

APPLICATION TECHNIQUES AND IN-PLACE FIELD PERFORMANCE OF COLD ADHESIVE APPLIED MODIFIED BITUMEN MEMBRANES

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The cold adhesive application method for bituminous membranes dates back to the 1930s. The technology for manufacturing cold process adhesives has existed for decades and been used extensively with various modified bitumen membranes since the early 1970s. The years of use and experience demonstrated excellent long-term performance.

The cold adhesive application method has recently gained tremendous momentum in the U.S. and European low-slope roofing markets. This presentation will explain the sudden growth in cold process materials usage and what can be expected in the immediate future.

The different application techniques for cold adhesive-applied modified bitumen membrane will be addressed along with the history of cold-applied roof systems and their proven field performance. This paper also will explain how this long-term, proven method can change the way roofing contractors look at their businesses, and, equally important, how roofing mechanics' jobs can be cleaner, safer, more efficient and thus more productive.

KEYWORDS

Bituminous Cold Adhesive = (BCA), Thixotropic, VOC, Red Label, Open Time, Modified Bitumen.

HISTORY OF BITUMINOUS COLD ADHESIVE (BCA)

Bituminous cold adhesive (BCA) has been used on low-slope roofs for more than 70 years. Bituminous flashing mastic once was applied regularly on roofs to fix leaks and provide roof component attachments. In Europe, mainly Belgium, traditional heavy roofing felts were applied in cold bituminous mastic as cap sheets. The mastic was applied to the surface of the roof with a trowel, with the membrane then laid into the mastic.

In the 1950s, softer formulations of adhesive were developed to allow easier and faster application. Today's formulations of cold bituminous adhesive are more stable and easy to use. They are becoming increasingly popular all over Europe and the United States. In fact, it may well be today the fastest growing segment of the low-slope roofing industry. More and more contractors are moving toward this technique to apply modified bitumen membranes and are finding application of this technique to be safer, faster, cleaner and easier to use.

For certain customers and areas of the world, the use of open flames on roofs using a torch has been restricted. This has pushed producers and contractors to find alternative solutions to roofing products that traditionally are

torch-applied. With cold-applied adhesives, the same modified bitumen membranes can be applied with no flame at all because there are effective no-flame methods in the marketplace. Hot air and/or a torch with a completely enclosed flame is used to seal the side and end laps.

These systems are applied with limited amounts of fumes and very little noise. In the end, the owner receives the same roofing membrane, but the job site is cleaner and safer, and today's cold adhesives can be made with no "red label" additives that normally pollute the environment. Another major benefit of the cold adhesive method is the addition of an extra layer of product on the substrate in the form of an adhesive layer. An uneven surface has less effect on the thickness of the installed membrane because of the extra layer of cold adhesive; the adhesive also equalizes the surface somewhat before the application of the membrane.

DIFFERENT TECHNIQUES OF APPLICATION

Each BCA manufacturer determines an acceptable substrate for its product. Some substrates, insulation panels and existing roof systems may not be compatible with BCA roof systems. BCA is normally applied to a clean, dry substrate, with the rate of application depending on the substrate. A modified bitumen membrane is then laid into the cold adhesive. Adhesion is created as the solvents in the adhesive evaporate. The solid asphaltic matter in the cold adhesive ultimately adheres and creates the long-term bond required to hold the system in place. The asphalt comprising the adhesive, along with various additives, acts as a strong adhesive and additional waterproofing layer.

The side and end laps usually are torched or welded with hot air. With some systems, manufacturers use cold adhesives in the side and end laps to provide watertightness. Adhesives for overlaps are usually more viscous, and applied heavily to ensure adhesion. Polymer modified adhesives are mostly used for overlaps as they generally provide more adhesive power. In cold climates, below 40°F (5°C), it is more difficult to adhere overlaps with adhesives because the modified bitumen membrane needs a little heat to lie flat. The adhesive does not provide any heat.

Most BCA is delivered in 5-gallon pails, 55-gallon drums, or steel tanks that hold 250 to 350 gallons. Several application techniques are commonly used with cold adhesive. Adhesives can be applied with a squeegee to a roofing surface or sprayed from a drum or tank with a spray gun. Notched squeegees are designed to provide the optimal amount of adhesive to ensure good application, but application is more

difficult to control with a spray gun. Generally, the amount of adhesive applied per square foot with a spray gun is greater than with a squeegee. On the other hand, sprayed application substantially increases labor productivity and job efficiency on larger jobs. The handling of equipment and materials is limited, there is no disposal of cans, and large surfaces can be prepared at one time. This can speed up the application by a factor of two to three vs. torching.

The amount of adhesive applied to the substrate depends on the porosity of the surface and viscosity and fluidity of the adhesive, which generally varies from manufacturer to manufacturer. Another major consideration is the ambient air temperature. Temperature can affect the viscosity and should always be monitored to ensure optimum adhesive coverage and adhesion to the membrane. Most spray equipment is equipped with heaters to keep the adhesive at the right temperature for the application. Drums can also be heated easily to reach proper temperature for a quality application.

Using BCA in cold climates is not easy, and proper equipment and techniques are required to guarantee a quality application. Bituminous membranes become hard in cold climates and need to be kept in a heated place before cold adhesive application to ensure they lie flat on the surface. If the overlaps are applied with adhesive, extra pressure will need to be applied all over the laps (with a roller or sandbags) for a period of time until the adhesive has a strong enough bond to ensure the memory of the membrane does not pull the lap open.

WHAT TO LOOK FOR IN A COLD ADHESIVE

Bituminous cold adhesive is a generic term. There can be substantial differences between one cold adhesive and another. BCA components are critical to the adhesive's long-term performance. These basic components are also critical in determining how safe the application will be and how much the BCA will affect, modify, enhance or damage the characteristics of the applied modified bitumen membrane.

Most BCA contains asphalt, fillers, fibers and solvents. The type and amount of solvent used in each type of BCA vary widely and are the key ingredients in the product's formulation. Many countries and a number of states within the United States have developed environmental restrictions on volatile organic compounds (VOCs). National, regional or local VOC regulations restrict the use of many types of solvents found in a number of current BCAs. The selection of BCA with a lower solvent content is preferable (i.e., higher solids content). In addition BCA without red label solvents should be used whenever possible. The solvents are necessary for the production and the application cycles, but disappear over time through the membrane and/or substrate. The adhesive strength is provided by the bitumen and additives to the bitumen.

A solvent with low odor and fuming characteristics is best and should comply with local regulations and not adversely affect the job environment. Although many BCA roof assemblies are Underwriter Laboratories and Factory Mutual approved, the quantity of solvent present can also affect the fire resistance of BCA. During application, large areas of a roof may be covered with adhesive and remain exposed until the membranes are laid in place. At that time, the use of a torch on the roof can present a real fire

danger, especially if too much solvent is present. Lower solvent content BCA is generally much safer and presents a lower fire risk.

Higher solvent BCA requires an "open time" to allow the solvents to "flash off" before setting the membrane. This time can be subjective and creates a difficult challenge for the roof mechanic to get the membrane laid in to the adhesive at the "right time." If the membrane is applied too early, the solvents may attack and deteriorate the sheet, yet if the membrane is applied too late, the adhesive may cure too quickly and develop a poor bond between the substrate and membrane. This is why low solvent BCA should be used whenever possible.

BCA components should remain homogenous (well mixed) during manufacture, transit, storage, application and in-place use. If BCA components settle during manufacture or storage prior to application, they will require remixing. Job site mixing can normally be accomplished using a drill and "Jiffy Mixer." Failure to remix adequately will result in a spotty application and poor performance of the finished membrane system. Mixing on the job site can prove quite difficult but the homogeneous quality is critical to BCA's long-term quality and performance.

BCA must have thixotropic characteristics, where its viscosity decreases with shear rate. The viscosity of BCA will return to its initial state upon removal of the external forces. Compatibility is a key factor when evaluating BCA. Care should be taken to ensure the adhesive is designed to work with the selected membrane. Quality manufacturers provide BCA that has been specially developed to work with their specific membranes, because selection of random adhesive and membranes can lead to long term compatibility problems. For example, membranes with a polyethylene burn-off sheet are not compatible with BCA. Also, some types of insulation can be affected adversely by the solvents in BCA.

BCA PERFORMANCE IS TIME PROVEN

Selecting a high-quality bituminous cold adhesive will actually enhance the durability and thus the longevity of the finished membrane. A scientific field study concluded that a membrane applied in BCA will age more slowly than a membrane applied with a torch. (See Patrick Cogneau's presentation paper from the International Symposium on Roofing Technology, Montreal, 1994.) This study was done on 132 samples taken from roofs in Norway, Belgium, France and Spain and represented all climatic conditions found in Europe. The samples were tested in a laboratory, comparing their current cold bend flexibility with the cold bend flexibility recorded when the products were manufactured. The membranes selected from the roofs all carried a production code that was traced to the original quality assurance testing data.

It was remarkable to note that the cold bend flexibility results obtained from the samples, which were taken from membranes applied in cold adhesive, were noticeably better than the results from the membranes applied without cold adhesive in the same area. BCA actually enhanced the long-term durability of the modified bitumen membrane.

Bituminous cold adhesive develops excellent wind-uplift resistance. It has performed effectively through heavy storms and even hurricanes. Numerous successful case

studies exist on this subject. In fact, Buro Dak Advies (DBA) in Holland conducted an extensive study concluding that the long-term adhesion high-quality BCA surpasses that of torching.

BCA has passed rigorous FM wind-uplift tests in the United States. It should be noted that the set-up time for the finished membrane is a key issue. BCA solvents take time to set up and thus do not exhibit the initial holding power of some other membrane systems. However, slower set-up times are offset by the product's ability to ensure a proven, long-term, wind-resistant roof system. Testing methods must be continually evaluated to adapt to this new technique and its proven performance in the field.

THE FUTURE OF COLD-ADHESIVE APPLICATION

BCA-applied modified bitumen roof systems are becoming increasingly popular. This application technique continues to grow rapidly and has a bright future. Contractors using this method of application can be more competitive as they experience the high productivity rates that accompany successful cold-adhesive usage. Roof mechanics seem happier with this application method and are exhibiting substantial productivity improvements. This helps roofing contractors to experience improved profitability.

Environmental standards will have an impact on this product as VOC regulations become tougher. Some producers will have to adapt their formulations and production processes to cope with these changes. There is already BCA available on the market that is compatible with the strictest VOC regulations. These regulations will eventually push producers toward emulsions for bituminous cold adhesives. However, this solution is not yet ready and many problems need to be solved before these products are ready for the marketplace.

PACKAGING ISSUES FOR THE FUTURE

Many areas in Europe and numerous areas within the United States are taxing or restricting the use of pails, and manufacturers are being held responsible for the packaging they provide. The broader use of drums and larger steel tanks will help alleviate this problem, reducing solid waste and supporting the environment. Tanks and drums can be recycled and reused. This means that roofing contractors will have to equip themselves to handle drums or tanks properly and be able to use cold adhesives economically on jobs.

Many contractors are experiencing the positive results of spraying BCA with specifically designed spray equipment. These specially designed spray rigs can further enhance labor productivity while reducing handling costs and environmental concerns.

Cold-process modified bitumen adhesive roof systems are providing superior waterproofing performance in the marketplace today and will be a main source of successful roofing applications in the future.