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THE IMPORTANCE OF ASSESSING ADHESION
By Bob Cusumano

One of the worst nightmares that a painting contractor can experience is getting a call from a customer saying "You've got to come over and look at this. Your paint is failing everywhere!" Sound familiar? Probably. At one time or another we've all had occasions where products we've applied have not met our expectations or that of our clients'.

Sometimes, that failure is the painting contractor's fault due to defects in the manner in which the surface to be painted was prepared. In other instances, the defect is in the application of the paint. At other times, coatings failures are due to improper material specifications or deficiencies in the coating material. Often, coatings failures are not a direct result of improper preparation, application, or defective materials but are the result of a reaction to unusual environmental or chemical conditions or substandard installations by others. No matter what the cause, you as the painting contractor will be involved and will have to participate in the solution.

Costly paint failures can often be predicted and prevented. In this column, we'll discuss tests that every painting contractor should perform to enable proper evaluation of surfaces and items prior to coating. We'll also offer procedures that will reduce defects that result from application. Case histories will be presented and examined with the hope that you will recognize similar situations and will take the necessary steps to avoid the failures others have experienced.

Let's begin by discussing adhesion. The loss of or failure to achieve adequate adhesion can result in catastrophic coating delamination. Adhesion may be defined as the property or force that causes a paint film "to stick" to the surface to which it was applied or as the degree of attachment between a coating film and the underlying material with which it is in contact. Paints and coatings bond due to both mechanical and chemical adhesion. The surface profile is an important factor in establishing mechanical adhesion. A very smooth, glossy surface will have compromised adhesion as opposed to a rough, porous one. Creating a surface profile by sanding, abrading, etching, or abrasive blasting is often necessary to provide a suitable surface prior to coating application.

In repaint situations, it's important to assess the adhesion of existing coatings prior to the application of new paint. We'll review a case history to illustrate this point:

A painting contractor bid the repainting of six hundred interior hollow metal doors and frames in a high rise condominium. The contractor's proposal specified the surfaces in question would be lightly sanded and painted with two coats of a "top-of-the line" interior semi-gloss enamel. The color selected was a dark green. The doors and frames had been previously painted several times with various shades of gray.

A short time after completion of the painting, it was noted that some doors and frames began to chip and show signs of paint delamination (photo #1). The Association contacted the contractor, expressed its concern and demanded that the situation be assessed and corrected.

Photo 1

Adhesion tests were performed on randomly selected hollow metal doors and frames that did not exhibit any peeling or coating delamination. These were performed in general accordance with ASTM D3359, Adhesion by Tape Test, Method A. Incisions were made through the coating in an X pattern. A specified adhesive tape is firmly applied to the area and then sharply removed. The adhesion of the coating is then evaluated by the amount of paint that is removed. Photograph #2 show the typical result of the adhesion tests. A great deal of paint could be easily removed using a putty knife as illustrated in photograph #3.

Photo 2

Photo 3

Paint chips removed during adhesion tests were visually examined. While the front side of the chips was green, the rear side of the paint samples was gray. This is an indication that the delamination included both the newly applied green enamel and previously applied coating. That is, the new enamel is well adhered to the previously applied gray paint, but that marginal adhesion exists between previous coats.

The cause of this failure is insufficient surface preparation. Because of the marginal adhesion of the existing paint, it was not proper to simply lightly sand the surface and apply additional paint. As a chain is only as strong as its weakest link, a paint system is only as strong as the weakest bond between or within individual coats. In this instance, a majority of the existing paint should have been removed to a sound surface by scraping or stripping. Although this process is tedious and costly, good paint adhesion cannot be accomplished on the existing painted surfaces unless this is accomplished. Each coat of paint over a marginally adhered coating tends to further compromise adhesion of the total applied system due to increased weight and stress.

This costly situation could have been easily avoided by using a very simple tool at every painting contractor's disposal, a pocket knife. One is attached to my key ring and I never assess a repaint job without it. By probing with a knife blade, it is possible to gauge the adhesion of existing coatings. If the paint is difficult to remove and the probing action only removes it at the tip of the blade, then the adhesion is relatively sound. If, however, the paint is easily removed and far exceeds the width of the knife blade then there is cause for concern. There are many instances where no peeling is evident and the existing coating appears to be well adhered , but when tested is found to be otherwise. This is especially true of coatings that have high degrees of cohesion like elastomerics.

In this particular case history, the painting contractor wrote the specifications and is therefore, responsible due to their inadequacy. Had the adhesion of the existing paint been properly assessed, then more strenuous surface preparation would have been bid and performed, resulting in a satisfied customer and a profitable job. Unfortunately, this case resulted in neither.