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“ Four Steps to Success ”

*The key elements for ensuring effective
through-life coatings management.*

*By David Keehan
Vice President, Sales & Marketing
Advanced Polymer Coatings, Ltd.*

*NACE Certified Coating Inspector #5803
(National Association of Corrosion Engineers)*

Advanced Polymer Coatings, Ltd., Avon, OH 44011 U.S.A. www.adv-polymer.com
Email: marineline@adv-polymer.com Phone: +01-440-937-6218 Fax: +01-440-937-5046

The cargo tank coating selection is a vital part of the design or repair of a ship and can have a lasting effect on the profitable operation of the vessel for many years. Selecting the correct coating is the first step to ensure years of tanker service in the harsh environments encountered when transporting caustics, acids, alkalis and other chemicals and liquid products.

For the marine industry, Advanced Polymer Coatings offers the unique MarineLine® coating which has been successfully coated on hundreds of tanker vessels which are today carrying the full range of IBC-approved cargoes. This article will consider the other critical part of the equation, which is ensuring that the surface preparation, application and inspection are equal to the task.

In general, coatings are an easy target should they fail. Often, coatings that should perform well are sold without further researching the capabilities of the company that will do the application work, or their level of experience and quality assurance and inspection capabilities.

Coating a cargo tank is much different to coating the hull of the ship or the ballast tanks, as these areas are going to be exposed to the same environment virtually every day. However, a cargo tank will often see a different cargo sequence, sometimes switching on every voyage.

The coating must deliver a number of performance expectations: first, it must be versatile enough to handle a wide range of cargoes; second, it has to protect the steel tank from corrosion; third, it must keep the cargo from getting contaminated by previous cargoes; and fourth, it must be easy to clean and maintain.

Surface Preparation

The entire cargo tank coating process can be broken down into four steps; surface preparation, application, heat curing, and final inspection. While every aspect is important, the surface preparation is often the most critical to ensuring that the coating achieves maximum adhesion to a clean surface without any design or structural defects that could lead to premature coating failure.

It is imperative that the tank surface be free of any defects or sharp areas that are difficult to coat. These areas can include; weld splatter, gouges, sharp corners, poor welding (skip welds, undercuts, sharp points) and delamination in the steel, as well as many others. When recoating existing vessels the surface preparation team should also look carefully for pitting and mechanical damage from previous use.

Abrasive blasting is the ideal way to clean the surface and promote proper adhesion. When blasting with abrasives it is important that the proper material is selected and that it is clean and free of contamination. Most coating manufacturers specify a degree of cleanliness and profile so that the contractor can make their abrasive selection accordingly. Advanced Polymer Coatings specifies grit-blasting to a SA 2.5 standard with a 70 to 100 micron profile.

The inspector can do several tests to ensure that the media is clean and will be able to provide the recommended profile. It is important that proper dehumidification and dust collection units are set up prior to the start of abrasive blasting. The specified humidity and number of air exchanges are located in the coating supplier's specifications.

The inspector should perform his environmental conditions inspections, humidity, temperature and dew point, prior to commencing any work in the tank. Again, for MarineLine®, we control the area to a minimum temperature of 10°C and a relative humidity of below 70%.

After the initial blast it is necessary to test the steel for contamination



by chlorides or hydrocarbons. These tests are easily administered and verified immediately. If the steel is found to be contaminated, it will be necessary to wash the tank with a solution to remove either or both contaminants prior to blasting. Another recommended practice at this time is to check the welds, pits and steel for any other potential problems that may have been exposed during the initial blast.

Four steps to SUCCESS

phase starts. It is of vital importance that the dehumidification equipment run at all times to ensure that the steel does not begin to flash rust and that moisture does not form on the surface, or penetrate the fresh coating after application.

MarineLine® coating is provided in separate containers and must be thoroughly mixed in the proportions supplied. The tank coating should be applied in a cross-hatch method to ensure proper coverage and limit the possibilities for pinholes or problems. The higher the solids content of the coating the better the coverage rate. This also limits the opportunity for pinholes and problems to arise. Generally, higher solids tank linings are applied in two coats, with a stripe coat of all welds and critical areas in between.

Lower solid content coatings are applied in three coats with two stripe coats in between. However, in most cases when three coats are needed, the first coat is only a primer coating that has little or no chemical resistance but is needed in order to get good bonding between the primer coat and the second coat.

The inspector will check the application between coats and stripe coats to ensure proper thickness and total coverage of areas, especially at the seams, welds, and corners. Prior to the application of the remaining coats, the inspector will check the surface for cleanliness, proper curing and any over spray.

Upon completion of the coating work, the inspector will perform Dry Film Thickness (DFT) tests to ensure that the thickness is up to the speci-



■ Following inspector approval, coating application can commence. Seen here, MarineLine® is applied using the spray (top) and rolled techniques.



cation provided by the coating manufacturer.

As an additional safety check beyond what other inspectors in the industry provide, MarineLine® inspectors also do spark tests of the entire tank coating to ensure it is pinhole free. While performing these tasks the inspector also continually performs visual inspections for any areas that could cause

Once everything has been repaired and/or cleaned, then final blasting can commence. Upon completion of the final blast the tank should be blown down and vacuumed out to remove all dust and contaminants. Once this work is completed, the inspector performs his final inspection of the steel prior to coating.

Coating Application

Once the preparation is approved by the inspector, the coating application

problems such as overspray, runs or sags in the coating.

As a coating side note, some ship owners have recently requested not only that their tank coatings withstand chemical corrosion and ensure product purity, but also that the tank tops and bulkheads have the added strength to prevent basic mechanical damage. In these situations, Advanced Polymer Coatings installs a special barrier made of MarineLine®-impregnated fiberglass-reinforced matting measuring approximately 95-130mm thick.

This provides exceptionally high tolerance to mechanical damage – more than 10 times greater impact resistance than the coating alone. The matting is then over coated with the coating to create a smooth surface for a complete and consistent solution in the tank.

Heat Curing

Upon completion of the application phase, the cargo tanks lined with MarineLine® are heat cured prior to sailing. We are often asked why we go through this step in the process. The reasons are numerous.



■ Heat curing delivers a uniform and more complete cure of the entire coating application.

First, heat curing removes all solvent entrapments in the coating. Second, it fully cures the polymer while it is at the shipyard so that the tanks can carry any cargoes recommended by the coating manufacturer immediately after leaving



Thorough tank inspection is crucial in ensuring each step in the coatings process is performed correctly.

the shipyard. This does away with the 90-day waiting period requirement that Phenol Epoxy coatings must adhere to regarding the carriage of aggressive chemicals, and also the stipulation that they need to carry hot oil as their first cargo.

Heat curing also prevents leaching of the solvents into future cargoes eliminating contamination. It also delivers a uniform and more complete cure of the entire coating application.

Heat curing is performed by inserting long tubes that are connected to natural gas burners into the cargo tanks.

The tubes are brought up to temperature with forced hot air between 80 and 90°C for a minimum of six hours. The temperature is monitored and regulated by the use of computer control and a chart recorder that is connected to thermocouples throughout the tank, thus enabling the tank coating to receive a uniform and complete cure as opposed to having to carry hot cargoes on its initial voyage to achieve a similar result.

So with proper heat curing, the ship owner is now able to leave the shipyard and immediately load higher revenue earning aggressive cargoes right out of the yard.

Inspection

Inspection of the coating process gives the owner peace of mind that the cargo tanks have been coated to the highest standards and quality.

Proper inspection should be performed during the entire process of the coating work by technical personnel of the coatings manufacturer who are knowledgeable in both their coatings and the procedures required for surface preparation and application.

Inspectors should be aware of the requirements and expectations that the ship owner has established for the cargo tank coating. Upon completion, the surface of the coating should be very smooth and slippery, so it is easy to clean. This enables the ship to get in and out of port quickly, saving costs and increasing the profitable passage time when on the seas.

The coating also should be fully cured prior to leaving the yard so that the owner can maximize earnings right from the very first voyage.

The inspector should train the crew on how to do proper repairs should mechanical damage occur so that down time is minimal and the repair lasts for a long time. Lastly the inspector should be involved in every aspect of the cargo tank coating process so that the warranty provided by the coating manufacturer can be long term and hassle free.

Advanced Polymer Coatings chooses to have its own team of inspectors that work with shipyards throughout the world, following a standard set of specifications and procedures that ensure MarineLine® performance. □