

Sure-Flex™ KEE HP (High Performance) Membrane

Raising Roofs to New Heights

A HISTORY OF PERFORMANCE

Traditionally, PVC membranes have been formulated using liquid plasticizers to create a more flexible product. As technology has improved over time, the use of higher molecular weight plasticizers increased, bringing better performance and stability to PVC roofing membranes. Beginning in 1977, DuPont® developed a higher molecular weight solid plasticizer Elvaloy® KEE, which would not migrate from the PVC membrane like traditional liquid plasticizers thus increasing the performance and stability of the PVC membrane beyond what liquid plasticizers could do.

Sure-Flex KEE HP Membrane

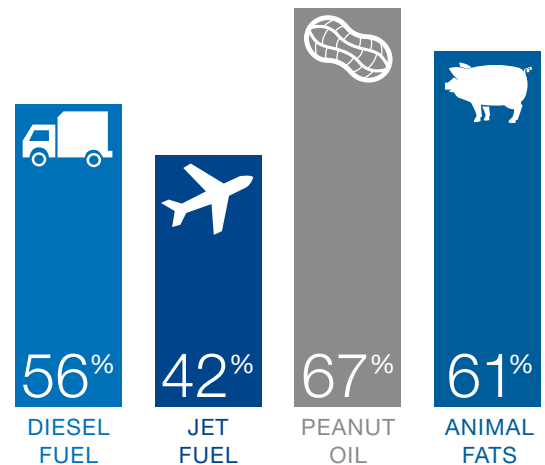
Recommended for roofing membranes in 1991, DuPont developed an even higher molecular weight solid plasticizer and labeled it Elvaloy KEE HP. The HP refers to “high performance.” The DuPont Elvaloy KEE HP resin modifier is an extension of the standard Elvaloy KEE grade. The benefits that standard KEE provided PVC roofing membranes were enhanced by the Elvaloy KEE HP with increases in permeance, thermal stability and durability, improved resistance to dirt and microbial growth pickup, and flexibility while extending the low and high temperature performance limits of standard KEE. Since then Elvaloy KEE HP has been used in a variety of industries and products, including roofing membranes, pond liners, and industrial films, consistently providing longer term performance and ease of use.

CHEMICAL RESISTANCE

The increased stability of the KEE HP provides a greater resistance to chemicals, pollutants, and abrasion. KEE HP is able to resist harsh chemicals, acid rain, industrial pollutants, oils, fats, and jet fuel. This resistance is due to its increased molecular weight and stability. Harsh chemicals can extract liquid plasticizers out of PVC membranes or cause premature degradation in other roofing products. Because KEE HP plasticizers are stable and will not migrate out of the membrane, the membrane is protected from the effects of harsh chemicals.

To the right are the results of tests conducted to assess the resistance of KEE HP, as well as that of regular PVC to various chemicals.

PVC & KEE HP Chemical Resistance - Percent of Improvement (Aged 28 Days at 140°F)



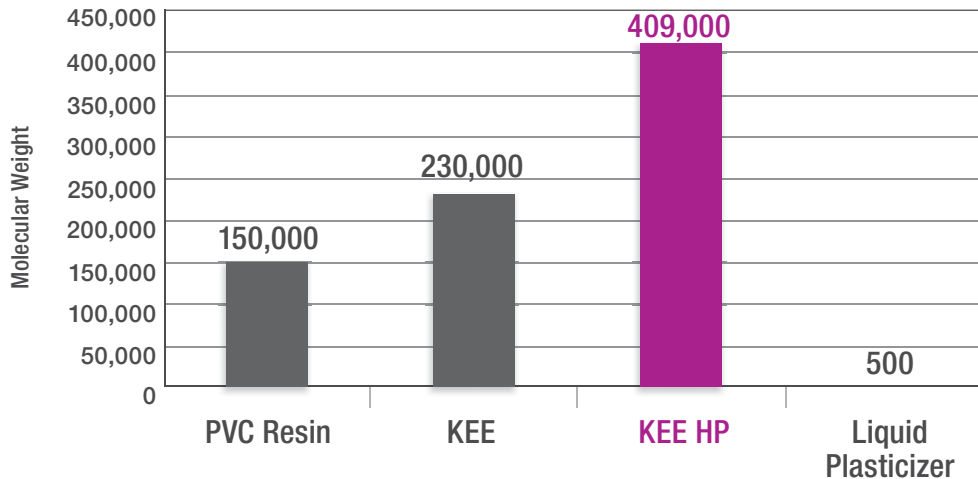
Percent of Improvement over Standard PVC

EXPERIENCE THE CARLISLE DIFFERENCE

HIGHER MOLECULAR WEIGHT

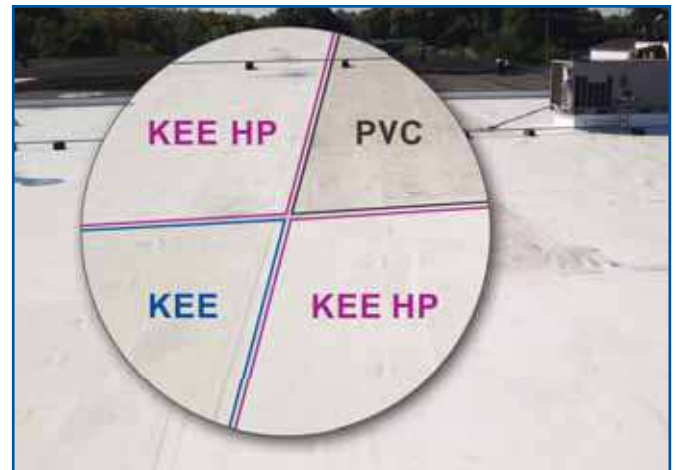
Molecular weight significantly impacts long-term performance and flexibility of roofing membranes. The higher the molecular weight, the greater the performance of the membrane. Throughout the history of PVC membranes, molecular weight has constantly been increasing while improving performance. With the traditional liquid plasticizers, PVC membrane technology moved from a lower molecular weight to a higher molecular weight. The same transition is taking place with the KEE plasticizer – technology is moving from a lower molecular weight solid plasticizer to a higher molecular weight solid plasticizer with KEE HP.

The KEE plasticizer has a higher molecular weight than liquid plasticizers, and the DuPont Elvaloy KEE HP plasticizer has an even higher molecular weight, meaning it is more stable and will remain in the membrane for a much longer period of time. This creates a KEE HP modified PVC membrane that will help maintain its flexibility and weldability throughout a roof system's entire service life.



IMPROVED AESTHETICS

Carlisle's KEE HP membranes are also more resistant to microbial growth and dirt pickup, ensuring that the membrane stays cleaner and whiter than the standard KEE membranes, which stay cleaner than the standard PVC membranes. This not only cuts down on required rooftop maintenance but also maintains the reflectivity values and aesthetic appeal of the roofing system, especially on sloped roofs that would be visible to the public.



A comparison of a rooftop in New Jersey illustrates the improved aesthetics achieved with KEE HP

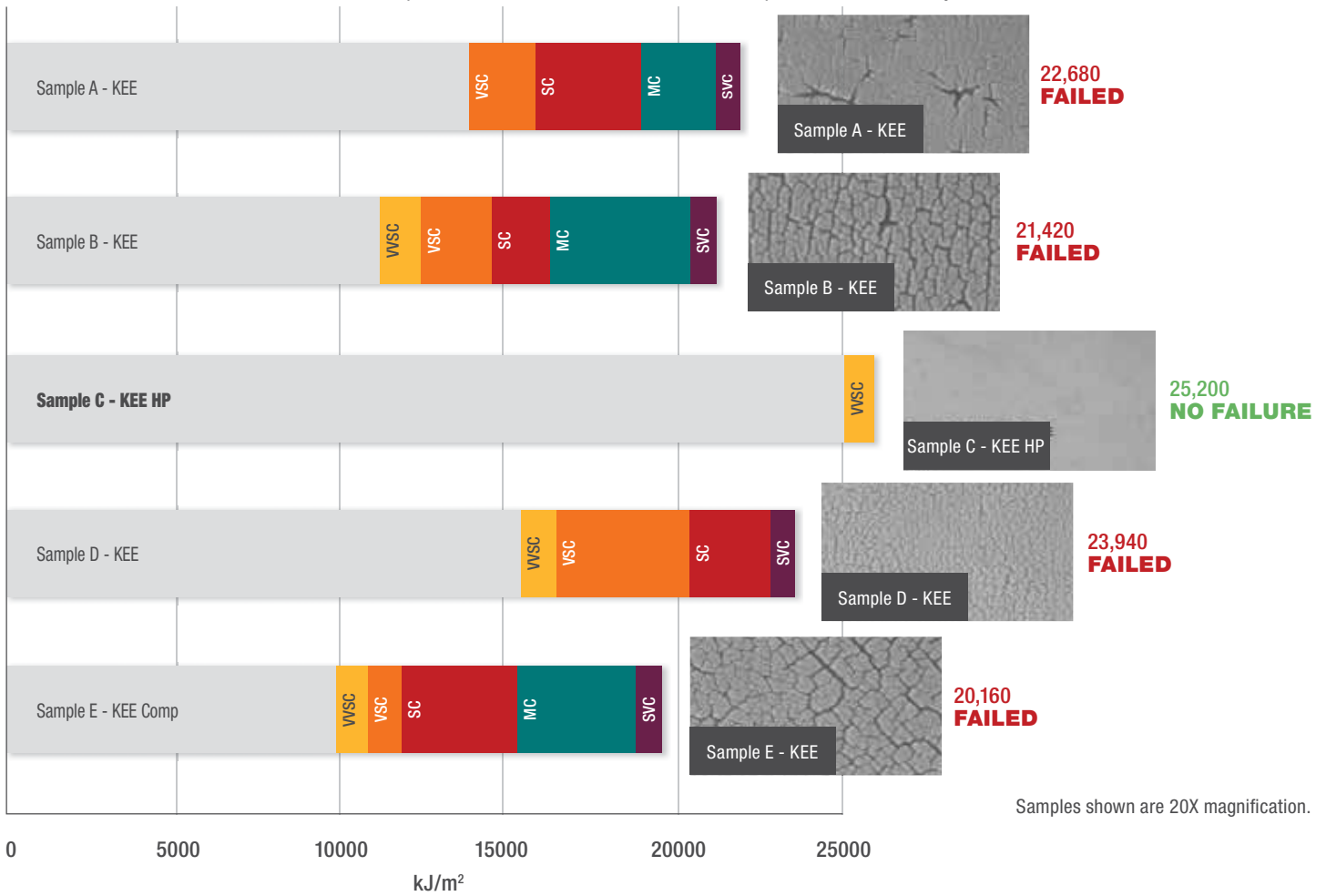
THERMAL PERFORMANCE

The stability of DuPont’s Elvaloy KEE HP, as used in Carlisle’s KEE HP, provides enhanced resistance to UV degradation and heat-related failures. With traditional liquid plasticizers, or other lower molecular weight plasticizers, UV exposure causes plasticizer migration, which degrades the membrane over time. The increased stability of the KEE HP plasticizer enables the membranes to withstand severe heat and UV exposure without suffering the degradation found in other lower molecular weight plasticized PVCs. This provides longer-term weatherization and performance for the life of the roofing system.

To ensure long-term performance in the most severe climates and conditions, Carlisle’s KEE HP membrane, along with other membranes, were exposed to Xenon Arc testing at conditions typically used to test TPO and EPDM membranes, which are more stringent than the conditions traditionally used to test PVC and standard KEE membranes.

A variety of PVC membranes were tested, which were enhanced with DuPont’s Elvaloy standard KEE and KEE HP. Carlisle’s KEE HP is by far the best performing membrane, surviving the severe exposure of 25,000 kJ/m² without cracking and only very, very slight crazing occurring on the membrane.

XENON ARC AGING (ASTM D7613)
 0.70 W/m² Exposure @ 340nm, 80°C BPT • Inspected after every 500 hrs



Samples shown are 20X magnification.

WSC	Very, very slight crazing (just able to observe under 10X)	MC	Moderate crazing (can observe within 24" from eye)
VSC	Very slight crazing (cannot see with unaided eye, but easily observed under 10X)	SVC	Severe crazing (can observe from 6 ft away, similar to alligating)
SC	Slight crazing (able to observe with unaided eye within 12" from eye)		

WELDABILITY

51% ↑
WELDABILITY

When Carlisle upgraded from KEE to KEE HP, the window of weldability improved by 51%. KEE HP's enhanced flexibility provides an easier, faster installation. In testing, the membranes were welded with a Leister® robotic heat welder at various temperatures and speeds. The results show that KEE HP significantly widens the window of weldability.

COLD TEMPERATURE FLEXIBILITY

Not only is KEE HP resistant to heat and weatherization, it also improves flexibility in cold temperatures. Carlisle's KEE HP membrane passed ASTM D2136 testing for low temperature flexibility and passed at -51°F (-46°C), ensuring that it will maintain its flexibility, weldability, and performance even in severe cold temperatures. It is important to note that the ASTM D4434 low temperature testing requirements for PVC only require the membrane to pass at -40°F, (-40°C); KEE HP far exceeds the requirements for PVC membrane.

The glass transition temperature of KEE HP is -64°F (-54°C), nearing that of EPDM, which is recognized as the most flexible membrane in the industry. This is a 22°F improvement over the glass transition temperature of regular KEE.

Each test specimen was conditioned for four hours at the specified temperature. At the termination of the exposure period, and while still in the low-temperature test chamber, the specimen was loaded into the bending apparatus, the release trigger is pulled, and the flexing plate makes a free fall around a 1/8" mandrel (hinge pin).



Same formulation except for the upgrade from standard KEE to KEE HP

KEE HP has a proven history of performance. It has an improved chemical resistance and higher molecular weight compared to standard KEE. It has improved aesthetics, better thermal performance, a wider window of weldability, and improved cold temperature flexibility, making it an ideal roofing membrane for virtually any condition.

If your building requires first-class protection from the elements, demand a roofing system that has proven long-term superior performance and dependability.

Carlisle's Sure-Flex KEE HP meets that demand and outperforms the competition.
