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Sent: Wednesday, October 18, 2017 11:02 PM
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Subject: Tip Block Process Changes

In our teleconference last week, I was asked to put together a summary of the process changes we've put in place in response to the investigation of the tip block departure on N457PH. Listed below are the changes. These changes are documented in Bell expanded repair 04LR-004, Rev D, which is the approved repair procedure used by all blade repair facilities approved by Bell to perform the block replacement (Bell Broussard in Louisiana, RBL in UK, and RBIH in Dubai).

1. The cure process was revised to only use positive pressure during the cure cycle curing the adhesive that bonds the block in the blade tip. The previous process allowed either positive pressure or vacuum pressure. It was determined that vacuum pressure and its tendency to pull air and volatiles through the adhesive layer during cure was the likely cause of the high degree of porosity and voiding in the incident blade. X-rays of tip block bonds cured with vacuum consistently showed similar porosity, while blocks bonded with positive pressure consistently showed a solid bond with little to no porosity.
2. Added detail describing initial removal of block with a Dremel tool followed by hand sanding. Added allowance for leaving up to .50" of original block in the trailing edge area to prevent local skin damage. Also added exemplar photos of blade with block removed.
3. Added dry fit of tip block along with .005 to .014 gap requirement.
4. Added controls for insuring block is inserted to proper depth when bonded.
5. Specified cloth type (AMS 3819) to be used for wiping bonding surfaces.
6. Specified dry grit blast control parameters and added another block-skin gap check after grit blast.
7. Specified dry wiping method for skins and block after grit blast.
8. Added requirement for application of EC3924B primer on any exposed metal surfaces of the abrasion strip prior to bond.
9. Added a required layer of unsupported adhesive (AF 163-2U) all over in addition to the supported layer of AF 163-2K.
10. Added allowance for using heat up to 200°F for positioning of block into blade tip cavity. Disallowed the use of cooling to aid in positioning.
11. Cure cycle changes included:
 - a. Positive pressure required with a double-bladder clamping tool – prior repair procedure allowed vacuum or positive pressure.
 - b. Use of carbon cauls to control pressure distribution
 - c. At least two thermocouples in contact with the adhesive and at least one in contact with the abrasion strip during the cure.
 - d. Required control of cycle dwell time of 120 minutes based on lagging thermocouple.
 - e. Allowed maximum of 20°F difference between thermocouple readings.
12. Added void allowance for up to two voids less than 0.15" wide and 2" long provided total void area doesn't exceed 0.3 sq in.
13. Increased proof load after cure to 1984 lbs – was 1320 lbs.
14. Added leak inspection.
15. Added edge void inspection and repair allowance.
16. Added drill fixture usage for drilling tip weight holes.
17. Added controls on thread tapping method.

18. The following inspections are now required to be performed and stamped by a repair shop inspector:

- a. Complete tip block removal
- b. No damage to blade skin (after Dremel too work and again after grit blast)
- c. Tip block fit and gap
- d. Properly blasted surfaces (this was also on prior procedure)
- e. Proper cleaning and priming of surfaces prior to bond
- f. Backing removal prior to bond
- g. Cure time and temperature
- h. Void inspection after bond (this was also on the prior procedure)
- i. Void inspection after proof load (this was also on the prior procedure)
- j. Leak inspection (this was also on the prior procedure)
- k. Edge void inspection
- l. Proper hole position and block condition after hole drilling
- m. No cracks after thread tapping
- n. Balance operation and paint thickness

Regards,

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