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Introduction

On May 12, 1994 Wills Wing issued a temporary grounding order for the RamAir 154. This order was issued following a turbulence induced tumble and subsequent structural failure in Germany, and reports of three other turbulence induced upsets without structural failure. Because of these incidents, both the DHV and Wills Wing retested the RamAir 154 on their test vehicles. In both cases, areas of noncompliance were found at some intermediate VG settings. As of the date of this bulletin, no incidents or problems have been reported on the RamAir 146.

Wills Wing has since developed a retro-fittable modification. This modification has been tested and shown to substantially increase the RamAir 154's and RamAir 146's margin of compliance with U.S. H.G.M.A. standards and also improve some qualitative handling characteristics. The modification includes a new bridle set, a bridle compensator adjustment, the addition of reflex to the profile root area battens and a CG/hang loop adjustment. The parts are available free of charge through Wills Wing dealers world wide. Installation instructions follow.

Batten Reflex Modification

The 154 has reflex added to 4 battens: no. 8 through no. 11, the 146 has reflex added to 3 battens: no. 8 through no. 10. Refer to figure no. 1. Measure and mark each batten at distance "A". Bend each batten in a smooth radius over a 3 inch length centered on the mark. Verify the reflex specification "B" using the replacement batten chart available from Wills Wing. Use the X's, and the unchanged root and #7 battens to align the overlays to the chart. Use care to keep the reflex bend in the same plane as the nose area camber. You will achieve better quality results if you work on a large flat unobstructed surface.

Batten	#8	#9	#10	#11 (154 only)
Distance A	12 in [30.5 cm]	13 in [33 cm]	14 in [35.5 cm]	15.5 in [40 cm]
Distance B RamAir 154	1 in [2.5 cm]	1-1/2 in [3.8 cm]	1-3/4 in [4.5 cm]	2-1/8 in [5.5 cm]
Distance B RamAir 146	1-3/8 in [3.5 cm]	1-3/4 in [4.5 cm]	2-1/4 in [5.7 cm]	NA

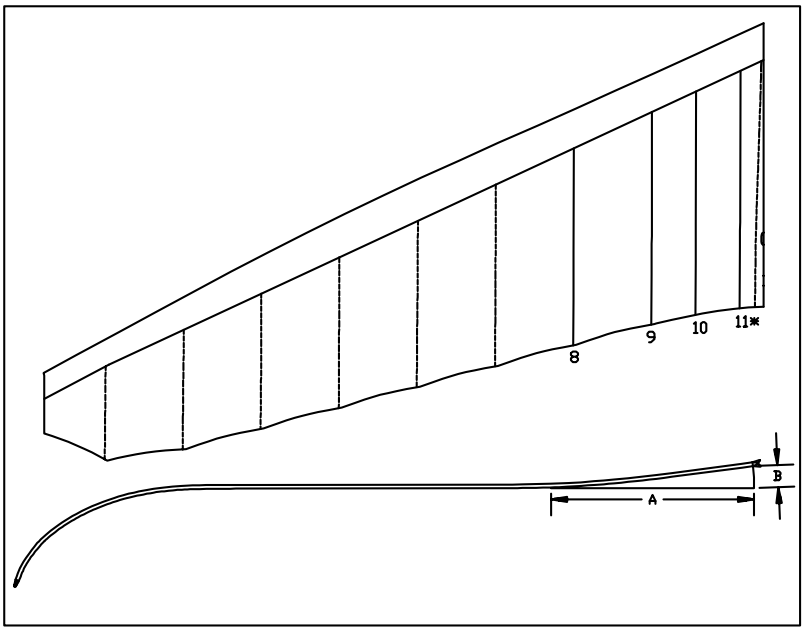


Figure no. 1

Bridle Installation

Remove the original bridle set from the #4, #6 and #8 batten stations. Save the 6 bridle balls. Install the retrofit bifurcated bridle set at the #4, #5, #6 and #7 stations. Install the cable loops through the original bridle anchor grommets at the #4 and #6 stations, and through the outboard of the two batten tension grommets at the #5 and #7 stations. Refer to figures no. 2 and no. 3. Check that

all cables are free from twists. Be sure to pre-flight the bridles at the #5 & #7 battens carefully, as there is an increased chance of the bridle ball not fully seating in the grommet because of the batten string. ***Please return your orignal bridle set to Wills Wing.***

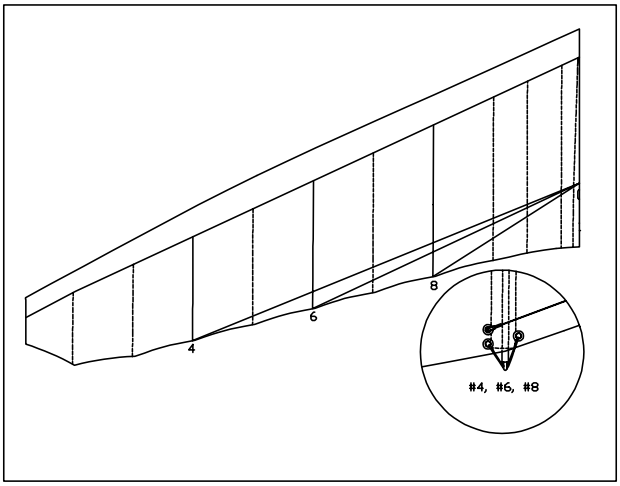


Figure no. 2 — Original Configuration

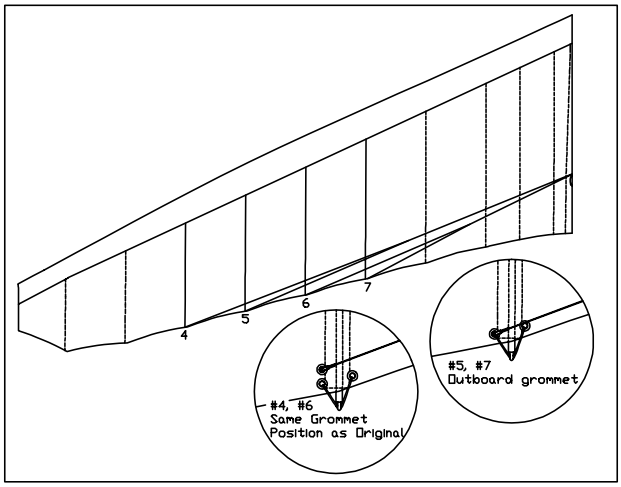


Figure no. 3 — Modified Configuration

Compensator Adjustment

Adjust the perlon rope compensator link (near the crossbar junction) to the following specifications, measured between the centers of the holes in the tangs. Refer to the illustration below. ***Use overhand knots only—previous "figure 8" type knots have been known to slip.***

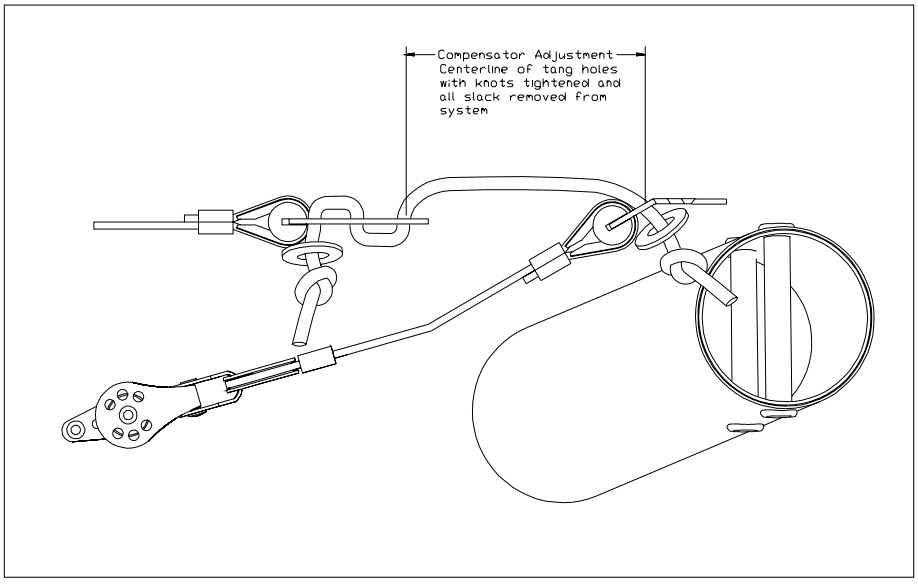
RamAir 154 2.75 inches / 7.0 cms

RamAir 146 4.75 inches / 12.0 cms

Tighten both knots firmly, using pliers if necessary. Support the rear keel at the rear wire station and pull down on the bridle compensator clip at the top of the kingpost with 50-75 lbs of force. Recheck the specification.

Set the VG to the full loose setting. Check the bridles at each batten station by hooking a tape measure over the top front wire at the kingpost top and reading the measurement at the trailing edge hem, at the intersection with the pencil line on the sail which marks the batten pocket application line. Your measurements should be those shown below, plus or minus 1/4 inch.

Model	#7	#6	#5	#4
RamAir 154	97 in [246.4 cm]	117-1/4 in [297.8 cm]	138-1/2 in [351.8 cm]	160-1/8 in [406.7 cm]
RamAir 146	93 in [236.2 cm]	113 in [287 cm]	134 in [340.4 cm]	155-1/2 in [395 cm]



Hang Loop / CG Adjustment

Reflex slows the glider trim speed approximately three mph. Mark the location of the rear of the hangloop on the keel. Adjust the hang loop 1/2 inch forward. Check that the forward hang loop adjustment tang is pinched firmly against the keel so loop can not shift position.

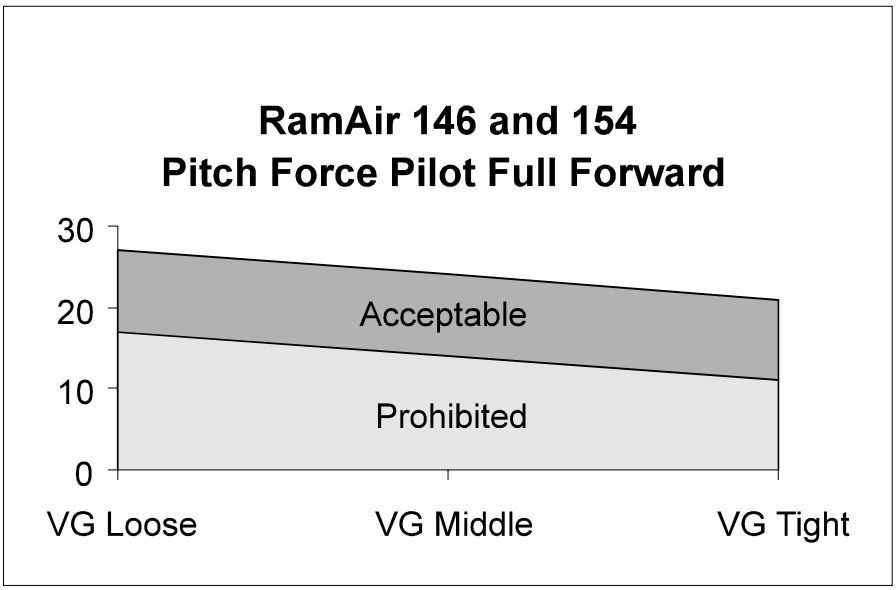
Flight Test Verification

A flight test verification is essential for proper adjustment of the bridle system. The shadow of the bridle cables can be seen on the sail when flying in direct sun exposure. Perform a shallow circling turn away from obstacles or traffic. When the shadows of the cables are visible on the sail, lightly shake the control bar basetube. The degree of movement will indicate the amount of slackness in the cable. At VG loose, the slackness should progress from *just slack* to *slack,* inboard to outboard. VG tight, the progression should be from *snug* to *just slack* (slightly tighter than VG loose). Please refer to your ***Owner/Service Manual*** under the section ***Test Flight and Checking The Bridles*** for definition of the terms *slack* and *snug*.

If the outboard bridles become tight before VG tight, pitch bar pressure at high speeds will be higher VG tight than VG loose, and handling in rough air will be adversely affected. If the bridles are looser than specified, optimum stability will not be achieved.

A final evaluation of the bridle adjustment should be made by flying the glider in a steady state, pilot full forward dive at each of three settings from VG loose to tight and checking the pitch bar pressures. *This should only be done in smooth air*. The pilot full forward position should be approached slowly and gradually so that zooming and hysteresis in speed are avoided. At steady state pilot full forward, the pitch pressure should fall in the range indicated on the graph below. As a reference, the VG loose pitch pressure on a RamAir is approximately 1/2 to 2/3 of an HP AT. The pitch pressure will decrease slightly and progressively as VG engagement is increased, as indicated on the graph.

Please note that new RamAir 154 bridle system does not induce reflex in the inboard sail at VG tight position as it did with the original bridle set.



Modification Verification Card

Please complete and return the attached **Modification Verification Card** promptly. This information will provide the basis for tracking the progress of the upgrade and providing you with supplemental information or instructions if necessary.

Glider Owner's Manual

Please staple this Technical Bulletin into the rear of your **RamAir Owner's Manual** for future reference.

In Closing

We apologize for any inconvenience and frustration this action has caused to our valued customers. Please feel free to contact Wills Wing if you have any questions.