Auditing of Composite and Metal Bonding Facilities

Part 4

Bonding

OK, we now have the facilities sufficient to perform our bonding operations, the materials stored and ready for bonding and materials (metal/core) properly cleaned and stored in order to facilitate a proper bond. It's time to discuss the proper use of the tools, materials, adhesive primers and adhesives in order to prime, lay up, bag, cure, and inspect the components repaired or overhauled by composite or metal to metal bond operations.

Bonding (continued)

As stated earlier, the qualifying specification used for information disseminated in this presentation is the Boeing process specification

BAC 5514

Spray Application of Adhesive Primers

- Details must be primed with the required adhesive primers within 72 hours of drying when processed IAW BAC 5555.
- When paint primers are required to be applied during the bonding process, they may be sprayed in the same booth, but not at the same time as the spray application of adhesives and adhesive primers.
- Keep details free from all deposits from adjacent spray operations.
- After spraying, baking or curing, keep all parts in the CCA until assembled or packaged for storage as specified in the “dash-numbered” specification.

Certification of Spray Coat Operators

The specification allows the spray coat operators to be certified to Levels 1 and 2 dependent upon the level of rejection of parts processed. While this would prove to be beneficial in a mass production facility, the repair facility may choose to perform 100% inspection of processed parts in lieu of applicator certification.

Primer Application (continued)

During priming, the details should be supported to prevent the details from touching, striking or scratching each other. Contact points of parts clamps shall not exceed 3/32 of an inch. Apply a continuous wet coating to the surface with an overlap of at least 0.125 inch beyond the actual bonded surface if possible. Details with visible droplets or runs are unacceptable.

Primer Application (continued)

Primer coating below minimum thickness can be overcoated prior to baking provided the details are baked within 120 hours of application of the first coating. The details should then be baked as required by the "dash numbered" specification. The most common Boeing adhesive primer is BMS 5-89, whose use would then be described in BAC 5514-589.

Core (General)

- Core shall be clean with no evidence of corrosion, etching or contamination.
- There shall be no evidence of columnar failure (unless that area is to be subsequently completely removed).
- Flat sheets shall have cell walls perpendicular to the plane of the core faces.
- Prior to bonding the core shall be vapor degreased IAW BAC 5408.

Application of Film Adhesive

General:

Wear clean gloves when handling cleaned, coated parts or adhesives.

Before opening the wrapper, condition refrigerated adhesives to 65 to 90F. No moisture present inside wrapping.

During use in the production shop, rolls of adhesive should be supported horizontally through its axis, free from contact with other rolls or objects.

Application of Film Adhesives (continued)

Do not touch the adhesives with bare hands or other parts of the body.

Do not fold, stretch or otherwise thin the adhesive.

Apply one layer only to one side of the primed surfaces of each joint.

Leave the separator sheet on the side of the adhesive which will be exposed to the atmosphere as a protective cover.

Press the adhesives smoothly and firmly in place, using care not to entrap any air.

Application of Film Adhesives (continued)

Excess adhesives may be applied up to .125 inch beyond the bonded joint, however, at no point shall the adhesive be less than net.

Remove the remaining separator sheet just prior to assembly of the details.

When adhesive film is placed prior to shape, trimming shall be done in a manner that will not damage the underlying aluminum sheet.

Bagging

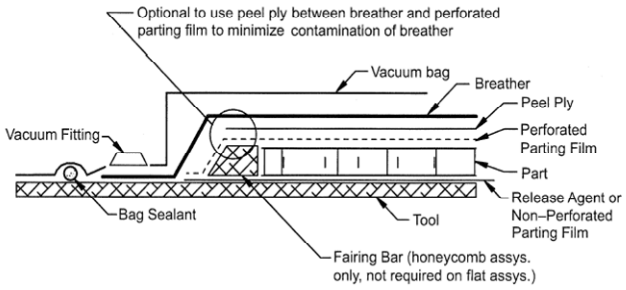


FIGURE 2 RECOMMENDED BAGGING DIAGRAM

Bagging (continued)

Once bagged, the integrity of the bag must be verified. The bag must evidence a minimum of 22 in hg with a bag leakage rate not to exceed 2 in hg over a period of 5 minutes.

Bagging (continued)

A minimum of two thermocouples shall be used for individually bagged assemblies.

A minimum of one per part must be used for up to four parts under one bag.

A minimum of four must be used for more than four parts situated to record the slowest and fastest rate of temperature rise for the parts under the bag.

Bagging (continued)

For individual part tooling, install a minimum of one pressure sensing device situated to provide the best possible representation of pressure under the bag.

Continuous recorders and pressure gauges used for measuring pressure under the bag shall be capable of recording vacuum and pressure over a range of 30 in hg to 15 psi with gauge graduations not exceeding 5 psi.

Cure

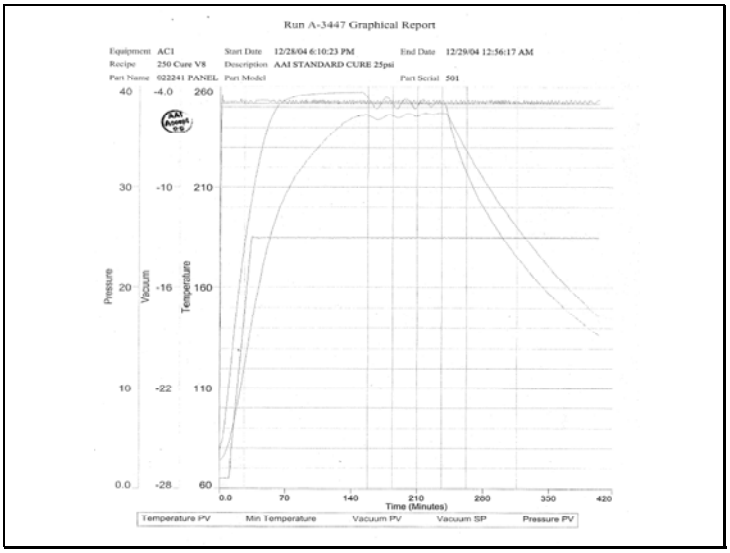
The cure cycle shall commence before the expiration of the lot of adhesive being used. Do not subject the cured bond to stress until the end of the cure cycle. Minimum and maximum rates of temperature rise shall be as specified in the applicable “dash numbered” specification.

Cure (continued)

When autoclaves are being utilized for the curing process, vacuum may be used to seat the part and check the seal of the vacuum bag. After the parts are placed in the autoclave, the vacuum shall be vented when the vessel pressure reaches 10 psi and before the bondline temperature reaches 120F.

Cure (continued)

Autoclave pressure and temperature shall be recorded continuously throughout the cure cycle. The recorders shall be capable of recording over a range of 0 to 100 psi. Optional – record pressure and temperature from each sensing device during the entire cure cycle at an interval not to exceed 10 minutes.



Cure (continued)

During the cool down period, the autoclave pressure may be allowed to drop as a result of cooling. Pressure requirements do not apply during cool down below 150F. After cool down, the autoclave may be opened and the components removed from the tools.

Cure (continued)

For SRM type repairs that allow full vacuum (hot bond) or oven curing, the temperature, vacuum and heat up/ramp down cycles shall be followed as stated within the appropriate repair specifications.

Quality Control

QC is responsible for ensuring that the requirements of the applicable specifications are met by monitoring processes and examining the end items in accordance with established quality assurance provisions. Bonded assemblies shall be visually inspected to ensure that adhesive flash is continuous along the faying surfaces. Discontinuities are acceptable provided NDI demonstrates that there are no voids present along the faying surface edges.

Quality Control (continued)

Bonded assemblies shall be inspected for internal flaws such as voids, blisters and delaminations. The most common method of determining these conditions is the “coin tap” method. Other, more sophisticated techniques (UT, RT) may be required based upon the drawing or repair instructions. Any technique used must be able of detecting a defect of ¾ inch diameter. Defects exceeding ¾ inch diameter are cause for rejection.

Quality Control (continued)

Surface imperfections – Dents, dimples, etc., shall be cause for rejection when:

a. The cladding has been penetrated.
b. The imperfection is larger than 1 inch in diameter.
c. The depth of round bottom dents exceeds .020 inch.
d. Dents have sharp bottom, or
e. The edges of the imperfections are closer to each other than four times the diameter of the largest imperfection.

Rework

Certain non-structural dents on the assemblies (for painted surfaces only) may be reworked by sweeping the surface with a number of adhesives or resins. The adhesives/resins are then cleaned, cured and the areas primed and subsequently painted.

CASE 1A

While it may be impossible to personally witness each of the processes and controls presented herein, any noted deviations from the required procedures or process controls could be indicative of several CASE standard violations.

CASE 1A (continued)

Specific CASE Standard policies which relate to the processes and procedures common to a bond facility are (but are not limited to):

- Section 3 Quality Programs
- Section 5 Personnel
- Section 7 Shelf Life Program
- Section 10 Housing and Facilities
- Section 13 Work Processing