CorrosionCOPS
When it's Rust Call US!

Coatings Adhesion Test

Proper applications of coatings will result in longer performance and better surface protection where coatings have been used.

Use of a wet film thickness gauge or comb makes translation of what has been applied easy to understand and you can then calculate what happens to dry film thickness by review of product technical sheet.

Here is a formula that can be used for calculations should the Wet Film Thickness (WFT) to Dry Film Thickness (DFT) not be on technical sheets. Find the solids on the product technical data sheet and use the following information to calculate WFT:

Wet Film to Dry Film Thickness Formula:

If you need 10 dry mils of coating and the solids of the product is 71% divide 10 by .71 and you will get 14.
14 then is the WFT. The formula is DFT/solids = WFT.

With thinners: $WFT = \frac{\text{desired dry film thickness / \% of solids by volume}}{100\% + \text{\% of thinner added}}$

Adhesion Testing:

After the coating has been permitted to dry per manufacturers specification, testing of adherence should be performed to realize how well the substrate preparation was performed. Correct adhesion equals high performance, less issues with coating delaminating, peeling, better edge protection and finally higher resistance to corrosion and undercutting. Keep in mind that edges are the most difficult area to protect, and when applying coatings edges are treated first, then top coated for complete surface coating application. A second coat should then be applied to the edges before a complete second coat for complete surface coating and so on until the final dry film thickness specification is reached.

Also available are magnetic adhesion test gages which perform a similar function. Magnetic pull-off gages use a permanent magnet, a calibrated spring, and a graduated scale. The attraction between the magnet and magnetic steel pulls the two together. As the coating thickness separating the two increases, it becomes easier to pull the magnet away. Coating thickness is determined by measuring this pull-off force. Thinner coatings will have stronger magnetic attraction while thicker films will have comparatively less magnetic attraction. Testing with magnetic gages is sensitive to surface roughness, curvature, substrate thickness, and the make up of the metal alloy.

Magnetic pull-off gages are rugged, simple, inexpensive, portable, and usually do not require any calibration adjustment. They are a good, low-cost alternative in situations where quality goals require only a few readings during production. Pull-off gages are typically pencil-type or rollback dial models. Pencil-type models use a magnet that is mounted to a helical spring that works perpendicularly to the coated surface. Most pencil-type pull-off gages have large magnets and are designed to work in only one or two positions, which partially compensate for gravity. A more accurate version is available, which has a tiny, precise magnet to measure on small, hot, or hard-to-reach surfaces. A triple indicator ensures accurate measurements when the gage is pointed down, up, or horizontally with a tolerance of ±10%.

The selection of adhesion instruments has many levels of tools available which also means higher prices as one seeks electronic tools for adhesion testing.

Formula for Adhesion Test:

Allow coated surfaces to dry per manufacturers specification. Curing is not required for this test as curing of coating can take up to 30 days depending on product used. With a razor blade or razor knife etch a **#** symbol to the metal substrate through the primer. Be sure to press hard enough to bite into the metal. The center of the **#** symbol should be no larger than ¼. Apply masking tape (do not use the blue masking tape, specifically use the crème colored masking tape as no other tape is acceptable for this test) over the etched symbol. Extend the tape 1 – 2" on each side of the etch. Rub the tape down with some force. Lift on edge of the tape so as to hold the tape firmly with your index finger and thumb and pull the tape back. Do not pull with force, such as trying to rip apart paper, but a firm steady pull on the tape. Once the tape is removed, look at the **#** symbol, and then look at the adhesive side of the tape.

If there are small dots of coating along the horizontal and vertical etch lines on the tape, and the tiny areas exposed where the dots of coating were lifted, your preparation of the surface was performed well. If the treated surface reveals the 90 degree corners have lifted and peeled back, or the center of the **#** symbol has lifted with the tape, the surface preparation was not performed well enough for best adhesion of the coating.

In conclusion, both steps for WFT to DFT and adhesion are necessary parts of the coating process, and should be performed until your confidence in surface preparation for best adhesion is well in hand. The WFT to DFT is a separate function as typically each coating manufacturer has different WFT specifications for their coatings. If you use one manufacturers coating by specific product number, after a few completed projects the WFT to DFT step can be eliminated. As a precaution we recommend a spot check to be sure that the application has not been circumvented by marginal application of coatings.

Additionally, today's technology has gone beyond the hands on approach as written above, as technology today brings automated depth meters and adhesion testing equipment. This equipment is highly practical for the coating specialists in the field who daily are servicing large projects, but for the occasional project the prices may put these instruments out of reach.

The most important aspect in gaining the highest performance for any coating is based on how well the surface preparation has been performed. One could use the least expensive coating and prior to application of the coating perform the highest degree of surface preparation which will result in long lasting protection. If one uses the most expensive coating but does a poor job with surface preparation, the coating will fail early.

Take the time to do surface preparation correctly as anything less will result in premature failure of the coating due to poor adherence of the coating.