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# Stall warner - retrofit installation - XS

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## Part 1 - retrofit to aircraft with XS wings

Mark a point on the starboard wing root rib half way between the forward lift pin and the front of the spar, and half way between the upper and lower surface - see figure 1. Drill a pilot hole approx 3mm (1/8") diameter.

Enlarge this hole to 13mm (1/2") diameter, being careful not to let the drill bit 'grab' on entry or exit from the rib. Aim the drill bit towards a point on the leading edge 1321mm (52") out from a point halfway between the two wing spar mounting pin bushes. This will be BL (butt line) 52 (52" from the aircraft centreline).



*Fig 1. Position of pilot hole.*

Protect the upper surface of the wing in the spar area with masking tape, and with a straight edge aligned with the front face of the spar, draw the extended spar line onto the upper surface. Mark butt line 52. Protect the leading edge area at about the BL52 position with masking tape, and with a square or tee, transfer the BL52 position to the leading edge - see figure 2.



*Figure 2. Marking BL52 on the leading edge.*



A long 1/2" diameter hole cutter needs to be made from the piece of steel tube (W40) supplied by making a saw tooth form on one end.

Cut down half the depth of a hacksaw blade into the end of the tube, keeping the two cuts diametrically opposite (Fig 3 - a)! Rotate the tube in your vice by 90° and cut through again to the same depth (fig 3 - b). Repeat with two further cuts at 45° to the first two so that you have eight cuts (fig 3 - d). Now cut away what will be the trailing edge of the saw tooth, down to the leading edge of the following tooth. Electric drills rotate clockwise! Precision is not necessary - the saw only needs to last for one hole!

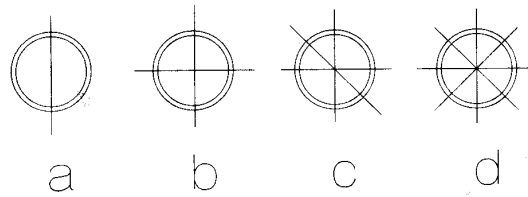


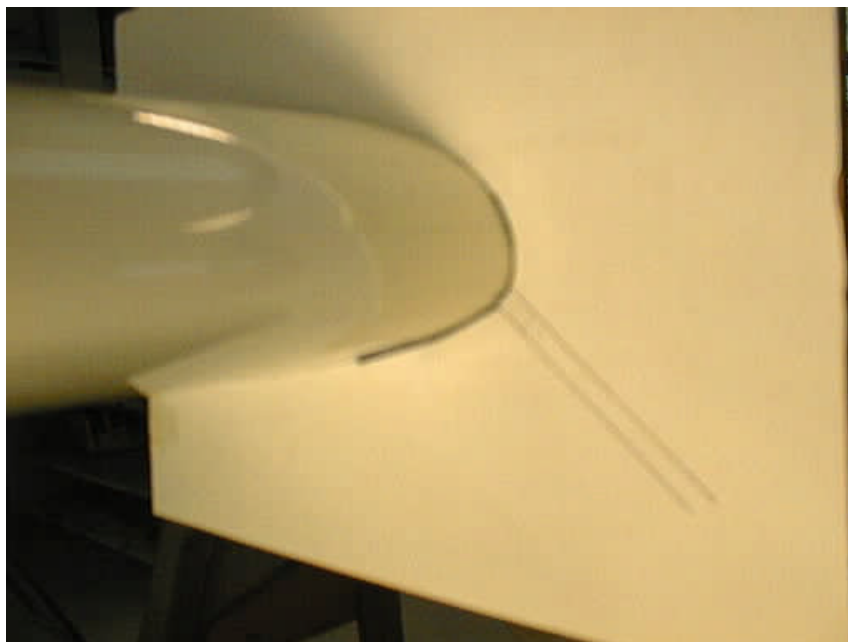
Fig 3. Cutting saw teeth.

With the hole cutter fitted to your drill, insert it through the hole previously made in the root rib, and aim it at a point on BL52 approx 50mm (2") aft of the leading edge. Keeping the cutter parallel to the upper skin, drill through the 2nd rib using as slow a speed as possible. Now, without drilling, push the cutter forward until it touches the third rib, and then withdraw it about 75mm (3"). At this point remove the cutter from the drill, and **leave it in place** for use as a guide later on - see figure 4.



Fig 4. Hole cutter in position.

Glue the leading edge template supplied (see last page) to a piece of firm card, and cut it out using a sharp craft knife. Push the template firmly on to the leading edge at BL52, and transfer the probe opening centreline onto the wing - see figure 5.



*Fig 5. Template in position on wing leading edge.*

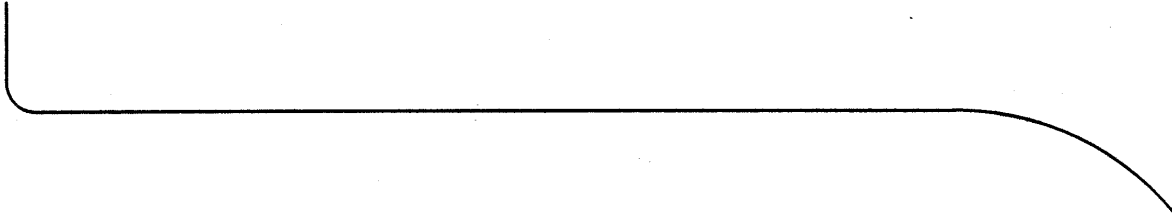
Move the template approx 50mm (2") inboard, keeping it firmly against the leading edge. Using the probe centreline on the template as a guide for the angle, drill a 3mm (1/8") pilot hole through the leading edge at the marked position, keeping it at 90° to the spar line. Enlarge the hole to 10mm (3/8") - see figure 6.



*Fig 6. Drilling hole in wing leading edge.*



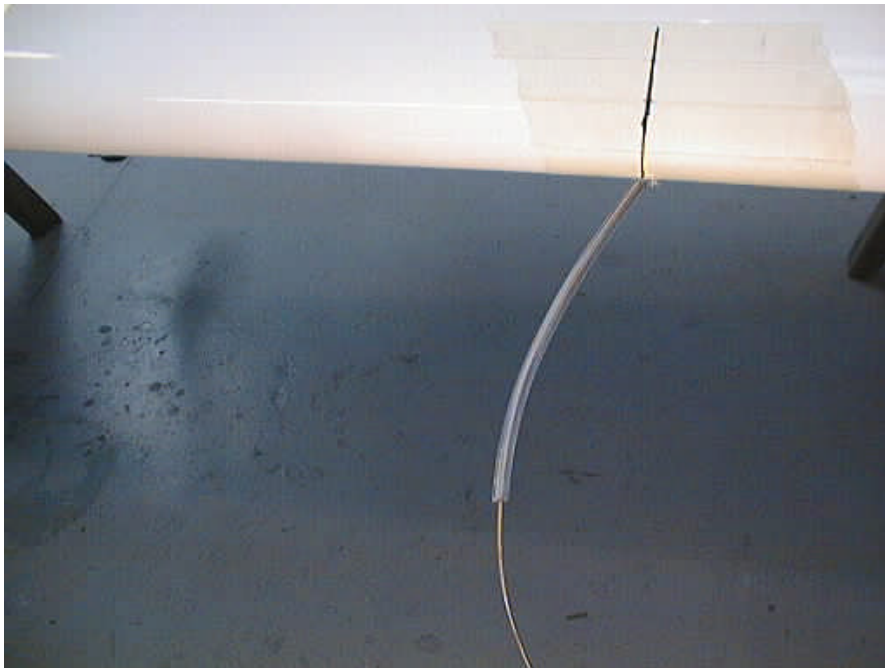
Take the metre length of wire (part no. A31 1.2mm welding rod) supplied and bend one end to a gentle curve as in figure 7, and make a 13mm (½”) long 90° bend at the other, in the same plane as the curve to act as a handle.



*Fig 7. Wire bending.*

Insert the curved end through the hole cutter from the root rib end, and push until the wire makes contact with the rib. With an assistant looking into the leading edge hole to spot the end of the wire, push / rotate the wire until it can be pulled out by the assistant with a pair of needle nose pliers (experience in key hole surgery could be useful here).

Cut the 90° bend off the wire at the root rib end, and push the 3mm PVC tubing (part number TU21RM) over the wire as far as possible, which will probably be up to the beginning of the curve. When the tubing is on the wire inside the hole cutter as far as it will go, simultaneously remove the wire from the leading edge end and push the tubing further in until it comes out of the leading edge - see figures 8 and 9.



*Fig 8. Wire and tubing at leading edge.*



*Fig 9. Tubing and cutter at root rib.*

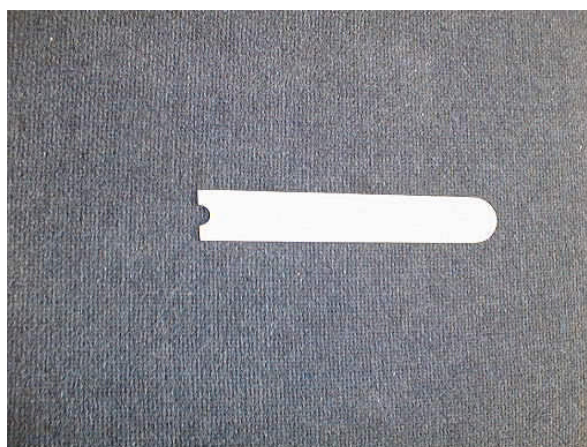
Scuff sand the outside of the W39 probe starting about 13mm (1/2") from the reducer end for a length of approx 25mm (1") - you could use a hacksaw blade to provide a good key for the adhesive which will be applied later.

Ensure that the TU21RM tubing is cut off square, and push it over the reduced end of the W39 probe - a little heat on to the plastic tubing may help.

Apply a layer of clear cellophane tape to protect the card template from adhesive in the area of the hole.

Remove the masking tape from around the hole, and remask that area with cellophane tape.

Cut off the end of a mixing stick, and file a 6mm (1/4") semicircle in the end - see figure 10.



*Fig 10. Modified mixing stick.*



Mix up some epoxy adhesive with a little floc to create a 'non-run' mix, and apply a generous amount around the probe. Insert the probe into the wing, gently pulling the tubing back through the hole cutter, and position the probe in the correct location, as shown by the template, leaving a short amount protruding. Keep adding adhesive, driving it into the hole with the shaped mixing stick. Remove any excess adhesive and tape the end of the probe to the template, checking again that it aligns with the marks. Allow to cure.

Once the adhesive has cured fully, cut off the excess of W39 and file it flush with the wing skin.

On a finished and painted wing a little hobby paint will make good the tube/glue line. (Using a different colour will avoid having to colour match, and will also highlight the hole for inspection).

Slowly withdraw the hole cutter, taking care not to pull the plastic tubing as you do so. Cut the exposed plastic tubing approx 300mm (12" from the root rib, and insert the female half of the quick connect coupling on to the end.

Put the tubing where it passes through the root rib with an epoxy/floc fillet.

## **Fuselage installation**

Drill a 6mm (1/4") hole through the starboard fuselage side in line with the lower edge of the spar slot, and 13mm (1/2") forward of the front face of the cut out.

Feed a 75cm (30") length of the 3mm bore tubing out from inside the fuselage for about 15cm (6") and terminate with the male half of the quick connector.

Run the tubing down into the outboard seat pan. This is where the vacuum switch will be positioned. There is no need for it to be secured; in fact it is required to be loose for access during calibration.

The horn needs to be mounted in a place that will be audible to both crew members. The roof panel just aft of the screen is the recommended position, but make sure that its position doesn't interfere with the compass. Run the wires from the horn down to the vacuum switch, down either the screen pillar and under the door sill, or follow the rear edge of the door surround.

Connect the wires and tubing according to the diagram in figure 11, leaving the wires and tubing loose at this time, so that adjustment to the vacuum switch can be made with the switch on the co-pilot's lap, during flight testing. The tubing must be connected to the vacuum switch on the same side as the wiring, otherwise it will not work. An optional red warning light (not part of the kit) can be fitted to the instrument panel if desired.

## **Electrical connection**

Depending on where you wish to connect the power and earth connections will determine the routing of the loom, and perhaps the exact position of the horn on the ceiling panel. It is recommended that the +12V supply is permanently live, as a landing without the master switch on (after an electrical fire for example) would otherwise isolate the stall warner too. Direct connection to the battery under the

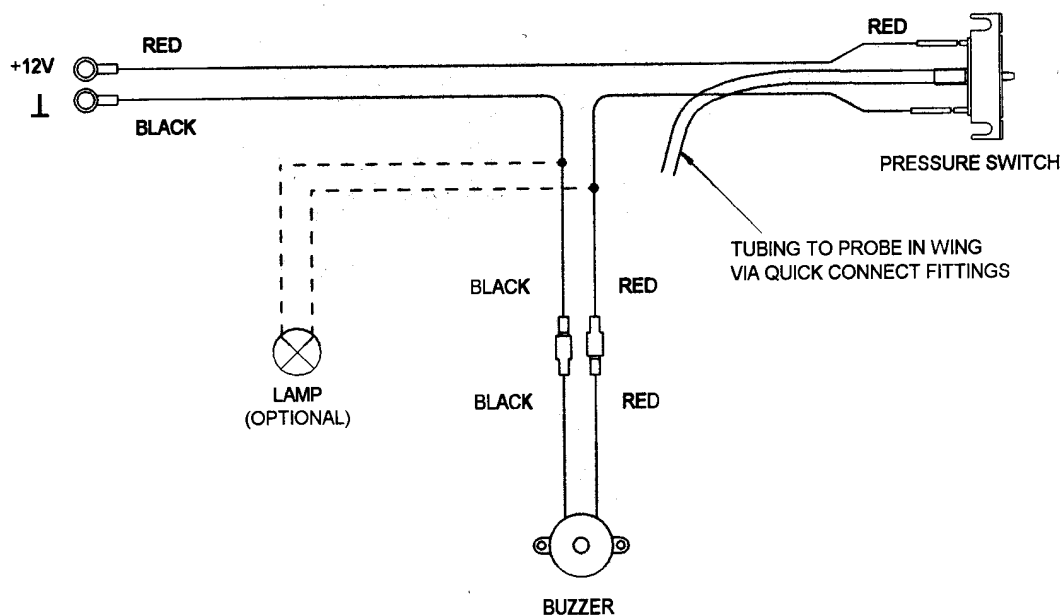


Fig 11. Wiring diagram

baggage bay, or to the battery solenoid connections would be suitable. Alternatively run the wires forward to the back of the instrument panel. You could connect the +12V terminal to the same fuse / circuit breaker as the trim system, as this should also be wired directly to the battery.

### Inspection

Arrange for the installation to be inspected by the appropriate authority before flight.

### Calibration

It is recommended that the stall warner is made to sound at least 5 Kts prior to the stall break, and at no more than 10 Kts before.

Prepare for calibrating the stall warner, which is done by adjusting the pressure switch with a small crosshead screwdriver.

Load the aircraft to gross weight and arrange for a fairly central C. of G; between 60" and 61" aft of datum would be ideal. Carry an observer who can make the adjustments while you concentrate on flying the aircraft.

Climb to a safe height to conduct the stalls (not below 3000 ft. a.g.l.).



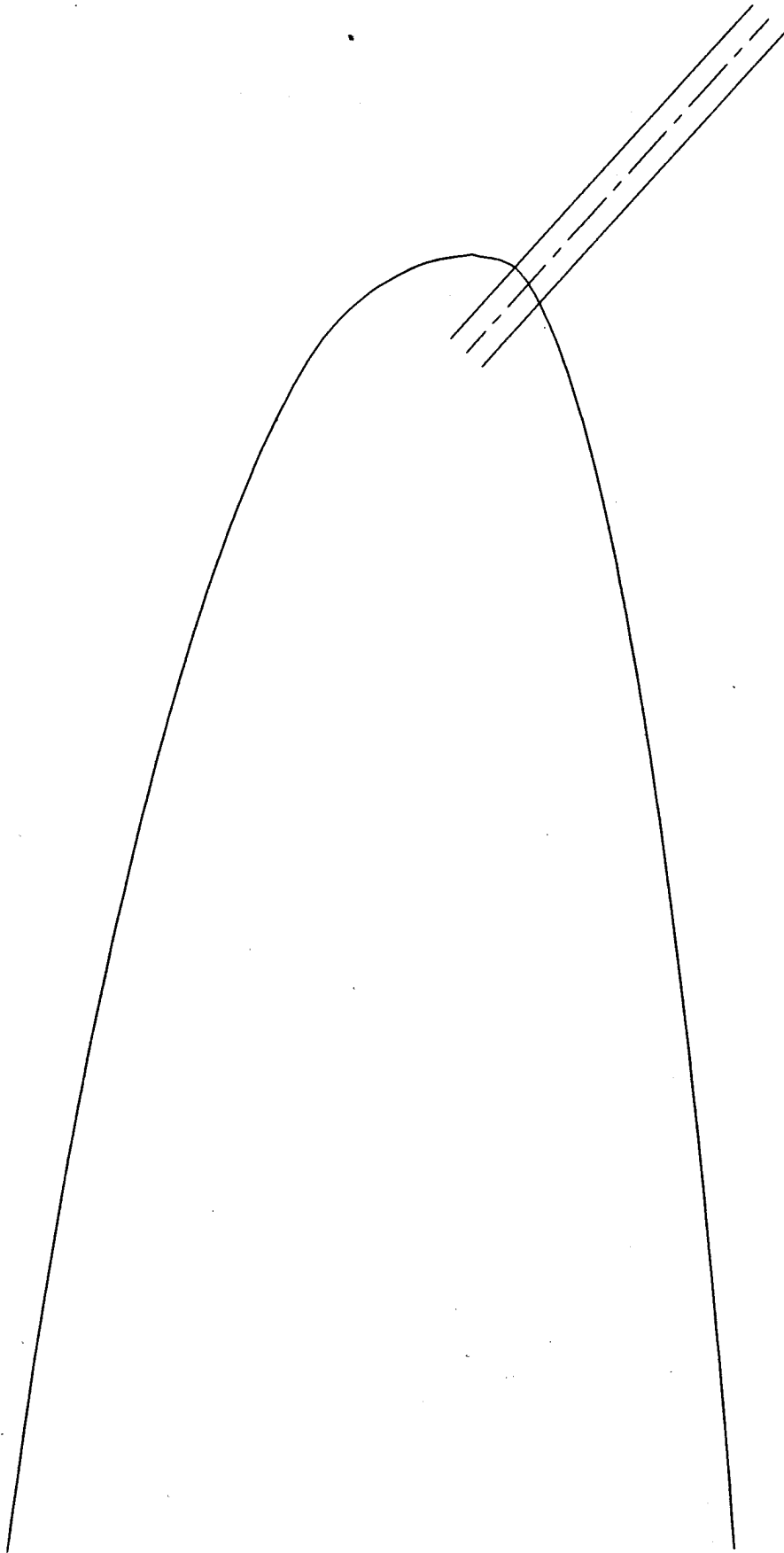
Firstly, by reducing airspeed at approximately 1 Kt / second, verify and note the stall speed of the aircraft with flaps up. Fly the aircraft at no less than 5 Kts above this speed and adjust the pressure switch so that the horn just starts to sound. Adjust the speed above and below the speed at which the horn sounds, and make fine adjustments as necessary.

Conduct stalls at full flap and confirm that you get adequate stall warning, adjusting the switch as necessary. Check also that the stall warner provides adequate warning at full power, flaps down and up and also during accelerated stalls (at more than 60° of bank).

## **Documentation**

Enter the incorporation of Mod 61B into the aircraft log book.





*Stall warning leading edge hole template*



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# Stall warner - retrofit installation - classic

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## Part 2- retrofit to aircraft with Classic wings

Mark a point on the starboard wing root rib half way between the forward lift pin and the front of the spar, and half way between the upper and lower surface - see figure 1. Drill a pilot hole approx 3mm (1/8") diameter.

Enlarge this hole to 13mm (1/2") diameter, being careful not to let the drill bit 'grab' on entry to and exit from the rib. Aim the drill bit towards a point on the leading edge 1321mm (52") out from a point halfway between the two wing spar mounting pin bushes. This will be BL (butt line) 52 (52" from the aircraft centreline).



*Fig 1. Position of pilot hole.*

Protect the upper surface of the wing in the spar area with masking tape, and with a straight edge aligned with the front face of the spar, draw the extended spar line onto the upper surface. Mark butt line 52. Protect the leading edge area at about the BL52 position with masking tape, and with a square or tee, transfer the BL52 position to the leading edge - see figure 2.



*Figure 2. Marking BL52 on the leading edge.*



A long 1/2" diameter hole cutter needs to be made from the piece of steel tube (W40) supplied by making a saw tooth form on one end.

Cut down half the depth of a hacksaw blade into the end of the tube, keeping the two cuts diametrically opposite (a). Rotate the tube in your vise by 90° and cut through again to the same depth (b). Repeat with two further cuts at 45° to the first two so that you have eight cuts (c,d). Now cut away what will be the trailing edge of the saw tooth, down to the leading edge of the following tooth. Electric drills rotate clockwise! Precision is not necessary - the saw only needs to last for one hole!

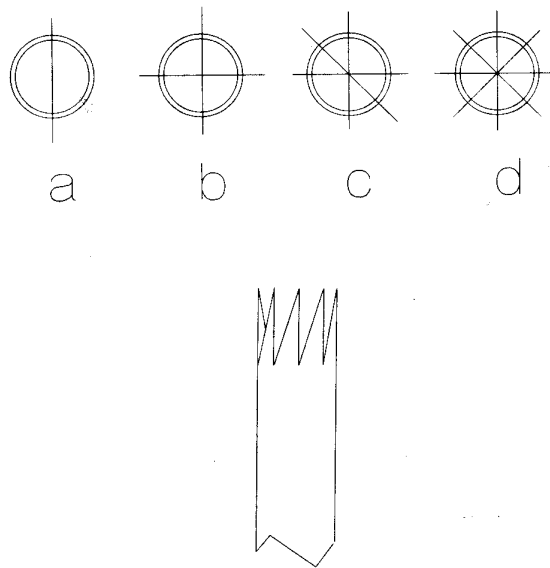


Fig 3. Cutting saw teeth.

The hole cutter will be used to “core” through the foam block, either by melting with the hot cutter, or drilling, using an electric drill, or a combination of both.

The initial stage of coring will have to be done with heat, as the hole cutter cannot be fitted to the drill until the non-saw end has passed the spar. Heat the first 150mm (6”) or so, with a blow lamp or hot air gun, to a temperature too hot to touch by hand... (Warning - do not touch the tube to test this yourself - get someone else to do it!)

Insert the hole cutter into the hole in the root rib, aiming to intersect the leading edge at about the BL52 position. When aiming ensure that the lateral “aim” will not allow the hot end of the hole cutter to come into contact with either of the wing skins (have your assistant check this from in front of the wing).

The hole cutter can be reheated to melt through to the BL52 station, or spun in a drill, whichever you feel more comfortable with.

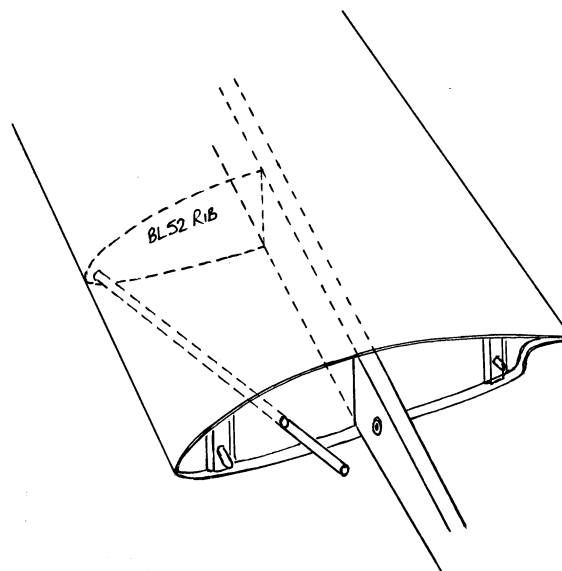


Fig 4. Hole cutter in position.

Glue the leading edge template supplied (see last page) to a piece of firm card, and cut it out using a sharp craft knife. Push the template firmly on to the leading edge at BL52, and transfer the probe opening centreline onto the wing - see figure 5.



*Fig 5. Template in position on wing leading edge.*

Move the template approx 50mm (2") inboard, keeping it firmly against the leading edge. Using the probe centreline on the template as a guide for the angle, drill a 3mm (1/8") pilot hole through the leading edge at the marked position, keeping it at 90° to the spar line.

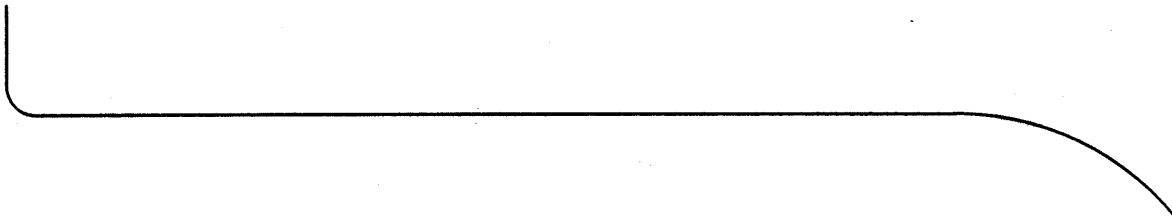


*Fig 6. Drilling hole in wing leading edge.*



Enlarge the hole to 10mm (3/8") and run the drill bit inside the wing until contact is made with thole cutter. Further coring with the hole cutter may be required until the cutter and drill bit make contact.

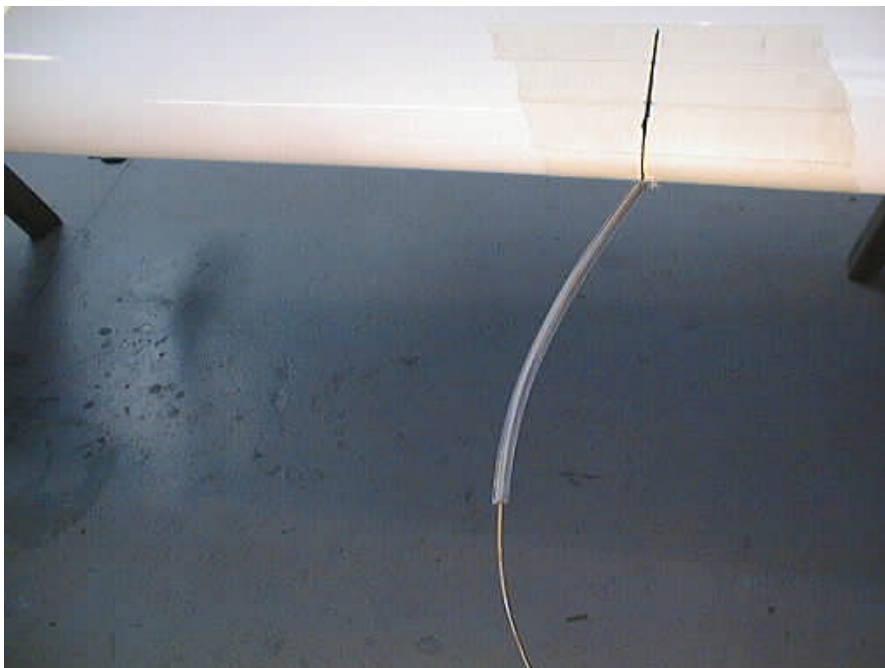
Take the metre length of wire (part no. A31 1.2mm welding rod) supplied and bend one end to a gentle curve as in figure 7, and make a 13mm (1/2") long 90° bend at the other, in the same plane as the curve to act as a handle.



*Fig 7. Wire bending.*

Insert the curved end through the hole cutter from the root rib end, keeping the 90° bend in such a way as to allow the curved end to find its way out of the leading edge. Have an assistant with a flashlight to look out for the wire at the leading edge.

Push / rotate the wire until it can be pulled out by the assistant with a pair of needle nose pliers (experience in key hole surgery could be useful here).



*Fig 8. Wire and tubing at leading edge.*

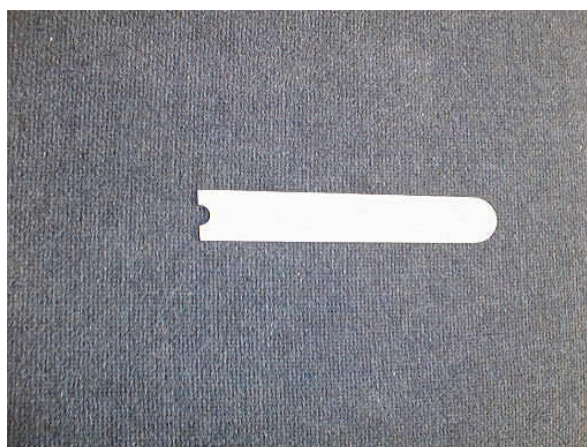


*Fig 9. Tubing and cutter at root rib.*

Cut the 90° bend off the wire at the root rib end, and push the 3mm PVC tubing (part number TU21RM) over the wire as far as possible, which will probably be up to the beginning of the curve. When the tubing is on the wire inside the hole cutter as far as it will go, simultaneously remove the wire from the leading edge end and push the tubing further in until it comes out of the leading edge - see figures 8 and 9.

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*Fig 10. Modified mixing stick.*



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Once the adhesive has cured fully, cut off the excess of W39 and file it flush with the wing skin.

On a finished and painted wing a little hobby paint will make good the tube/glue line. (Using a different colour will avoid having to colour match, and will also highlight the hole for inspection).

Slowly withdraw the hole cutter, taking care not to pull the plastic tubing as you do so. Cut the exposed plastic tubing approx 300mm (12" from the root rib, and insert the female half of the quick connect coupling on to the end.

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## **Fuselage installation**

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Connect the wires and tubing according to the diagram figure 11, leaving the wires and tubing loose at this time, so that adjustment to the vacuum switch can be made with the switch on the co-pilot's lap, during flight testing. The tubing must be connected to the vacuum switch on the same side as the wiring, otherwise it will not work. An optional red warning light (not part of the kit) can be fitted to the instrument panel if desired.



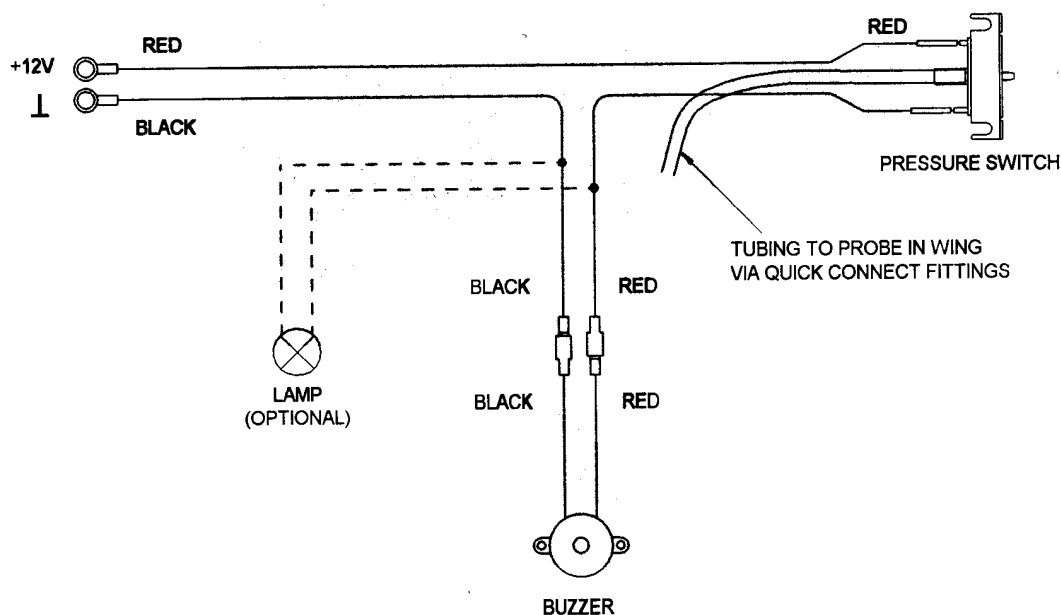


Fig 11. Wiring diagram

### Electrical connection

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### Inspection

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### Calibration

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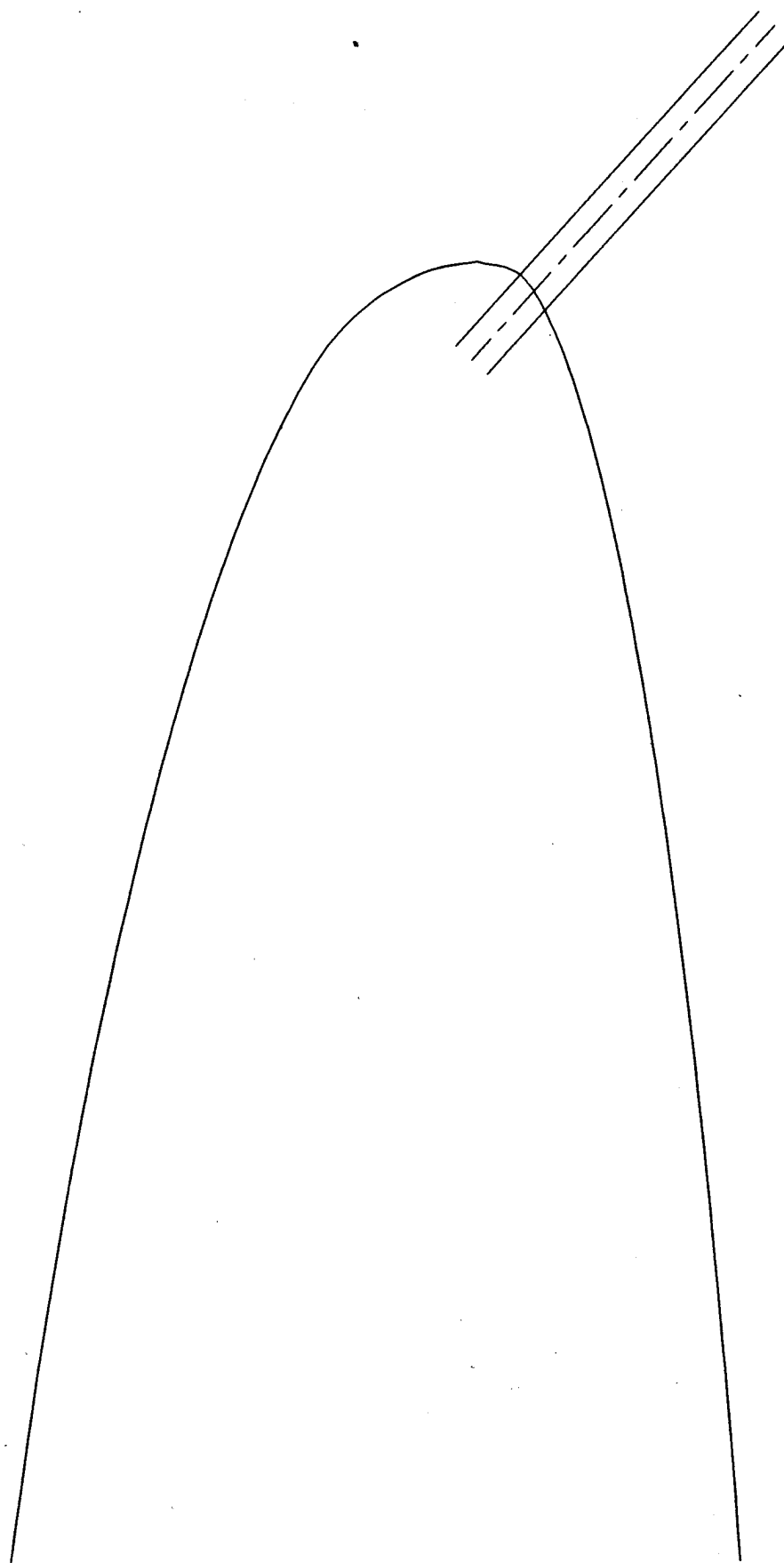
Climb to a safe height to conduct the stalls (not below 3000 ft. a.g.l.).

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Conduct stalls at full flap and confirm that you get adequate stall warning, adjusting the switch as necessary. Check also that the stall warner provides adequate warning at full power, flaps down and up and also during accelerated stalls (at more than 60° of bank).

### **Documentation**

Enter the incorporation of Mod 61B into the aircraft log book.



*Stall warning leading edge hole template*



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