

***Marine*LINE[®] 784**

APPLICATION PROCEDURES

FOR

**COATING IMO CLASS II, III
CHEMICAL TANKERS**

*Current Specifications are also available on
APC website; www.adv-polymer.com*

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1.0 SCOPE :

- 1.1** The coatings are to be applied to all internal surfaces of each tank designated above, including: Bulkheads, Deck and Shell Plating, Framing, Girders and Stiffeners, Brackets, Expansion Trunks, Ladders and Ladder Rungs and all other internal structures and fittings as required.

In order to accomplish this total coating, all existing tank coatings shall be removed.

- 1.2** The Shipyard or its subcontractors must not deviate from these specifications without the written consent of the MarineLine's Inspector.

- 1.3** Shipyard shall supply all coating material (including solvents), labor, staging, lighting, blasting equipment, dehumidification equipment and any other material required in preparing and lining all internal surfaces of the designated tanks. SHIPYARD shall supply and maintain, at all times, adequate ventilation and proper dehumidification during all phases of blasting and coating.

2.0 GENERAL INFORMATION

2.1 LIGHTING

The shipyard and/or its subcontractors shall furnish and fit appropriate explosion-proof, low-voltage lighting so that good working light is achieved in all parts of the tank during all work operations and inspections. During all coating applications, touch-ups and other work operations involving flammable and/or explosive materials, only approved explosion-proof lighting shall be used. General lighting in the tank shall be at least 500 Lux and shall be approved by the Owner's Representative prior to any application, stripe coating/touch-up and inspection work. If lighting is insufficient, further work will be postponed until corrective action has been taken.

2.2 RAIN PROTECTION & EXCESSIVE HEATING-COOLING PROTECTION

Suitable protection shall be used above the deckhead area including all hatches of all tanks to be coated. In addition, water guards are to be installed around the entrance holes of tanks being coated to prevent rainwater from draining into the tank. These protection guards are to be erected and maintained at all times to provide protection in the event of rainstorms, excessive cooling and heating of deckhead. Abrasive grit used for blasting is to be sheltered from the rain.

2.3 STAGING

- 2.3.1 Staging Material.** Only combination "pipe and cable ladder-type" with expanded metal grate staging, suspended from specially fitted stainless steel overhead lugs or

rigid knock down pipe staging, is acceptable. All pipe ends shall be fitted with plastic plugs to prevent grit accumulation within the pipe. Other types of staging can be used subject to approval of the MarineLine's Inspector. All staging is to be erected so that it will leave a clear area of at least 300 millimeters, but not further away than 600 millimeters from all surfaces to be blasted and coated.

Staging is to be of such construction that it can be disassembled and removed from the tank without damage to the coating. Staging is to remain erect and in place until the tank has passed coating inspection on the deckhead and bulkheads.

2.3.2 Destaging. Prior to destaging, the coated areas of the tank near tank openings and tank top to be used for removal of staging material shall be protected with either a canvas or foam rubber cover to prevent damage of the lining. Repairs shall be made according to the MarineLine Inspector after destaging is completed. During destaging of the tank, staging clamps shall remain attached to the staging pole and shall not be removed inside the tank.

2.4 SURFACE PREPARATION (Per APC's EQS-9)

2.4.1 Pre-Surface Preparation. Each tank will be delivered in a clean and gas free condition, prior to the start of any surface preparation in the tank.

2.4.2 Pneumatic Descaling. Heavily scaled surfaces are to be de-scaled by pneumatic tools and/or hammers prior to abrasive blasting. After pneumatic descaling is done, the tank shall again be certified gas free.

2.4.3 Edges, Corners, and Welds; (NACE SP0178-2007/C grade) Prior to blasting all edges and corner welds shall be rounded to radius greater than 2 millimeters and all welds shall be ground smooth prior to grit blasting. Steel plates are to be free of gouges, deep scratches, and all other surface flaws. No sharp edges are to be protruding from the steel plate.

2.4.4 Preblasting; Pre-blasting of all welds and all internal surfaces is mandatory for early detection of pinholes and other irregularities which may require re-welding.

2.4.5 Equipment. The yard and/or its subcontractors will supply the necessary abrasive blasting equipment, air compressors, abrasive vacuum suckers, dehumidifiers, and other tools and coverings in order to be able to carry out the accepted work efficiently under all weather conditions.

2.4.5.1 The compressed oil-free air used for abrasive blasting shall be cooled after compression and shall not have a higher temperature, volume and humidity, than the air fed into the tanks by the dehumidifiers. A "Blotter Test" shall be performed periodically to confirm that the air is free from oil.

2.4.5.2 The abrasive to be used is to be clean, dry, sharp and of good quality with a content of soluble salts not to exceed 250 micro-siemens with a chloride content of 25 ppm or less per 300 ml of abrasives as specified in the ISO Standard. A quality certificate shall be issued by the abrasive supplier for each shipment of abrasive stating batch no., type of abrasive, origin of abrasive mesh size, hardness, chemical composition and content of soluble salts.

2.4.5.3 The abrasive blasting process shall produce a profile of (Per APC's EQS-10):

Profile; Average	75 micron
Profile; Maximum	100 microns
Profile; Minimum	50 microns

2.4.5.4 Advanced Polymer Coatings reserves the right to conduct chloride testing before or after abrasive blasting is completed. If testing is deemed necessary by the MarineLine's Inspector, the following criteria will apply: testing for surface contamination on blasted surfaces shall be accomplished using a "Bresle Sampler Kit" or SCAT kit in order to determine the amount of total soluble salts. The acceptable level of chloride contamination is (per APC's EQS-6):

Chloride Content	Max. 1 mg./L (1 Quantab = 32 ppm)
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If after testing, the chloride level exceeds the acceptable level, all contaminated surfaces shall be pressure washed with clean, warm water and retested. When the chloride level is acceptable, the washed area shall be reblasted.

2.4.6 Blasting (Per APC's EQS-9).

All internal surfaces and parts including, but not limited to: bulkheads, deck, shell plating, stiffeners, brackets, expansion trunks and hatch covers, pipelines and valves, reach rods and supports, ladders, ladder rungs, and all other internal structures of the designated tanks are to be blasted to;

Sa 2.5 (SSPC-SP 10) Near-White metal blast specification prior to the application of the first coat of the tank lining system.

The blast cleaned surface finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface, except for very light shadows, very slight streaks, or slight discoloration caused by rust stain.

Particular attention will be paid to areas of heavy pitting to assure thorough cleaning.

2.4.6.1 The surface preparation is to be accomplished with mineral slag grit or steel grit (other abrasive materials may be used, but are subject to approval by MarineLine's Inspector), salt and sulfur free, of 12 to 20 mesh size forced by compressed air, that has a minimum pressure of 100 psi at the sandblasting nozzle and a volume of 250 cfm per nozzle. The compressed air used in blasting and blowing surfaces must be

segregated from the shipyard area, be cleaned and cooled after leaving the compressor, and be free of oil and moisture.

2.5 SURFACE CLEANING (Per APC's EQS-9)

2.5.1 Suitable industrial-type vacuum cleaners are to be provided and used for removing residual grit and dust from internal surfaces after blasting and prior to coating. Particular attention is to be given to removal of grit and dust in pitted and horizontal areas. All staging to be vacuumed cleaned. Tank shall be free of dust and contamination prior to coating.

2.5.2 Around the main entrance hatch coaming, a proper protection shall be rigged in order to prevent dust, dirt, moisture, water and other contaminants from entering the tank and contaminating the immediate entrance area surrounding the coaming of the tank. The immediate entrance area of the tank shall be kept clean, dry and free of debris at all times during the coating operations. A wooden grate shall be placed next to the hatch coaming entrance in order to help to prevent contamination from foot traffic. MarineLine Inspector approved foot protection equipment shall be used during all inspections to prevent contamination being carried into the tank. Special care shall be taken to avoid all spills of sea water on the main deck area from leaking fire hoses, dehumidifiers, etc. in order to minimize the danger of chloride contamination into the cargo tanks.

2.6 DEHUMIDIFICATION EQUIPMENT / VENTILATION (Per APC's EQS-7 and EQS-11)

2.6.1 Adequate dehumidification equipment/ ventilation is to be maintained at all times in the tanks during the blasting, coating application and the drying of the lining. The dehumidification equipment/ventilation should be of sufficient capacity and properly installed to maintain the Sa 2.5 (SSPC-SP 10) Near-White blast specification within the entire tank while the tank is blasted and lined in its entirety. Further, the equipment must have the drying capacity to achieve the relative humidity, dew point, steel temperature of:

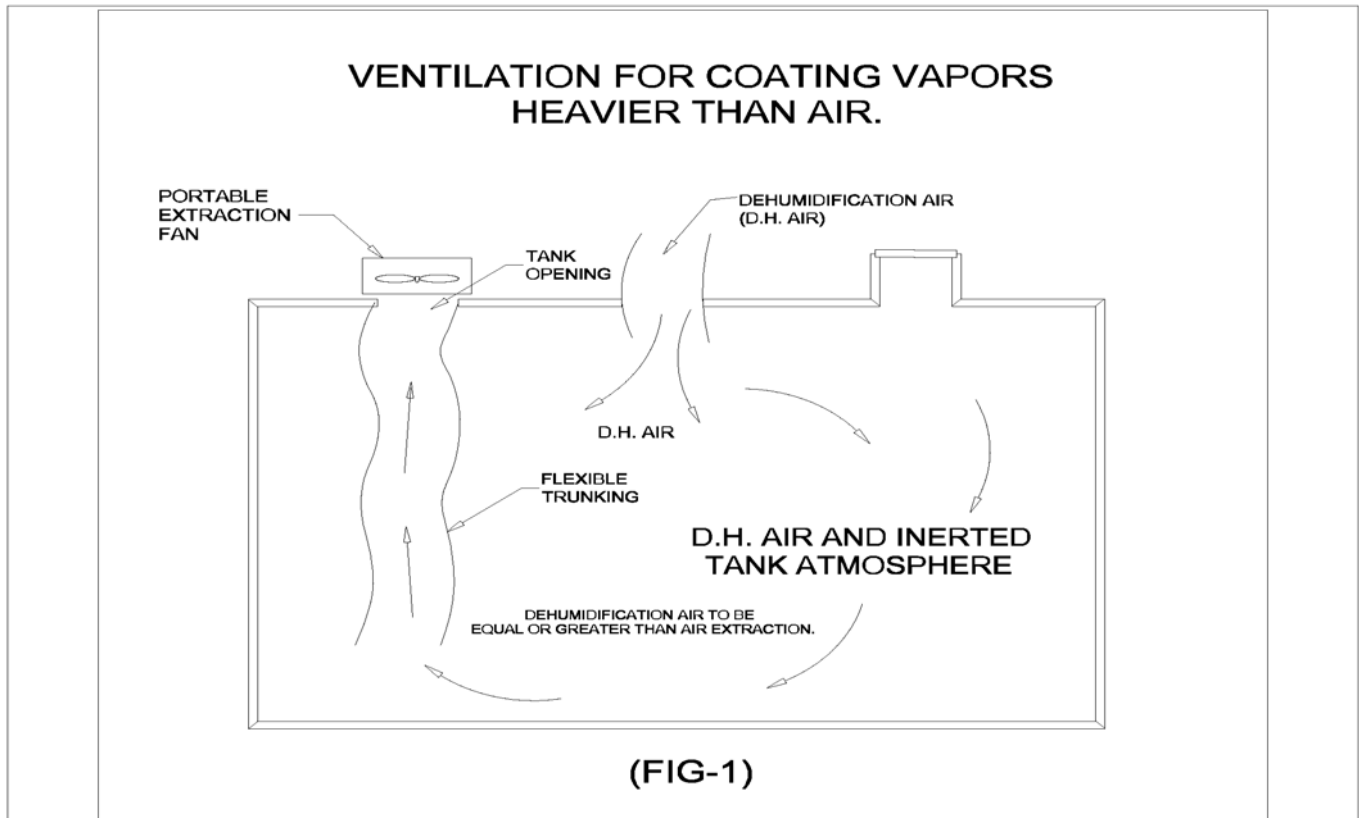
Humidity; During Blasting	50% or lower
Humidity; During Coating Operations	65% or lower
Substrate Temperature; range	10° to 40°C
Substrate Temperature; minimum	3°C (5°F) above the dew point

NOTE: It is recommended minimum ventilation is 10 air exchanges per hour in a 100 m³ tank and 4 air exchanges for tanks of 2000 m³ and above. For tanks between these values, the requirements for air exchanges should vary correspondingly.

The volume of the dehumidification air shall always exceed the volume of the extraction air (ventilation fan) in order to maintain a positive balance of air to prevent humid and unfiltered air from entering and contaminating the tank. This equipment must remain erect and functioning during the application of the 1st and 2nd coats.

Note: *Dehumidification equipment shall be operated 24 hours a day during MarineLine application. This covers both 1st and 2nd coats plus all stripe coating and touch-up applications*

SEE FIG-1



2.6.2 Environmental conditions shall be measured and recorded by the Contractor (Shipyard's Representative) and MarineLine's Inspector (the MarineLine inspector shall record environmental data on appropriate log sheet) a minimum of every four (4) hours in tanks where work is in progress unless weather conditions dictate more frequent measurements.

The coating system shall not be applied when minimum steel temperatures are within 3°C (5°F) of the dew point or the humidity level is above 65%. Adequate ventilation is to be maintained at all time in compartments to be lined. (Per APC's EQS-7, EQS-9 & EQS-11)

2.6.2.1 Ventilation is to be of minimum capacity to maintain a clear atmosphere within the tanks during both blasting and coating operations. During application, tanks must be

sufficiently ventilated to maintain the atmosphere within the tank below 10% of the lower explosive limit. Bag hoses or other dust collection equipment must be used to conform with environmental regulations and so there will be no contamination damage to deck equipment and machinery. Ventilation shall be continued for minimum of twenty-four (24) hours at a minimum temperature of 15°C. or until coating is dry and hard to the touch.

2.6.2.2 Penetration bends to be used for ventilation ducts to avoid sharp edges, at tank hatches, which otherwise may reduce the ventilation efficiency.

2.6.2.3 All dust collection equipment must be explosion-proof.

2.7 CARGO PUMPS AND STEAM COILS

2.7.1 Cargo pumps located in all tanks where blasting is to be performed shall be properly marked, disconnected and brought ashore for safe storage. The pumps shall be reinstalled after completion of the coating work.

2.7.2 **Steam Coils installed prior to MarineLine coating work.** Prior to start of grit blasting wrap all coils with sponge rubber tubing. Wrap securely. After grit blasting remove dirty sponge rubber tubing and replace with new sponge rubber tubing after vacuum cleaning and prior to stripping and spraying. **Remove sponge rubber tubing after completion of last spray application and BEFORE heat curing.**

2.7.3 **Steam Coils installed after last spray application.** After installation of steam coils all areas where coils were installed are to be sparktested and damaged areas marked for repair (reference 3.12 Repair Procedures).

3.0 APPLICATION OF THE LINING SYSTEM

3.1 GENERAL NOTES PRIOR TO COATING

3.1.1 **Abrasive Blasting Inspection.** During abrasive blasting inspection and prior to applying the first coat of the system, the surface shall also be inspected for corrosion pitting. The Owner's Representative in consultation with the MarineLine's Inspector will determine if the pitted areas require welding or pit filling with MarineLine.

3.1.1.1 If the pitted area requires welding, the pitted surface will be marked and the pits will be welded and then smoothly ground to the adjacent steel area. The repaired areas shall be abrasively blasted to a Sa 2.5, 75 micron average profile, at the same time when blasting the balance of the tank (ref. APC's EQS-9)..

3.1.1.2 If the pitted area requires "pit filling," the following shall be done a minimum of 8 hours prior to the application of the first coat:

Apply with a brush a thin coat (approximately DFT 75-100 microns) of MarineLine, thinned 5% with Toluene or Xylene, to corroded, pitted surfaces and welding seams with pinholes.

3.1.1.3 STORAGE (Per APC's EQS-5)

Resin and catalyst materials shall be stored inside a "climate-controlled" container as follows:

Storage temperature; for a minimum of 48 hours prior to mixing and application	20°C to 25°C
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During summer period the coating shall be stored inside out of direct sunlight and kept as cool as possible.

NOTE: *During colder temperatures the MarineLine coating may crystallize during transport. If this occurs heat the material to approximately 40°C. for a few hours until material is smooth and homogeneous. VERY IMPORTANT -- COOL MATERIAL TO 20-24°C. PRIOR to MIXING IN CATALYST and application!*

3.2 MIXING: MarineLINE is supplied in kits which contain the proper ratio of ingredients.

NOTE: Complete kits must always be used for mixing. Splitting of kits for the purpose of making smaller portions are under no circumstances allowed. Smaller units will be supplied.

Mechanically agitate Component A (resin) for 1-2 minutes. Slowly add Component B (catalyst) to the resin and mix thoroughly for 3-5 minutes using a high shear (SSPC recommended) mechanical mixer.

The mixture must be homogeneous and uniform in consistency before use. New spray hoses are to be used (maximum 45 mtrs. In length). **DO NOT USE** spray hoses that have been used for other coating systems.

Pumps and spray guns should be properly cleaned with Acetone or MEK, by recirculating the solvent through the pump for 15 minutes.

The area where mixing is to be performed shall be protected from rain, kept clean, and free of debris at all times. All empty drums shall be stacked in a designated area, and it is the inspector's responsibility to record the number of drums used and the associated lot numbers for both resin and catalyst for each coat in each tank and record this information on the appropriate Project Documentation form.

- 3.3 THINNING.** Some thinning of the coating may be required. When thinning is required Toluene or Xylene is recommended. Do not add more than 1.0 liters of Toluene or Xylene to the 20 liter kit (5 gallon) or more than 200 ml to the 4 liter kit (1 gallon).
- 3.4 SCREENING.** Pour mixed MarineLine through 60 mesh screen into a clean can, to remove any large particles, and use a filter on the pump suction.
- 3.5 POT LIFE.** The pot life of MarineLine is approximately 75 minutes at 20°C. Actual pot life is dependent on temperature and will be shorter at higher temperatures.
- 3.6 SPRAY EQUIPMENT.** All full coats are to be applied using hand-held airless spray guns. It is recommended that an air assist spray gun be used for finer atomization and thickness control. The coating pumps should be 60:1 or higher, 3 gpm minimum, air operated and have air line filters and oil and moisture extractors. A #50 - #60 mesh in-line filter on discharge side of pump must be used. A #50 - #60 mesh filter to be located between gun and whip hose. A filter on the siphon line is recommended. The air-input line should be 1/2 inch (1.25 cm) I.D. minimum. It is suggested that airless tip sizes from .017 to .020 inch (0.43–0.50 mm) and a minimum of 3/8 inch (0.95 cm) I.D. fluid hose with a 1/4 inch (0.63 cm) I.D. 15 meter whip be used. In addition, a minimum 100 psi air pressure at the airless spray pump giving minimum 3000 psi at gun nozzle and a fluid hose length of a maximum of 100 meters should also be used. Only properly overhauled and cleaned spray pumps and spray guns will be allowed.

NOTE: New hoses shall be used for the spray application of MarineLine products.

Each pump shall be fitted with an air pressure gauge and a reduction valve so air pressure can be adjusted to the correct level.

NOTE: Pump shall be located as close to tank as possible to provide shortest hose length possible.

- 3.7 STRIPE COATING.** The main reason for stripe coating is to induce maximum paint adhesion in the most critical areas. Stripe Coats (SC) shall be applied by suitable natural bristled brush to all edges, welds, ratholes, lighting holes, scallops, drain holes, behind all bulb profiles, angle bars, corrosion pits, corroded and otherwise irregular shapes, and other hard to reach areas.

The stripe coating shall be done in a "stipple and level method." Stripe coats shall be applied before final spray coat. The MarineLine's Inspector may at his own choice decrease the number of stripe coats depending on the local situation.

NOTE: Contractor to use MarineLine in 1-gallon (4 liter) container kits for striping as required. **ONLY COMPLETE KITS TO BE MIXED AT A TIME, NO SPLITTING OR BREAKING DOWN OF KITS PERMITTED.**

3.8 APPLICATION REQUIREMENTS OF *MarineLINE 784*

3.8.1 Extraction Ventilation. Extraction ventilation shall be erect at all times from the time the coating application starts, until the 36 hours after final spray coat. The capacity shall be enough to keep the condition inside the tank below 10% of LEL at all times, but never higher than the capacity of the dehumidifier.

The extraction hose/s shall be erected to draw the contaminated air from the lower farthest portions of the tank, to ensure proper removal of the air/solvent vapors. The DH shall be supplied to the upper and farthest portions in a way to ensure maximum air velocity near to the surface of the applied coating. Rigid penetration bends to be used on both DH hoses and extraction hoses to ensure proper air flow and avoid sharp edges which otherwise will reduce the ventilation efficiency. Should additional penetration be required for rigging of ducts, only APC approved size and location of deck and bulkhead holes will be permitted.

VENTILATION: All equipment must be explosion-proof. Ventilation shall continue for a minimum of 36 hours after final coat. Volume capacity shall be a minimum of 75% of dehumidification requirement listed in 2.6.

3.8.2 Environmental Conditions During Entire Lining Process (Per APC's EQS-7 & EQS-11) The relative humidity inside the tanks shall be as follows:

Humidity; During Coating Operations	65% or lower
Substrate Temperature; range	10° to 40°C
Substrate Temperature; minimum	3°C (5°F) above the dew point

NOTE: If the humidity level rises above 65% or the dew point drops below 3°C. at any time during the 1st coat spraying process for maximum 12 hours or less – the following procedure must be followed PRIOR to the application of the next coat of MarineLine to remove all moisture from the coating surface:

Bring the Humidity level of the tank to 50% or below and the dew point above 3°C. – HOLD these conditions for minimum of 24 hours PRIOR to re-starting MarineLine application.

Re-starting of MarineLine application MUST be approved by MarineLine Inspector – DH, dewpoint AND re-coat window must all be within spec.

IF DH IS LOST FOR MORE THAN 12 HOURS – tanks are to be blasted and all coating be removed prior to reapplying MarineLine.

3.8.3 Space Heaters. If the steel surface temperature is less than the above specified, space heaters shall be installed to ensure that the proper conditions are kept at all times inside the tanks. The only LP combustion type heaters permitted are those with **INDIRECT** heated air supply. If direct flame heaters are used they are to heat the ballast tanks. Electrically heated units are preferred. No combustion air is to be blown into the tanks. The warm air shall be supplied to the lower regions of the tank. The Shipyard shall ensure that there are such units available for urgent supply, should conditions warrant.

NOTE: AT NO TIME IS CARBON MONOXIDE OR CARBON DIOXIDE FROM DIESEL OR GAS BURNING HEATERS TO BE ALLOWED IN THE TANKS.

3.9 RECOAT TIME FOR MARINELINE (per coat) (Per APC’s ESQ-13)

Steel Temperature		
Temperature, °C	Recoat Minimum (hours)	Recoat Maximum (hours)
10	24	96
15	18	96
20	16	96
25	16	72
30	12	72
35	10	48

If the temperature in tank varies, the highest temperature shall be used.

NOTE 1: The maximum recoat times apply only to situations where the relative humidity is maintained below 65%.

NOTE 2: If the dehumidification equipment is turned off or malfunctions during the application process, immediately notify the MarineLine Inspector – reference 3.8.2.

3.10 COATING SEQUENCE

NOTE 1: Before coating application, the bottom stage level shall be covered with a plastic or absorbent cover in order to catch overspray and falling debris. The protective cover on the bottom stage level shall be kept in place, removed or repaired and sealed as required.

3.10.1 First Spray Coat. Apply first coat MarineLine Red to deckhead, tank top and all bulkheads at 150-200 microns wet film thickness. (The coating material, **only if**

required, may be thinned with maximum 1.0 liters per 20 liter kit of Toluene or Xylene to facilitate penetration of the coating into surface discontinuities.)

3.10.2 **As required**, after spray coat has been completed and is partially dry (approximately 1 to 2 hours) remove overspray by using solvent wetted **SPONGE ROLLER** and roll area smooth.

3.10.3 **First Stripe Coat.** After first spray coat has dried, approximately 12-16 hours depending on temperature, apply first stripe coat of MarineLine Grey to all weld areas on deckheads, bulkheads, and tank top areas.

3.10.4 **Second Stripe Coat.** If necessary, apply the second stripe coat of MarineLine Red on the deckhead, bulkhead, and tanktop areas. (In order to avoid excessive thickness, the MarineLine Inspector may, if appropriate, decide not to apply the second stripe coat)

<p>3.10.5 <u>Protection of First Spray Coat (Red) on Tanktop.</u> Prior to applying Second Spray Coat (Grey) cover First Coat (Red) with new clean plastic sheeting to protect First Coat from falling overspray, drips, dirt, etc.</p>

3.10.6 **Second Spray Coat. (Grey) Deckhead and Bulkheads** – Upon completion of Stripe Coat, and after a minimum of four (4) hours with free flowing air, apply a second coat of MarineLine Grey at a range of 125-175 microns wet film thickness on the deckhead, bulkheads and within approx. 0.5 meters from tanktop adjacent to bulkheads.

3.10.7 **As required**, after Second Spray coat has been completed and is partially dry (approximately 1 to 2 hours) remove overspray from Deckhead and Bulkheads by using solvent wetted **SPONGE ROLLER** and roll area smooth.

3.10.8 Following overspray check and rollout and after a majority of overspray has fallen and been addressed and when the 2nd coat is sufficiently dry to avoid contamination / damage, remove plastic sheeting from the tanktop. Remove any remaining debris.
Note: If desired a period of up to 12 hours maybe delayed prior to removing plastic sheeting from tanktop.

3.10.9 **Holiday Testing / Repairs of Lining in Upper Portions of the Tank.** Make repairs to holidays, around open areas, thinly lined areas and mechanically damaged areas using MarineLine Grey according to instructions provided.

3.10.10 **Second Spray Coat. (Grey) Lower Bulkhead and Tanktop**
Spray Second Coat (Grey) to tanktop and lower bulkhead at a range of 125-175 microns wet film thickness.

3.10.11 Destaging. After inspections and repair work has been completed and accepted by the Owner's and MarineLine's Inspector, respectively, destage according to procedures outlined in Section 2.3.2.

3.10.12 Repair of Stage Pole Areas - Tanktop – (reference Section 3.12)
A. Mechanically disc sand with coarse grit sandpaper open metal pole area.
B. Apply 1st coat Red MarineLine to prepared stage pole areas.
C. Once first coat is "B-staged" apply 2nd coat Grey MarineLine.

3.10.13 Inspection and Repair of Tanktop – After the coating is dry and firm to the touch perform inspection of the tanktop and lower bulkheads of tanks for holidays, surface imperfections, and dry film thickness as outlined in 3.11 to 3.14

3.11 COATING INTEGRITY INSPECTION PROCEDURES

3.11.1 Spark Testing. After the lining has dried thoroughly, 100%, pinhole testing shall be performed using a calibrated Tinker & Razor Model AP/W Pinhole Detector or equal. Initial sparktesting shall be conducted at 2,500-3,000 volts (Per APC's EQS-14).

3.11.2 Pinhole testing can be performed as soon as the coating is firm-to-the-touch, normally after approximately 16 hrs. at 20°C. If required, repair any damaged areas as per this specification. Additional spark tests to repaired areas to be conducted at 1,500 volts. Record all pertinent data concerning spark testing on the appropriate Project Documentation form.

3.11.3 Dry Film Thickness Criteria - The minimum dry film thickness of the tank (deckhead, bulkheads, and tanktop, corners, edges, & seams.) (Per APC's EQS-15):

DFT	Thickness	% of Total Tank Surface
Average DFT	250-350 microns	90% of all measurements
Lowest DFT	200 microns	Max. 10% of all measurements
Maximum DFT	600 microns	Max. 0.1% of all measurements

3.11.4 Dry Film Thickness Readings. The required number of dry film thickness readings shall be determined by the overall condition and appearance of each tank, and by the MarineLine's Inspector conducting the inspection. "Spot" dry film thickness readings shall be in accordance with SSPC-PA2 Specification. Record all pertinent data concerning DFT measurements on the appropriate Project Documentation form.

3.12 REPAIR PROCEDURES. Mark all repair/damage areas. All marked damaged areas are to be sanded with mechanical sander using medium grade sandpaper. Hand sanding with medium grade sandpaper is also allowed.

Do not use grinding stone or metal grinding wheel.

Sand damage area plus minimum of 37 mm (1.5 inches) of good coating around outer perimeter of damaged area. Be sure to remove top layer of MarineLine coating.

Mix 1-liter kit (1-quart kit) or 4 liter kit (1-gallon kit) of Grey MarineLine.

Do not breakup kits – mix whole kits ONLY!

Apply to sanded area, by spray, brush or roller, 1st and then 2nd coat MarineLine to build up the thickness to average 250-350 micron DFT (Per APC's EQS-15). Allow to dry. Sparktest at 1500 volts maximum (APC's EQS-14). If no further damage heat cure tank.

3.13 CURING PROCEDURE FOR MARINELINE.

When application of the complete coating system in the tank has been approved, the heat curing of the MarineLine coating will be performed by **MarineLine/APC** crew and equipment.

Shipyards to supply propane or natural gas and electricity for heat curing (gas consumption 0.50 kg / m³ of tank volume – 380/440 volts, 100 amps, 3 phase, 8 connections – distribution duct).

NOTE: If heating coils to be installed, installation and repair to damaged areas are to be carried out prior to heat curing.

3.14 SOLVENT WIPE TEST. Solvent wipe test will be performed by MarineLine inspector. Testing will be done in a minimum of six (6) areas (per APC's EQS-19).

3.15 HARDNESS TEST. A pencil hardness test will be performed with a Pencil Hardness Tester. A minimum Hardness of 9H shall be obtained (Per APC's EQS-20)

3.16 INSPECTION CRITERIA

3.16.1 General Information. All working operations and areas that are to be inspected by the MarineLine's Inspector shall be pre-inspected by the Subcontractor's and Shipyards Representative as well as the Shipyards QC Inspector to ensure that the work performed conforms to the specifications outlined herein. Substandard work areas shall be corrected prior to requesting inspection by the OWNER'S REPRESENTATIVE.

A Shipyards QC inspector shall be available at all times, and the inspector(s) shall be experienced for carrying out inspections/quality control work for cargo tank coating work. Upon calling the MarineLine's Inspector for inspection, portable spotlights shall be ready in the tank for the inspector's use.

3.16.2 Inspections. All pertinent information concerning inspections shall be recorded by the MarineLine Inspector on the appropriate Project Documentation Forms. Inspections will be performed after the following operations, however, other

inspections may be conducted when requested by either the Owner's or the MarineLine's Inspector:

- a) before staging
- b) after staging installed and before blasting
- c) protection of heating coils, removal of pumps, etc. before blasting
- d) after blasting and cleaning
- e) after each spray coat and touch-ups

3.16.3 Testing/Quality Acceptance Equipment

- a. Surface contamination testing for chlorides, sulfates, sulfides, etc. will be done using a Bresle Sampler Kit or SCAT kit.
- b. Dry film thickness measurements will be taken using a non-destructive method such as an Elcometer model 345, Quanix 1500 or equal.
- c. Testing for pinholes, will be done using a Tinker & Razor, model AP/W, or equal.
- d. APC solvent testing.
- e. Hardness test will be done by pencil hardness test – minimum 9H.

3.16.4 Acceptance Criteria. (Per APC's EQS-12)

Areas in the tanks may be rejected if any of the following occur:

- a. sags or runs;
- b. pinholes in film;
- c. air bubbles and air bubble craters;
- d. dry spray and rough "grainy" finish;
- e. low film build per coat;
- f. excessive coating film thickness per coat;
- g. blistering;
- h. lifting or peeling;
- i. insufficient dehumidification and ventilation, heat;
- j. poor cleaning procedures
- k. insufficient cure

3.17 GENERAL NOTES

3.17.1 All blasted surfaces must be absolutely clean and dry prior to applying the first coat. Coated surfaces ready to receive subsequent coats shall also be clean and dry prior to the application of MarineLine.

3.17.2 Steel surfaces to be coated must be within the temperature range (Per APC's EQS-11):

Substrate Temperature:	10° to 40°C
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- 3.17.3 Application of the first coat must be made within 4 hours after completion of blasting, or before any visible discoloration or deterioration of the surface appears, whichever is sooner.
- 3.17.4 Resin and catalyst containers shall be stored in "climate controlled" areas for 48 hours prior to application in order to achieve a uniform temperature of 22-35°C. (Per APC's EQS-5) (see 3.1.1.3).
- 3.17.5 Contractor is to mix the coating (resin and catalyst) in strict accordance with the instructions outlined in this specification.
- 3.17.6 The tank lining system is to be applied in sequence as outlined in this specification. Recoatability guidelines are mandatory.
- 3.17.7 During the application of these coatings, open flames, welding, smoking and the use of spark-producing equipment (such as lights, wiring, motors, etc.) are absolutely prohibited in and around tanks being coated.
- 3.17.8 Rat holes, lightening holes, welds, behind lips and other areas inaccessible by the spray equipment shall be striped coated (hand painted) to the satisfaction of the MarineLine Inspector.
- 3.17.9 Approved fresh air masks and safety suits as specified by Advanced Polymer Coatings shall be used by all painters and all personnel involved in the application of the coating system.

3.17.10 Required Safety Equipment.

	While Striping
Respiratory Protection	Gas & Vapor-Removing Air Purifying Respirator (Cartridge)
Eye Protection	Chemical Goggles or Face Shield
Protective Clothing	Tyvek Suit
Protective Gloves	Natural Latex Rubber or Neoprene

	While Spraying
Respiratory Protection / Eye Protection	Full Face Positive Pressure Demand Type (Supplied Air Mask)
Protective Clothing	Tyvek Saranex Suit
Protective Gloves	Natural Latex Rubber or Neoprene

REVIEW ALL INFORMATION IN THE *MarineLine 784* MATERIAL SAFETY DATA SHEETS PRIOR TO USE OF COATING MATERIAL.

- 3.17.11** Spray pots, lines and spray equipment are to be cleaned with approved solvent immediately after each use. Clean equipment shall be used for application of each coat of MarineLine.
- 3.17.12** Areas where the coating has failed due to poor surface preparation, improper application of coating, etc. are to be reblasted and recoated. All ladder connections, reach rods, reach rod supports, bellmouths, cargo valves, etc. and all disturbed areas are to be cleaned and recoated upon completion of tank coating.
- 3.17.13** After staging removal, all damaged areas shall be suitably repaired.
- 3.17.14** Upon completion of coating application, destaging and heat curing, the entire tank is to be washed down with clean, fresh water.
- 3.17.15** The Yard and the Applicator are responsible for following the coating manufacturer's material safety data sheets at all times. All safety related rules and requirements that apply to any specific work area shall be adhered to.
- 3.17.16** A pre-job conference shall be held with all individuals involved in the project including, but not limited to, representatives from following parties: contractors, subcontractors, Owner's representative, and MarineLine Inspector. This meeting is required in order to discuss in detail the requirements of the Owner and MarineLine's requirements.
- 3.17.17** Calibration of the magnetic thickness gauges shall be in accordance with SSPC-PA2.
- 3.17.18** In daily meetings, the following information is to be discussed and recorded: work progress; scheduled inspections for the day; any changes to the work schedule; past problems or anticipated problems. At intervals MarineLine's Inspector shall provide the following records: material consumption for each step in the lining process for each tank; lot numbers for consumed material; and environmental conditions, including air and steel temperatures, relative humidity and dew point.
- 3.17.19** Any non-conformance with regard to this specification is to be reported at once.
- 3.17.20** If any modification of this specification is requested, it must be sent in immediately the Advanced Polymer Coatings for approval.
- 3.17.21** For final approval of each tank, a sheet shall be signed by the representatives of the Ship Owner and Advanced Polymer Coatings, Ltd..