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To:	All Surveyors/Auditors
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Subject:	Coating Failure
Reference:	CONARINA CLASS

Coating Failure

No coating is better than a bad coating because recoating can cost much more than the initial coating application. Prevention is always a better cure.

Even a tiny area of coating failure can result in corrosion, weaken a structure, and eventually lead to catastrophic failure. Because coating failures—such corrosion, deterioration, and loosening adhesive coats—involve huge repair costs and a long down time, engineers and chemists aim to examine the causes of failures to avoid additional costs.

Coating-related failure is a complicated subject. As a result, the identification of underlying causes of failure isn't an easy task, especially since these causes tend to involve a combination of mechanical and environmental factors. It is vital to assess the main reasons for coating failures in order to measure financial responsibility, as well as to understand the fundamental causes. Therefore, it is imperative to have a detailed understanding and knowledge of the frequently encountered failures, reasons for their occurrence, and potential remedial measures to efficiently deal with coating failures.

What is Coating Failure?

Coating failure can be defined as the loss or reduction of a coating's bond strength between coats and the substrate. Premature coating failure happens before the expiration of a coating's potential lifespan, while catastrophic coating failure is extremely abrupt, terribly dramatic, and very severe. When failure occurs, some action is required to revive the coating's properties to the level necessary for it to function as intended.

How Coating Failure Happens

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Coating failure is said to happen when a protective coating fails to protect the substrate, provides an aesthetic look, or serves some other intended function. A typical coating system functions in many ways, often acting as an impervious barrier, providing powerful adherence with the substrate, keeping the cohesive and adhesive integrity of film throughout its service life, and resisting atmospheric and chemical deterioration. The period during which the coating can be relied upon to retain its bond strength through all types of stress and strain is determined by the strength of the initial adhesion of the coating with the substrate and the conditions to which it is exposed. The initiation of coating failure is often slow, but once started it propagates quickly, thereby defeating the very purpose of using a costly coating system.

There are various forms of coating failure, most of which are marked by paint or coating detachment. Coating failures can also occur throughout the application, curing stage, or after application. Statistics suggest that the majority of coating failures are a result of poor surface preparation and application. Typically, the failure takes place for a combination of reasons that need professional investigation.

The Consequences of Coating Failure

Coating failures can occur as a result of basic formulation design, incorrect system specification, poor surface preparation, improper application, and environmental stress factors. Coating failure entails various kinds of coating defects with varied degrees of impact on the general coating life. One of the real problems with coating failures is that they typically appear relatively innocuous from the surface, while examination of the substrate beneath can reveal major corrosion defects.

The blame for coating failures is often placed on coating materials. In fact, the majority of failures occur in applications wherever specifications for surface preparation, undercoating, or coating application haven't been developed or are simply not followed. For instance, improper or incomplete cleansing and removal of rust, mildew, abrasive, or different surface contamination will result in the deficient adhesion of a coating to a metal surface. An inadequate surface profile will also limit the utility of an ordinarily acceptable coating system. Coating failure tends to occur frequently when there's insufficient curing between coats and improper mixing of multi-component systems. All such potential contributory factors must be examined to determine the causes and mechanisms of a coating failure. Background data on the history of coating systems, application procedures, service atmosphere, and physical and instrumental characterizations of the failed coating are necessary for distinguishing the right causes of such failures.

Coating failures might result in serious corrosion and operation issues with economic losses. Also, repairing a damaged coating is often a very hazardous and complex process. For example, a number of oil and gas projects have suffered huge losses that can be attributed to premature failures of paints and coatings, including the massive natural-gas explosion that occurred in Sweet Water, Alabama, in December 2011. The expenses to repair such failures far outweigh the initial cost of coating. The cost of having to shut down can also be significant. Of

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course, in situations such as this one, where a pipeline is carrying dangerous goods, serious liability is also a major concern.

Common Forms of Coating Failure and How to Prevent Them

Several common forms of coating failures and ways to prevent them are indicated below:

Chalking

Chalking is indicated by a dusty material on the surface of the coating. Using a coating with better UV resistance can reduce chalking.

Erosion

Erosion refers to the elimination of a coating by contact with environmental components. Reformulation or choice of substitute materials with higher hardness ought to lessen erosional effects.

Blistering

Blistering is the development of little to large, broken or unbroken bubbles underneath or inside a coating. Greater attention to surface preparation can help remove contamination and enhance adhesion between the coating—and therefore the substrate—to decrease blistering.

Orange Peeling

Orange peeling refers to the development of hills and valleys on the coated layer resembling an orange peel. It can be eliminated by altering coating conditions or solvents, and may be removed by sanding and applying another layer of coating.

Pin-Holing

Pin-holing refers to the presence of little holes on a coating surface that provide a path of exposure to the substrate. It often occurs as a result of improper spray atomization and can be reduced by coating the system more than once.

Undercutting

Undercutting occurs when corrosion byproducts from the substrate under the coating cause the coat to rupture. This can be mitigated by increasing coating/substrate adhesion and using an inhibitive primer on the substrate before applications of the prime coat.

Cutting Coating Costs

Avoiding coating failures is vital in almost any engineering application. The most common causes of coating failures include inadequate specifications, poorly prepared substrates, inappropriate application, use of unskilled personnel, and dangerous construction practices. Failure, once it has occurred, can be corrected by deploying appropriate remedial measures.

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However, this method will be cumbersome, time-consuming, and costly. Prevention is always a better cure.

REFERENCES:

- **CONARINA Class Instructions**

ATTACHMENTS: No.

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