

ABC's of Adhesion

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Fundamentals:

Adhesion is described as an "interfacial property". That is, it requires something of both the coating and the substrate to which it is applied. Thus, the coating with the "best" adhesion will not adhere well to the substrate if the substrate surface is not suitable for that coating.

The Role of the Substrate

Roofing materials span the gamut from a chemistry perspective, ranging from asphalt, to coal tar bitumen, and thermoplastic single plies such as PVC, PIB, CPE and TPO. Other substrates are EPDM, sprayed polyurethane foam, and various metals including cold rolled steel, galvanized steel, terne coated steel, galvalume, and stainless steel. Metal roofing material is often precoated with organic coatings, which creates a new class of roofing substrates. Each of these can be subcategorized into new and aged. As roofing materials age, they change both chemically and physically. The physical changes are the most obvious; metal corrodes, smooth surface asphalt degrades and chalks, roof granules become dislodged, asphalt and single ply membranes develop cracks.

Substrate Surface

Fresh modified bitumen surfaces often are covered with release agents to prevent blocking of the roll during shipping and storage. These release agents may be particulate material such as sand, silica or talc. They can also be a thin layer of dried soap. In either case, presence of the release agent will reduce the adhesion of the coating to the bitumen membrane if not properly addressed. These release agents must be removed by pressure washing prior to coating in order to get adequate adhesion.

Fresh EPDM surfaces are usually coated with talc, mica, cellulose or other particulate to prevent the roll from "blocking" during the vulcanization process. Without these surface treatments, the cured roll of rubber could not be unrolled, and would become a 20' long rubber rod. Some roof coating manufacturers require the use of a corrosive high pH pretreatment to prepare the substrate for coating application. National Coatings has solved that problem with our AcryShield A502 base coat, eliminating the need for this time consuming costly and hazardous step.

Surface Degradation

Coating aged roofing materials presents its own set of problems. During natural weathering the surface of the roofing material degrades and creates a thin layer of powdery residue. This along with the airborne particulate dirt also interferes with proper adhesion.

Surface Preparation

Proper surface preparation requires that the roof substrate be clean, dry and free of any loose material. After cleaning it is advisable that a piece of duct or masking tape be applied to the surface and pressed firmly into the roofing material. When peeled off, if the tape adheres well, so will a coating. However, if the tape peels off easily and the back side of the tape has imbedded dirt on it, then additional cleaning is required.

Surface Contaminants

What's next door/down wind?

All roofs are next to something else. This trivial statement has a deeper and more salient meaning as we consider the sources of airborne contaminants that may accumulate on the roof. These may include: soot from electrical power generation plants, effluent from manufacturing plants, grease from the fast food restaurant next door, or merely airborne dirt from the farm up wind. All of these materials can accumulate on the roof and interfere with adhesion of the coating to the roof substrate if not properly removed before coating.

Dirt in Ponded Areas

When coating an aged roof, the ponded areas require specific attention for two reasons. First, this is the area where dirt and degraded roofing materials have accumulated for many years. This buildup may be very well adherent and difficult to remove from the roof surface. The second issue regarding ponded areas is these are the areas where most roofing failures occur.

The Coating

Glue, Rocks and Salt and Pepper

In its most simplistic terms, a roof coating, or any coating for that matter, is a physical blend of three components; the pigment, the binder (read: the glue that holds the pigment to the substrate) and some additives that may improve in-can stability, application ease, and on roof performance.

Right Coating, Right Substrate

Consider an experiment of applying a 2 part epoxy adhesive to a TeflonR non-stick frying pan. While the adhesive has incredible adhesion to typical surfaces, such as wood, uncoated metal, glass and some plastics, it would not adhere well to the non-stick surface. Similarly, coatings may contain additives that enable them to adhere to a specific material, but not adhere to others. It is vitally important that the roof coating be designed and formulated to adhere to that specific roof surface.

Drying and Curing Conditions

Proper Film Thickness

Roof coating film thickness recommendations are typically much higher than traditional house paints or industrial coatings. This is because the coating is actually a functional membrane imparting weatherproofing properties to the roof membrane composite (the underlying roof membrane and the coating).

Weather Effects, Temperature, RH, Dew Point, Sunlight, Coating Color, Wind Speed, Coating Film Thickness

The question is often posed of "How long will it take for the roof coating to dry. Obviously, if the coating isn't dry, it won't adhere. All of the effects listed in the subtitle above will have an impact on the length of time required for the coating to dry. If the coating is not fully dried, it does not have adequate adhesion (see section below).

The Last Place to Dry is at the Coating Interface!

Sometimes coatings are applied, and after several days, it is observed that the coating has delaminated in a ponded area. An examination of the weather records for the area reveals that rain occurred or there was unusually high humidity or heavy dew shortly after the coating "dried". What may have happened was the coating "skinned over", i.e. the surface of the coating was dry so that it did not wash off during the rain or heavy dew. The coating may even have enough integrity so it could be walked on. However, the coating/ roof surface interface, the last place for the coating to dry, may have still been wet. The dew or rain further prevented the coating from drying and appears as though the coating has disbonded. In actuality, the coating was never fully adhered.

Conclusion

Be sure the proper coating is used for the substrate in question.

Be sure the surface is clean and dry.

Do not use a primer as a substitute for proper and thorough cleaning.

Be sure the base coat is fully dried before applying the next/top coat.