

## Design Flexibility with Vinyl Roofing Systems

Determining the degree to which form follows function in a building project is always a balancing act, but with the right materials, aesthetics doesn't have to take a back seat to all of the other critical considerations involved in designing a building envelope. Architects and specifiers who have selected vinyl roofing membranes know it is not unusual for worry-free performance and complex roof curvatures or other stunning lines and details to converge in one project.

For commercial and industrial roofing applications, the thermoplastic material known as PVC or vinyl offers a broad assortment of benefits that make it a clean, easy-to-install and safe alternative, offering greater design flexibility than any other roofing system. For more than 40 years, this versatile, highly-engineered material has been protecting buildings of all types in all climates around the world.

### ***Strong, secure performance***

To meet building design criteria and building code and insurance requirements, vinyl roofing membranes can be installed with a variety of fasteners or adhesives, or loose laid in green, or planted, roofs and plaza decks with pavers.

A single ply product, vinyl roofing membrane is factory-manufactured to strict quality control requirements, minimizing the risk inherent in field-constructed built-up systems. Membranes can be fabricated in a variety of widths and lengths to meet the exact dimensions of a roof. On all installations, roofing sheets are joined by hot-air welded seams.

Vinyl, or PVC, is a thermoplastic material, which means it can be heated repeatedly without changing its fundamental characteristics over its lifespan. Consequently, the heat-welded seams form a permanent, watertight bond – regardless of roof slope – that is stronger than the membrane itself. This is a major advantage of thermoplastic membranes over other types of roofing systems that rely on adhesives, tapes and caulks to seal the seams.

### ***Stands up to the elements and other stresses***

Most membranes are internally reinforced with a woven fabric such as polyester, or incorporate glass fibers, making them highly durable and able to withstand both extreme temperatures and stresses imposed by building movement, without cracking or deterioration. Properly designed vinyl roofing can meet or exceed the wind uplift requirements needed to obtain Factory Mutual approvals.

ASTM D4434, "Specification for Poly (Vinyl Chloride) Sheet Roofing," establishes minimum standards for vinyl roof membranes. Under these test criteria, a vinyl sheet must show no evidence of cracking or crazing after 5,000 hours of exposure to a xenon arc light source, water spray and elevated temperatures – all factors that can degrade roofing membranes and lead to failures in service.

These stringent standards make it possible to use vinyl roofing material on everything from flat roofs with ponding water to vertical wall waterproofing applications. This kind of roofing also may be used in concealed applications such as the waterproofing layer in green, or planted, roofs and plaza deck applications.

### ***Inherently fire resistant***

The composition of the vinyl polymer gives vinyl roofing membranes an inherent fire resistance not found in alternative materials without the use of additives. A simple vertical fire test reveals how these membranes will self-extinguish when a flame source is removed. This is in stark contrast to other roofing materials that will continue to support combustion even after the flame source is no longer present. In the U.S., these systems are available with unlimited slope Underwriter Laboratories Class A fire ratings and Factory Mutual Class 1 approvals.

### ***White, reflective, energy efficient***

Increasingly, owners of large commercial and industrial buildings are using white reflective vinyl roofing systems to reduce heat gain inside the building, as well as curb the large roofing surface's potential for contributing to the urban heat island effect.

Reflective roofing or planted roofs meet the design criteria for one point under the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Sustainable Site Credit 7: Landscape and Exterior Design to Reduce Heat Islands, Req. 2. Credit 7 states, "Use/maintain ENERGY STAR® roof compliant, high-reflectance AND high emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E-408) for a minimum of 75 percent of the roof surface; OR install/maintain a "green" (vegetated) roof for at least 50 percent of the roof area (1 point)."

Roofing technologies are increasingly included in energy efficiency standards proceedings, and specifiers are turning to the Cool Roof Rating Council's (CRRC) product rating database to help make purchasing decisions. The CRRC Product Rating Program provides roofing manufacturers with a means to label various roof surface products with radiative property values rated under a strict CRRC-administered program.

Cool roofs are noteworthy for their ability to reduce the temperature of the roof surface and thus the amount of heat radiated to the building envelope. For example, the standard black roof has a temperature rise of 90 degrees F in full sun, while the corresponding temperature rise for the standard white reflective roof is 14.6 degrees F.

In a 2001 federal study, the Lawrence Berkeley National Laboratory (LBNL) measured and calculated the reduction in peak energy demand associated with a vinyl roof's surface reflectivity. LBNL found that, compared to the original black rubber EPDM roofing membrane on the Texas retail building studied, a retrofitted vinyl membrane delivered an average decrease of 42 degrees F in surface temperature, an 11 percent decrease in aggregate air conditioning energy consumption, and a corresponding 14 percent drop in peak air conditioning energy consumption.

### ***Customizable, stunning visuals***

With all of this functionality to consider in the specification process, still, architects need not be limited in their thinking about materials by complex roof lines or multiple roof penetrations that may be cosmetically critical to a project. All can be accommodated by vinyl's inherent flexibility and strength. Tight seals are easily formed around these details and penetrations.

Membranes can also be manufactured in a wide spectrum of color options to match a building's color palette; even logos can be incorporated. Extruded profiles can be welded to the membrane to replicate the appearance of standing seam or batten metal roofs, while providing the security of watertight hot-air welded seams.

### ***Cost efficient over a long life cycle***

Vinyl roofing systems can deliver reliable service for decades; it is not unusual for them to last more than 20 years. When damage occurs to vinyl roofing – such as a tear or cut – it can be repaired without recoating or resurfacing. The membrane need only be cleaned and then repaired with the same techniques used to weld the seams during installation. Although vinyl roofing systems require little maintenance, manufacturers recommend that they be inspected twice a year for plugged drains and weathered sealants, and after each heavy storm for possible damage.

Vinyl roofing membranes' long service life combined with the need for virtually no maintenance results in low life cycle costs. Life cycle analyses comparing vinyl building products to similar products made of alternative materials have generally shown them to perform favorably in terms of energy efficiency, maintenance costs, low contribution to greenhouse gases and product durability, which means using fewer resources.

In addition, vinyl membranes are recyclable at both the post-industrial and post-consumer phases. Although their long service life does not yet yield a large quantity of these membranes, there is an established vinyl roofing recycling program in Europe, and the industry is actively researching and investing in technologies to improve the availability of recycling alternatives in North America.

The versatility, energy efficiency, overall track record and incomparable design flexibility of vinyl roofing membranes make them a solid – and sustainable – choice for architects and specifiers who are as committed to innovation as they are to reliable, optimum performance.