Because of increasing costs, owners are demanding longer coating service life. Ten to 15 years is no longer satisfactory. Simply adding dry film thickness will not work since many coatings crack at excessive thicknesses. Recent coating technology advances permit the use of solvent-free epoxy and polyurethane systems having >15-year lives. Newer combinations of epoxy and polysiloxane resins will make a 25-year life achievable.

Faced with increasing costs of surface preparation, application, and replacement/repair of protective coating systems, owners are demanding longer and longer service life of the coatings on their structures. Where they previously expected 10 to 15 years of service life prior to first maintenance, owners are now asking for 25-year life systems. Unfortunately, simply adding more dry film thickness (DFT) is not the answer as many protective coating systems develop brittle tendencies when applied at more than 25% above the recommended DFTs on their product data sheets.

Maintenance of Protective Coating Systems

Historically, there have been two main schools of thought regarding the best way to maintain protective coating systems. One practice was to apply the coating system during new construction and allow it to deteriorate with age until the coating could be totally removed by abrasive blasting and completely replaced. This method has been proven to be the most expensive, particularly when sensitive equipment has to be protected from abrasive, rust, and coatings residue during the abrasive blasting process.

The second school of thought was to periodically maintain the coating system whenever small areas began to deteriorate, but before corrosion had become extensive. The least invasive surface preparation was used, such as power tool cleaning or pressure washing, with the intent of removing loose coatings and rust without destroying the existing surface profile. A spot prime and a full top coat of the existing system was applied. This repair procedure could be done several times (usually at five-year intervals) before excessive coatings thickness caused the system to become brittle and start to break down.
Periodic Maintenance

To understand how periodic maintenance works better than total replacement, one has to comprehend the nature of protective coating systems. Typically large structures are fabricated with either inorganic or organic pre-construction zinc-rich primers applied over centrifugally blasted steel to a total DFT of 15 to 18 µm. With the exception of areas of the structure that are intended for immersion service, the preconstruction primer remains intact (except for secondary cleaning) prior to the application of a full coat of zinc-rich primer of 50 to 75 µm. Depending on the method of construction, a full coat of high-solids, solvent-borne epoxy is applied at a DFT of 125 to 175 µm either in block stages or at completed fabrication stages. The finish coat of solvent-borne aliphatic polyurethane (PUR) is applied at a DFT of 50 to 75 µm before delivery of the structure.

While this common coating system works reasonably well on vertical ambient service areas and equipment, it is not durable enough for rough service areas such as decks. In these areas, abrasion-resistant epoxies applied at total DFTs of 500 to 750 µm are more commonly applied over the zinc-rich primer. Finish coats of 50 to 75 µm of aliphatic PUR may or may not be used depending on the owner’s preference.

The corrosion resistance is provided by the zinc-rich primer while the intermediate epoxy coat provides a barrier against penetration of corrosive liquids. The finish coat of PUR adds another layer of barrier protection plus resistance to ultraviolet (UV) rays of sunlight.

Coating Breakdown

The real culprit in the breakdown of the typical coating systems in ambient service is UV rays of sunlight. They attack the resin system and gradually destroy the integrity of the resin to the extent that it begins to chalk. As the UV attack progresses, the epoxy resins become brittle and the coating film breaks apart. This is why the UV resistance and flexibility of aliphatic PUR finish coats have the greatest value and why periodic renewal of the finish coat has the ability to extend the service life of the epoxy intermediate coat.

Increased Service Life

In recent years, advances in coatings technology has led to increased use of solvent-free epoxy and PUR systems. While the increased DFT of these systems has made it easier to go beyond the typical 10- to 15-year service life of traditional systems, it does not mean 20- to 25-year service life will be achieved.

In order to have a reasonable assurance of getting a 25-year service life of a coating system, it is critical to have a very good relationship with the manufacturer to ensure that the coating system chosen for the structure is appropriate for the environment in which that structure will serve. Out of competitive necessity, manufacturers make both epoxies and PURs with low, medium, and high selling prices. Typically, the lower the price, the cheaper the resins. Pigments, solvents, and additives are important, but the most important component of a coating when it comes to service life is the resin.

Newer resin/curing agent combinations can increase the flexibility of the epoxy coating without compromising the barrier properties of the coating.

Newer combinations of epoxy resins and polysiloxane resins, along with selective curing agents, can also make a 25-year coating system life achievable.

One thing is certain—the newer the coating system, the higher the initial cost to apply it to a structure. Over a 25-year service life, however, that first cost is usually overcome by several orders of magnitude when compared with the savings from not having to remove the old system completely and from not having to shut down or delay production on the structure while coatings maintenance is being performed.

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