Wing Spar Inspection, 7, 8, and 11 Series

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HOW TO INSPECT YOUR WOOD SPAR

1) **Required Inspection Tools:**
   a) Locally obtain a "Bend-A-Light® Pro" or a direct equivalent. (The "Bend-A-Light® Pro" is **strongly recommended** because the light bulb and socket are less than ¼" diameter and the 8" shaft is stiff but bendable, yet less than 3/16" diameter.) To aid in directing and maneuvering the light, bend the shaft at a 30º to 40º angle, ½" radius (the arc of a 1" diameter mirror), 1 ¾" from the tip of the bulb. It has a very high intensity for a very small bulb. The unit is 16" long, extendable to 27".

   b) You will need a small (approximately 1 ½" diameter) "dental" type flexible head mirror or 2" diameter mechanic's inspection mirror with a minimum 14" to 20" long handle. (The mirror must be small and **thin** for access to the top of the spar.) These cost approximately $5.00 each.

   c) Locally fabricate a couple of small (approximately 1/2" high by 1" long) wood wedges and attach a two-foot length of string to each, to preclude inadvertently leaving one in the wing.

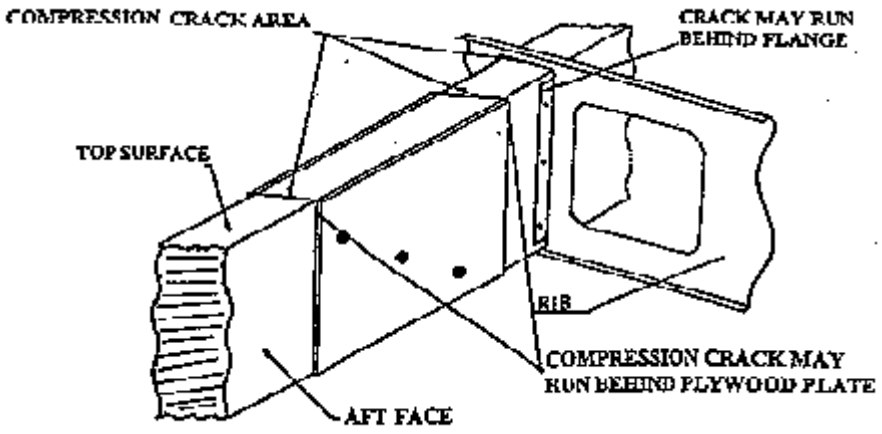
   d) Locally fabricate or obtain an approximately 6" long by 2" wide glass mirror. (An old, broken mirror can be cut to size.) Tape edges as necessary to preclude damaging the wing internal fabric surface. As this mirror will be placed under the spar, attach a two-foot length of string to preclude inadvertently leaving it in the wing. The mirror must be as thin as possible, i.e., no thick frame.

   e) The Citabria Owners Group recommends that a significant "tail" of light rope or string be attached with glue to all tools used in this procedure. This will make it easier to retrieve tools and hopefully prevent tools from being left in the wing after the inspection is

complete. **Do not leave tools in the wing after the inspection is complete!**

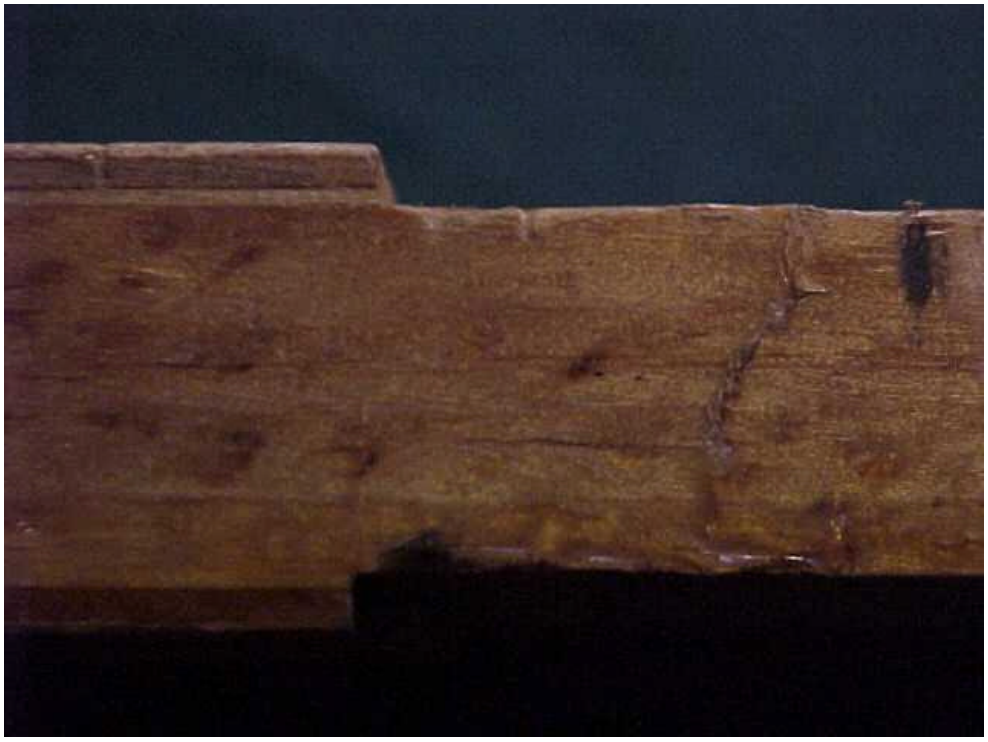
2) **General Inspection Notes:**

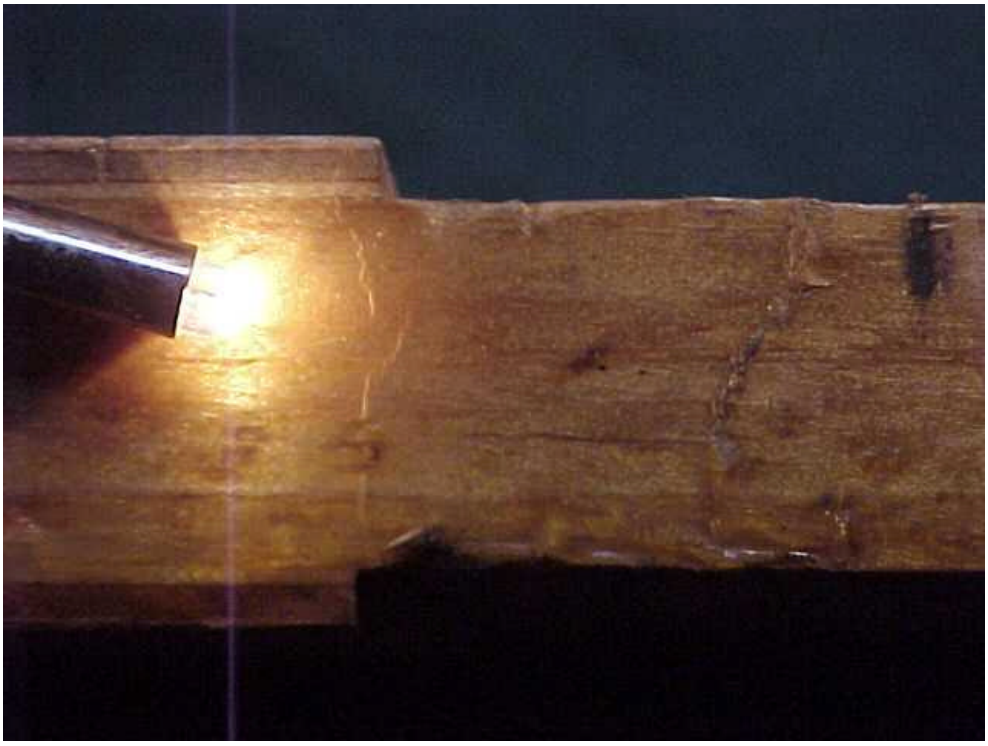
a) Compression cracks can occur along the entire length of the spar. Information to date has shown that compression cracks occurring inboard and/or outboard of the strut-attach-bay will be accompanied by cracks in the strut attach bay itself. Please refer to the latest version of Service Letter 406 for information regarding inspection of the spars for longitudinal and butt cracks.



b) Please review the following photographs. Both photos are of the top surface of the same section of spar. The first photo utilizes ambient light only. Note that a severe compression crack is visible. In the second please notice that a second, very fine, crack becomes apparent.

i) The bright light passing through the second crack at an angle different from the viewing angle makes the crack become apparent. The light source **must not** apply light to the surface from the direction of view.





ii) To accomplish these inspections place the light on the surface to be inspected and **view the area between the light source and the mirror**.

c) If available, review additional photos of cracks and of inspection tools located on the internet at the Citabria Owners Group website at **www.citabria.com**.

d) NOTE: Compression cracks typically have a **jagged** or broken "chainlink" appearance and in the early stages of growth they may be limited to the top surface. Older compression cracks travel down the spar side face and may be found to turn toward a strut attach bolt hole (spar tensile strength may be reduced by 2/3s). Discovery of an anomaly that is straight is likely to be a scratch from assembly of the ribs to the spar or a glue line. If you are unable to determine if an anomaly is actually a compression crack get a second opinion before disassembling the wing.

e) Note that if loose rib nails and rib to spar working-abrasions are detected, particularly under ribs adjacent to the doubler plates, that a compression crack could be hidden behind the rib flange. Additional inspection may be required.

f) Inspect in a hanger or drape a tarp over the wing (to reduce ambient sunlight) to enhance the visual contrast inside the wing and allow eyes to adjust. Failure to do so will make it impossible to properly inspect the spars.

3) **Front Spar Inspection:**

a) **Spar Top Edge:** Place the light bulb between the spar top surface and metal leading edge, i.e., "D" cell. (Place the small wedge(s) between the "D" cell and spar top if needed for additional working room.)

b) Moving the light bulb and inspection mirror together, slowly scan the width of the spar, front to rear, along the spar top from rib to rib at the strut attach doublers. Closely inspect the doubler plate edge areas, where compression cracks are more likely to occur.

c) **Spar Bottom Edge:** To inspect the lower spar surface of the forward spar, place the 2" x 6" flat mirror on the fabric under the spar. Starting at the outboard end of the spar doubler, position the light bulb **on** the mirror **well under** the spar. Using the 2" inspection mirror, view the larger mirror and light under the spar.

i) NOTE: The eye will need to adapt to the inverted view presented by looking through two mirrors, up at the spar bottom edge. The clue will be when the spar **doubler plate edges** are clearly in view. When this view is acquired, the spar bottom surface should be clearly visible all the way across from front to back.

ii) Double mirror "orientation" is aided by having the light source very close to the area you want to view **under** the spar. The long narrow mirror under the spar is helpful and will have to be moved only occasionally as your inspection progresses inboard along the spar.

iii) When you get to the steel strut attach fitting, view the bottom of the spar all the way to the inboard rib by looking toward the fuselage and up through the strut attach fitting (from the wing bottom surface). The spar bottom surface should be readily seen. This area may have the same dope or paint overspray on it.

d) **Spar Side/Face and Rib Flange:** Moving the light and mirror together along the side of the spar between the ribs and both doubler plate edges, closely inspect for evidence of compression cracks propagating down the side of the spar.

i) The front inboard face may, **optionally**, be accessed through the very narrow gap between the fabric and the steel strut fitting. A smooth wire hook may help open the gap slightly. Scan the glue line and spar, moving the bulb up or down on the spar. Here is one place where the 30º bend at the tip helps maneuver the light.

ii) NOTE: The front outboard face cannot be readily inspected. Though this inspection is not impossible to accomplish it is not required unless adjacent areas indicate a suspected problem.

e) NOTE: If a lateral crack is noted between the rib and spar doubler plate, a compression crack may be hidden behind the adjacent rib flange.

4) **Rear Spar Inspection**

a) 4.1 The rear spar is easily accessible; it usually has two inspection holes. The top and faces of the spar can be scanned with the light and

mirror combination. The bottom surface can be seen by drawing down on the bottom fabric and viewing directly with the aid of the light. Alternatively, the double mirror method may be used, and will be necessary in the case of a factory-covered 8KCAB due to the extra rib in this area.

5) **Repair**

a) 5.1 Upon the discovery of a compression crack upon any spar, repair the wing in accordance with the latest revision of AC 43-13. In most cases repair of the wing will entail replacement of the spar(s) which have compression cracks.

b) Please note that disassembly of the wing, replacement of defective parts, and re-assembly is a repair and NOT a rebuild per FAA terminology and may be performed in accordance with AC 43-13.

6) **Addendums to this document**

a) As new information becomes available regarding compression crack causal factors, prevention, or other inspection information the information will be available on the technical page at www.citabria.com.