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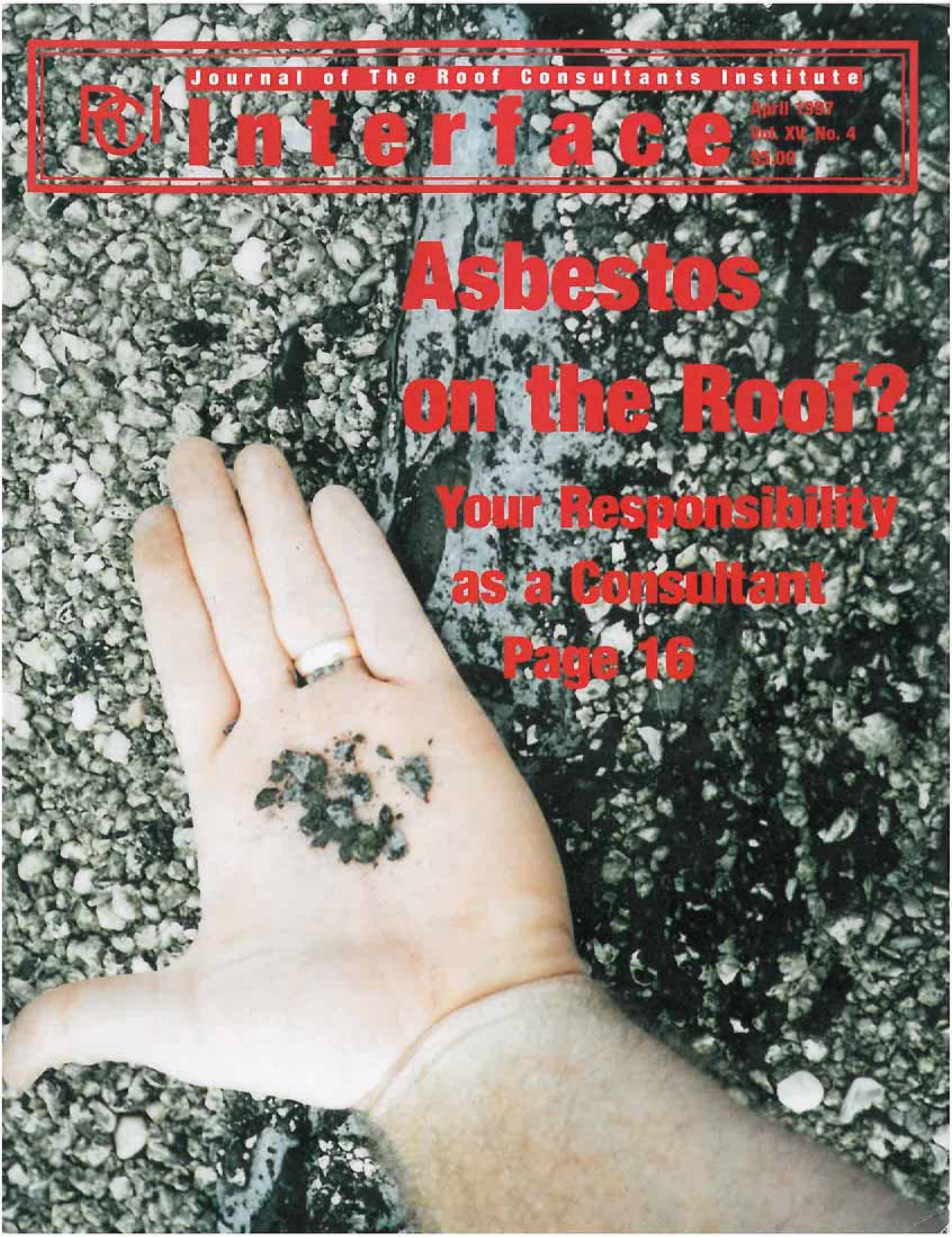

Asbestos on the Roof?

Your Responsibility as a Consultant

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Guidelines for Achieving Long-performing Seams for Granule-surfaced Roofing Materials

By Karl A. Schaack, P.E., RRC

A common protective surfacing or finishing ply that is utilized throughout the industry in the application of bituminous roof systems is a granulated cap sheet. These sheets, whether in single- or multi-ply assemblies, include modified bitumen products (either SBS or APP polymer) and asphalt-coated fiberglass reinforced roll roofing (cap sheets). According to the NRCA, modified bitumens now account for approximately 20 to 25% of the commercial roofing market. Not all modified bitumen systems incorporate a granulated cap sheet. However, "hybrid" built-up roof systems, which incorporate a cap sheet and multiple layers of built-up roofing plies, are grouped in with the built-up category. Therefore, roof systems utilizing a granulated cap sheet more than likely comprise one-fourth of the commercial roofs installed today.

A critical step in the application of granule-surfaced sheet materials is the proper adhesion of lap seams that occur at both the sides and ends of sheets. According to NRCA's "Project Pinpoint Analysis, 1983-1992," lap seam deficiencies were considered to be the number one problem associated with modified bitumen membranes, accounting for approximately 43% of the problems associated with them. Modified bitumen roof systems made up approximately 14% of the problem roofs recorded in the Project Pinpoint survey.

There are several basic techniques and general application methods typically used to achieve long-term performance of lap construction on modified bitumen sheet products. The type of product or process used to adhere the cap sheet determines the technique/procedures. When using traditional mopping grade asphalt as the "adhesive," the highest optimum temperature should be maintained for the asphalt at the point of application flash point, etc. This technique will allow the hot asphalt to "melt" the coating on the backside of the sheet at the time of the application. Both ASTM D 312, Type III and Type IV asphalt are recommended by the membrane manufacturers for the application of cap sheets. A minimum temperature of 400 degrees Fahrenheit is recommended by the membrane manufacturers to be maintained for the asphalt at the point of application of cap sheets. By using Type IV grade of asphalt for the application of granulated sheet materials, the highest optimum temperature can be obtained at the point of application. The EVT (Equiviscous Temperature) of Type IV asphalt varies depending on the manufacturer, but is approximately 450 degrees Fahrenheit, versus 430 degrees for Type III. Some manufacturers recommend that only Type IV can be used to install the cap sheet. This is a two-fold reasoning with the first being the higher EVT and the second being the higher softening point. These two characteristics aid in achieving optimum adhesion and avoiding slippage.

There are several practices that can be followed to assist in maintaining optimum temperatures during the application of roofing materials. These include: 1) setting the kettle/tanker in close proximity to the point of application, 2) using insulated piping and luggers, 3) minimizing holding time of asphalt in luggers/mop carts and 4) keeping the roll in close proximity to the applied asphalt.

When using cold process materials as the adhesive, the material is dispersed onto the substrate and the sheet is applied onto the adhesive. The cold process adhesive can be dispersed onto the substrate by pouring the material from pails and distributing across the sub-

Installer heating granule surfacing at end lap of bottom sheet prior to applying overlying sheet.

Fusing the side laps of a torch-applied modified bitumen cap sheet utilizing hand-held torching equipment, rolling the heated seam and embedding granules into the bleed-out.

ject area utilizing either a squeegee, roller or notched trowel. The material can also be dispersed utilizing spray-type equipment. After the adhesive is appropriately applied, the sheet is laid onto the adhesive and then rolled. A large weighted roller is typically used in the field of the sheet and a hand-held roller is used at the lap seams. A roller, hand-held or with handle, can be used during the application of cap sheets to assist in the bonding of side laps. Care should be taken when using a roller during the construction of seams. The roller can become "contaminated" with bitumen and granules, creating unsightly markings or causing the roller to "jump up" as the accumulations are rolled over. In addition, if the sheet or roller becomes too hot, displacement or damage to the protective granule surfacing can occur.

When the sheet is adhered by either torching or "heat-welding" methods, two basic techniques are utilized. One method involves heating the entire width of the sheet with either a hand-held torch or wagon-mounted type equipment. Upon heating/melting the coating, the sheet is adhered to the substrate. The second method involves heating the width of the sheet except for the last three to four inches or width of the selvage edge. The remaining edge can then be addressed utilizing a smaller or "detail" torch. Torch-applied sheet goods typically are supplied with a polyethylene film. During application, proper torching techniques will result in melting or burn-off of the polyethylene film. If the film is not burned off, it will act as a bond breaker and prevent proper adhesion of the sheet.

Other techniques involve actual methods that can be implemented during the application of the sheet goods. One such method involves the "mop and flop" technique. This technique involves applying the hot asphalt directly to both the backside of cut sections of the sheet that are positioned granule-side down prior to application, and adjacent to the subject area to receive the product. After the asphalt is applied to the sheet it is then "flopped" into place. The basic principle of this technique is that the hot asphalt is applied directly to the bituminous coating on the sheet, providing more opportunity for the coating to be "melted." The practice of maintaining the highest optimum temperature for the asphalt should also be used in conjunction with the "mop and flop" technique.

Another common recommended application method is to maintain a constant downward pressure on the roll while the roll is being laid into the asphalt mopping, adhesive and/or molten coating. This can be accomplished with a properly-positioned foot or hand on top of the roll. During the initial installation, the actual weight of the roll provides relatively good downward pressure. However, as the roll is unrolled and the weight diminishes, manually applied downward pressure becomes more critical.

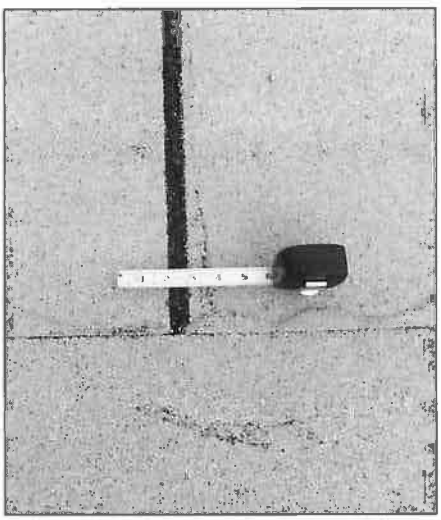
In addition, the roll should be maintained in a relatively tight configuration during the application to aid in achieving the proper downward pressure and subsequent adhesion. "Kicking out" a roll, such as that commonly used with felt products, should be avoided during the application of cap sheet products. A cap sheet material will in most instances sit on top of the mopping if the roll is not wound relatively tight and downward pressure is not exerted on the roll. This will result in inadequate adhesion (voids). Cap sheet products are often unrolled, sometimes cut to specific lengths, and laid out to "relax." This practice is used to assist in eliminating "tension" that may have been introduced into the sheet as it was wound and bound at the manufacturing facility. Laying the cap sheet granule-side down on the substrate promotes a quicker or shorter relax time. The black underside of the sheet more readily absorbs heat than the reflective top side, consequently allowing the sheet to relax. Prior to installation, the sheet should be re-rolled using the cardboard insert that was originally

Installer applying downward pressure on cap sheet roll while maintaining roll in close proximity to asphalt mopping source.

Granules embedded in asphalt bleed-out and rounded corner of end lap.

with the roll. Using the insert aids in maintaining a more round profile and somewhat "tight" configuration throughout the roll, primarily towards the end of the roll.

Cap sheets, like most roofing products, are installed in a shingle fashion with the sheets extending over the preceding adjacent sheet. This overlap (side lap) is typically a minimum of 3 or 4 inches or the width of the selvege edge (non-granulated edge). At the end of a roll, the cap sheet installation is continued by overlapping an end of a new roll on top of the end of the previously installed sheet. This overlap (end lap) is typically a minimum of 6 inches. Since end laps are constructed by overlying the cap sheet onto the granule surfacing of the underlying sheets, attention to detail and a "light" application of primer on the subject area can aid in positive adhesion of end laps. With torch applied products, the subject area of the underlying sheet can be heated and the granules "pressed down" into the sheet with a trowel. This technique creates a bituminous surface on which to apply the overlapping sheet.



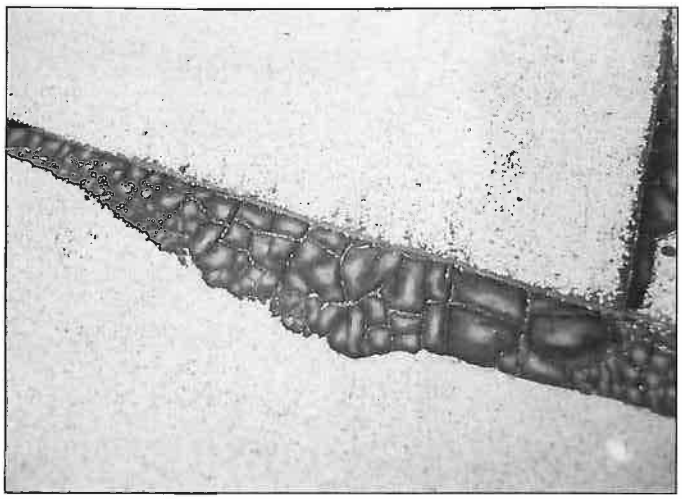
Polyester reinforced modified bitumen cap sheet exhibiting shrinkage at end lap.

Care and attention should be directed at end lap construction of modified bitumen sheets that utilize polyester reinforcement. These types of sheets—predominantly those adhered in hot asphalt—have exhibited some instability after installation. This instability is typically characterized by shrinkage. Shrinkage, whether induced during the manufacturing or application process, currently occurs in the longitudinal direction of the sheet and shows up at the end lap with approximately 1/4 to 1-1/2 inch reduction in the length of the installed sheet. Since the ends of the sheets are overlapped approximately 6 inches, this shrinkage is not a significant concern at this location. However, the concern of shrinkage is at the adjacent side lap interface with the end lap. This interface is commonly referred to as "T-joint." When shrinkage occurs, a "channel" or void is created under the adjacent sidelap seam, which could allow possible moisture migration under the sheet. One step to maintain continuity of these laps and sheet alignment during the application is to lay out chalk lines on the substrate in order to line up the side and end laps. Another technique that can be utilized during the installation of modified bitumen sheet is staggering of lap seams. With two-ply modified bitumen roof systems (smooth surfaced base ply and granule surfaced cap sheet), the side laps of the cap sheet should be offset from side laps of the base ply. Due to the relative thickness of modified bitumen sheets, side lap alignment will result in a build-up and more difficult level of construction of the sidelap in the cap sheet. The cap sheet will lay flatter when side laps are offset.

During the installation of the cap sheet, the asphalt, adhesive or molten coating is typically extended or exposed beyond the edge of the sheet. This "exposed" bituminous material is commonly referred to as "bleed out." The actual asphalt applicator or "mop man" will apply the mopping of hot asphalt on the substrate extending approximately 1/4 to 1/2 inch beyond the chalk line and/or selvage edge of the previously laid sheet. A technique to minimize the flow of asphalt across the previous sheet is to position a sacrificial piece (approximately 18 inches wide) with the granule side down and located approximately 1/2 inch from the outer edge of the subject selvage edge. If the asphalt mopping is extended up to the sacrificial piece, a relatively straight line or strip of bleed-out can be achieved. With cold process adhesive applications, the adhesive is typically extended past the edge of the sheet, commonly approximately 1/2-inch. With torch-applied methods, the molten back coating is typically "pressed" out beyond the edge of the sheet during application. For torch applications, a bleed-out of 1/4 - 1/2 inch in width is an indication that the proper temperature was obtained during the torching process.

If, during the initial application process, proper lap seam adhesion is not achieved, there are several processes that can be followed to rectify the condition. One process involves heating a metal trowel with a torch and applying the "heated" trowel under the disbonded or unbonded area in order to melt the coating. After melting the coating, the subject area can then be rolled or pressed into place. Another method involves inserting a cold process adhesive into the subject area and then "stepping-in" or rolling the lap seam together.

Several techniques can be utilized during application that can assist in attaining well performing end lap seams. During the application process, as a sheet is overlapped on to the end of the preceding sheet, the outside corner of the upper sheet can be trimmed to create a rounded finished corner. A non-rounded corner can act like a piece of "dog-eared" paper and the corner can be pulled up or become readily disbonded. Another method that can be utilized at end laps is to trim the outside corner of the underlying sheet. Starting at the end of the sheet and at 3 or 4 inches from the outside corner, the corner should be trimmed at a 45 degree angle. This particular technique helps in achieving a



Alligatoring of exposed asphalt bleed-out along edge of cap sheet.

well adhered and superior watertight "T-joint" at the end lap.

A common practice that is often implemented during the installation of cap sheets and the adhering of lap seams is the broadcasting of loose granules into the bleed out. This practice can lend itself to creating well constructed and performing lap seams. Loose granules are typically manufactured by either 3M or GAF and supplied by the manufacturer of the cap sheet in 100 pound paper bags. The granules are small mineral fines that have a colored ceramic coating that is "baked-on." There are two critical steps in this process. The first step requires that the granules are broadcast into the "bleed-out" while the bituminous material is sufficiently hot, or in the case of the cold process material, prior to initial set or "skinning over." The second important step is ensuring that the granules not only get broadcasted, but are embedded into the bleed out. This can be accomplished by the applicator "tamping" or "stepping" the granules down into the bleedout. Since the granules are relatively light in nature, simply broadcasting them will not result in complete adhesion of the granules to the bleedout. When broadcasted, the granules come to rest on the top surface of the bleedout. If the granules are not embedded into the bleedout, once the bleedout cools or cures, wind or water will readily displace the granules toward the low part of the roof (i.e. drains, gutters).

The broadcasting technique typically involves a roofing laborer, with granules in a readily accessible container, following in close proximity of the roofing technician(s) rolling out the sheet goods. Once the sheet goods are applied, the "granule person" broadcasts the granules into the bleedout. An ample amount of granules should be broadcasted into the bleedout and then be stepped-in to ensure embedment of the granules. A linear mound of granules piled on top of the bleedout allows the applicator to "step-in" the granules without getting hot asphalt and granules stuck to the bottom of the applicator's shoes. Contractors have utilized various containers for carrying the granules. Common "nail pouches," metal/plastic buckets or pails and/or customized holders have been used. Once a respective area is completed, the excess granules should be removed from the roof surface. This can be accomplished with "leaf" blower type equipment or a soft bristled broom. These procedures will remove a large percentage of the excess granules. If the excess granules are not removed, they will collect at low points or in drainage mediums, possibly resulting in restricted flow of rooftop drainage. Significant amounts could also be considered unsightly if deposited into parking or walk areas located adjacent to the building.

The broadcasted and embedded granules provide a two-fold function, the first being a cosmetic or aesthetic function. By embedding granules in the bleedout, a more homogenous surface appearance of the roof surface is achieved. Together with the alignment of end laps and rounded corners of end laps, embedded granules help to result in a finished roof surface that by appearance indicates an attention to detail. The finished appearance is often important to the designer, the contractor and/or the owner, as the appearance of the completed roof is often the final "judge" of the performance of the contractor. In addition, these roof areas can often be visible from higher adjacent viewing points, therefore a pleasing appearance can be in the best interests of the project participants.

The second function is more performance based. The granules can provide both a stabilizing factor and protective factor for the bituminous bleedout. This effect can be compared to the similar effects gravel has when embedded in a bituminous floodcoat. The granules can be a stabilizing factor or act like a "reinforcement" which can minimize movement due to shrinkage as the bleedout material cures and weathers. In addition, the granules can also reflect ultraviolet rays and promote moisture evaporation from the roof surface. If the bleedout remains exposed, it can become readily affected by the weathering elements. Direct exposure to ultraviolet and moisture will result in increased weathering, consequently resulting in oxidation, embrittlement, and cracking. These cracks in the bleedout (which are commonly referred to as alligatoring in asphaltic flood coats) are like "fissures," as they can extend into and/or under the overlying sheet, consequently allowing moisture migration beneath the lap seam.

If granules are not placed in the bleed-out in a timely manner during the application, it is possible to adhere them after completion of the installation of the cap sheet. A hand-held detail torch can be utilized to "re-melt" the bleedout and then the granule application can take place. However, this process is not advisable, as damage to the surfacing sheet can occur if extreme care is not taken. Topically applied bituminous or modified bituminous cements/mastics with embedded granules

can be used to conceal bleed-out and other surface irregularities (i.e. bitumen spillage, scars, etc.). The membrane manufacturer should be consulted regarding compatibility of these products with the respective cap sheet.

In summary, simple techniques can be implemented during the application process of cap sheet materials in order to achieve the best possible lap seam construction and minimize those problems that are typically associated with these products.

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