

Auditing of Composite and Metal Bonding Facilities

Part 2 Material Control

Material Control

By far, the best general discussion I have read or come about concerning materials usage and control, came from a most unusual source.....

The FAA!

AC 145-6

6. RAW MATERIAL INSPECTION PROCEDURES.

a. General. The processability and resulting strength-related properties of composite materials used in structural repair depend upon the composition of the fiber/resin prepreg materials from which they are manufactured. In general, prepreps consist of surface-treated glass, aramid, or carbon fibers impregnated with a reactive and chemically complex thermoset resin formulation or an amorphous or semicrystalline thermoplastic resin. Thermosetting resins are often "staged" or partially reacted during the prepregging process and may undergo compositional changes during transport, handling, and storage. Inadvertent or minor changes in resin composition may cause problems in processing and may have adverse effects on the performance and long-term properties of many composite repairs. This also applies to adhesive systems used in structural bonded repairs (e.g., film adhesives, primers). The capability of a repair to satisfactorily maintain its structural integrity for the remaining life of the part or aircraft is dependent, in part, on the maintenance organization's knowledge of the physical, chemical, mechanical, and processability properties of the incoming materials (e.g., prepreg materials, adhesives, etc.) used in that repair. The physical, chemical, mechanical, and processability test results are; therefore, vital to the continued airworthiness of the repaired structure.

The Repair Station's Knowledge.....

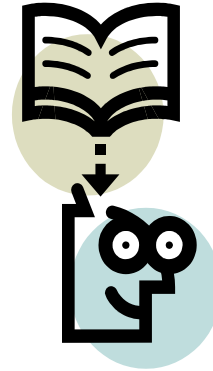
Interesting..... It has been stated that the airworthiness of the component is based (in part) on the knowledge of the repair station concerning material usage, storage and physical properties.

145-6 also states:

b. Material Acceptance.

(1) **General.** The maintenance organization should have an incoming material acceptance plan (see paragraph 7 for material handling and storage procedures) addressing the issues in paragraph 6a, above, that ensures conformity of purchased material (i.e., prepreg material, film and paste structural adhesives, and wet lay-up resins, etc.) to OEM or other FAA-approved material specifications. Copies of the original material manufacturer and supplier laboratory test reports showing actual test results, if applicable, should accompany each batch of material received for review and approval. When material is purchased from an approved supplier in accordance with the OEM or other FAA-approved material specification, such test reports are usually adequate documentation of the material condition and conformity to the material specification. When material is purchased from a non-approved source, verification testing should be performed. Specific material called out in the SRM or maintenance manuals without material specifications should be controlled as indicated in the material manufacturer's recommendations covering the material designation, storage, and handling requirements.

It is important that the repair station have at least some personnel who are thoroughly familiar with the specifications and their limitations. This knowledge may fall within the quality, engineering or production departments. This knowledge is then used to implement systems that will not allow production personnel to have or utilize materials beyond their intended shelf or out time limits.



Material Storage

The repair station must have facilities to properly store the materials used for repairs. This is typically a freezer (walk-in or floor type) able to maintain sub-zero conditions. Spikes in the temperature are allowed provided that the spike (usually during defrost mode or while the door is open) does not exceed 20F nor above 0F for more than 15 minutes. The total time above 0 in a 24 hour period should not exceed 60 minutes. All conditions outside this range are considered "out time".

Material Storage (continued)

Materials must be protected from damage during storage from loads other than their own weight. It is recommended that each roll be stored in the original shipping container with the material certifications attached. Before returning the materials to storage, they must be sealed in an airtight wrapper of equivalent weight and maintain a moisture proof seal. Typically a polyethylene film of 6 mils in thickness.

Freezers

It is required that the temperature be monitored and recorded. Deviations from the storage requirements should be documented on the material sheets as out time.

Kitting

Kitting of materials is permitted provided:

1. The adhesives must be at ambient temperature prior to kitting to prevent moisture condensation.
2. Adhesives kits must be stored in 6 mil minimum polyethylene film.
3. An ID label must accompany each kit with storage expiration date and cumulative out time.

Solvent Storage/Dispensers

Solvents must be stored in labeled, non-contaminating containers. Plunger type containers/dispensers may not be used. Containers must be either:

1. Dedicated containers which have only been used for storage of one type of solvent since new. Or....

Solvent Storage/Dispensers (continued)

2. Containers which contained a different solvent prior to reuse, and have undergone a cleaning and rinsing process, including rinsing with the new solvent, which removes any potential contaminating materials from the container. Containers may not be used which have previously contained materials other than solvents such as mold release agents.

BSS 7002

This document contains information concerning the testing requirements for adhesives/primers and associated products certified for production and repair of Boeing products. It may be referenced when specific shelf life limitations are not called out within the basic material specifications.

BSS 7002 (continued)

The auditor should inquire about shelf life extensions and verify that the manufacturer's requirements are being met. Note that there should be no extensions granted for "out time". The volatile nature of the resins (usually MEK) limit the materials usable life due to evaporation.

Typical Testing Capabilities

- Overlap Shear
- Wide Area Lap
- Drum Peel
- T Peel
- Roller Bell Peel
- Compression
- Short/Long Beam Tension
- Flatwise Tensile
- Flow
- Gel

Testing (continued)

While there is no requirement for this type of testing to be performed “in house”, the auditor should verify that the required testing is being performed by the repair station or by an approved vendor. Copies of the physical test reports should be readily available for review.

Blue Tuna Docs
A Paper Plane Project
www.bluetunadocs.com

Applied Aerodynamics

29-Dec-04

NEW Applied Aerodynamics Lap Shear Test (10,000 lb

Report No. 7869

Test Date 29-Dec-04
Operator Eddie Lowe
W.O. 022214
Temperature 72

PIN 5910414-501
PAD NO.
S/N NSN

Other

Load Cell Capacity (Lbs)		10000	Cross Head Speed (lb/min)		1300
Preload Value (Lbs)		5			
Test No	Spec ID	Peak Stress (psi)			
29349	1ST-1	6,648.97			
29350	1ST-2	6,498.02			
29351	1ST-3	6,652.44			
29352	1ST-4	6,635.31			
29353	1ST-5	6,466.45			
Mean		6,580.24			
Rel Std Dev %		1.37			
Std Dev		90.38			
Maximum		6,652.44			
Minimum		6,466.45			
Range		186.00			

Required Minimums

Minimum lap shear values for the BMS 5-101 (AF-163, 180F service temperature film adhesive) is 4200 psi. As you can see by the previous report, proper surface preparation and handling of the materials leads to an exceptional bond with high shear characteristics.

Testing Equipment



Single Overlap Shear



Cohesion Failure



Cohesion Failure (Close-up)



Additional Equipment



Case 1A Requirements Concerning Materials Control

Section 12.A. states "Parts and materials shall be correctly identified and properly stored so that only acceptable parts and supplies will be issued for any job." And... Section 12.D. follows with "Parts and materials shall be protected in storage and during transit, until installation, in a manner that will prevent damage, contamination, loss or substitution."

Case Requirements (continued)

And, it goes without saying, the equipment, tools and monitoring devices used to verify compliance with the storage of TATS materials must be calibrated as required by the CASE 1A standard, Section 8.