COLD-APPLIED COAL TAR AS A SUSTAINABLE ROOFING SYSTEM

STEVE RATCLIFF AND FRANK O. MOORE JR.

AS THE ROOFING INDUSTRY ENTERS A NEW MILLENNIUM, NEW ROOFING MATERIALS AND NEW installation methods continue to be introduced. Until very recently, premium coal tar roofing systems have required a high level of commitment on the part of building owner and contractor. Installation required considerable dedication, expertise, and hard work on the part of roofing contractors. Building owners prefer reliable roofing systems. Roofing contractors prefer simple application methods. What's needed and wanted is a simple and reliable roofing technology.

The good news is that the desired technology is already here. A few years ago, research scientists at AlliedSignal Inc. discovered a way to modify coal tar with polymers to produce a membrane that can be cold applied.

Modified bitumen membranes are attractive for many applications, particularly in climates where roofing systems are exposed to thermal extremes or freeze-thaw cycles. They offer superior strength, durability, and moisture protection with fewer plies.

Moreover, polymer-modified coal tar membranes are chemically much the same as a coal tar roofing system. They offer the waterproofing characteristics and chemical resistance of coal tar, withstanding ponded water and attack by chemicals, including petroleum-based pollutants, oils, and fats.

The most important thing to remember about these new systems is that no hot-mopped interply pitch is needed. The membrane gets its waterproofing properties at the factory. Thus, polymer-modified coal tar membranes can be hot-mopped in pitch, but they don't have to be. The focus of this article is on new cold-application methods and hot-air welding. Each has its own advantages and may be best suited to a particular job.

Squeegee Application

For squeegee application, the adhesive is applied using a V-notched squeegee (*Figure A*). The air temperature should be 50 F and rising. The membrane adhesive is poured in front of the blade directly from the can and spread to the recommended thickness of 1-1/2 to 2 gallons per square. An area slightly wider than the width of the roll is covered, leaving no voids.

The notched squeegee creates a striated pattern as the adhesive is spread. The roofing mechanic assures that the laps of the membrane are properly aligned and then rolls the membrane into the adhesive. Pressure is applied with a following tool (e.g., a broom or aluminum rake) to embed the membrane firmly in the adhesive (*Figure B*).

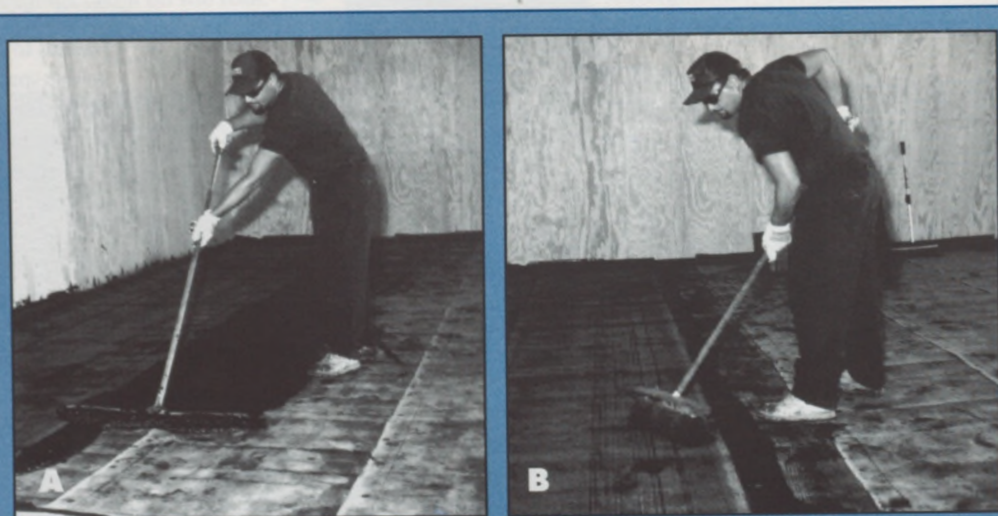

Figure A (left)—Adhesive is applied using a V-notched squeegee.
Figure B (right)—Pressure is applied with a broom to embed the membrane firmly in the adhesive.

The roofing mechanic cuts 45-degree dog-ears at the corners of the underlying sheet where end laps make a T-joint and places extra adhesive in the cutout area to ensure better adhesion (*Figures C and D*).

A 6-inch end lap is created where one sheet ends and another begins. The adhesive is spread with the squeegee, as before, covering 6 inches at the end of the sheet already in place. The next roll is then positioned so that its end lap overlaps the installed sheet by 6 inches. The mechanic rolls out the membrane and embeds it, pressing it into place with the following tool. Some adhesive should squeeze out around the end lap. Otherwise, the roofing mechanic picks up the lap and spreads more adhesive beneath it with a notched trowel, then brooms down the lap or applies pressure with a roller.

The adhesive for the next course is applied following the guide mark along the layout line. Sheets are trimmed to stagger the end-laps and rolled out, embedding the next membrane sheet (*Figure E*). A bit of adhesive squeeze-out along the seams is desirable to verify that there are no adhesive voids. Membrane application is continued in this way, until the ply is complete.

Figure C—The roofing mechanic cuts 45-degree dog ears at the corners of the underlying sheet.

Figure D—End laps make a T-joint in the cutout area, where extra adhesive is then placed.

Figure E—Sheets are trimmed to stagger the end laps and rolled out, embedding the next membrane sheet.

Figure F—Spray application is even faster than a squeegee.

Spray Application

Spray application is even faster than a squeegee (*Figure F*). The adhesive temperature is maintained as close as possible to 70 F to facilitate pumping and spraying. The membrane adhesive is sprayed 24 to 32 mils thick, using a film thickness gauge to verify the coating thickness. After spraying the substrate, the membrane sheet is rolled out and embedded in the adhesive with a broom or following tool. Where side laps occur, the edge of the sheet already in place is sprayed along with the substrate. The adhesive can be applied on the end laps with the sprayer or with a notched trowel.

The sheets are trimmed and positioned to form 4-inch side laps and 6-inch end laps. They are rolled out and embedded in the adhesive with a broom or following tool. Again, adhesive squeeze-out at all lap joints is desirable to assure a tight seal.

For both the squeegee and spray methods, the membrane adhesive is a coal tar-based polymer-modified material. Polymer modification assures the strength and flexibility needed for long-term performance and low maintenance.

Hot-air Welding

Hot-air welding is suitable for use with a cold-applied process since it requires no hot kettles or open flames. Moreover, the hot-air welding process allows polymer-modified coal tar membrane field sheets to be installed with no adhesive. Hot-air welding results in a monolithic roofing assembly. The hot-air welding process is appropriate for roofs with a wide range of slopes.

The roof deck must be a fire-resistant material or must be protected with overlay boards that prevent ignition during the installation process.

Hot-air welding equipment includes the Primus-Sievert Hot-Air Welding Cart, which features an array of eight hot-air outlets for applying full rolls of polymer modified coal tar in the most efficient manner.

The hand-held Primus Sievert 2981QD is convenient for welding membrane ends and working in confined areas. The dual-unit, Model 0000 is also available and may be useful in some phases of field-sheet application.

As a first ply, the membrane can be welded over a polymer-modified coal tar base sheet that has been applied according to specifications. The side laps of the first roll of smooth membrane sheet are staggered by the maximum distance possible with respect to those of the underlying base sheet (*Figure E*). Enough membrane is unrolled at first to cover up to the edge of the roof or, if starting at a vertical transition, up to the cant strip.

Once the mandrel is inserted through the core of the roll, the cart is rolled into position and locked onto the mandrel. The hot air outlets on the cart are turned on and adjusted. Using the controls on the cart handle, the mechanic moves the outlet array into position to heat both the roll and the base sheet. The material on the roll and the surface of the base sheet should darken and turn shiny. If flaming occurs, the mechanic moves the hot air outlets away from the surfaces with the controls on the handle, adjusting the distance and angle of the outlets so that heating is controlled and uniform.

When a section of material is sufficiently heated, the roofing mechanic pulls the cart along to apply the sheet, working at a moderate pace to ensure complete, even adhesion without overheating the material. Thin beads running out at the sheet edges indicate a good, watertight bond (*Figure G*). The mechanic continues heating and rolling out the sheet with the cart as long as practical. When the end of a roll or an obstruction is reached, the mechanic uses the controls on the handle to move the outlet array away from the roof surface, lifting the hot-air cart off the mandrel to move it out of the way.

Figure G—A continuous bead of squeeze-out along the lap indicates a tight, waterproof weld.

Figure H—The bead may be covered with loose slate granules matching the color of the cap sheet.

Returning to the starting end of the roll, the mechanic heats both the underside of the sheet and the surface of the base sheet with a hand-held hot-air welder. The material is pressed in place when the surfaces are sufficiently heated.

A roll for the adjacent course of smooth membrane is positioned to create a 4-inch side lap. The cart is attached onto the mandrel, the hot air outlets moved into position, and the smooth membrane applied until the ply is completed.

Cap Sheet Application

Granular cap membrane can also be set entirely in adhesive, but hot-air welding of end and side laps is recommended on roofs subject to ponding and to meet certain warranty conditions. To set the cap sheet, the membrane adhesive is first applied to the substrate with a squeegee or sprayer. A squeegee is used to spread the adhesive near the laps that will be hot-air welded, taking care not to spread adhesive onto the selvage. Some mechanics prefer to lift the edge of the cap sheet and push the end of the squeegee along underneath it to keep the adhesive off of surfaces that will be hot-air welded. When spraying on membrane adhesive, it may be helpful to use a protection sheet to keep overspray off the area that will be hot air welded. The protection sheet is moved along the edge of the membrane sheet as spraying proceeds.

The cap sheets are unrolled after applying adhesive, aligning them to create 6-inch end laps and 4-inch side laps. The surface is broomed to embed the membrane. At end laps, 45-degree dog-ears are cut at corners of the sheet that will lie beneath another layer of material. Again, the hand-held Primus Sievert hot-air welder is used to fuse the membrane at the end laps. The surface of the underlying membrane is heated until its granular surface darkens. The underside of the overlying lap is heated until it turns shiny. Flaming indicates that the material is overheated. The membrane is pressed down to set it after heating both surfaces. A continuous bead of material around the edges indicates a tight, successful weld.

To fuse the side laps, the shoe of Primus Sievert lap welder is inserted beneath the edge of the upper sheet. The membrane is heated until a bit of smoke appears. The tool is then moved along the lap, heating the material evenly and continuously.

A 5-pound roller follows 6 to 8 feet behind the lap welder to set the lap. A continuous bead of squeeze-out along the lap indicates a tight, waterproof weld. The bead may be covered with loose slate granules matching the color of the cap sheet (*Figure H*). The mechanic presses the granules onto the bead while the material is still warm. An hour or so after welding, the mechanic probes with a round-nose trowel to check the integrity of the bond. Any loose area is reheated and pressed down.

Granulated cap sheet can also be applied using only the hot-air welding process. The first roll is positioned to stagger the side laps by the maximum practical distance with respect to those of the underlying smooth ply. Wherever possible, the cap sheet is applied with the Primus Sievert Hot-Air Cart. Thin, black beads along the side laps indicate a complete, watertight bond. Hand-held hot-air welders are used at the edges of the roof and end laps. End laps should be 6 inches and staggered in adjacent courses.

The granulated surface of the underlying sheet is heated until it darkens. The bottom of the overlying sheet is heated until it turns shiny and then pressed in place. The bead of squeeze-out around the edges assures a good seal. An hour or so after application, the mechanic probes all lap joints with a round-nose trowel, re-heating any found to be loose or open and then pressing the material into place.

Curing Period

Cold-applied, polymer-modified coal tar takes an extended