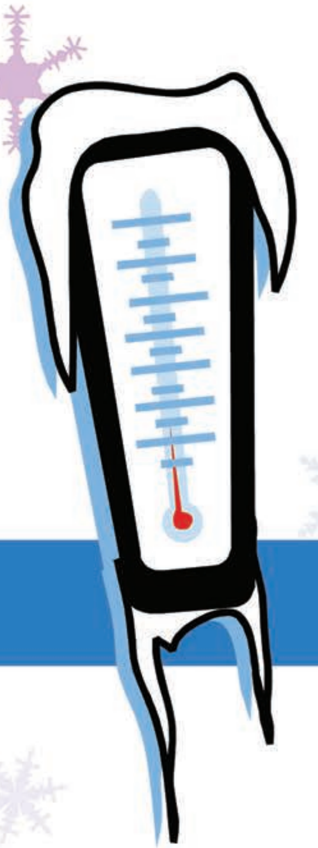

Cold-Weather Application of Modified Bitumen:

Temperature's Effect on Adhesives

By Kirk Goodrum

Given a choice, most roofers would probably prefer to work when the weather is the perfect balance of mild temperature and a light breeze. However, unless they are lucky enough to work in our favorite vacation spots, the weather at some point results in rosy cheeks and heavy coats.

The application of styrene butadiene styrene (SBS) modified bitumen is not halted just because Old Man Winter peeks around the corner. During periods of cooler weather, though, it is important that installation and storage techniques be adapted to ensure proper application of SBS modified-bitumen membranes. Material temperature management during cooler weather is vital in achieving a modified-bitumen roof system of which manufacturers and professionals alike can be proud.

In general, when the temperature dips below 50°F, adhesives and roll goods should be stored in a warm place, such as a heated trailer or other conditioned storage area. When roofing is scheduled under severe winter conditions, torch-grade systems are the most forgiving and often offer the best results. If the system will be applied using hot asphalt or cold process, cutting the sheets into halves or thirds can facilitate uniform adhesion. Cutting the sheets and letting them lie in the sun for at least 15 minutes will allow the membranes to acclimate and relax.

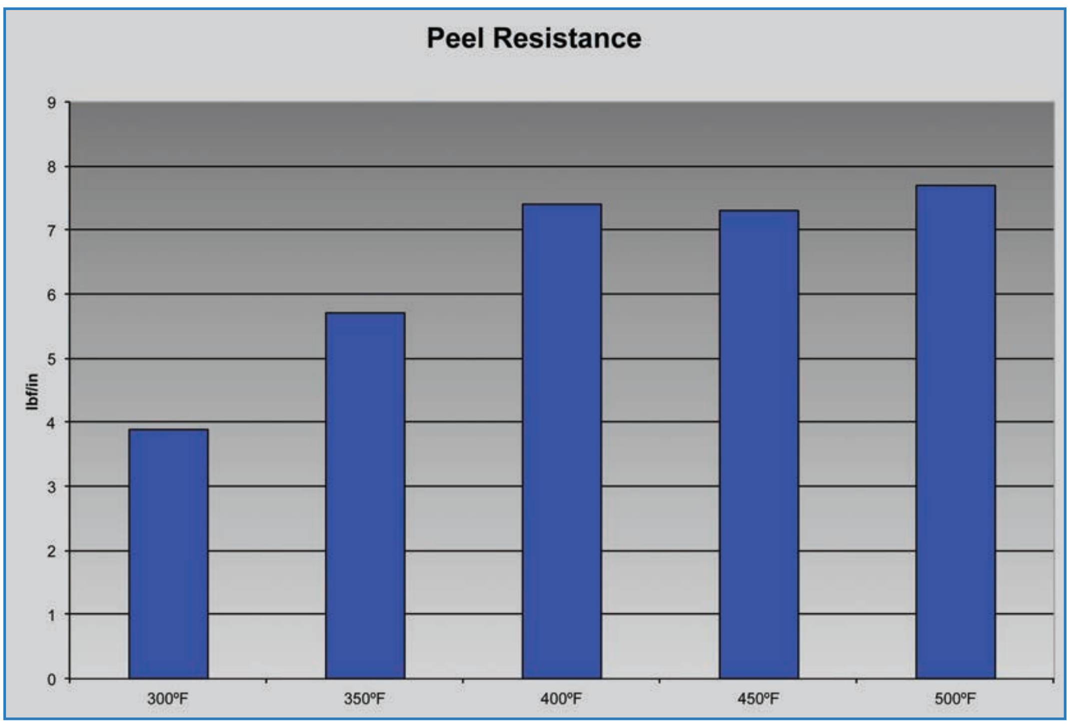

Figure 1 – The data shown here are from a study using Type 4 asphalt. The reduction in peel strength can be seen as the temperature decreases below 400°F. Peel strength was essentially the same for all application temperatures above 400°F. Actual peel values will vary, depending on the type and composition of the mopping asphalt and SBS membrane.

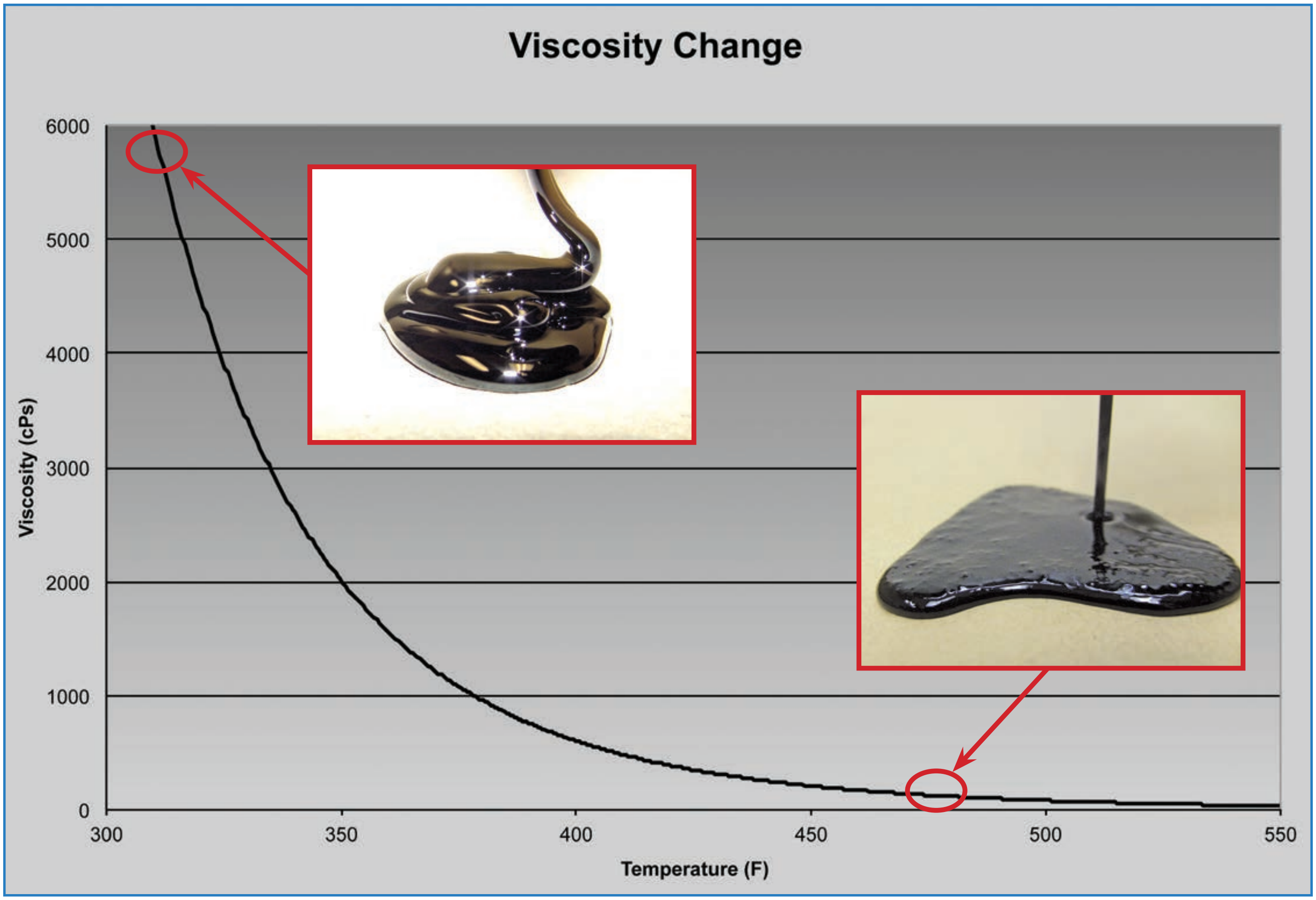

Figure 2 – EVT for this particular example occurred at 475°F. Viscosity will vary depending on the type of mopping asphalt. Data contained in the graph is an example of Type IV Mopping asphalt.

MOPPING ASPHALT

Mopping asphalt can be an effective application tool—even in the colder months—as long as the right precautions are taken. Arguably, mopping asphalt is the most temperature-dependent adhesive, primarily because it relies on a specific temperature and viscosity for proper adhesion and application rate.

The natural tendency is to turn the kettle temperature up to compensate for the heat loss; however, mopping asphalt should never be heated above the manufacturer's recommended values. Overheating can damage the asphalt and change its physical properties, and fire is a risk when the temperature exceeds the flashpoint. Heat loss should be controlled by the use of insulated pipes, luggers, and carts. Common cold-weather recommendations suggest mopping no more than 4 to 5 feet ahead of the roll.

Mopping asphalt that meets ASTM D312 comes in four types and has softening points ranging from 135°F to 225°F. Type 3 or 4 mopping asphalt is the most commonly used in the industry for the application of SBS modified bitumens. The molten adhesive must wet-out the back surface of the modified-bitumen membrane. The ability to wet the surface is directly related to the viscosity of the asphalt. Mopping asphalt must also be sufficiently high in temperature to melt the back surface of the membrane to achieve proper adhesion strength. This is a critical difference between standard built-up roofing (BUR) and modified-bitumen applications. Most cold-weather bulletins recommend the asphalt be a minimum of 400°F at the point when the mopping asphalt makes contact with the membrane. If the mopping asphalt cools to the point it will not melt the modified, then the peel resistance is only reliant on the adhesion to the sand and not a bitumen core. *Figure 1* shows the change in peel strength as the temperature of mopping asphalt drops below 400°F.

Equiviscous temperature (EVT) is the temperature at which asphalt has a viscosity similar to olive oil (75-125 cPs). As temperature decreases, the viscosity of the mopping asphalt increases at an exponential rate, meaning it can go from the consistency of olive oil to molasses in minutes or even seconds, depending on the weather conditions (*Figure 2*). Mopping asphalt should be applied at approximately 25 lb./sq., which is easily done when the asphalt is at EVT. As viscosity increases, so does the potential for overuse or the creation of interply voids.

MEMBRANE "COLD" ADHESIVES

"Cold" adhesive is a term commonly used to describe adhesives sold in a can or drum. Cold is a relative term in comparison to mopping asphalt. Membrane adhesives that fall under this description vary widely in composition, from solvent-borne cutbacks to solvent-free technologies. As the temperature changes, the viscosity will rise and fall, though not as dramatically as mopping asphalt. Cold adhesives are typically designed to be applied within an optimum temperature range, which some manufacturers vary by creating summer- and winter-grade versions.

No matter the application method, whether it's by squeegee, brush, or spray, the viscosity can affect the usage rate. Much like EVT, if the adhesive is in the recommended application range, the proper usage is easily accomplished. Bulk warmers, inline heaters, or other preheating equipment is often used to maintain the proper temperature and viscosity for application. As with mopping asphalt, overheating the product is never a good idea. Refer to the manufacturer's guidelines regarding flashpoints and maximum heating temperatures.

Temperature will have less of an effect on the bond strength of adhesives, because most rely on a chemical or solvent weld to achieve adhesion. An appropriate follow tool should be used to apply pressure to the membrane to ensure uniform contact is achieved between the membrane and the adhesive. This is even more critical during cold-weather applications, because the membranes can be stiffer, coupled with a higher viscosity of the adhesive, which can make it harder to get full contact. Using conditioned materials when possible will make the application of the SBS modified-membrane system relatively easy in less-than-perfect conditions.

Even with today's technology, weather is still a guessing game. When working in the transitional seasons, it is important to know the techniques that make a job successful. Roofing professionals make great efforts to ensure the roof design meets the needs of the facility. Understanding how cold weather can affect the products and application methods can be the key to a trouble-free, quality SBS modified-bitumen roof membrane installation.

Kirk Goodrum

Kirk Goodrum is the research and technical development manager for Siplast. He earned his degree in physics with a minor in mathematics from Henderson State University (AR) prior to joining Siplast in 1999. During his tenure, he has had extensive hands-on involvement with Siplast R&D efforts in all of its product lines, resulting in development of advanced products, introduction of new products, and procurement of patents. Goodrum participates in ARMA, SPRI, and ASTM and has coauthored several technical papers for industry periodicals.

Pitch Drop Experiment Goes On Despite Custodian's Demise

Professor John Mainstone, only the second guardian of the "Pitch Drop Experiment," died while the drip was yet young.

The famous Pitch Drop Experiment is believed to be the world's longest-running laboratory experiment and, indeed, is so listed in the *Guinness Book of World Records*.

Professor Thomas Parnell, a physics professor at the University of Queensland, Australia, began an experiment in 1927 to illustrate that everyday materials can exhibit quite surprising properties. The experiment "demonstrates the fluidity and high viscosity of pitch" or bitumen. At room temperature, pitch feels solid and even brittle, and can easily be shattered with a blow from a hammer. But at room temperature, it is fluid.

Professor Parnell heated a sample of pitch and poured it into a glass funnel with a sealed stem. Three years were allowed for the pitch to settle, and in 1930, the sealed stem was cut, allowing the pitch to start flowing. From that date on, the pitch has slowly dripped out of the funnel – so slowly that now, 86 years later, the ninth drop is only just fully formed.

Fluctuations in air temperature mean that the time between drops has varied. It is expected that at the current rate, there is enough pitch in the funnel to allow it to continue for at least another century. The experiment is monitored by a webcam by which anyone can check the live drip in action (or almost-action). Check it out at smp.uq.edu.au/content/pitch-drop-experiment.

Professor Parnell's successor guardian, John Mainstone, 78, died August 23, 2013, between drips eight (Nov. 28, 2000) and nine (in progress), but the pitch drop experiment lives on.

— uq.edu.au and Wikipedia