

## **SAFETY ALERT FROM THE FACTORY**

### **Tail Cracks**

#### **Service Letter 85B and AD75-20-06 for Bellanca Models 14-19-3A, 17-30, 17-31, 17-31TC, 17-30A, 17-31A and 17-31ATC**

Bellanca/AALLC has received a new report of horizontal stabilizer fuselage attachment tube cracks in a Viking aircraft. This report is significant in that 1) it occurred on a relative new (1990) Model 17-30A aircraft with low time (approximately 1000 Hours), 2) the airplane had the factory installed version of SK0004 installed, and 3) it was outside the eligible SN range of AD75-20-06. This is at least the third aircraft to develop cracks with SK0004 installed. The mechanic who found the cracks happened to look at our website Safety Alert and proceeded with the detailed inspection recommended therein although he was not required to perform same detailed inspection since the airplane is outside the AD eligibility range.

We believe the cracks are fatigue cracks which are the result of cyclic bending loads in the tubes. The tubes are subject to bending as the result of unsymmetrical loads on the horizontal stabilizer. Low compression on one or more cylinders, as was the case for the airplane in this report, could provide the unsymmetrical (torsion) load if it occurs at or near a resonant fuselage or horizontal stabilizer torsion mode frequency. We believe the SK0004 reduces the bending loads and thereby increases the fatigue life of the affected tubes but it obviously does not eliminate the problem.

There are approximately 260 aircraft which are not within the eligible SN range of AD75-20-06 and Service Letter 85A. Bellanca/AALLC and prior Bellanca companies have shipped approximately 300 service kits; installation of same eliminates the repetitive AD inspection. The detailed inspection required by the AD and Service Letter is required as the cracks are very difficult to detect without the detailed guidance provided by same. We therefore have recommend that the AD75-20-06 be revised to 1) make it required for all serial numbers for Bellanca Models 14-19-3A, 17-30, 17-31, 17-31TC, 17-30A, 17-31A and 17-31ATC airplanes and 2) reference the inspection as presented in Service Letter 85B: Horizontal Stabilizer Fuselage Attachment Tube and Carry-Thru Tube Support Bracket Inspection and Repair .

Additional information will be posted on the AALLC Web as soon as possible. Contact the factory if you need specific information about any of the items mentioned above.

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### **VIKING – CRACKS IN THE HORIZONTAL STABILIZER ATTACHMENT TUBE**

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**MODELS: 14-19-3A, 17-30, 17-31, 17-31TC, 17-30A, 17-31A & 17-31ATC All Serial Numbers.**

Alexandria Aircraft LLC has received a field report of severe cracks in the vertical tube that supports the horizontal stabilizer on a 1967 Viking Model 17-30. The airplane had approximately 3700 hours TT. The cracks are shown in the following three photographs; fuselage fabric was removed after the cracks were discovered to facilitate repairs. The cracks are on both left and right tubes and appear to start near the point where the horizontal stabilizer carry-thru tube support bracket flange is welded to the vertical fuselage tube. There are also cracks in the



Photo # 1: Right Side Looking Inboard/Aft

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Photo # 2: Right Side Looking Outboard/Aft



Photo # 3: Left Side Looking Inboard/Aft

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carry-thru tube support bracket. They are on both sides at the edge of the weld. Looking inboard at the right bracket, they are at the 11 o'clock position (see Photo # 1). Looking inboard at the left bracket, they are at the 4 to 5 o'clock position (not visible on the photographs).

We believe the current problem is related to the 1975 problem: structural fatigue caused by cyclic bending stresses at the top of the horizontal stabilizer vertical support tubes resulting from unsymmetrical aerodynamic and/or inertia loads of the horizontal stabilizer. At that time Service Letter 85A: Horizontal Stabilizer Attachment Tube PN190202-37 Inspection and Repair and Airworthiness Directive 75-20-06: Detect Cracks in Either Vertical Side Fuselage Tube Adjacent to Horizontal Stabilizer were issued. They required a 100 hour repetitive inspection of the top of the vertical tubes until Bellanca Service Kit SK1234789-0004: Gusset – Stabilizer, Installation and Drag Brace – Stabilizer, Installation is installed. The aircraft in question had the Service Kit installed. The problem is exasperated by fuselage/tail first torsion mode resonance. Analysis of the tail structure including struts shows that unsymmetrical horizontal stabilizer aerodynamic and inertia loads cause even larger inboard/outboard loads into the cross tube that supports the stabilizer leading edge. These inboard/outboard loads cause the vertical horizontal stabilizer support tubes (Fuselage Station 7) to be loaded in combined bending (dominant) and torsion. The resultant bending stresses are maximum at the top of the tubes resulting in the cracks we saw in 1975 (ten aircraft; two 17-30 and eight Lycoming).

The gussets and a drag brace were added to reduce the bending stresses in the vertical tubes. This fix was selected because it took care of the problem (cracks at the top of the vertical tube) and was field-doable. The current horizontal stabilizer support tube problem is the result of this same unsymmetrical loading condition but it is different - the next weakest link, the carry-thru tube support bracket and its attachment to the vertical tubes, has become critical.

The unsymmetrical cyclic loads can be coming from a variety of sources: engine vibrations, unbalanced propellers, propeller slipstream, wing-root vortex, repeated pushing on the tip of a horizontal stabilizer. The most influential loadings will be those that excite the airframe closest to the fuselage/tail first torsion mode resonance frequency. During the 1975 problem we observed large displacement of the tips of the horizontal stabilizer during engine start-up and shut-down (close to first mode resonance) on Lycoming powered airplanes, ie: the Lycoming engines seemed to put larger torques into the airframe than the Continental engines for this condition. We

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think this explains why more Lycoming powered airplanes had the problem than Continental powered airplanes.

We do not believe the 1975 or current problem is a single occurrence problem. This is not to say that you cannot fail the vertical support tube or bracket with a single load, but a single load failure would probably cause the structure to permanently deform more than that which we have observed.

Alexandria Aircraft LLC recommends that owners/operators of all Model 14-19-3A, 17-30, 17-31, 17-31TC, 17-30A, 17-31A and 17-31ATC All Serial Numbers have their aircraft inspected for this condition. The inspection should look for cracks 1) in the vertical tubes at Fuselage Station # 7 which support the horizontal stabilizer paying special attention to the area where the horizontal stabilizer carry-thru tube support bracket flange is welded to the vertical fuselage tube, and 2) in the carry-thru tube support bracket at the edge of the weld around the aft side of the carry-thru tube (inboard and outboard sides). If the Service Kit is not installed, the inspection should also look at the upper portion of the vertical tube as required by Service Letter 85A and AD 75-20-06. **The inspection should be accomplished with a mirror and flashlight; it does not require removal of fabric.** This is a potentially dangerous condition and we are trying to get this information out to aircraft owners and maintenance facilities ASAP. We have notified the FAA as we are required to per FAR 21.3: Reporting of Failures, Malfunctions and Defects. We are working with the FAA to resolve this issue. We probably will issue a new service letter and/or revise Service Letter 85A, and the FAA probably will issue a new AD and/or revise AD 75-20-06. The new service letter and AD probably will require a repetitive inspection. **DO NOT WAIT FOR THE UPDATED SERVICE LETTER OR AIRWORTHINESS DIRECTIVE;** have your airplane inspected ASAP. Please report your findings to Alexandria Aircraft LLC: 1) Owner Contact Information, 2) Airplane Model and Serial Number, 3) Total Time, 4) were cracks found as a result of the SL85A/AD75-20-06 inspections, 5) did you find cracks as a result of the inspection described herein and if so, describe where you found the cracks.