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APPLICATION NOTE NO. 88 **October 2012**

Frame Coating Repair for the SBE 32 Carousel Water Sampler

This Application Note reviews making repairs to the coating on the frame of the SBE 32 Carousel Water Sampler.

Background

The SBE 32 Carousel's frame is aluminum. The frame components are coated with Plascoat® PPA 571ES, a polymer alloy coating manufactured by Plascoat Systems Limited. PPA 571ES is a thermoplastic coating powder, which melts to form a fusion-bonded coating. PPA 571ES is unlike the thermosetting power paints normally associated with the *powdercoat* process, as it does not undergo chemical cross-linking during the curing process.

Damage (chips, scrapes, etc.) to the coating can lead to corrosion of the frame. Additionally, use of the Carousel for trace metal analysis of water samples requires that the aluminum frame be completely encapsulated. The best method for repairing damage to the frame coating is to have the part(s) stripped and recoated. However, this is not always practical; this application note provides a method for repairing frames in the field, using the PPA 571ES powder.

Notes:
- While other paints and materials *may* be used to make cosmetic repairs to the frame parts, they are not likely to completely adhere to the existing PPA 571ES coating, and may allow water to penetrate, leading to corrosion of the aluminum frame. In addition, most other coating products do not have the elasticity of the PPA 571ES, and are likely to crack and flake when exposed to sea pressure; again, this will allow water penetration, leading to corrosion of the aluminum frame.
- A copy of the current product data sheet for PPA 571ES is included at the end of this Application Note for your convenience. See Plascoat's website for the most up-to-date specifications (http://www.plascoat.com/GB%20content/Coating%20products/PPA%20571.html).

Repairing Small Chips and Scrapes

This repair procedure applies only to small areas of damage, where the coating has been *pushed* away from the surface rather than scraped off of the surface. For example, a small gouge caused by a tool or a small nick can be repaired using this technique.

Note: If there are multiple gouges or nicks on a part, consider carefully removing the material around the gouges / nicks and following the instructions for repairing larger damaged areas. It may be easier to repair one large area than to repair many small gouges / nicks.

Recommended Tools and Supplies
- Soldering iron with clean tip, preferably un-tinned (electric or propane)
- Heat gun, high temperature (648 °C recommended); typically available at industrial supply shops
- Cellulose thinner or white spirit, for degreasing

Procedure
1. Clean the area of any salt residue.
2. Clean / degrease the exposed metal using a cellulose thinner or white spirit.
3. Heat the outside edges of the damage, using direct contact with the tip of the **soldering iron**. Use the tip of the soldering iron to push the plastic material back together.
4. Once the material has been pushed together, smooth the material with the **heat gun**. Aim the heat gun directly at the repair until enough heat is built up to allow the repaired material to flow and smooth out. This will take quite some time, due to the large thermal mass of the frame parts (in tests at Sea-Bird, it took approximately 5 minutes to heat the part sufficiently for the material to flow and smooth out).

Repairing Larger Scrapes

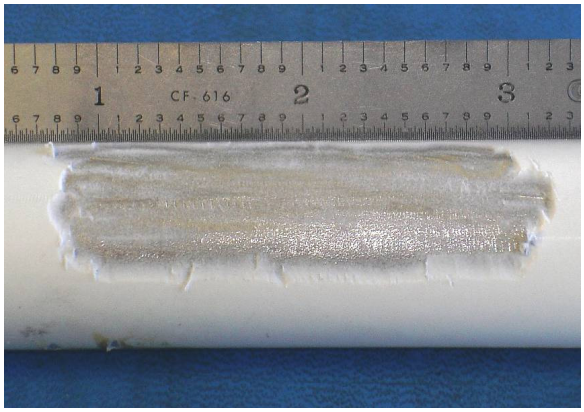
This procedure applies to larger areas of damage, where the coating has been severely scraped and removed from the part (see photo below).

Recommended Tools and Supplies

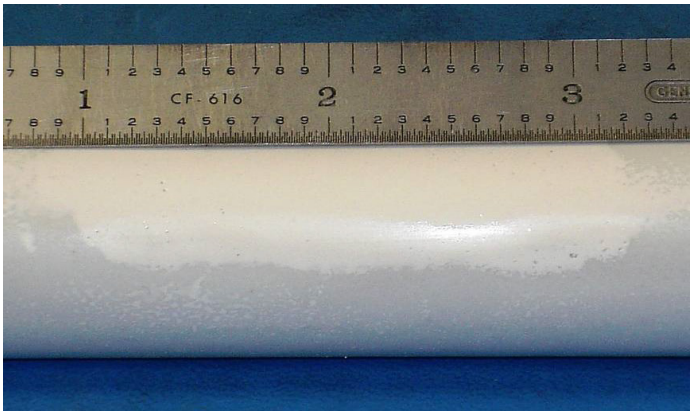
- Heat gun, high temperature (648 °C recommended); typically available at industrial supply shops
- Propane torch (for extremely large areas)
- Infrared thermometer, to determine temperature of repair area; typically available at industrial supply shops
- Metal file, for removing loose coating
- Sandpaper, non-metallic, varying grits, for removing loose coating and sharp edges, and smoothing new coating
- Cellulose thinner or white spirit, for degreasing
- Plascoat® PPA 571ES powder; available from Sea-Bird in part number 50439 (Carousel Frame Powder Kit), which contains 100 grams of the powder in a small container. *The example repair shown in the photos below used approximately 5 grams of the powder.*
- Small flour sifter, for evenly dispersing powder onto the metal surface

Procedure

1. Completely remove all loose coating material from the area to be repaired, using a metal file or sandpaper.
2. Sand any burrs or gouges in the aluminum to remove sharp edges.
3. Clean / degrease the exposed metal with a cellulose thinner or white spirit.
4. Heat the exposed metal using a heat gun or propane torch. **Do not allow a direct flame to contact the undamaged coating material;** direct contact will damage and discolor the material. Use the IR thermometer to monitor the temperature; a minimum temperature of 150 °C is required for the powder to adhere to the part. (In tests at Sea-Bird, it took approximately 15 minutes to heat the part to 150 °C with a heat gun).
5. Once the part has reached the required temperature, carefully apply the PPA 571ES powder to the part. Sprinkle the powder on evenly, in thin coats, using a small flour sifter. It is important to build the repair slowly, with thin coats of powder. Continue to maintain the heat on the part to allow the material to flow evenly. When enough powder has been added to fill in the damaged area, allow the part to cool.
6. When cool, the new coating can be treated further to improve the appearance of the repair, if desired (these steps improve the appearance of the repair, but are **not required**):
   A. To match the contour of the surrounding coating, sand the new coating.
   B. To restore the *gloss* to the coating, heat the repaired and sanded area with the heat gun.



Coating scraped from frame part;
damaged area approximately
2 inches (5 cm) long



Repaired frame part.
Repair has been sanded and had heat applied to restore *gloss* finish (steps 6A and 6B).

Application Note Revision History

Date	Description
April 2008	Initial release.
October 2012	• Update link for Plascoat. • Update brochure included with pdf to Plascoat's latest brochure. • Delete Griot's Garage part numbers for heat gun and infrared thermometer – Griot's Garage no longer carries these items.

TECHNICAL DATA

PLASCOAT PPA 571 ES

Performance Polymer Alloy Coating

GENERAL DESCRIPTION

Plascoat PPA 571 ES is a thermoplastic coating powder which has been specifically designed to provide a long lasting, tough coating for exterior applications to mild steel, galvanised steel and aluminium. It is based on an alloy of acid modified polyolefins. Therefore it is Halogen free and the combustion fumes are low in smoke and have a low toxicity index.

Plascoat PPA 571 ES is resistant to stress cracking, adverse weather conditions, detergents, salt spray and typical airborne pollutants. The coating maintains excellent adhesion to the metal substrate without the need for a separate primer. The material also provides good abrasion and impact resistance.

If PPA571ES over-sprayed powder is to be recycled then blend a maximum of 25% of this over-sprayed powder with 75% of virgin powder.

TYPICAL USES

Fencing, fan guards.

SUMMARY OF ESSENTIAL COATING REQUIREMENTS

1. **The metalwork must be either grit blasted or chemically pretreated prior to coating. ***
2. **Set amps to 5 – 15 microAmps and voltage to 100kV if both settings are available.**
   For Corona guns with voltage setting only, set voltage at 30-50 kV. Failure to use the correct settings may result in coatings that are too thin or with poor coverage.
3. **Heating schedule typically as polyester (See below). Ensure metal temperature exceeds 300°F. ***
4. **Thickness must be a minimum of 7 mills. (See note 2 re voltage above). This may also require a longer spraying time or increased powder supply. This thickness should be periodically checked.**
5. **Galvanised substrates may need degassing. Preheat to 60°F higher than the postheat temperature for at least as long as the postheat time.**
6. **Do not use cured resin based pretreatment systems. E.g. acrylic based phosphates or chromates. If the metal-work has been pretreated with these remove by gritblasting or strong alkaline rinse.**
7. **Adhesion checks should be carried out at regular intervals.***

* **See "PPA571 Process Guide"**

GUIDE TO TYPICAL COATING CONDITIONS

Recommended Pretreatment:
The metal must be degreased and all mill scale and corrosion products removed.
Mild steel should be solvent degreased then either grit blasted to Swedish Standard SA 2½ to 3 or phosphated. Galvanised steel should be either grit blasted at 0.3MPa (40 psi) using a fine grit (0.2 to 0.5mm) or treated with a phosphate system. To achieve maximum long term adhesion, Plascoat recommend the use of zinc phosphate systems on both steel and galvanised steel. If chemical pretreatment is used it is essential to remove any previously applied resin based pretreatment systems. Discuss this with your pretreatment supplier.
Aluminium should be degreased to remove lubricants and processing soaps. For most purposes no further treatment is necessary. However for maximum long term corrosion resistance chromate treatment is recommended.
Coating Conditions:
When the powder is applied using a Corona Discharge gun a negative polarity is required. A voltage of 30-50 kV or 10 to 20 micro-amps is recommended. Plascoat PPA 571 ES can also be applied by Tribocharge guns. The heating schedule should be 320°F to 428°F for 5-40 mins depending on metal thickness. To ensure optimum adhesion, the metal temperature during processing must exceed 302°F. Since Plascoat PPA 571 ES is a thermoplastic there is no crosslinking to take place. Therefore when the powder has melted to form a smooth coating no further heating is required.
Overheating can cause craters to form in the coating, or the coating to reduce in gloss. It may also cause the coating to discolour in storage or in service

TYPICAL PROPERTIES OF THE POWDER

Coverage (100% efficiency)	25.4 ft^2/ib at 8 mils
Particle Size	95% less than 6 mils
Bulk Density (at rest)*	25 ib/ft^3
Packaging	44 ibs cardboard boxes

TYPICAL PROPERTIES OF THE MATERIAL

Specific Gravity*		0.96 g/cm^3
Tensile Strength	ISO 527	2030 ib/in^2
Elongation at Break	ISO 527	800%
Brittleness Temperature	ASTM D-746	-108°F
Hardness	Shore A	95
	Shore D	44
Vicat Softening Point	ISO 306	158°F
Melting Point		221 °F
Tear Strength	ASTM D1938	0.13 ibf./mil
Environmental		
Stress Cracking	ASTM D1693	Greater than 1000 hrs
Toxicity Index	NES 7	1.8
Flammability	UL94 3.2mm moulding	Unrated
	(see also Properties of Coating)	
Electrical		
Dielectric Strength	IEC243 VDE0303	1.21 KV/mil at 15 mils
Volume Resistivity	IEC 93	3 x 10^{17} Ohm.cm
Surface Resistivity	IEC 93	8 x 10^{17} Ohm at 8 mils
Water Absorption	ASTM D570-81	<0.03%

**These values may vary from colour to colour*

Thicknesses outside the recommended range may be detrimental to the properties of the coating.
Do not cure thermosetting powder paints with PPA 571 ES. The fumes from such systems can affect the surface of the PPA 571 ES coatings.

STORAGE

Stored in a clean dry area at 50-77°F and out of sunlight, the material should not deteriorate. However, in the interest of good housekeeping, old stocks should be used first.

HEALTH AND SAFETY

Plascoat PPA 571 ES is supplied as a finely divided powder. Whilst there are no known health hazards associated with PPA 571 ES, normal handling precautions for dealing with fine organic powders should be taken - i.e. excessive dust generation and inhaling of the powder should be avoided. Facilities may be required for removing excess dust from the working area during the coating of certain difficult items.

As with all polymeric powders, the material can ignite if brought into contact with a high temperature source or ignition - particularly in the fluidised condition.

Reference should be made to the respective Plascoat Health and Safety Data Sheet, available on request.
Should the coating be required for contact with food or potable water, further details should be obtained from Plascoat.
For typical properties of the coating see overleaf.

TECHNICAL DATA

PLASCOAT PPA 571 ES

Performance Polymer Alloy Coating

TYPICAL PROPERTIES OF THE COATING

The following data applies to an 8 mils coating applied under standard conditions onto 118 mils thick steel or aluminium. The pretreatment consisted of degreasing and gritblasting unless otherwise stated.

Recommended Coating Thickness		7 - 12 mils
Appearance		Smooth/Glossy
Gloss	ISO 2813	70
Impact Strength	Gardner (drop weight) ISO 6272	
	Direct 73°F (118mils plate)	24 in.lbs
	Indirect 32°F (118mils plate)	160 in.lbs
	Direct 73°F (27.6 mils plate)	Greater than 240 in lbs
	Indirect 32°F (27.6 mils plate)	Greater than 240 in lbs
Abrasion	Taber ASTM D4060/84	
	H18, 500g load, 1000 cycles	60 mg weight loss
	CS17, 500g load, 1000 cycles	25 mg weight loss
Salt Spray	ISO 7253	Results after 1000 hours
	Steel - Scribed	Loss of adhesion less than 10mm from scribe. Under film corrosion 2-3mm
	- Unscribed	No loss of adhesion
	Aluminium - Scribed	No loss of adhesion
	- Unscribed	No loss of adhesion
Chemical Resistance*	- Dilute Acids 140°F	Good
	- Dilute Alkali 140°F	Good
	- Salts (except peroxides) 140°F	Good
	- Solvents 73°F	Poor
Adhesion	PSL, TM 19	A-1
Weathering	QUV ASTM G53-77	2000 hrs - No significant change in colour or loss of gloss.
	Florida 45° facing South	3 years - No significant change in colour or loss of gloss.
Burning Characteristics		
Ignitability	BS476: Pt5: 1979 500 micron coating	P - not easily ignitable
Surface spread of flame	BS476: Pt7: 1979 500 micron coating	Class 1
Fire propagation	BS476: Pt6: 1989 500 micron coating	I = 0.2
Flammability	UL94	V_o (see also Properties of Material)
Safe Working Temperature	(Continuous in air)	140°F max

*The results given are for full immersion in the chemicals for a prolonged period of time. The coating is resistant to splashes and short term contact of most chemicals. *Further technical advice may be obtained from Plascoat concerning the effects of particular chemicals or mixtures.*

QUALITY

Plascoat is committed to the manufacture and supply of a wide range of thermoplastic coating powders. This service is backed by the unrivalled experience of over 50 years of powder coating application. With a policy of continuous improvement to its range of products, Plascoat reserves the right to alter or amend any item. Stringent quality control procedures are carried out at every relevant stage of manufacture and Plascoat operates a quality management system approved by BSI in accordance with ISO 9001:2008.

Plascoat can also offer, through its factories in Europe, specialist plastic coating equipment, an extensive custom coating service and a size reduction service for plastics and other materials.

Plascoat is a subsidiary member of the IPT Group of companies. Plascoat is an EU registered trade name.

DISCLAIMER

The information given here is, to the best of our knowledge, true and accurate.

Product and item design, pre-treatment, coating conditions, quality assurance and conditions of product end use are among the factors that affect performance of the coated products and are outside Plascoat's control.

Conditions under which our materials may be used are beyond our control. The suitability for application and performance of finished goods coated with Plascoat material is the sole responsibility of the customer and end user.

Plascoat expressly denies specific or implied warrantees including warrantees for fitness for a particular use or purpose.

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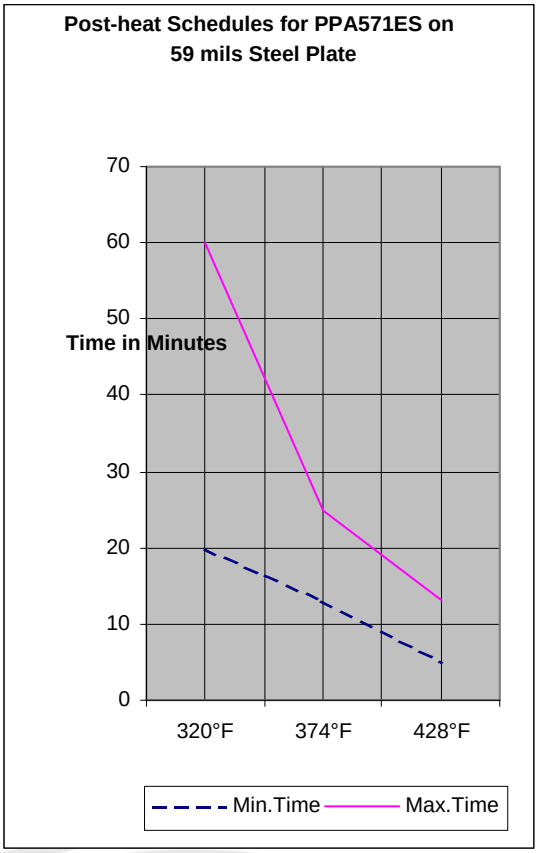
PPA571ES TIME TEMPERATURE CURVES



Time and Temperature Graphs Collated From Empirical Test data

Application settings : For Corona guns with voltage setting only, set voltage at 30-50 kV. Use overspray setting if available, or set amps to 10 to 20 microamps and voltage to 100 kV if both settings are available. (*depending on profile to be sprayed.*)

59 mils	320°F	374°F	428°F
Min. Time mins	20	13	5
Max Time mins	60	25	13

78.7 mils	320°F	374°F	428°F
Min. Time mins	25	16	8
Max Time mins	70	30	15

118 mils (3mm)	320°F	374°F	428°F
Min. Time mins	30	17	9
Max Time mins	80	40	17