



## WHY a Fully Cured Cargo Tank Coating Matters For Long Term Performance

To adequately protect coated cargo tanks of chemical and product tankers, the lining must be cured. For the MarineLine® system, this means a 'Forced Hot Air Heat Cure', which is the final step in the entire application process. MarineLine® is regarded as the Gold Standard in the industry. This final heat curing step is what enhances and accelerates MarineLine®'s patented polymers to highly crosslink together, forming a tightly knit, nearly impenetrable structure. APC has built its unique heat curing system for MarineLine® over many years and millions of dollars to acquire the necessary infrastructure and heat curing equipment, and to develop stringent operating procedures, and to extensively train its operators. This technical report explains this system and presents the various heat curing steps.

### MarineLine® Believes a Cured Coating is Critical

The MarineLine® application process begins with proper surface preparation of the substrate, followed by careful application and inspection of the coating at each stage. Final curing of the coating while the ship



*Applying thermocouple to monitor temperature during heat curing of the cargo tank coating.*

APC's unique heat curing system for MarineLine® has been built up over many years through continual investment to acquire necessary infrastructure and heat curing equipment and to develop stringent operating procedures, and to extensively train its operators. Note heat tubes (far right) that carry hot air to cure the MarineLine® cargo tank coating.



TECHNICAL REPORT



**Advanced Polymer Coatings**  
Avon Ohio 44011 U.S.A.  
www.adv-polymer.com

+01 440-937-6218 Phone  
+01 440-937-5046 Fax  
800-334-7193 Toll-Free in USA & Canada

is still at the yard provides the maximum level of corrosion protection for the steel tank, ensuring long term performance, and protecting chemicals carried at a high purity level.

Shipowners specify the MarineLine® coating system because they know when a ship leaves the shipyard, it is immediately ready for service, able to safely carry thousands of chemicals and liquids approved by the IMO, including aggressive cargoes and other profitable cargoes. There is no waiting time for additional curing, or the need to carry hot cargoes for post curing.

### **Other Coatings Companies Take a Different Approach**

Some coatings companies that offer phenolic or bimodal epoxy tank linings state a “post cure is mandatory prior to carriage of any cargoes.” However, while they cite various ways to possibly achieve a post cure, none of these methods are under their control, with all responsibility forced upon the shipowner to perform the post cure and carefully document all steps.

Note that other coating companies insist as a “condition of service” that the shipowner guarantee that records be maintained at specified temperature and time requirements at all times during post curing. So if tank coating problem arises in the future, the shipowner must take the blame if the post curing was not done perfectly or not diligently recorded fully. This is a great risk to the shipowner that could present a large future liability.

So unlike the MarineLine® system with its turnkey approach, when shipowners ask other coatings companies how to post cure their tank linings,

they offer various methods. Here is a sampling:

- A. forced hot air heat cure (just like APC/ MarineLine® recommends in the shipyard)
- B. carry a full hot cargo as specified
- C. immerse (fill to maximum capacity) the cargo tank with hot seawater/freshwater for a specified time and temperature
- D. carry non-aggressive cargoes for three months as specified
- E. apply a hot recirculating wash with seawater/freshwater using tank cleaning machines (butterworth) for a specified time and temperature.

NOTE: Published independent studies show that ‘D’ and ‘E’ do not fully cure these systems. For complete post cure information on any cargo tank coatings, check directly with the coatings manufacturer.

Again, proper post curing with any of these methods is the full responsibility of the shipowner, so before those cargo tanks can be put into full service, the shipowner will have to incur large heating fuel expenses to heat the water needed for butterworth or immersion, or other methods, further reducing profitability. As one coating company states, “It should be noted that failure to observe the specified curing conditions prior to cargo immersion may have a permanent adverse affect on the resistance properties of the coating.”

### **Problems Emerge by Not Fully Curing Coatings**

Some coating companies are promoting that they are ‘equal’ to MarineLine®.’ This cannot be true, as MarineLine® is based on a unique patented polymer system with the highest resistance

capability of any cargo tank on the market, with the industry's best heat curing system. In fact, if a competitor's tank coating does not achieve a full cure, problems can arise. Reports from inspectors and surveyors of competitor's cargo tank coatings show that ships are being taken out of service for various issue including cracking, and are being recoated, even after just a short service life and

carrying easy cargoes. Many times the problem is the post cure, which again, is forced upon the shipowner to assume all responsibility. FOSFA even has a stipulation in its operating procedures that says coated cargo tanks must be fully cured prior to any carriage.

*Cracks and blisters found on a bimodal epoxy coated tank, after less than 2 years service carrying easy cargoes.*



## MarineLine® Heat Curing Steps

APC's heat curing system removes solvent entrapments in the MarineLine® coating and serves to fully activate polymer crosslinking, delivering a uniform cure of the entire coating application.

Prior to starting, tank dimensions and volume are taken into consideration when setting up the

equipment. Next, a meeting is typically arranged at the shipyard prior to the arrival of APC's heat cure crew to discuss the schedule and requirements of each party involved and the general parameters of the project. This will ensure that this process goes smoothly and all parties work together.



**Photo 1** During heat curing setup, long heat distribution tubes are fitted through suitable deck penetrations (butterworth, pump, or other openings).



**Photo 2** The heat distribution tube is shown inside



the cargo tank.

**Photo 3** A standard high velocity burner, connected to a natural gas supply,



**Photo 4** is then inserted



**Photo 5** into the distribution tube. The burner unit is then connected to a high velocity fan



**Photo 6** that forces hot air down into the cargo tank where it is circulated.



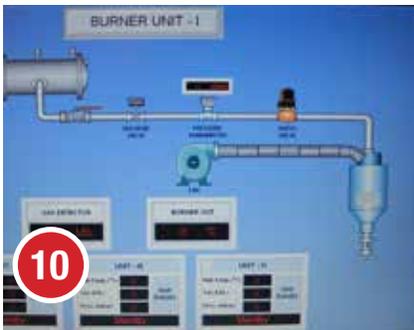
**Photo 7** shows the multiple fans used in each tank. The operator has placed a number of thermocouples within the tank



**Photo 8** on the tank coating and these are then connected to the Control Booth



**Photo 9** on the deck where a computer



**Photo 10** and chart recorder reads and records the tank steel temperatures



**Photo 11** during heat curing. The forced hot air temperature is regulated at approximately 90°C to 110°C for six hours soak time to ensure the MarineLine® coating cross-links to provide superior



chemical resistance.

**Photo 12** After removing the thermocouples, the cured MarineLine® coating is inspected throughout the tank and after approval, is now ready to immediately carry aggressive cargoes and other chemicals upon leaving the shipyard.

**APC/MarineLine® takes turnkey responsibility for the final curing of the coating as part of its ongoing partnership with its customers.**