On The Roof Processing Asphalt With EVT

by Dick Baxter

The concept of equiviscous temperature (EVT) has provided users of waterproofing asphalt with a powerful tool in the quality control process of hot applied reinforced asphalt roofing membranes. EVT applies only to roofing asphalt and not to coal tar pitch which is also used as a waterproofing medium for built-up roofing membranes. To fully understand the concept of EVT requires some fundamental knowledge of asphalt processing and petroleum fluxes from which roofing asphalt is produced.

The function of waterproofing bitumens in roofing membranes is complex in that the material must provide a barrier to water entry and also act as an adhesive for the various components of the roof assembly. The adhesive properties of bitumens are directly proportional to the temperature at which they are applied. Obviously, cold bitumen has very little adhesive property while hot bitumen bonds to almost any dry surface or material.

Since it is essential that reinforcing plies in the roofing membrane be solidly bonded together, it seems logical that the interply-mopping bitumen must be "hot" at the point of application. How hot is "hot?" That's where EVT and asphalt processing temperature information become useful tools.

TEMP° EVT RIGHT

ASPHALT APPLICATION TEMPERATURES

Roofing asphalt is oxidized by processing or "blowing" to alter its softening point and penetration properties to improve its versatility as a waterproofing medium and adhesive. ASTM Specification D-312 outlines the characteristics of four grades of roofing asphalt: Types I, II, III and IV.

The basic difference between the four types is the softening point range which is a function of "oxidizing"—introducing the oxygen molecule to the petroleum flux to act as a catalyst in order to alter the physical properties of basic petroleum "straight run asphalts or flux." The longer the blowing time, the more oxygen molecules are introduced into the asphalt batch and the higher the resulting softening point.

Blowing or oxidizing roofing asphalt is accomplished in a blowstill in which the temperature of the flux is raised to a point where the material is best able to accept oxygen introduced to the asphalt in the process. This "finished blowing temperature" varies from batch to batch and from asphalt source to asphalt source due to variations in crude oil and straight-run asphalt.

The finished blowing temperature (FBT) is important information in the field handling and storage of asphalt, since storing the material for prolonged periods at temperatures above the manufacturer's FBT may result in a phenomenon called "fallback"—the softening point of the material is lowered during long storage periods or heating at temperatures above the processing FBT. Asphalts so affected may allow slippage of membrane reinforcing plies or flashing components.

The "flash point" is defined as the temperature at which asphalt will "flash" if exposed to fire or an ignition source. At the flash point temperature, light oils or volatiles in the asphalt are escaping from the heated bituminous material and will catch fire when exposed to a source of ignition. This occurs in much the same manner as propane ignites when lighted by a spark generator.

Asphalt heated in a kettle or tanker will not begin to lose significant quantities of volatiles until reaching the flash point.

Loss of volatiles results in a more brittle asphalt, but the jury is still out on how long it takes to drive off enough volatiles from the asphalt to significantly alter its weathering properties. We do know, however, there are asphalts which are affected more quickly than others (by maintaining temperatures at or above the finished blowing temperature or the flash point), so it appears prudent to ensure that heated asphalts do not remain at temperatures approaching the flash point for any extended periods of time.

Maintaining asphalt temperature below the flash point is not only desirable, but it usually helps preserve the integrity of the kettle or tanker. Flash point should not be confused with the point of ignition—the temperature at which bitumens will spontaneously ignite and burn.

Finished blowing temperature and flash point are the two bits of process information necessary to control bitumen field storage temperatures and heating apparatus temperatures during installation.

The ASTM type information for asphalt is based on softening point (SP) and penetration (PEN) information derived from batch testing at the manufacturing facility. Certification of asphalt type provided now by asphalt processors will usually include a softening point range and penetration expressed as a single member. For purposes of this discussion, identification of the ASTM type asphalt is sufficient when process information is included with the certification. Without process information, the applicator can be hindered in his evaluation of proper storage, heating and application temperatures.

With this background in mind, the equiviscous temperature (EVT) can be defined as the temperature at which asphalt will attain a viscosity (flow and adhesion) of 125 centistokes. This is the practical and optimum temperature for wetting and bonding plies at the point of application. For practical purposes, the point of application is defined as the mop bucket or bitumen dispenser.

A tolerance range is added for field handling to account for the effects of the sun, wind chill and ambient temperatures. The tolerance range is 25 degrees (Fahrenheit).

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EVT

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What all the available information makes possible is the ability to better evaluate heating and application temperatures of thermoplastic asphalts to minimize potential damage to the bitumen during heating and storage and maximize the chances of successful application of the asphalt built-up roof assembly.

A few important conclusions must be drawn from a basic understanding of this information: In order to provide adequate adhesion properties, asphalt (regardless of type) should be applied at the EVT indicated for that particular batch of asphalt. This concept should be of paramount concern in the construction of all asphalt built-up roofs.

Another important point to remember is since a significant drop in temperature can be anticipated with normal handling and transfer of hot asphalt in an average roofing application, the temperature of the asphalt in the heating apparatus must be maintained such that application temperature remains at the EVT. As a rule of thumb, a 100 degree F. temperature drop can be anticipated in an average installation with moderate ambient temperatures.

In most specifications, restraints are placed on temperature of the asphalt in the heating apparatus without regard to anticipated temperature drop and the resulting inadequate application temperature. With process information—finished blowing temperature and flash point—appropriate adjustments can be made to the asphalt temperature in the heating apparatus to ensure adequate application temperature and minimize the chance of damaging asphalt properties during the heating and storage process.

Since only minor quantities of volatiles are driven off from the asphalt until it reaches its flash point, it is unlikely that weathering properties of the asphalt would be affected when asphalt is heated to the flash point temperature in the heating apparatus (the "smoke" visible from a kettle is usually steam from small amounts of water in asphalt or kettle, and not volatiles from the asphalt).

To be on the safe side, kettle operators can use information on the finished blowing temperature as a check of the field heating procedure.

Since maintaining asphalt at high temperatures in a heating device for extended periods of time may result in fallback of the asphalt softening point, a limit on the time the asphalt remains above the FBT may be used. This approximate time limit for asphalt exposure to temperatures above the FBT in the heating or storage device has been set at four hours.

There are many variables in the processing and heating of asphalts, not the least of which are the variations that exist within the onsite heating apparatus. Asphalt immediately adjacent to flues are hotter than asphalt on the top of the kettle. Convection inside the heating device will normally result in natural cycling of liquid asphalt through the tank.

The most positive way to ensure cycling of liquid material—and the resultant more uniform asphalt temperature in the heating device—is to run the pump on the heating device continuously. Since the asphalt will be "continuously picked up" by the pump from between the flues and discharged near the top of the tank, asphalt will not stay in contact with the flues for any length of time, and temperatures in the tank will be more constant overall.

In summary, requesting and using all available process and asphalt type information—especially EVT—will result in more acceptable guidelines for asphalt heating, storage and application. So long as the asphalt temperature in the heating device remains below the flash point, the bitumen temperature does not remain above the processing FBT for periods in excess of four hours, and the EVT can be maintained at the point of application, good roof assemblies are possible. If the kettle temperature is maintained below the flash point and the asphalt temperature can be maintained at the point of application, a good working range for asphalt heating has been established.

The chances of damaging the asphalt within this working range appears rather remote. Asphalt exhibits better handling properties, the roofing mechanic's "frustration factor" is minimized and the end resulting better built-up roofs are all possible when the EVT is recognized as a valuable roofing resource.

About the Author

Dick Baxter, an NRCA Director, is the president of Carolina Roofing Service, Inc., Monroe, N.C. During his term on the NRCA Board, Baxter has contributed his roofing expertise in a wide variety of programs ranging from the recent revision of the *NRCA Energy Manual* and a new audio-visual program on the proper installation of glass fiber roofing felts.
