

Auditing of Composite and Metal Bonding Facilities

Part 3

Phosphoric Acid Anodizing

PAA
(BAC 5555)

Introduction

PAA is a process by which the surface of aluminum parts are prepared for bonding. The basic process flow includes: Desmutting, deoxidizing, anodizing, rinsing and drying. The resulting anodic coating has proven to provide a superior surface for bonding in comparison to the deoxidizing process previously recommended by some manufacturers (i.e. Douglas).

Definitions

- Discontinuous Current Draw: Current draw which has abrupt amperage fluctuations, spikes or interruptions.
- Shadowing: A condition whereby an indirect or lengthy path for anodizing to a cathodic surface results in a low part-to-solution voltage.

Definitions (continued)

- Smut: A dark powder-like coating on the part surface usually caused by insufficient part-to-solution voltage.
- Water Break Free: A surface which maintains a continuous water film after having been sprayed or immersion rinsed.

Facilities Control

The phosphoric acid anodizing tank shall be equipped with automatic temperature control and recording equipment and a voltage and amperage recorder capable of detecting discontinuous current events. All processing tanks should be equipped with time and temperature control devices designed to maintain solution operating conditions within the specified limits.

Facilities Control (continued)

Electrical contact areas shall be maintained free of anodize, smut or any other foreign material, to ensure good electrical contact on all parts. Racking of parts shall be such that all parts maintain 6 volts PTV. This process will be discussed in detail later. It is recommended that this test be performed each time that there is a major change in racking configuration.

Facilities Control (continued)

Prohibit the immersion cleaning of parts that have riveted faying surfaces or parts that might entrap the processing fluids.

Rinsing may be by spray or immersion. Single or double rinse operations may be used. Any combination of rinse operations may be used.

General Requirements

- Rack details so that solutions and rinse waters contact all surfaces and drain freely, and so that details do not contact each other.
- Position parts so that gas cannot be trapped and prevent solution contact.

General Requirements (continued)

- Bare spots caused by contact points of parts clamps shall not exceed the equivalent of 3/32 inch diameter except that one contact point may be 1/8 inch diameter per clamp. There is no limit on contact size if the contact is made in a trim area such as a tooling tab.

General Requirements (continued)

- Parts shall be spaced so that they may be examined to the water break free requirements.
- Solutions shall be agitated to ensure uniformity of concentration and temperature after standing for prolonged periods or after addition of water or chemicals.

General Requirements (continued)

- Control solutions as to preclude the accumulation of sludge.
- Control the time interval between withdrawal from processing solutions and rinsing so that there is no drying of the solution on the details.
- Alkaline cleaning, deoxidizing, vapor degreasing or solvent wiping after anodizing and prior to priming for bonding is not permitted. If recleaning is required, the details must be completely reprocessed.

General Requirements (continued)

- After final rinse, the parts shall be moved through drying and inspection in a timely manner to prevent contamination. Move all parts into the CCA within 2 hours after the parts are dry. The drying oven shall not be used as a storage or holding area.

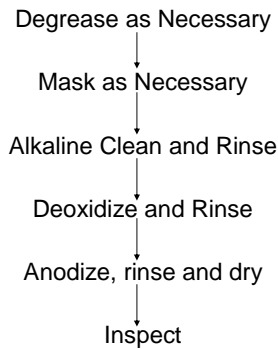
General Requirements (continued)

Wear clean, new cotton gloves at all times when handling surface treated details. Rubber gloves may be used during the primer spray and related operations. When detail handling is necessary, handle them by edges to be subsequently trimmed or other edges if practical. Minimize any material contact with the anodized surface. Do not rub or abrade surfaces with gloves, kraft paper or tooling used in post anodize priming operations. If anodized sheets are interleaved with kraft paper, do not allow the sheets to rub or slide against the paper. Details with visible oxide abrasion must be reprocessed.

CAUTION:

IMPROPER HANDLING OF ANODIZED
SURFACES CAN BE DETRIMENTAL TO
PART BONDABILITY (Boeing's word).

Process Flow of Aluminum Details (Except Core)



Degreasing

Vapor degrease (BAC 5408), Emulsion degrease (BAC 5763) or manually solvent degrease (BAC 5750) if required by the condition of the part. This step may also be referred to as Desmutting. This step may be omitted when the parts are not excessively greasy or oily.

Degreasing (continued)

The most popular form of degreasing in an established process line is the emulsion (immersion) process described in BAC 5763.

This specification lists numerous chemical types and manufacturers dependent upon the types of materials being processed.

Degreasing (continued)

The auditor should review the table and verify that the type of chemical chosen is appropriate for the materials being processed (typically aluminum).

Temperatures vary based upon the materials used. Proper temperatures of the degreaser should be verified to the specification called out.

Degreasing (continued)

Within the specification, general immersion or spray cleaning is considered to be Type I. Class I is degreasing followed by another chemical operation (such as alkaline cleaning). Therefore, Type I, Class I is the most common process in the repair/overhaul scenario. Make sure that the chemicals chosen meet this criteria.

Degreasing (continued)

Post immersion, the details must be rinsed. Spray or immersion is allowed. It is recommended that the water be heated (not required) and that the total solid content not exceed 750 ppm. Post rinse inspection shall reveal no evidence of residue, pitting, etching, smut, soil or other contaminants. Water break free surface is not required.

Alkaline Cleaning

BAC 5555 then requires that the materials be alkaline cleansed IN ACCORDANCE WITH BAC 5749, Method I. Method I is defined as (Soak Cleaning) which is generally used for all metals. Soil is removed almost entirely by the surface action of the cleaner since there is very little agitation of the solution.

Alkaline Cleaning (continued)

As with the degreasing solutions, there are numerous possible selections of materials to be used for alkaline cleaning. The various chemicals have unique temperature and solution control requirements called out on tables within the specification. The auditor should ensure that the chemicals chosen are appropriate for the material being processed.

Akaline Cleaning (continued)

The details are to be completely immersed within the alkaline cleanser. When possible, part agitation is recommended. No minimum time is given, just that the details must evidence a water break free surface after a minimum of 5 minutes rinsing in clean water (750 ppm). Rinse water temperature may exceed 100F. Parts may be reprocessed to obtain this condition. At no time shall the deoxidizer solution be allowed to dry on the surface of the details.

Deoxidizing

The details are to be immersed in a non-agitated solution (typically a fairly diluted Sodium Dichromate/Sulfuric Acid bath) for 10 to 20 minutes. Be advised that in the event that reprocessing is required, there is a maximum time allowed in this solution. The parts are then to be rinsed for 5 minutes minimum and evidence a water break free surface.

Deoxidizing (continued)

The deoxidizing solutions are to be maintained at a temperature of 65 to 90F with a metal removal rate of 0.00015 to 0.00040 inch/surface/hour as clearly detailed in the specification (section 12.2). This test requires measurements within 0.0001g. Appropriate equipment should be available to perform this test or certifications from an approved outside source indicating compliance.



Anodizing

After degrease, alkaline cleansing and deoxidation, the details are to be submersed in a phosphoric acid solution. The rectifier voltage is to be raised to 15+/-1 V with an initial setting of 5V max and an average increase of 2 to 7.5 volts/minute. Voltage and amperage shall be recorded with equipment capable of detecting discontinuous current events of one second duration.

Anodizing (continued)

Maintain the 15+/- 1 volt potential for 20 to 25 minutes. If the potential is interrupted or drifts outside the operating range, the load shall be reprocessed. Once the potential is above 5V, a continuous current draw is required. If discontinuous current draw is obtained, the load shall be reprocessed.

Anodizing (continued)

Note: The solution is not to be agitated during anodizing.

Remove details from the solution and rinse. The interval from the interruption of current to start of rinse shall not exceed 2.5 minutes. Rinse for 5 to 15 minutes, 110F max. Parts shall exhibit a water break free surface upon removal from the rinse water.

Anodizing (continued)

The details are then to be dried thoroughly at 160F (max). After drying, the details are to be inspected for the presence of the anodic coating.

This test is performed with the use of a polarizing filter held at an incident angle to the material surface not to exceed 5 degrees. The filter is then rotated and a color change must be noted. Different pieces may exhibit different interference colors due to alloy or metallurgical condition. The most common colors are purple, yellow and green hues.

Tank Maintenance

Each processing and rinse tank utilized in the process has concentration, contamination and functional testing requirements that must be maintained. The auditor should request evidence of the required tests. If properly equipped, these tests may be performed by the repair station or by an approved outside source.

Anodizing (continued)

Don't Forget:

As previously stated, the anodized and dried details must be taken into the CCA within 2 hours of drying to prevent contamination.