

PREPRODUCTION INITIATIVE LOW TEMPERATURE POWDER COATING TEST PLAN

SITE: PORTSMOUTH NAVAL SHIPYARD, NH

1.0 OBJECTIVE

This test plan describes the data collection procedure for evaluating in a Navy operational environment the use of powder coatings that cure at lower temperatures than standard powder coatings. Standard powder coatings cure at temperatures above 350°F, a temperature that is detrimental to many metal components. Therefore, these metal components are currently protected from corrosion using liquid coating systems (i.e., paints). The data collected during this test period will be used to determine the efficiency, effectiveness, and overall success of low temperature powder coating (LTPC) systems that cure at temperatures as low as 250°F.

Powder coatings have successfully replaced liquid coatings on various Navy components. Introducing a powder coating that cures at lower temperatures will provide the environmental and operational benefits inherent to powder coating to a wider variety of metallic components (specifically those manufactured of aluminum substrate).

The environmental and cost benefits of powder coatings versus liquid coatings include:

- Reduce paint waste associated with liquid coating operations.
- Assist in complying with air quality requirements.
- Reduce volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions.
- Provide enhanced worker safety and industrial hygiene.
- Decrease the maintenance-intensive rework associated with liquid coatings.

2.0 BACKGROUND

Due to the environmental and health concerns associated with the application and removal of liquid coatings, powder coatings were investigated as a replacement on Navy components. Because of the success of the investigation, Navy powder coating systems have replaced liquid coating systems at numerous sites (e.g., MOMAU underwater mines, AIMD SE). Powder coatings have proven to be beneficial in reducing the costs, pollutants, hazards, and regulatory burden associated with liquid coating systems.

3.0 DESCRIPTION

The powder coatings currently used by the Navy cure at temperatures above 350°F. This temperature is detrimental to some metallic components, especially those constructed of aluminum. This program will incorporate powders that cure at lower temperatures (as low as 250°F) to increase the opportunity to apply powder coating and reduce the use of liquid coating on these parts.

During the test program, metallic components and other equipment will be coated with LTPC. Information on the ease of processing and durability of the coating will be collected for each coated component. Coating success will be based on the performance of the candidate LTPC systems compared to liquid coating and standard temperature powder coating systems. Environmental performance and cost benefits will be assessed to evaluate the potential reduction in the pollution generated while using the powder coating system versus the liquid coating system. Given the nature of the test site, a limited quantity of components will be coated. Qualitative data from existing powder coating operations will be used.

4.0 TEST PLAN

This test plan will be used to evaluate the effectiveness of commercially available LTPC offered by several manufacturers. Quantitative and qualitative data will be collected and used to evaluate the coating system's ability to replace the liquid coating process, as well as to identify environmental benefits, cost savings, and improvements to mission readiness.

4.1 Approach

It is expected that as many as 10 5-pound boxes of each type of LTPC will be used during the implementation of this test plan. Quantitative and qualitative data will be collected during the test period through completion of the Coating Application Log Sheet (Table 1), Maintenance and Repairs Log (Table 2), Monthly Evaluation of Coated Component Log (Table 3), and Outside Activity Tracking Log (Table 4).

4.2 Scope of Tests

4.2.1 *Coating Materials*

The following table identifies the different coatings that initially may be used for this test program.

Manufacturer	Product	Type
Morton Powder Coatings	Corvel 10-7199	LTPC
TIGER Drylac	Series 89	LTPC
North American Powder Coatings	Durvel Low Temp Epoxy	LTPC
DuPont	450°F Powder	Standard temp PC
Devoe Coatings Co.	F-125 Pastel Green	Liquid coating
Crawford Laboratories, Inc.	F-84 Molybdate Primer	Liquid coating primer

4.2.2 *Material Applications and Restrictions*

Steel, aluminum, and zinc components are all suitable for LTPC. Rubber, composite, and other components not suitable for exposure to high temperatures should be removed before this operation.

4.2.3 *Operational Testing Criteria*

Components will be completely coated with the LTPC, the standard temperature powder coating, the liquid coating, or some combination of the coatings. The coated components will then be placed in service for a period not to exceed 6 months and inspected/evaluated monthly. In some cases, components for this evaluation will be shipped to Portsmouth Naval Shipyard from offsite locations (e.g., NAS Whidbey Island and NSWC Louisville) to be coated with LTPC and their current coating system. After the components are coated, Portsmouth will ship them back to their respective locations, where they will be returned to service at their respective activities for performance monitoring and reporting.

4.2.4 *Materials Testing*

Several components coated with the LTPC will be subjected to testing at Portsmouth's onsite materials testing laboratory. Testing will include, but is not limited to the MEK test, the bend test, and the drop test. All results will be reported to Ken Wright, UTRS, and Chris Mahendra, NAVAIR Lakehurst (see Section 5.1 for contact information).

4.3 *Instructions for Completing the Log Sheets*

Log sheets are to be submitted on a monthly basis to Ken Wright, UTRS, and Chris Mahendra, NAVAIR Lakehurst (see Section 5.1 for contact information).

4.3.1 *Coating Application Log Sheet (Table 1)*

The following information should be completed for every component that is coated.

- **Date:** Enter the date on which the component was coated.
- **Operator Initials:** Enter the initials of the operator who applied the coating.
- **Component Nomenclature:** Enter the name of the component being coated.

- **Serial No.:** Enter the serial number of the component.
- **Component Substrate:** Enter the material of which the component is made (i.e., aluminum, steel, zinc).
- **Originating Activity:** Enter the component’s originating activity (i.e., Portsmouth Naval Shipyard, NAS Whidbey Island, Naval Surface Warfare Center Louisville).
- **Coating Applied:** Enter the coating applied to this component: LTPC, standard powder coating, liquid coating, or some combination thereof. If a combination was applied, indicate the combination. If LTPC was applied, identify the manufacturer and coating.
- **Curing Process (Oven):** Enter the temperature at which the component was cured and the amount of time the component remained in the oven until it was completely cured. Indicate “N/A” if using liquid coating.
- **Total Time for Coating Process:** Enter the total time it took for substrate preparation, component coating, transfer to the curing oven, curing, and cleanup. Note that this is for LTPC only.
- **Comments:** Enter any comments relative to the LTPC’s ease of application (i.e., did the LTPC clog in the hopper, was the transfer efficiency similar to standard powder coatings) and the curing process (i.e., did anything abnormal occur during curing, did it take an abnormally long time to cure, did the coating properly adhere to the component surface).

4.3.1 Maintenance and Repairs Log (Table 2)

This log should be completed when maintenance or repair is required on the powder coating application equipment (the spray gun and the hopper containing the LTPC powder). Consult the equipment manual for scheduled maintenance. Operators should indicate on the log the unit repaired or maintained, a description of the repair or maintenance, any parts required, repair time in man-hours, and equipment downtime in days. In addition, include any comments on the application equipment (e.g., difficulty of use, coating application delayed or unable to be performed due to failure).

***NOTE:** If the hopper or spray gun requires repairs, they should be arranged through Ken Wright, UTRS, or Chris Mahendra, NAVAIR Lakehurst.*

4.3.2 Monthly Evaluation of Coated Component Log (Table 3)

The Monthly Evaluation Log is used to assess the condition of the coated component. Once per month the coated component should be visually inspected—whether it was coated with the LTPC, the standard powder coating, or the liquid coating—for durability and component protection. **The first observation shall be made on the same day that the coating was applied or put into service.** In addition to answering the questions on the log, add any comments or observations. The monthly inspection should be continued for 6 months.

4.3.4 *Outside Activity Tracking Log (Table 4)*

The Outside Activity Tracking Log is used to identify parts that are being shipped from outside activities to Portsmouth for coating. The outside activity (e.g., NAS Whidbey Island or NSWC Louisville) will complete this log for each component and ship it to Portsmouth Naval Shipyard with the component to be coated.

- **Date** – Enter the date on which the component is shipped.
- **Outside Activity** – Enter the outside activity providing the component (i.e., NAS Whidbey Island, NSWC Louisville, etc.).
- **Component Nomenclature** – Enter the name of the component being shipped.
- **Serial No.** - Enter the serial number of the component.
- **Component Substrate** - Enter the material of which the component is made (i.e., aluminum, steel, zinc).
- **Present Coating Applied** – Indicate how similar components are currently coated (i.e., liquid paint, standard powder coating, etc.)

5.0 REPORTING

As previously described, the Coating Application Log Sheet will be completed each time the powder coating application system is used. The Maintenance and Repairs Log will be completed as repairs and maintenance are required, and submitted monthly. Additionally, the coated components will be evaluated once per month using the Monthly Evaluation of Coated Component Log. Data will be collected for at least 6 months. During the evaluation period, the data sheets will be transmitted to Ken Wright, UTRS, and Chris Mahendra, NAVAIR Lakehurst (see Section 5.1, Points of Contact, for fax numbers and e-mail addresses) each time a log is completed, but monthly, at a minimum. The final report will include information on the system's overall performance, cost-effectiveness, environmental benefits, and ability to interface with site operations.

5.1 Points of Contact

If at any time during the prototype period the equipment malfunctions or additional coating material, consumables, or technical support is needed, contact the assigned POC at UTRS and/or NAVAIR Lakehurst (see below). Do not contact any vendors directly unless there is an emergency. Do not make repairs to any equipment without specific direction from the vendor as this may invalidate warranties. Discuss any ideas concerning equipment modifications or improvements with NAVAIR Lakehurst or UTRS; do not discuss these ideas with vendors as contractual problems may arise. NAVAIR Lakehurst and UTRS will arrange and procure all reasonable orders for consumables and repairs as soon as possible to ensure minimal impact to your site's operations. Please keep in mind that regular communication with NAVAIR Lakehurst and UTRS, and regular submittal of your data sheets are vital to the success of the technology demonstration.

POC	Ken Wright	Chris Mahendra
Affiliation	UTRS Cherry Hill, NJ	Naval Air Systems Command (NAVAIR) Lakehurst, NJ
Phone No.	(856) 667-6770	(732) 323-7131
Fax No.	(856) 667-7586	(732) 323-4917
E-mail	kwright@utrsmail.com	christopher.mahendra@navy.mil

**TABLE 1
COATING APPLICATION LOG SHEET**

Date	Operator Initials	Component Nomenclature	Serial No.	Component Substrate	Originating Activity	Coating Applied* (LTPC, Standard, or Liquid)	Curing Process (Oven)		Total Time for Coating Process**	
							T (deg. F)	Elapsed Time	Start Time	Finish Time

* If a combination of coatings was applied, list the combination (i.e., liquid paint and LTPC).

** Enter the total time it takes to prep the substrate, spray the component, transfer it to the curing oven, cure, and clean up.

Comments:

Fax or E-mail Log Sheets on a monthly basis to Ken Wright, UTRS (856-667-7586 or kwright@utrsmail.com) and Chris Mahendra, NAVAIR Lakehurst (732-323-4917 or christopher.mahendra@navy.mil).

**TABLE 2
MAINTENANCE AND REPAIRS LOG**

Month: _____

Was maintenance or repair work required on the powder hopper or spray gun this month?

Yes No If yes, complete the following information.

Date	Unit (hopper, spray gun)	Equipment Downtime (days)	Description of Repair or Maintenance	Parts Required	Scheduled Maintenance (Y or N)	Time Spent (man hours)

Comments on the equipment:

***NOTE:** If the hopper or spray gun requires repairs, it should be arranged through Ken Wright, UTRS, Inc., (856) 667-6770, or Chris Mahendra, NAVAIR Lakehurst, (732) 323-7131*

Fax or e-mail log sheets on a monthly basis to Ken Wright, UTRS (856-667-7586 or kwright@utrsmail.com) and Chris Mahendra, NAVAIR Lakehurst (732-323-4917 or christopher.mahendra@navy.mil).

TABLE 3
MONTHLY EVALUATION OF COATED COMPONENT LOG

Component Serial No. _____
Evaluating Activity _____

Date of Inspection (must be same date as coating cure date) _____

	Yes	No
Is the component completely coated?		
Is the component free from corrosion?		
Overall, is the coating system holding up well?		
Is the component free from chipping?		
Is the component free from flaking or peeling?		
Is the coating free from discoloration?		

Comments and observations: _____

Date of Inspection _____

	Yes	No
Is the component completely coated?		
Is the component free from corrosion?		
Overall, is the coating system holding up well?		
Is the component free from chipping?		
Is the component free from flaking or peeling?		
Is the coating free from discoloration?		

Comments and observations: _____

Date of Inspection _____

	Yes	No
Is the component completely coated?		
Is the component free from corrosion?		
Overall, is the coating system holding up well?		
Is the component free from chipping?		
Is the component free from flaking or peeling?		
Is the coating free from discoloration?		

Comments and observations: _____

**TABLE 4
OUTSIDE ACTIVITY TRACKING LOG**

Date	
Outside Activity	
Component Nomenclature	
Serial No.	
Component Substrate	
Present Coating Applied	

This log should be shipped to Portsmouth with the component to be coated as follows:

Portsmouth Naval Shipyard
Bldg. 18
Code 960
Portsmouth, NH 03804
Attn: Ken Rollins

Phone: 207-438-2574