Curing the Coating

In order for MarineLine to achieve its optimal performance capabilities it requires a low temperature force cure. This is achieved by forcing hot air into the tank and across the surface of the coating to a minimum temperature of 90°C for a minimum of 6 hours. This ensures that the coating is fully cross-linked and cured to provide superior chemical resistance and cleaning. This is the only way that the coating can be cured fully and must be performed by APC or an approved heat curing contractor.

Necessary Information

Prior to the heat curing it is important that we identify certain areas on the tank including openings and potential cold points or obstacles to achieving a full and uniform cure. Listed below are the criteria that we would look for prior to beginning the heat cure:

1. Dimensions and Volume of the Tanks
2. Dimensions and positions of man-way openings, butterworth's, pump, radar and all other deck penetrations.
3. Ladder construction. (Stainless Steel/carbon steel/coated)
4. Internal tank fittings and fixtures. (Stainless steel/carbon steel/coated)
5. Freedom of access on the deck. (Access is inherently difficult to do the mass of pipe work as well as other jobs being performed by other contractors and can create major delays or problems to the curing if not worked out prior to commencing)
6. Temperature limitations of adjacent coatings
7. Gas and electrical supplies. (It is critical to ensure that the yard is capable of handling these requirements)
8. 24-Hour operations and assistance. (Crane operator, electrician, lighting, etc.)
9. Schedule of activities prior to curing.

A meeting should be arranged prior to the arrival of the heat cure crew to discuss the schedule and requirements of each party involved. This will ensure that this process will go smoothly and all parties are working together.

Pre-Curing Checks and Safety

It is important that we confirm that there is no ballast water in the ballast tanks and have the ship's Captain or First Officer sign off on the appropriate "sign off" sheet.

The coating should be firm to the touch and there should be no solvent fumes in the tank. This means that the spraying of the coating should have been completed a minimum of 36 hours prior to heat curing of the tank with the ventilation and dehumidification equipment in constant operation.

No personnel are to enter a tank until it has been certified "Gas Free" by a member of the ships crew and signed off on.

Method of Curing

Thermocouple wire is attached to the coating surface by magnets in order to read and record the steel temperatures during the heat curing process. The size of the tank will determine the number of thermocouples necessary to ensure a uniform cure of the coating. Most tanks would require about 12 thermocouples but larger tanks may require more and should be decided by the onsite heat cure specialist. The placement of the thermocouples is also important and should be properly charted out prior to beginning the heat cure.

It is ideal to use Type J thermocouple wire with a 0-250°C chart recorder. This ensures accuracy on the readings and enables us to know that the coating has been cured. If Type J wire is not available, than it is possible to use Type K wire to perform the cure, although it is not recommended. As for the chart recorder it is not recommended to go to the higher temperature recorders because their accuracy at lower temperatures is not very good and can be off by as much as 10% either way. With our new computer controlled equipment this is not a problem, however if we are using a third party contractor to perform the work it will be important to document all this information.

Distribution tubes, normally supplied by the shipyard, are fitted through suitable deck penetrations (butterworth , pump, radar or other openings) to force the air to the lower portions of the tank. The length of these tubes should be no less than 1 meter from the Tank-top and no more than 2 meters from the Tank-top. It may be necessary on larger tanks to fit piping on these tubes to force the hot air to the furthest corners and potential cold spots in the lower portions of the tanks. The size of the tank will determine the number of distribution tubes (burners) needed to achieve proper cure and should be charted accordingly. In the case of very small tanks a distribution tube may not be necessary, but that is a decision for the heat cure specialist and the home office to make together.

A standard high velocity burner fitted with a 600mm x 180mm diameter cone is inserted into the distribution tube. A 1500mm stainless steel thermocouple is placed directly in the combustion airflow to enable the exit temperature to be monitored and adjusted. Flame impingement on the coating surface must be avoided.

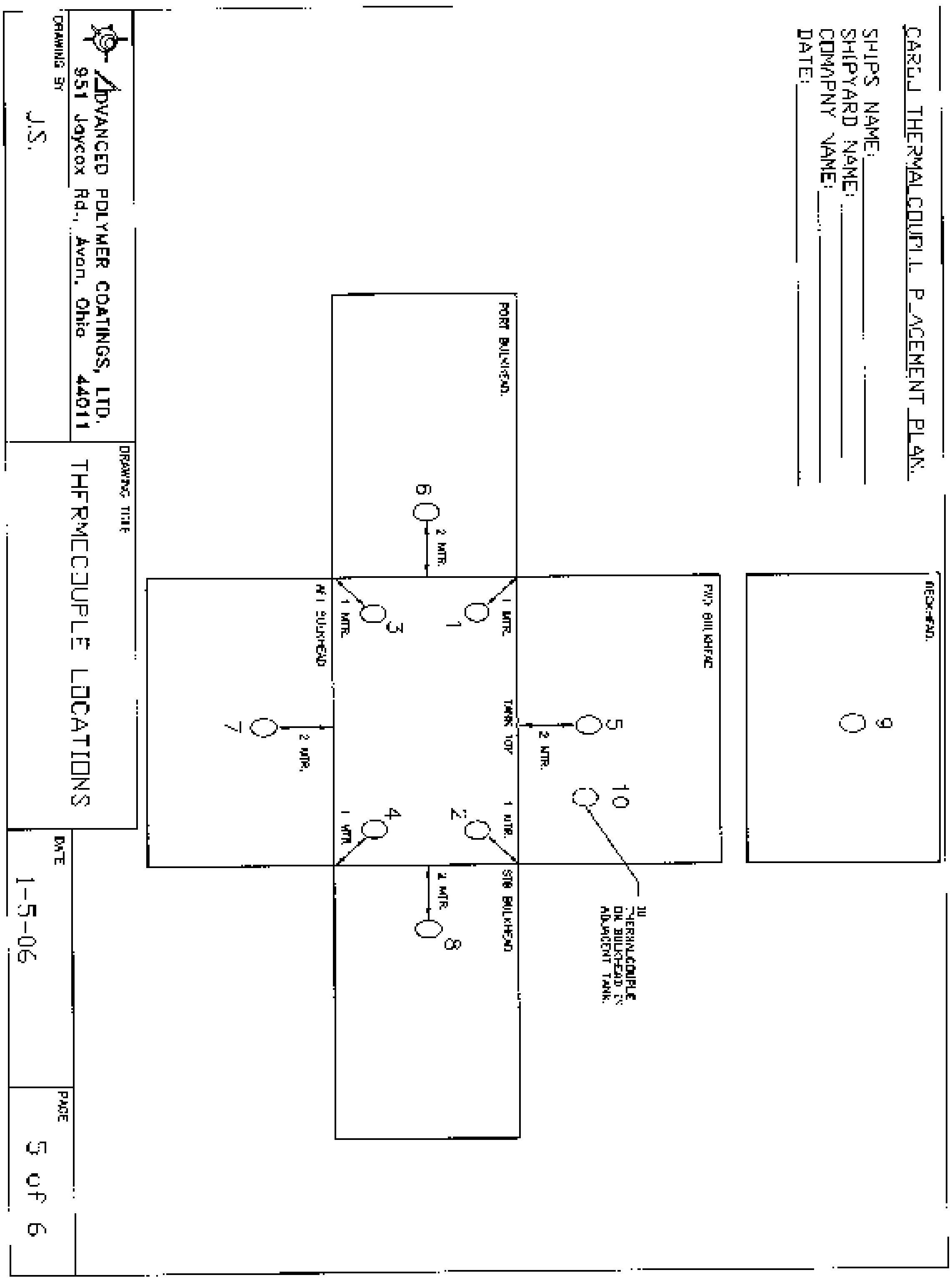
The hot air is forced into the distribution tube with high velocity fans. These fans are designed specifically for this purpose and are able to achieve this process on smaller ships (1500dwt) to larger ships (45,000dwt). The fans must be working properly in order to be effective and should be kept away from closed in areas.

The manway is normally selected as the exhaust port because we can utilize the cover as an adjustment plate. All other deck penetrations should be closely monitored to avoid “chimneying”. Chimneying is the effect where airspace just below the overhead can become an insulator due to heated air rising from one vent and being replaced by cold air entering another. This upsets the temperature uniformity within the tank and reduces fuel efficiency. This can be easily avoided by keeping a slight positive pressure in the tank at all times.

When “lighting off” the burner, the air and gas ratio is set to ignition level. Immediately after the flame is established and registered by the flame failure unit, the settings are adjusted to give a stable flame on minimum gas and maximum air. The air temperature in the tank is allowed to stabilize, at which point the ramp is commenced at a pre-determined rate. The following critical temperatures are constantly monitored:

1. Coating/Steel Temperature
2. Combustion Air
3. Air Mix (if required)
4. Adjacent Bulkhead (if required)

Control is achieved by adjusting the combustion air temperature to achieve the indicated steel temperature ranges (90-110°C). Soak time is commenced when all thermocouples register the minimum temperature.


CARGO THERMALCOUPLE PLACEMENT PLAN.
SHIPS NAME:
SHIPYARD NAME:
COMPANY NAME:
DATE:
PORT BULKHEAD
FWD BULKHEAD
DECKHEAD
AFT BULKHEAD
TANK TOP
STB BULKHEAD
2 MTR.
1 MTR.
1
2
3
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10
10 THERMALCOUPLE ON BULKHEAD TO ADJACENT TANK.
ADVANCED POLYMER COATINGS, LTD.
951 Jaycox Rd., Avon, Ohio 44011
DRAWING BY
J.S.
DRAWING TITLE
THERMOCOUPLE LOCATIONS
DATE
1-5-06
PAGE
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