


The Protective Coating User's Handbook

Third Edition

by Louis D. Vincent


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Preface

This handbook has been created especially for the person who is responsible for the selection and use of protective coatings in either new construction or maintenance activities. It is intended to be a practical presentation of the basics of corrosion prevention through the use of protective coatings. Every attempt has been made to use everyday English rather than complex chemical terms. A valiant attempt has been made to de-mystify the complex chemistry of common coatings for metal and concrete structures.

Chemical terms have deliberately been reduced wherever possible to allow protective coatings users at all levels of skills, education, and experience to find the information they need for their everyday activities, whether they are engineers, technicians, salespersons, contractors, inspectors, or painters.

The book is designed to cover the basic activities of most industrial and commercial painting projects. Although there is some difference between the new construction and maintenance types of painting programs, these are minor enough to allow both to be treated as one overall painting scheme.

With the rapidly changing state of coatings technology, it is possible for portions of the technical information to be out of date by the time the book is printed. Therefore, every effort has been made to condense the information in such a manner as to make periodic updates possible.

Critique and comments from users of the handbook are welcome. They will be considered in all future updates.

Acknowledgments

The author is particularly indebted to several people for the help and inspiration for this handbook. Sixtus J. (Jack) Oechsle (deceased) served as a valuable resource of historical data. C.G. (Chuck) Munger has been a lifelong source of inspiration and technical knowledge, which he so freely gave with grace and humility. G.B. (Geoffrey) Byrnes has been a priceless source of chemical knowledge in the formulation, testing, and analytical composition of coatings. Lloyd M. Smith, PhD, as General Editor of SSPC 95-08 publication *Generic Coatings Types*, has provided excellent readable material on protective coatings of all types. Clive H. Hare has been a lifelong contributor of excellent articles on coatings chemistry including his book, *Protective Coatings, Fundamentals of Chemistry and Composition*. Gordon Brevoort, Michael F. Melampy, and Kirk R. Shields did excellent work on economic cost analysis published in NACE Paper No. 477, Corrosion 96.

The author is also indebted to several representatives of major coatings manufacturers who have provided technical data on their main line products. There has been such a tremendous increase in new protective coatings since 2010 that it is difficult for the average user to keep up with the changes that affect the coating systems he/she is accustomed to either using or inspecting on a job site. These form the basis of generic product comparisons found in each chapter. These representatives are Vijay Datta, ICI Devoe Coatings, Louisville, KY; Kat Coronado, International Paints, Houston, TX; Yakov Radonovic and Arlan Caballero, Hempel Coatings, Humble, TX; Steve Harrison, Carboline, St. Louis, MO; Todd Hart, Sherwin-Williams, Detroit, MI. Jim Simmons, PPG, Houston, TX, Billie Edwardson and Earl Bowry, Jotun Paints USA.

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Coating Failures

Introduction

This book has an unorthodox beginning. It starts with a discussion of coating failures, simply because if one knows how coatings fail under various conditions, it gives that person the knowledge necessary to avoid those failures.

Depending on the speaker and the audience, it is common to hear that anywhere from “seventy-five percent (75%) to ninety-five percent (95%) of all coating failures are caused by surface preparation and application errors.” However, rarely does the speaker present any factual data to back up these claims.

Discussion

One person who has performed such research and has published several papers on his work is Mark Weston of Incospec & Associates of North Adelaide, South Australia.

In 1993, Weston published the results of more than 120 failure analyses, which are broken down as follows:[1]

2% Caused by faulty paint
19% Caused by incorrect specification
11% Caused by change in environment from original design criteria
68% Caused by application error

After several years of additional investigations, Weston's failure breakdown statistics changed as follows:[2]

2% Caused by faulty paint
41% Caused by incorrect specification
11% Caused by change in environment from original design criteria
46% Caused by application error

Dr. Louis D. Vincent's research into 84 failure cases also looked in great detail at the true causes of coating failures.[3] His statistics were first compiled according to the type of failure. These failure modes include:

33.3% Delamination and/or disbondment
21.8% Blister failures
11.8% Adhesion failures
8.9% Physical damage
6.9% Cohesive failure
9.7% Loss of gloss
9.7% Solvent entrapment
9.7% Pinholes and discontinuities in coating film

Note: Percentages total more than 100% due to more than one mode of failure being present in many cases.

Dr. Vincent also analyzed the persons and/or companies responsible for the causes of these failures.[4] The findings were significant:

24.3% Owner error
27.0% Engineer/specifier error
16.2% Manufacturer error
27.0% Contractor/applicator error
5.5% Inspection error

It should be pointed out that the 16.2% attributed to manufacturer error does not mean faulty paint in all cases. Inaccurate or incomplete product data sheets and application instructions caused many of these failures. Improper recommendations from manufacturer sales representatives are a significant contribution to these failures. Table 1 can be used as a guide when deciding on maintenance topcoats over existing coating systems.