weathering surface that is reflective. Vinyl membranes are also offered in a variety of thickness options ranging from 0.036 inch (0.9 mm) to 0.120 inch (3 mm), with the choice depending on requirements, preference and manufacturing method.

Under a new program, many vinyl membranes have the well-known Energy Star label from the United States Environmental Protection Agency (EPA) and the Department of Energy (DOE). This label assures the building owner that their roof membrane meets the energy-saving specification of the EPA and DOE. In addition, some vinyl membrane manufacturers offer a surface treatment that resists dirt attraction to enhance the visual appeal of the membrane even further.

This material also lends itself to recycling, particularly the excess material that occurs during the production process. These trimmings may be recycled back into the roof membrane itself or but also can be reprocessed into their own durable end-use products such as rooftop walkways or, roadway patch materials.

Another significant benefit of vinyl roof membranes is their fire resistance. Vinyl membranes are inherently self-extinguishing which enables them to perform exceptionally well in fire tests undertaken at organizations such as Underwriters Laboratories and Factory Mutual, etc. and to perform reliably in real-world flame exposure.

In addition to fire resistance, vinyl membranes also meet or exceed other industry performance standards that involve water leakage, puncture resistance, hail resistance, wind-uplift resistance and so on. Vinyl roof membranes also stand up exceptionally well to ponded rainwater, which often remains despite efforts for positive drainage, and to a variety of typical rooftop contaminants, such as air pollution, bird droppings, acid rain., etc.

Finally, vinyl roof membrane manufacturers offer a complete line of vinyl-based accessories for use within the roof system itself. Accessories such as vinyl-coated sheet metal for edge, curb and wall flashing, prefabricated corner flashing, and prefabricated vent pipe flashing, all lend themselves to an easier installation that is both highly functional and aesthetically appealing.

Over a long period of time, vinyl roof membranes have earned the recognition of being a proven and versatile thermoplastic for rooftop applications.

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