TNEMEC

SUBJECT

Overcoating Aged Paint Systems

PURPOSE

To discuss test procedures and criteria necessary to make decisions on overcoating (or not overcoating) aged coating systems.

GENERAL

The success or failure of an overcoat system depends on several variables:

- Condition of existing coating system.
- Geographic location (exposure conditions).
- Surface preparation prior to overcoating.
- Type overcoat system selected.

Determining Condition of Existing Paint System

Whether or not overcoating is a feasible alternative to complete removal and repainting depends a great deal on the condition of the existing paint system. The amount of corrosion present, number of coats, adhesion to the substrate, adhesion between coats and geographic location (exposure conditions) are all factors that need to be considered before a specifier can make an overcoat or complete removal decision.

Corrosion: One of the criteria used to determine if an existing paint system can be effectively overcoated is the extent of corrosion that has occurred. This can be evaluated by visual assessment using ASTM D 610 Evaluating Degree of Rusting on Painted Steel Surfaces. ASTM D 610 contains photographic reference standards that illustrate the degree of rusting on a numerical scale from 0 to 10 where Rust Grade 10 indicates less than or equal to 0.01 % rust and Rust Grade 1 represents greater than 50.0% rust. In other words, a higher rating indicates less rust. Steel surfaces with greater than 3.0 % spot rusting (Grade 4-S), greater than 1.0 % general rusting (Grade 5-G) or greater than 0.3 % pinpoint rusting (Grade 6-P) are normally not considered candidates for overcoating. See Table 1.

Table 1 (SSPC-VIS 2)				
		Photographic Standard		
Rust Grade	Percent of Surface Rusted	Spot	General	Pinpoint
10	Less than or equal or equal to 0.01%	None	None	None
9	Greater than 0.01% to 0.03%	9-S	9-G	9-P
8	Greater than 0.03% to 0.1%	8-S	8-G	8-P
7	Greater than 0.1% to 0.3%	7-S	7-G	7-P
6	Greater than 0.03% to 1%	6-S	6-G	6-P
5	Greater than 1% to 3%	5-S	5-G	5-P
4	Greater than 3% to 10%	4-S	4-G	4-P
3	Greater than 10% to 16%	3-S	3-G	3-P
2	Greater than 16% to 33%	2-S	2-G	2-P
1	Greater than 33% to 50%	1-S	1-G	1-P
0	Greater than 50%	None	None	None

Adhesion/Film Integrity: Before determining if the existing paint system is a candidate for overcoating, it is also important to obtain answers to the following questions:

1. What is the total film thickness?
2. How many coats of paint?
3. How good is the adhesion to the substrate and between coats?
4. Are there film defects such as cracking or blistering?

Physical and visual tests are required to answer the above questions and determine film integrity (overcoating risk factors). Conduct the following tests at a minimum of 3 locations (3 trials at each location) and record results on attached Form No. 101 X 588. Draw a diagram of the structure on a separate piece of paper and mark the locations where tests were conducted. Large structures such as bridges should be divided into zones and a minimum of 3 locations tested within each zone. Use a separate Form No. 101 X 588 for recording test results at each zone.

1. Measure total dry film thickness with a Tooke gauge, magnetic pull-off or magnetic flux film thickness gauge. Measurements should be taken at a minimum of 3 separate locations (3 trials at each location).

2. Determine approximate number of coats with a Tooke gauge or visual examination of a paint chip cross section.

3. Visually inspect the film for defects such as delamination, cracking and blistering. List any significant film defects that are observed. Existing coatings with extensive delamination or cracking should not be overcoated. If blisters are present, report blister size and frequency in accordance with ASTM D 714 Evaluating Degree of Blistering of Paints. (Existing systems that have extensive blistering should not be overcoated unless frequency of blisters is such that each blister or blistered area can be spot repaired.)

4. Check adhesion at the same locations (3 trials at each location) where dry film thickness readings were taken. Use the following adhesion test methods:

''X" Scribe and Tape Test - Conduct this test in accordance with ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test, Method A. Adhesion is rated on a scale of 0 to 5 as outlined in the ASTM Test
Method. No removal is rated as 5A and removal beyond the area of the ''X" is rated as 0A.

Knife Adhesion – Probe at the coating with the point of a knife blade in an attempt to delaminate the coating system between coats or from the substrate. Rate "knife adhesion" as poor, fair, good, or excellent.

Note: The ASTM D 3359 ''X" scribe and tape adhesion test can sometimes give misleading results if only delamination around the ''X" scribe is evaluated. Always examine the back (sticky side) of the tape. If it is covered with a thin layer of topcoat, rate the adhesion as ''0A" even though the ''X" scribe indicates better adhesion. Aged leafing aluminum coatings sometimes display this topcoat splitting phenomenon.

Selecting an Appropriate Overcoat System

Adding additional coats of paint to an old paint system will always increase the degree of cohesive stress. The risk factor question is usually not if the new system will adhere to the properly prepared surface of the old, it's whether or not the old system has good enough film integrity, adhesion between coats and to the substrate to support an overcoat system without literally falling apart.

Before selecting candidate overcoat system(s) one must keep in mind that cohesive stress exerted on the existing system will vary with generic type. Non-flexible conventional 2-component epoxies like Series N69, aliphatic urethanes like Series 1075 will develop more cohesive stress upon curing than more flexible coatings such as acrylic emulsions like Series 30, medium to long oil alkyds like Series 23, moisture cured urethanes like Series 1, and epoxy mastics like Series 135. One must also keep in mind that regardless of generic type overcoat system, the higher the film thickness the greater the cohesive stress on the existing system. For example, application of a Series N69/Series 1075 system at 12.0 mils total DFT to an old paint system possessing marginal adhesion would most likely lead to a delamination disaster. Enough cohesive stress will be developed that the old system will be literally pulled apart at its weakest adhesion link (between coats or from the substrate).

Geographic location (exposure conditions) also plays a role in the selection of an appropriate overcoat system. Paint systems in the northern states undergo more stress because of freeze/thaw cycling. Flexible, low cohesive stress overcoat systems, therefore, become even more important in those areas of the country that are subject to frequent freeze/thaw cycles during winter months.

Delamination Risk Factor: As mentioned earlier, it is important to check adhesion of the existing paint system before deciding whether or not it is a candidate for overcoating. After testing adhesion in accordance with ASTM D 3359 Method A, a delamination risk factor can be assigned on a scale of 1 to 5 with 1 the lowest delamination risk after overcoating and 5 the highest. See Table 2.

Worse case scenarios are multi-coat, high film thickness, existing coating systems with poor adhesion between coats or to the substrate in a freeze/thaw locale. A Tnemec overcoat system should not be suggested if a worse case scenario exists.

Old paint systems with high delamination risk factors (4.5 to 5) are usually not candidates for overcoating. When in
doubt check with Tnemec's Technical Services Department.

Cohesive Stress Factor: Cohesive stress factors for various generic type coatings on a scale of 1 (low) to 5 (high) can be found in Table 3.

System Selection vs. Risk & Stress Factors: Based on the fact that cohesive stress exerted by an overcoat system
is directly related to the delamination potential of an existing paint system, Table 4 can be used as a guide in selecting candidate Tnemec overcoat systems.

Candidate System(s) Test Patches: Before making the final decision on whether or nor to suggest a specific overcoat system, it is important to evaluate the adhesion of the candidate overcoat system(s) to the existing paint system. Make sure the existing system is dry and clean prior to applying test patches. Use ASTM D 5064 Standard Practice for Conducting a Patch Test to Assess Coating Compatibility as a guide in conducting adhesion test patches. Use ASTM D 3359 Method A to evaluate adhesion of the new system to the old. The overcoat system should not wrinkle, lift or show any other adverse effects to the existing system. The adhesion of the existing system should be at least as good to the substrate and between coats as originally tested. The adhesion of the overcoat system to the existing system should exhibit an average adhesion rating of at least 3.0.

Surface Preparation: Requirements may vary from job to job. All existing paint systems must be dry and clean prior to overcoating. This can usually be accomplished by power washing with 140o F. biodegradable detergent/water solution (1 to 2 oz. detergent per gallon of water) at 1000 to 2000 PSI at the rotating nozzle using 3 to 5 gpm delivery. It may be necessary to use some means of additional mechanical agitation during power-washing to help facilitate the removal of chalk or non water soluble contaminants. Rinse with clean tap water. Some existing paint systems (e.g. two-component aliphatic polyurethanes) may require scarification prior to overcoating.

If mildew is present, allow the surface to dry following the above power washing procedures. Wet mildewed surfaces with a bleach solution consisting of 3 parts warm water and 1 part household bleach. Allow the bleach solution to remain on the surface until dry. It will evaporate over a short period of time. Rinse with clean tap water.

Rusty areas should be power tool cleaned (SP11 is the preferred method), and spot primed (Federal and local laws pertaining to the removal of lead-containing coatings will need to be considered). Edges of existing coating should be feathered to form a smooth transition prior to spot priming.

If in doubt as to whether or not the surface preparation methods listed above are suitable for a specific job, please contact Tnemec's Technical Services Department.

Forms: If the generic type of existing system is unknown and/or assistance is needed in making overcoat suggestions, send a completed copy of attached Form No. 101 X 588, Request for Overcoat Candidate Systems, to Tnemec's Technical Services Department. The applicable sections of this form should be completed and filed regardless of whether or not assistance is requested from Tnemec Company. Attached Form No. 101 X 589,

Overcoat Test Patch Evaluation should also be completed and filed.

Note:Tnemec Company assumes no liability with worker safety, safety of the general public, contamination of the environment, or any other liability associated with removal of paint containing lead and/or other toxic substances.

Table 2				
DELAMINATION RISK FACTOR				
Adhesion Results*	Delamination Risk Factor (D.R.F.) **	Delamination Risk Factor w/ Freeze & Thaw	D.R.F. w/ Freeze & High Thaw Cycling & High DFT	
			10-20 mils	20+ mils
0 Poor	5 High	5+	5++	5+++
1	4.5	5	5+	5++
2	4	4.5	5	5+
3	3	3.5	4	5
4	2	2.5	3	4
5 Excellent	1 Low	1.5	2	3

*Average of adhesion tests at a minimum of 3 separate locations. (3 trials at each location in accordance with ASTM D 3359 Method A.)

**Degree of risk associated with the existing system delaminating between coats or from the substrate following application of an overcoat system.

Table 3	
Generic Type	Cohesive Stress Factor
A: Elastomeric acrylic emulsions	1 Low
B: Acrylic emulsions	2
C: Medium to long oil alkyds	3
D: Epoxy Mastics, water borne epoxy, urethane system or moisture cured urethanes	4
E: Conventional 2-component solvent- based epoxies and aliphatic urethanes	4 High

Table 4	
Delamination Risk Factor (From Table 2)	Coating Selection Based on Cohesive Stress Factors
5 or greater	Not Recommended
4.5	Not Recommended
3.5-4	A or B (From Table 3)
3	A, B, C or D (From Table 3)
2	A, B, C, D or E (From Table 3)
1	A, B, C, D or E (From Table 3)

Note: After spot priming, the number of coats required to achieve complete coverage depends on method of application and color of the intermediate and/or topcoat.

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