VEGA MANUAL

Incorporating

1. FLIGHT MANUAL

2. REPAIR MANUAL

3. SERVICE MANUAL

CONTENTS

2. REPAIR MANUAL

1. FLIGHT MANUAL

1.1 INTRODUCTION

Vega is the name given to the type 65A glider designed by Vickers-Slingsby.

The Vega is a high performance sailplane for the 15 metre class competition. It has excellent handling characteristics and its lack of vices in the stall and during attempted spinning make it suitable for pilots of relatively low experience.

Vega includes the following design features:-

1. Carbon fibre main spar. Carbon fibre tailplane spar.
2. One piece trailing edge flap/airbrake control surface with single lever operation. Air brake easily operated up to Vne and is speed limiting.
3. Forward hinging canopy allowing easy access to instruments; canopy sealing and gas strut retention in the open position. "Top Dead Centre" canopy catch easily operated from outside the cockpit without the need to reach in through the window. Instrument panel easily removeable.
4. Large (500 x 5) mainwheel with brake operated by lever on the control column. The wheel extends by its full diameter (14 inches) below the fuselage. Tow hook mounted on the U/C assembly so that it retracts with the wheel.
5. Tailwheel retracts simultaneously with the mainwheel.
6. Wings and Tailplane easily sealed to the fuselage fairings.
7. "Turn down tip" wings
8. Quiet air inlet system with nose pitot installed in the centre of the air intake.
9. Automatic coupling of all control circuits when the sailplane is rigged. Only two rigging pins, one for the wing, one for the tailplane, to be inserted on rigging.

10. Wide range of cockpit loads.

11. Roomy cockpit with wide range of seat back adjustment; headrest adjustment and rudder pedal adjustment.

12. Accessory tray above the wing spar junction for barograph and/or batteries.

13. Provision for 610 litre oxygen cylinder; High pressure oxygen pipe ready installed.

14. Fitted total energy tube of the Brunswick/Nicks/Irving type.

15. Positive pitch stability at all speeds but retaining light stick loads. Effective trim system.

16. Mecaplex canopy with Mecaplex, Vented, Sliding Window.

17. Dipole VHF aerial installed in Fin with co-axial cable to the instrument panel.

18. Special 'V' gap seal between rudder and elevator.

Recommended Instruments:

Altimeter:	Smith Mk.20A
Airspeed Indicator:	Winter 6FMS4
Accelerometer:	Kelvin & Hughes KB482/01
Turn & Bank Indicator:	Kelvin & Hughes 6A/3953/1
Variometer:	Winter STV5

Equivalent Instrument Characteristics

Instrument	Range	Tolerance (At 20° C)
Altimeter	0-35,000 ft. 0-10,000 m.	± 50ft. (0ft) ± 100 ft (5,000ft) ± 1% (10,000 - 35,000ft)
Airspeed Indicator	30 - 160 knots 55 - 300 km/h	± 2 knots ± 4 km/h
Accelerometer	- 4.5g + 12.0g	-
Turn and Bank Indicator	-	-
Winter Variometer	± 10 knots ± 19 km/h	± 10% (2000-10,000 ft) ± 15% (20,000-30,000ft)
Magnetic Direction Indicator	360 degrees	± 2%

1.2.1 Wing

The double taper plan form wing has skins of woven glass cloth - rigid acrylic foam sandwich construction. The main spars are of I-beam form with unidirectional carbon fibre booms and woven glass cloth - rigid acrylic foam sandwich shear webs.

1.2 GENERAL DATA

1.2.0 Schedule of Equipment

The T.65A. Vega glider consists of:

Port wing

Starboard wing

Tailplane

Fuselage

Wing attachment pin

Tailplane attachment pin

Tailplane locking pin

Rigging tool

Seat back and headrest) These items optional
Accessory tray) for flight

Instrumentation Required

All instruments to be aircraft approved.

For USA they should preferably comply with TSO C10B and TSO C2.

Minimum for clear weather flying

Air Speed Indicator 30 - 160 kts
Marked in accordance with Page 31

Altimeter

Minimum for cloud flying

As for clear weather plus:

Magnetic direction indicator

Turn and Bank Indicator

Variometer

Minimum for aerobatics

As for clear weather plus:

Accelerometer

The trailing edge one piece flap/airbrake assembly is of single skin woven glass cloth construction with the flap being hinged (GRP hinge) off the top surface skin of the airbrake box.

The flap moves up and down by 8° and the airbrake, which can be deployed with the flaps in either the -8° or +8° position, makes an angle of 48° (min) with the top surface of the wings.

The ailerons are of single skin woven glass cloth construction and the flap/aileron mixer unit allows them to be 'drooped' symmetrically up or down with the flaps.

Water ballast bags capable of holding 97.5 lbs (9.75 gallons) per wing are fitted along the inboard 3.50 metres of the wing, forward of the main spar.

Sealed access panels on the underside of the wings for access to Flap and Aileron Controls.

1.2.2 Fuselage and Fin

The monocoque fuselage is of all GRP construction and is moulded integrally with the fin.

The manually operated single mainwheel undercarriage, with integral expanding brake shoes, retracts into the fuselage. The tow hook is mounted on the forward leg of the main undercarriage and is used for both winch launching and aero towing.

The tailwheel is retractable and is coupled to the main undercarriage to give single lever operation.

The cockpit has a one piece jettisonable canopy fitted with a sliding window. An anti-glare cover is fitted to the canopy and the whole assembly hinges forward with gas strut retention in the open position, giving easy access to the instruments and rudder pedal assembly. The seat back, headrest and rudder pedals are fully adjustable.

1.2.3. Tailplane and Elevator

The 'T' tailplane is of GRP - rigid acrylic foam sandwich construction with carbon fibre reinforced main spar booms and tang assembly. The tailplane tang locates in a rib inside the fin and the tailplane itself is locked in position with a single pin, locating fore and aft.

The one piece elevator is of single skin GRP construction.

A rudder shroud located at the top of the rudder and driven by the elevator seals the gap normally present between the rudder top surface and the elevator.

1.2.4. Rudder

The rudder is also of GRP - rigid acrylic foam sandwich construction.

1.2.5. Colour

The sailplane is painted white to keep the surface temperature to a minimum. Under no circumstances should the general colour of the sailplane be changed. Certain areas of the sailplane may be painted in different colours to assist in collision avoidance. These are Wing tips inboard for 50 cms: Fuselage nose forward of the canopy: Undercarriage doors.

1.3 GEOMETRIC DATA

1.3.1 Wing

Area	10.05 m^2	108.12 ft^2
Span	15.00 m	49.20 ft
Aspect ratio	22.40	
Standard mean chord	0.67 m	2.20 ft
Root chord	0.846 m	2.77 ft
60% span chord	0.680 m	2.23 ft
Tip chord	0.360 m	1.18 ft
Aerofoil	Wortmann FX 67-K-150	
Incidence	0° 30' $^{+0^\circ 20'}_{-0^\circ 20'}$	
Dihedral	2° 30' $^{+0^\circ 10'}_{-0^\circ 10'}$	
Aileron area	0.259 m^2	2.79 ft^2
Aileron chord/wing chord	0.17	
Aileron span	2.9116 m	9.55 ft
Aileron root chord	0.1153 m	0.38 ft
Aileron tip chord	0.0629 m	0.21 ft
Flap area	0.525 m^2	5.65 ft^2
Flap chord/wing chord	0.17	
Flap span	4.060 m	13.32 ft
Flap root chord	0.143 m	0.469 ft
Flap tip chord	0.116 m	0.381 ft
Airbrake type	Trailing edge flap - airbrakes	
Airbrake span	4.0606 m	13.32 ft
Total effective area	1.22 m^2	13.13 ft^2

1.3.2 Tailplane and Elevator

Gross area	1.161 m^2	12.50 ft^2
Span	2.50 m	8.20 ft
Aspect ratio	5.38	
Elevator chord/tailplane chord	0.20	
Elevator area	0.232 m^2	2.50 ft^2
Section $^t/c$	0.15	
Type of elevator	Round nose - no balance	
Mass balance	No	

1.3.3 Fin and Rudder

Gross area	1.059 m^2	11.40 ft^2
Span	1.369 m	4.49 ft
Aspect ratio	1.78	
Rudder chord/fin chord	0.30	
Rudder area	0.314 m^2	3.38 ft^2
Section $^t/c$	0.15	
Type of rudder	Round nose - no balance	
Mass balance	No	

1.3.4 Fuselage

Length	6.430 m	21.10 ft
Max. depth	1.342 m	4.40 ft
Max. width	0.698 m	2.29 ft
Max. sectional area	0.44 m^2	4.74 ft^2
Wetted area	8.56 m^2	92.14 ft^2

1.3.5 Undercarriage

Dimension: Mainwheel to tailwheel	4.127 m	13.54 ft
Mainwheel	5.00 - 5 type III	
	Tyre pressure: 35 - 40 psi	
Tailwheel	200 x 50	
	Tyre pressure: 17 - 19 psi	

1.3.6 Weights

Max. A.U.W.	440 kg	970 lb
Max. landing weight	440 kg	970 lb
Empty weight	233.6 kg	515 lb
Water ballast	88.5 kg	195 lb

1.4 PILOTS NOTES

1.4.1. Introduction

The Vega T.65A. is a high performance sailplane with a 15 metre wing span. The basic structure of the aircraft is glass and carbon reinforced plastic, metal only being used for fittings and controls. The core material used in the various GRP sandwich structures is a rigid acrylic foam.

The external surface finish of the aircraft is acrylic and is achieved in three stages:-

(1) Single coat of white polyester gel coat applied in the moulding process of the components.

(2) An epoxy primer paint applied after 'Final Assembly'.

(3) A white acrylic final coat.

The flight handling characteristics of Vega are orthodox in most respects.

1.4.2. Controls and Cockpit

The controls are conventional in arrangement and are depicted overleaf.

The trailing edge flap brakes are operated by a single control lever positioned on the port side of the cockpit. The control has two distinct movements:-

(1) Rotation of the control lever enables the pilot to select any flap position between -8° and +8°. A ratchet arrangement fixes the flaps in the desired position with a resolution of ½ degree. The flaps are operated by squeezing the ratchet release handle mounted behind the control lever and then rotating the lever to the desired setting.

(2) A straight pull back of the same control lever deploys the airbrake; the flap/airbrake assembly rotating as one for this operation. It should be noted the airbrake can only be deployed when the flaps are in the -8° or +8° positions.

The elevator trimmer is a spring device mounted on the pushrod under the seat bucket and is controlled by a lever mounted on the port side of the cockpit. To adjust the trim the ratchet is disengaged by pulling the control knob away from the cockpit side and sliding it either forwards or backwards as required and re-engaging the ratchet.

The undercarriage retraction is simple and straight forward and a warning buzzer (if fitted) operates if the airbrakes are operated with the undercarriage up.

The remaining controls are conventional and require no description.

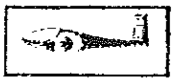
The seating position is variable by means of an adjustable seat back, headrest, and rudder pedals. The rudder pedals are adjustable in flight.

Cockpit Symbols


No smoking


Air vent control


Rudder pedal adjustment


Undercarriage up


Undercarriage down

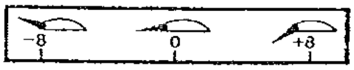

Trim, nose up


Trim, nose down


Tow release


Canopy jettison


Airbrake/flap control gate movement



Flaps up 8°/neutral/down 8°


Undercarriage up buzzer, press to test


Water ballast closed


Water ballast open

Typical Placards

(1) Flight limitations:

Flap Setting	Speed Vne	
+ 8° to - 8°	135 knots	250.2 km/h
Airbrakes Open	135 "	" "
Rough Air	106 "	196.4 "
Aero Tow	100 "	185.3 "
Winch/Auto Tow	70 "	129.7 "
Weak Link	1000 lbs	453.6 kg
Cloudflying T/S Fitted	Yes	

Non Aerobatic:-

The following are the only aerobatic manoeuvres permitted - loop, spin, stall turn, chandelles, lazy eights and tight turns up to 3.5g.

(2) Weight Schedule:

Constructors No.

Registration No.

The undermentioned items of equipment only are included in the empty weight:-

Airspeed indicator

Altimeter

Variometer

Accelerometer

Accessory Tray

Harness

Seat back

Headrest

The empty weight is 515 lbs (233.6 kgs).

The tare C. of G. at this weight is 22.59 ins. aft of the datum.

The datum is defined as the wing leading edge at the root end with the aircraft in the rigging position i.e. fuselage datum pins horizontal.

The maximum permissable A.U.W. is 970lbs (440 kg)

The maximum A.U.W. without water ballast is 775 lbs (351.5 kg)

The maximum landing weight is 970 lbs (440 kg).

The aircraft was weighed at Kirkbymoorside on 27th June 1978.

(3) Loading limitations:

Empty weight 515 lbs (233.6 kg)

Max A.U.W. 970 lbs (440 kg)

Weight and C.G. limits meet the loading as follows:

Max. cockpit load 252 lbs (114.3 kg)

Min. " " 154 lbs (69.9 kg)

Ballast must be carried forward/aft if cockpit load is less/more than lbs (kg) but max. all up weight must not be exceeded.

Max. Ballast tank capacity: 19.5 gallons (88.5 litres)

195 lbs (88.5 kg)

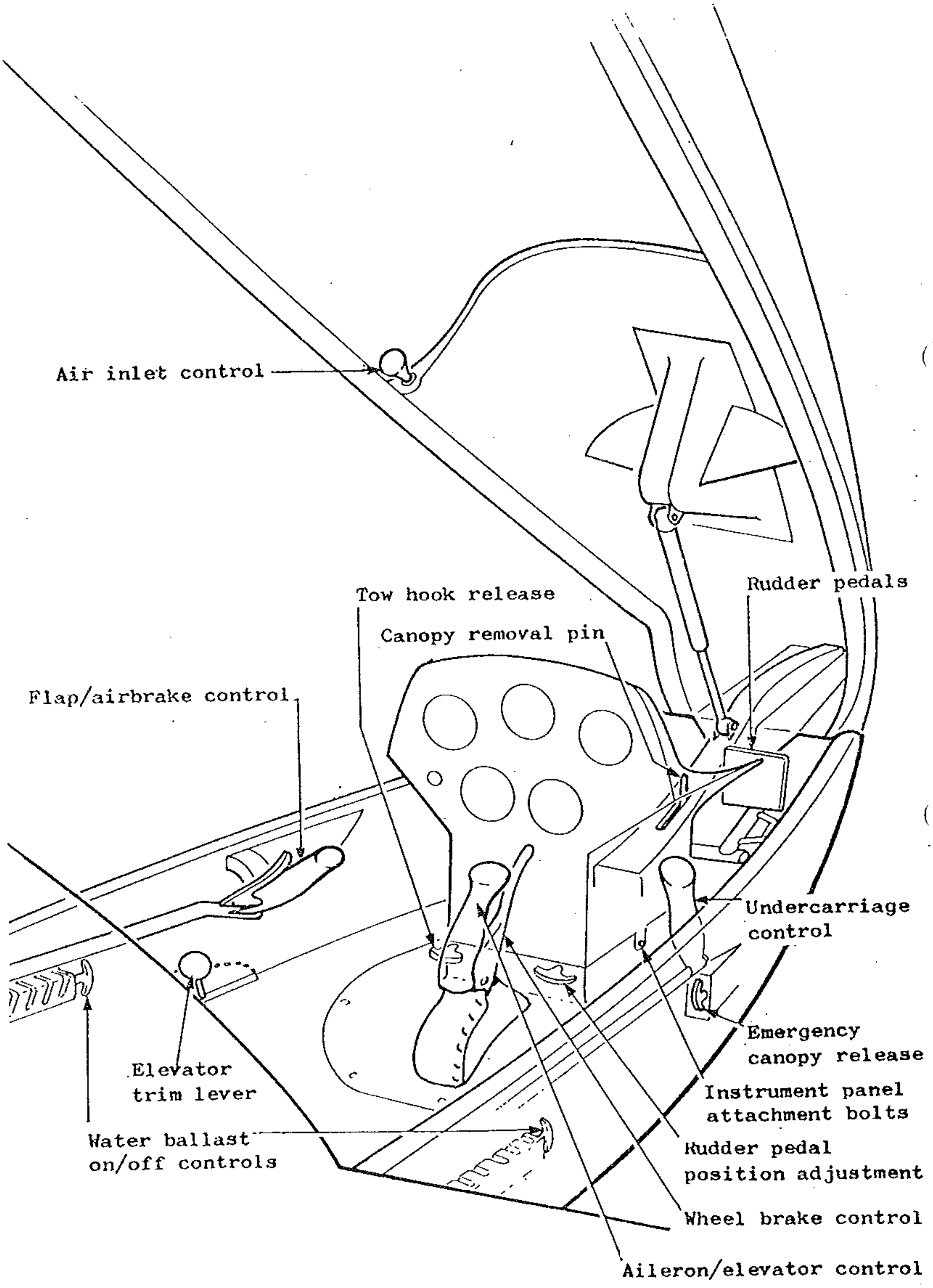
Max. A.U.W. of aircraft is 970 lbs (440 kg).

Do not exceed A.U.W.

Max. loading weight 970 lbs (440 kg)

Max. A.U.W. without water ballast 775 lbs (351.5 kg).

1.4.2 Controls and Cockpit



1.4.3 Rigging the Sailplane

Rigging generally requires four people for ease, or three if a fuselage stand is employed.

Commence by having the fuselage held or trestled in a level position with the flap and aileron controls in neutral, and the canopy and accessory tray removed.

Take either wing and offer it onto the fuselage, holding the flap and aileron in neutral and the airbrake nearly closed.* Accurately line up the fuselage rigging pins with their mating bearings in the wing root rib and check the flap, aileron and airbrake drives are correctly engaged before finally pushing the wing home.

Next take the other wing and offer up in the same manner. Care is required at this stage to visually line up all the pins and bearings and to check the flap, aileron and airbrake drives are coupling correctly before drawing the two wings together with the tool provided.

Next fit the single fixing pin through the tangs and rotate it until the handle locates in its retaining block.

As all the controls couple automatically when the wings are entered up to the fuselage it is now only necessary to carry out a function test on all the controls.

Similarly, the water ballast connections are automatically completed when the wings are fitted to the fuselage. The metal pins and bearings should be lubricated with a "molyslip" type grease and the water ballast connections with a Silicon grease before rigging.

* The ideal position for rigging is with the airbrake proud of the wing top surface by about 0.5 ins.

Slide the accessory tray onto the location spigots in the fuselage, securing in position by engaging the two spring loaded bolts at the forward end. If applicable connect any electrical plugs and the radio aerial.

Check the operation of the undercarriage warning buzzer (if fitted) which has a test facility for pre-flight testing. If the airbrake lock is broken the buzzer will operate if the test button is pressed, and should not operate with the airbrakes closed. In flight the buzzer will operate if the undercarriage is up when the airbrakes are deployed.

The canopy assembly can now be fitted to the fuselage. Slide the canopy assembly spigots into their unibal housings in the forward cockpit lining and lower the front end to enable the forward hinges to come to rest in their GRP housings and, at the same time engaging the locking spigot at the front end. Having pushed the locking spigot fully forward, check the emergency canopy jettison control functions correctly and then re-lock the sliding spigot.

N.B. Under normal circumstances the canopy assembly will already be in position on the fuselage, in which case the assembly instructions given above should be ignored.

It is advisable to ensure that in winds in excess of 10 knots the canopy should be left closed when not essentially required to be open and when left unattended.

Next take the tailplane and offer it up to the fin top ensuring the tailplane is correctly aligned relative to the fin. Check with progressive lowering into position that the elevator drive plate, spar tang and location spigots are coming together correctly.

Push the tailplane right home and slide the assembly pin into position with the aid of the rigging tool. Rotate the pin until the hole in the pin lines up with its counterpart in the tail-plane forward spigot; slide the locking clip into position and remove the rigging tool.

Check the elevator control circuit functions correctly.

In order to reduce drag and noise to a minimum it is advisable to seal the wing root/fuselage and tailplane/fin junctions with 25 mm wide white PVC tape, as follows:-

Lay one layer of tape around the inboard end of the wing and another layer around the fuselage fairing. Lay a joining layer over these two layers thus sealing the wing/fuselage junction.

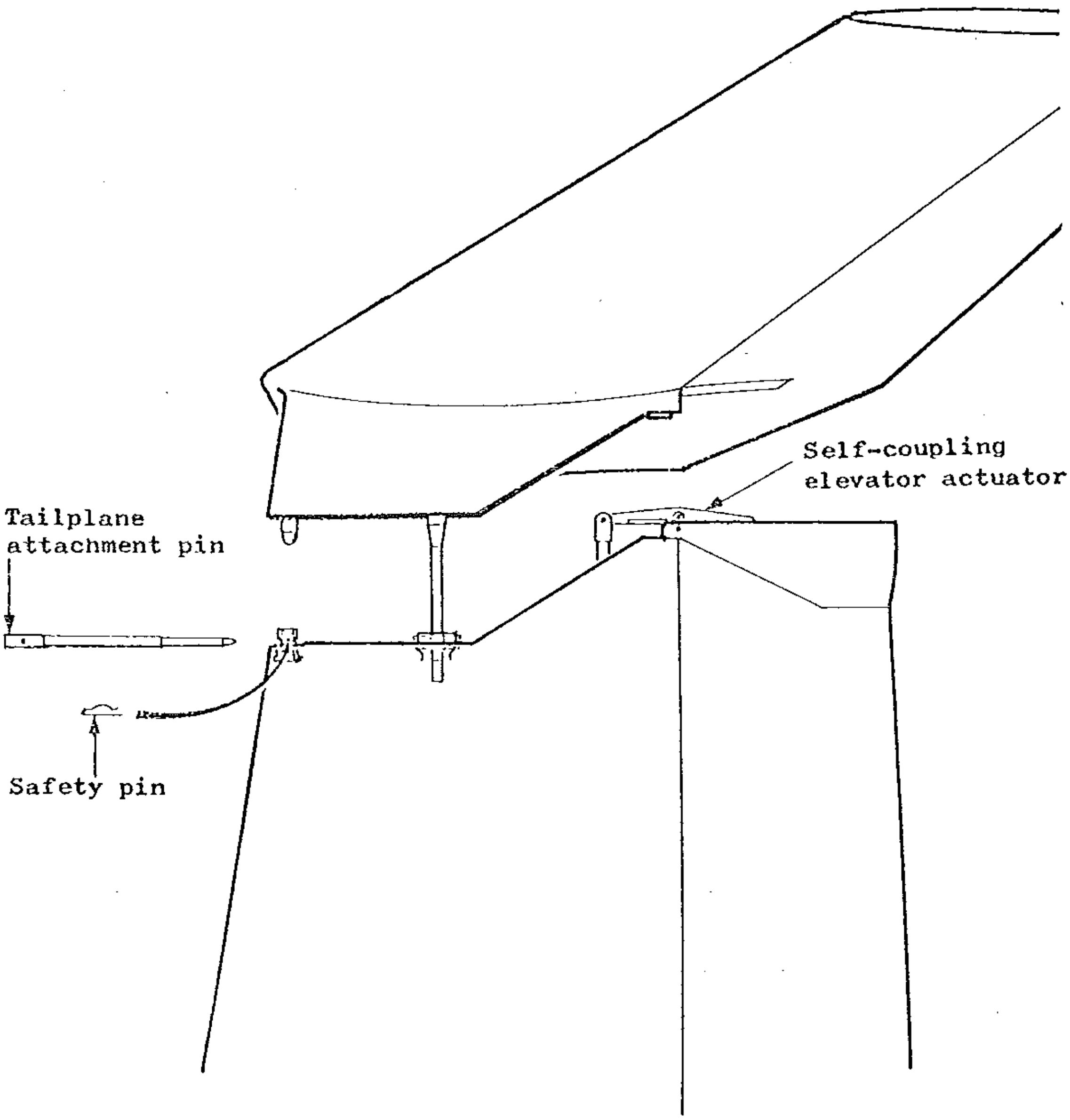
Tapes one and two should be left permanently in position on the wing/fuselage and only the joining layer peeled off/ replaced before de-rigging/rigging the sailplane.

This method of taping the junction prevents any possibility of peeling the Vega paintwork because the joining layer of tape does not come into contact with the paintwork. Extreme caution is necessary when removing the "permanent" tapes or the paint finish will be removed.

The tailplane/fin junction should be taped in a similar manner.

The rigging of the sailplane is now complete.

1.4.3 Tailplane Rigging



1.4.4 Pre-Flight Tests

Having prepared the glider in accordance with the rigging instructions, check the tailplane assembly pin is fully home and that the locking clip is in position. Check the wing rigging pin is in position and held by the lock provided.

Although all the controls are self coupling it is still necessary to check them for full and free movement and also to ensure that there is no free play in the circuits. The rudder cables should also be inspected for signs of fraying.

Level the wings and check the general symmetry of the rigging and the security of the wings and tailplane. Inspect all surfaces for damage .... dents, scratches, cracks, etc., and check the condition of the undercarriage doors.

Before entering the cockpit, check the condition of the seat harness and the security of the anchor points. It is also advisable to ensure the perspex canopy is clean. This normal precaution is important with a canopy of such streamlined proportions if good forward vision is to be maintained. Inspect the seat cushion (if fitted), and adjust the seat back as necessary. Ensure that the seat cushion does not restrict access to the cable release knob. The seat back can be adjusted with the pilot in the cockpit but should the required position be known, it is easier to adjust before occupation of the seat.

The seat back can be removed completely for the 'larger' pilot without loss of pilot comfort. Access to the cockpit is easiest with the flap control in the -8° position.

Having entered the cockpit and strapped in (strapping in before carrying out the cockpit check ensures that everything can be reached comfortably) the cockpit check can be carried out.

The tug pilot should be briefed to avoid jerking the glider at the beginning of the 'take off' run. A smooth initial acceleration is of great assistance to the 'abinitio' Vega pilot. Care should also be taken that the launch cable does not get wrapped around the mainwheel.

Cockpit check prior to take off

B	-	Airbrakes	full, free and correct movement.
C	-	Controls	full, free and correct movement, flap control set for initiation of take-off run.
B	-	Ballast	in placarded limits.
S	-	Straps	secure and comfortable.
I	-	Instruments	checked and set as required.
T	-	Trim	checked and set as required.*
C	-	Canopy	closed and locked by pulling the catch forwards (an audible click is confirmation of locking).

*The normal position is just forward of neutral (1 - 2 cm).

In addition to the normal cockpit check the following adjustments may be made.

Adjust the sliding vent in the canopy as required.

Check the operation of the canopy demister control and set as required for take-off. The filtered system eliminates unpleasant noise or the entry of any extraneous bodies such as sand, grit, etc., during take-off with the vent fully open.

Adjust the rudder pedals as required, by pulling the rudder release and allowing the rudder bar to adjust itself afterwards or press forwards with the feet to the desired position. Release the control handle and ensure the catch is fully engaged, by tapping the pedals lightly with the feet. Note the rudder pedals can only be adjusted symmetrically.

Engage the tow rope and check the operation of the release against a firm pull. Re-engage the rope and check for security.

The aircraft is now ready for 'take off'.

1.4.5 Aero Tow

Ensure the glider is lined up accurately with the intended direction of take-off to obviate the necessity for any early corrections. Hold the control column firmly back to keep the tailwheel in positive contact with the ground. This assists greatly in keeping the Vega straight in the first part of the run.

Any aileron correction required to level the wings during the initial acceleration should be made with care. The markedly 'tail down' attitude of the glider when on the ground means that the initial angle of attack of the airflow is about 10 degrees. Full down aileron deflection brings the wing section close to the stall. To increase the aileron effectiveness the flap lever should be set in the maximum negative flap position (-8 deg. flap).

As the speed increases the stick should be eased forward to lift the tailplane at about 20 knots. Elevator and rudder control are then effective. At 35 - 40 knots the flap lever may then be moved to 0 deg. or +2 deg. flap when Vega will lift smoothly off. Move the lever slowly and deliberately to avoid Vega suddenly leaping into the air.

Vega is stable on the tow and easily controlled. The trim may be adjusted to trim out elevator control forces. In the high tow position the flap may be adjusted to give more forward view of the tug in accordance with your personal preference.

DO NOT ATTEMPT TO RETRACT THE UNDERCARRIAGE WHILST CONNECTED TO THE TOW ROPE AS THE TOW HOOK IS MOUNTED ON THE FORWARD UNDERCARRIAGE LEGS.

Towing at a speed of 65 knots, the glider is comfortable and can be effectively trimmed. The minimum recommended speed for towing is 50 knots; and 55 knots at maximum A.U.W. with water ballast.

Release from the tug is effected by pulling the cable release and no change of trim occurs.

The undercarriage is easily retracted by rotating the lever anti-clockwise out of the down lock position and moving it smoothly to the rear, so retracting both main and tailwheels with the same action. The glider is very quiet with the canopy window and vent closed. However, should any noise persist, check the undercarriage doors have closed up by gently wagging the tail from side to side by gentle movement of the rudder.

1.4.6 Stalling

In all configurations the glider stalls in a completely vice-free manner. Reducing the speed at a rate of one knot per second you are gently warned of the approach of the stall by a slight buffeting. This commencing approximately two knots before the stall occurs.

At the stall in balanced flight, the glider 'nods', lowering the nose and the wings remain level. The ailerons and rudder remain effective throughout and even coarse use of ailerons does not usually cause any tendency to drop a wing.

With the C. of G. fully forward it is difficult to get the glider to remain stalled. But under normal C. of G. conditions with the control column held firmly back the Vega sinks slowly down, still laterally and directionally controllable, until the back pressure is eased to allow the aircraft to accelerate; the stall symptoms immediately disappear.

Standard stall recovery will effect a recovery with a height loss of between 15 and 20 feet.

1.4.7 Stalling in the Turn

Once again there is little or no tendency to drop a wing and in fact reducing the speed at the required one knot per second, it is difficult to get the aircraft to stall. The Vega just wallows round the turn with the speed oscillating between 35 - 40 knots. Recovery is effected by the easing of the backward pressure on the control column and allowing the nose of the glider to depress slightly in order to accelerate to the desired flying speed clear of the stalling range. The ailerons show a reduction in the force required to operate them at large deflections and low speed.

With the C. of G. fully forward it is almost impossible to get the aircraft to stall in the turn by slow reduction of speed.

The stalling speeds, as recorded during flight testing, are as follows:-

(i) Straight Flight (Knots - I.A.S.)

"Flap"	Without Water Ballast		With Water Ballast	
	Buffet	Stall	Buffet	Stall
-8°	42	40	47	-*
0°	42	40	46	44
+8°	38	36	42.5	41
Landing Configuration	38	36	-	-

* It was not possible to achieve a fully developed stall at this weight and C. of G. in the -8° flap gate.

(ii) Turning Flight (Knots - I.A.S.)

"Flap"	Without Water Ballast		With Water Ballast	
	Buffet	Stall	Buffet	Stall
-8^o	42	41	-	-
0^o	42	41	47	45
$+8^o$	38	37	44	43
Landing Configuration	39	38	44	43

The weights and C. of G.'s. used for the stall speed analysis were as follows:

A.U.W. 754 lb at 27.3% A.M.C.

A.U.W. 939 lb at 26% A.M.C. and 180 lb water ballast

(iii) Straight Flight (Km/h - I.A.S.)

"Flap"	Without Water Ballast		With Water Ballast	
	Buffet	Stall	Buffet	Stall
-8^o	78	74	87	-
0^o	78	74	85	82
$+8^o$	70	67	79	76
Landing Configuration	70	67	-	-

(iv) Turning Flight (Km/h - I.A.S.)

"Flap"	Without Water Ballast		With Water Ballast	
	Buffet	Stall	Buffet	Stall
-8^o	78	76	-	-
0^o	78	76	87	83
$+8^o$	70	69	82	80
Landing Configuration	72	70	82	80

1.4.8 Spinning

This glider cannot normally be made to execute a sustained spin. The entry when attempting spinning in the orthodox manner with ailerons neutral, is very gentle. Even with the C. of G. extended aft, it is difficult to achieve more than three quarters of a turn of a fully developed spin.

The aircraft rolls slowly into the spin in a regular manner but the nose drops very positively and the speed builds up rapidly. The spin rotation converts to a spiral dive with associated accelerations and it is necessary to move the control column forward to prevent excessive 'pitch up'.

Unless recovery is taken promptly, this spiral dive could cause undesirable accelerations. Therefore it is suggested that familiarisation with the aircraft's spinning characteristics is useful, but to carry out spinning with the subsequent spiral dive for no specific reason can serve no useful purpose and can only subject the glider to unnecessary 'positive and rolling' g forces.

Entry into a spin with ailerons opposing the spin creates a very slow entry with yawing. The spin progresses similarly to the 'ailerons neutral' situation.

With 'pro-spin' aileron, the sequence of events is similar to the 'ailerons neutral' situation but speeded up in a very positive manner and should only be practised with great care.

Recovery from the initial stage of the spin in any of these configurations is orthodox and rapid: if the spin configuration is held until the glider has entered a spiral dive then recovery takes considerably more height and care has to be taken not to exceed the speed and loading limitations of the aircraft.

1.4.9 Approach and Landing

The effectiveness of the airbrake and its ease of operation coupled with the absence of any 'change of attitude or trim', when operated even in the +8° flap position, makes it an ideal approach control.

Approaches have been made down to 43 knots but 50 to 52 knots should be considered the normal approach speed. Should it be necessary to land at maximum A.U.W. with water ballast, 5 knots should be added to the approach speeds and pilots should be prepared for a little less effectiveness of the controls. Similarly, a slightly faster approach is also desirable in gusty conditions.

Aileron control under normal circumstances remains good throughout the approach to touch down.

Elevator control during the 'round out' is positive and accurate, making it possible to carry out a very smooth 'flare' and consequent reduction of residual height to ground level.

Landing with the C. of G. fully forward particularly in bumpy conditions, should be carried out with extra care.

The wings may be held level during the landing run, using a similar technique to that used in 'take off'. Excessive use of the ailerons once the glider is on the ground, should be avoided.

With very little practice it becomes quite effective once the aircraft is on the ground, to retract the airbrakes and move the flap selector to the -8^{o} position, and then extending the airbrakes again. The wings can then be held level until the glider comes to rest of its own volition or as encouraged to do so by the use of the powerful wheelbrake.

Providing the tailwheel is held firmly on the ground during the latter stages of the landing run, even if the wing tip does strike the ground the likelihood of a ground loop is very small.

1.4.10 Emergency Procedures

These can be divided into three distinct possibilities:-

(i) In Flight:- In the event of having to abandon the glider in flight the safety harness should be removed and the canopy emergency release handle pulled. The canopy will then automatically remove itself from the cockpit leaving the pilot free to bale out.

(ii) Landing with Undercarriage Up:- This may be necessary when landing on a very small area where over-shooting would be dangerous. On a reasonable landing surface little damage would be caused to the glider.

(iii) Ground Looping the Glider:- This action may be necessary when it is not possible to stop the glider, by conventional means, in the distance required to prevent a more serious accident occurring. It is accepted that considerable damage may be done to the glider in a ground loop. The ground loop is effected by pitching a wing tip into the ground and applying rudder to turn the aircraft towards the drooped tip. This is only really effective if the tail is still just flying.

1.4.11 Winch Launch

The aircraft behaves quite normally on a winch launch. A slight push force required on the control column at 'unstick' changing to neutral stick forces during the climb and then to a slight pull force just before release.

Normal crosswinds experienced in winch launching present no problems as the aileron and rudder control remains good throughout the launch.

The minimum recorded speeds for a full climb at 750 lb A.U.W. is 47 knots and at 940 lb A.U.W. 52 knots. The speed of 65 knots is suggested as an ideal control speed although at the maximum permitted launch speed of 70 knots control remains good. The controls being light and positive throughout.

1.4.12 Aerobatics

The Vega is basically non-aerobatic but the following aerobatic manoeuvres are permitted up to 3.5 G with or without water ballast.

Loops, spins, stall turns, chandelles, lazy eights and tight turns.

It is, however, recommended that aerobatic manoeuvres be carried out without water ballast.

The recommended entry speeds for the manoeuvres are as follows:

Loops	105 knots
Stall turns	90 knots
Lazy eights	105 knots
Chandelles	not applicable
Spins	not applicable
Tight turns	not applicable

1.5 OPERATING LIMITATIONS - T.65A.

1.5.1 Weights

Max. take off weight with water ballast	970 lb
Max. take off weight without water ballast	775 lb

Landing with full water ballast is permitted.

C.G. range is 9.25 ins to 13.26 ins aft of datum where the datum is defined as the wing root leading edge with the fuselage datum points horizontal.

Each aircraft carries a weight schedule and loading limitations placard.

Any equipment changes must be recorded on the placard and new loading information computed in accordance with P.32.

1.5.2 Speeds

Flap operating range	*	41 - 135 knots	(76-250 km/h)
Max. rough air speed	*	106 knots	(197 km/h)
Max. aero tow speed		100 knots	(185 km/h)
Max. winch launching speed		70 knots	(130 km/h)
Max. speed airbrakes open		135 knots	(250 km/h)
Normal Operating range	*	48 - 106 knots	(89-197 km/h)
Lowest recommended approach speed	*	48 knots	(89 km/h)
Weak Link		1000 lb	

Cloud flying provided turn and slip, variometer and magnetic direction indicator are fitted.

Non Aerobatic

The following aerobatic manoeuvres only are permitted

Loops, Spins, Stall Turns, Chandelles,

Lazy Eights and Tight Turns up to 3.5 G

* 135 knots denoted by a radial red line on the airspeed indicator

106-135 knots denoted by a yellow arc on the airspeed indicator

41-135 knots denoted by a white arc on the airspeed indicator

48-106 knots denoted by a green arc on the airspeed indicator

48 knots denoted by a yellow triangle on the airspeed indicator

1.5.3 Pitot Static Error.

The pitot static error is insignificant throughout the speed range with a maximum reading error of 2 knots below the actual air speed value.

2. REPAIR MANUAL

1.6 WEIGHING SCHEDULE AND COCKPIT LOADS

1. The aircraft must be in the rigging position with the fuselage datum points horizontal

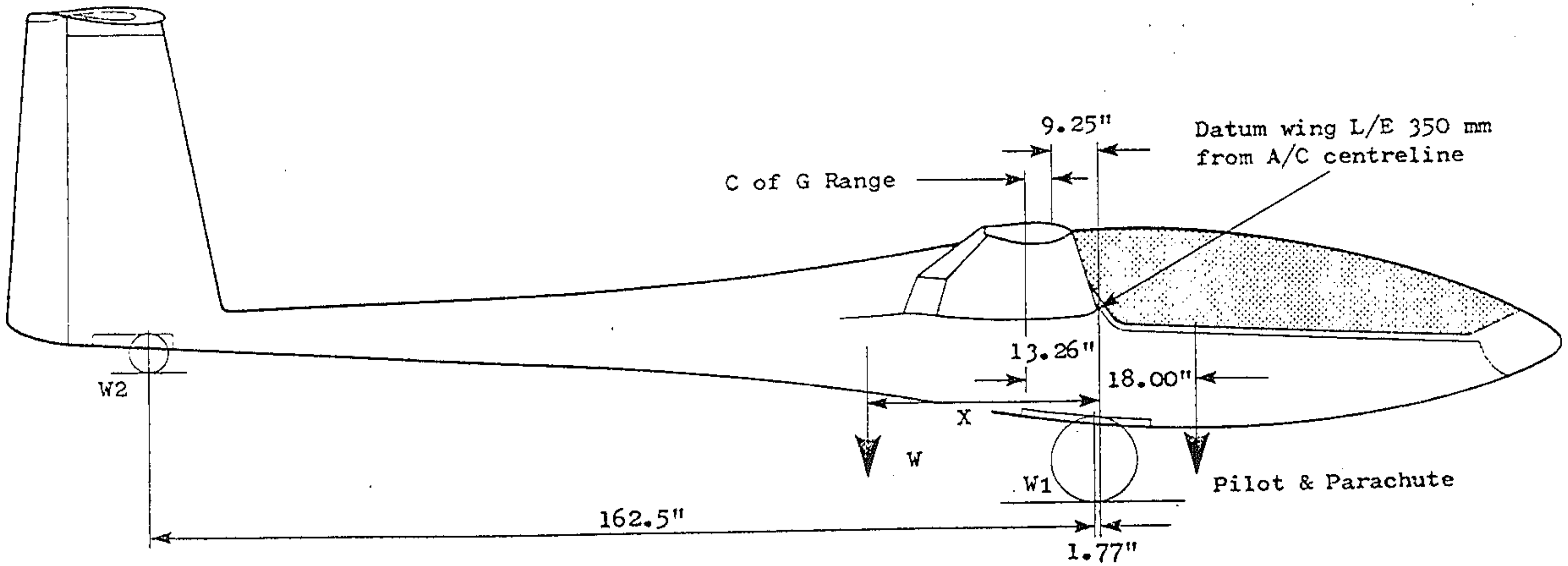
2. Empty weight: $W = W1 + W2$

3. Empty C of G: $X = \left(\frac{W2 \times 162.5}{W1 + W2}\right) + 1.77''$ aft of datum

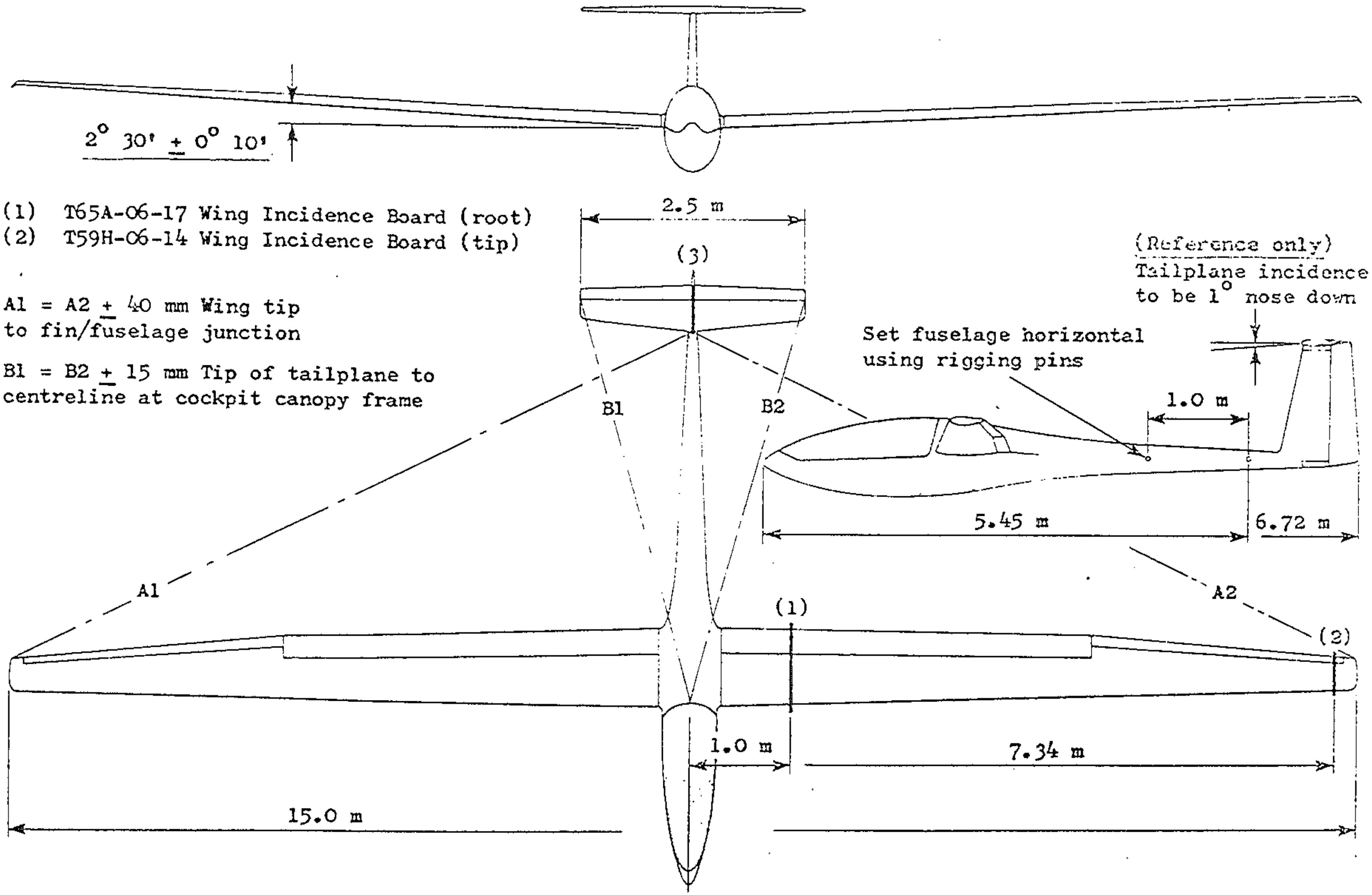
4. Minimum cockpit load $= \frac{W(X - 13.26)}{13.26 + 18.00}$ lb

5. Maximum cockpit load is minimum of $775 - W$ lb and or $\frac{W(X - 9.25)}{9.25 + 18.00}$ lb

The use of water ballast is permitted but the maximum all up weight of 970 lb must not be exceeded



1.7 RIGGING DIAGRAM

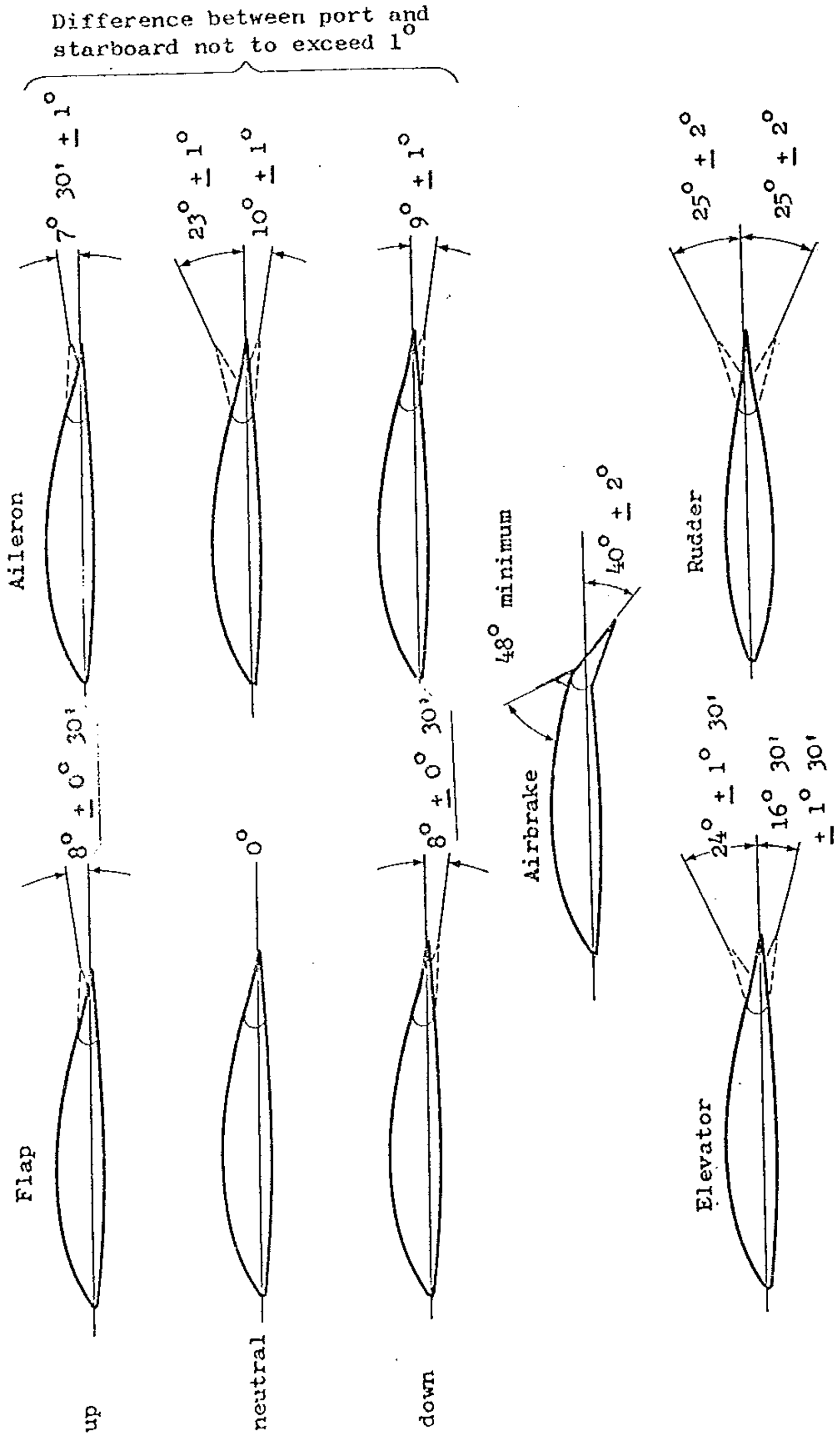


(1) T65A-06-17 Wing Incidence Board (root)
(2) T59H-06-14 Wing Incidence Board (tip)

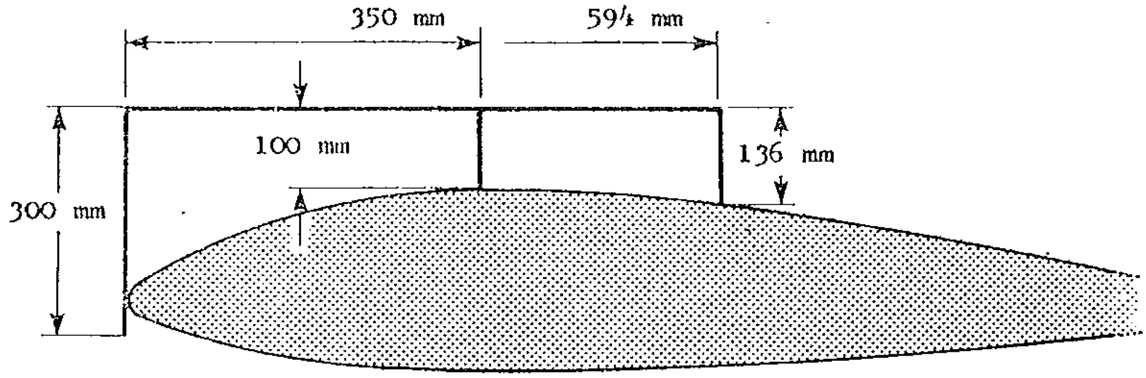
A1 = A2 ± 40 mm Wing tip to fin/fuselage junction

B1 = B2 ± 15 mm Tip of tailplane to centreline at cockpit canopy frame

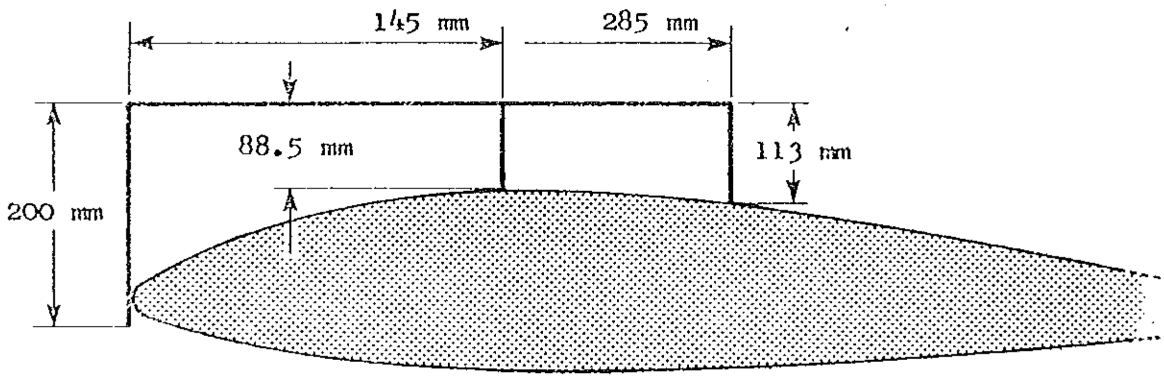
1.8 CONTROL SURFACE MOVEMENTS



1.9 INCIDENCE BOARDS



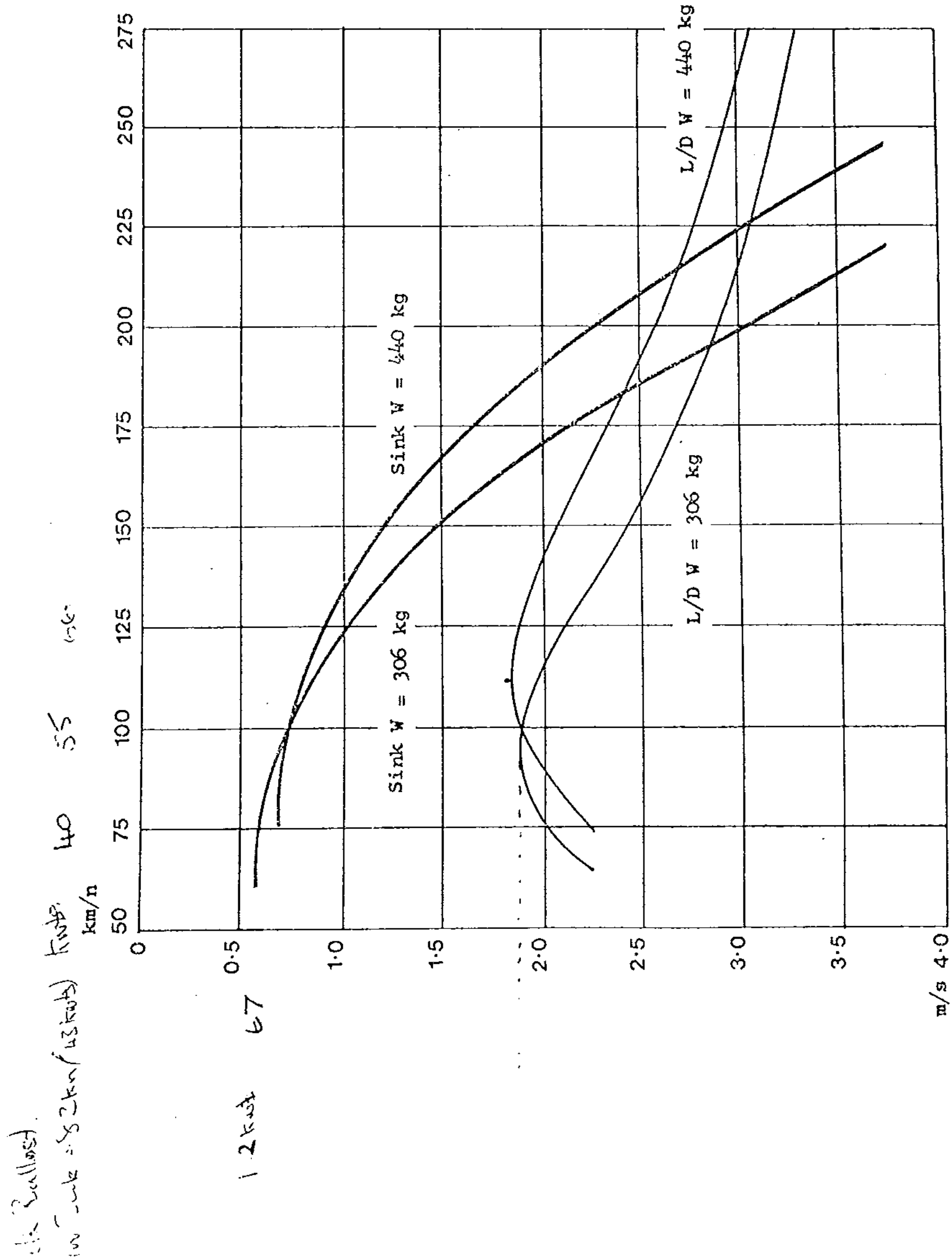
(1) T65A-06-17 (wing root)



(2) T59H-06-14 (wing tip)

See Rigging Diagram for locations

1.10 PERFORMANCE CURVE



INTRODUCTION

Glass fibre gliders have a load carrying, stressed skin method of construction. This means that any skin damage weakens the structure and must be repaired before further flying. Following any sort of an accident the glider structure should be systematically checked for damage before it is flown again.

Small holes in the wing or fuselage skin are easily repaired, and the techniques required are fully explained in this manual. If the damage is extensive and large areas of the structure are destroyed, then this manual will be of little value. In cases like this the glider should be returned to the manufacturer for professional attention.

The manual is divided into three parts:

1. An introductory section outlining some general topics to be noted when using glass fibre materials.

2. A repair section detailing repair techniques for the different glass fibre structure types.

3. A materials section giving details of the materials specified in the manual for repair work.

All the materials specified in the manual are obtainable from the Company. Any materials supplied will have been inspected and passed as conforming to the standards required for aircraft work.

2.1 GENERAL SECTION

2.1.1 Introduction to Glass Fibre

Glass fibre composites have two basic constituents, the glass fibres and a surrounding plastic matrix. The fibres reinforce the plastic matrix and carry most of the applied load. The matrix gives the composite its rigidity and protects the fibres from moisture or chemical attack during service.

Glass fibres, are generally woven into a fabric, which gives a regular orientation to the fibres and enables them to be handled more easily.

To produce a glass fibre laminate, successive layers of the fabric are placed into position and impregnated with resin. The liquid resin solidifies within a few hours, and after post curing at elevated temperature, forms a strong matrix around the fibres.

Using this technique, intricate shapes can easily be formed with the load carrying filaments orientated in the best possible manner. Furthermore, because glass fibre is built up in layers it is possible to locally reinforce the laminate and mould in load bearing fittings, etc.

Types of Glass Reinforcement - After production of the basic glass fibres, numbers of continuous filaments are gathered together to form a collection of parallel fibres known as a roving.

Glass fabrics are made by weaving rovings together. Depending upon the closeness of the weave and the number of rovings in each weave of the fabric different weights per unit area may be woven.

There are two main types of bidirectional glass fabrics. Plain weave has an over one and under one configuration (Fig. 1) and is used for most flat surfaces. Twill weave has an over two under two configuration (Figs. 3 & 4) and is used where a good drapeability around compound curve shapes is required.

A unidirectional glass fibre fabric has the majority of the glass fibres lying parallel and in one direction with only enough transverse fibres to hold the fabric together (Fig. 2).

Rovings may also be used either individually or grouped together to give a fully unidirectional composite.

Chopped strand mat has random short fibres lightly held together with a binder. A laminate of this material is heavy and of low strength compared with one of woven fabrics. As a result it is little used in glass fibre gliders.

<u>The Resin</u> - Most laminating resins come in two liquid parts, a basic resin and a hardener.

Once hardener is mixed with the basic resin a chemical reaction begins and the mixture begins to solidify.

The proportion of hardener to resin is absolutely critical, since the cured strength depends upon it. An excess of hardener in the mixed resin is as damaging as a deficit. In both cases the cured resin will have an incomplete molecular structure and poor physical properties as a result.

The temperature of the resin mix affects the rate at which the curing reaction occurs. If the temperature is too low the resin will be too thick to work and will drain out of the laminate before solidification occurs. Ambient temperature and humidity requirements are specified by the resin manufacturer.

The length of time before a mix of activated resin begins to solidify (pot life) is dependent upon the temperature, and the quantity of resin. Once the resin becomes thick and stringy, the curing process is well on its way. Resin in this state should not be used since the cured strength properties will be seriously degraded.

Once the resin has hardened, post curing at elevated temperature is required for the resin to gain its full strength. If a large enough oven is not available, a hot air tent should be constructed around the repair with a thermometer measuring the average temperature inside the tent.

Liquid resin is soluble in Acetone and Methyl Ethyl Ketone (MEK). Either of these solvents may be used to clean wet brushes or remove clothing stains, etc. (Note: many man-made fabrics are also soluble in Acetone or MEK). Once the resin has cured, it is absolutely neutral. It will not swell or shrink with changes in climate and is only attacked by a few chemicals.

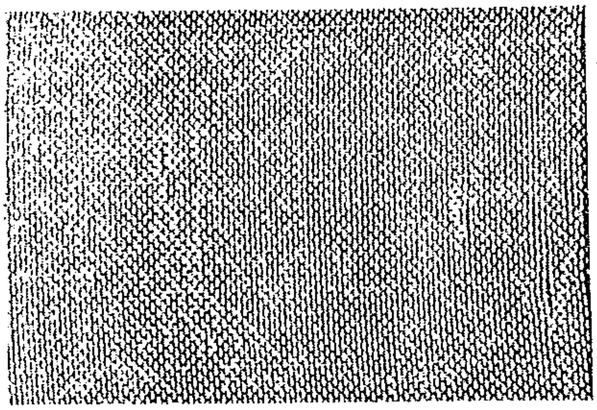
Gel Coat - A one coat white pigmented gel coat is incorporated in the moulding process to effectively seal the glass fibre mouldings. It also provides a very smooth base on which to spray finish the mouldings after final assembly.

Paints - The paint finish which is sprayed directly onto the gel coated mouldings consists of an epoxy primer and a white semi-gloss acrylic finishing coat.

The epoxy primer is selected for its excellent adhesion properties whilst the acrylic finishing coat (which also has fine adhesion properties) is primarily selected for its excellent weathering properties.

2.1.1 Fibre Glass Woven Reinforcements

Fig. 1.

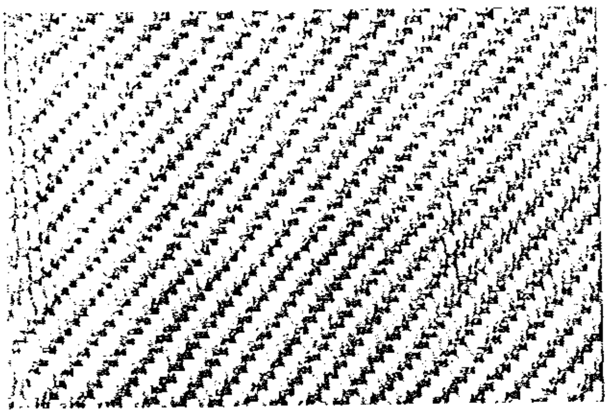


Interglas 90070
Plain Weave
78 gms/sq. metre

Fig. 2.

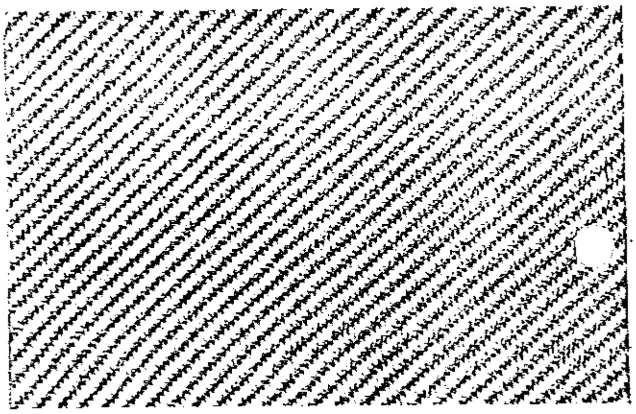
Interglas 92145
Unidirectional Plain Weave
210 gms/sq. metre

Fig. 3.



Interglas 92125
Twill Weave
280 gms/sq. metre

Fig. 4.



Interglas 92110
Twill Weave
160 gms/sq. metre

The pictures above show the cloth as seen when held up to a strong light. A cloth sample from the damaged area should be held to a strong light after the resin is burnt off for identification.

2.1.2 Storing of Glass Fibre Materials

Resin - Most laminating resins have a limited shelf life which is specified by the manufacturer. In general they should be stored in airtight tins at a cool temperature. The resin should be allowed to warm to workshop temperature well before use.

Hardener - Hardeners generally react with oxygen in the air so must be stored in airtight containers. Some hardeners may crystalise if they become cold. To liquify the hardener it should be warmed and then allowed to cool to room temperature.

Glass Fabric - Glass fabric should be stored in a warm dry atmosphere. In order to preserve the fibre surface treatment it must not get damp.

Before use it is recommended that the fabric is heated to 45°C in an oven to drive off any moisture that may be in the fabric.

Acetone, MEK, etc. - Both Acetone and MEK are highly volatile and inflammable. Containers must therefore be tightly sealed and kept at a low temperature.

2.1.3 Useful Tools for Glass Fibre Work

1. Brushes of 1" width to 3" width.
2. Clean splints of wood for stirring, etc.
3. Scissors.
4. Number of tin cans to hold solvents for brush cleaning, etc.
5. Unwaxed paper cartons or tin cans to hold quantities of resin.
6. Sanding blocks of various sizes and shapes.
7. Sharp trimming knife.
8. Hacksaw blades wrapped with tape at one end to form a handle.
9. Selection of hand files.
10. Weighing scale which is accurate to within one gramme.

2.1.4 General Safety Precautions when using Glass Fibre

Most resins are irritant to the skin. Many people are allergic to the resin and repeated skin contact can produce serious damage. If symptoms of an allergy appear when the resin is used, further contact should be avoided, and the symptoms will slowly fade away.

Direct skin contact with the resin should be avoided and rubber or plastic gloves worn when there is a possibility of the hands becoming severely contaminated.

The resins and solvents used in glass fibre are all poisonous so every precaution should be taken to keep them away from food. The face and especially the eyes should also be protected from resin and its solvents.

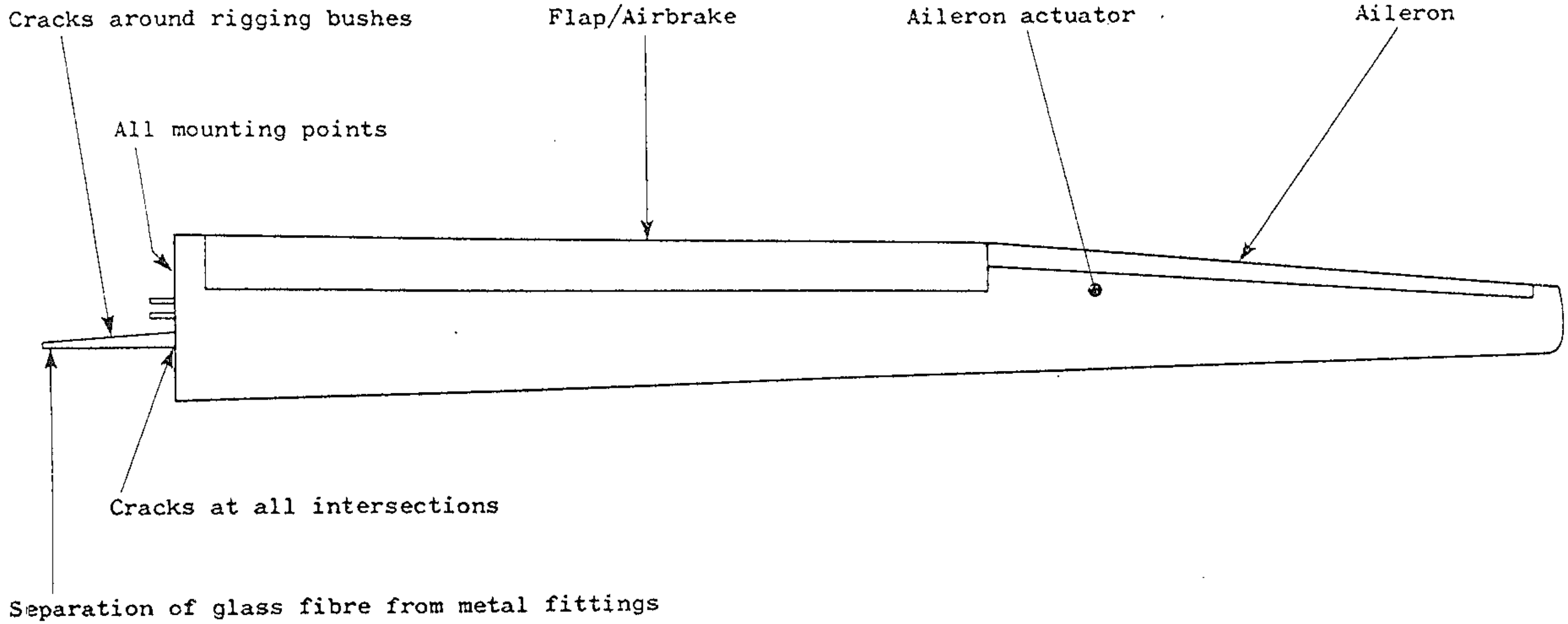
If a rotary grinder is used on a glass fibre laminate, much glass and resin dust will be produced and a respiratory mask should be worn for protection. The same dust is likely to cause an irritant skin rash to develop on the forearms, especially when glass fibre is being hand sanded. The arms should be washed in soapy water and the operator should avoid scratching, especially while dust is lying on the skin.

2.2 REPAIR SECTION

2.2.1 Wing Check Procedure

General
Look along the wing for dents, creases, etc. Fibre glass damage is mainly seen as cracked paint and gel coat and white blushes in the glass cloth. White blushes show as dark patches when a light is shone through single skin laminate. Check all hinges, pivots and attachment points for free play.

Note:
Small hairline cracks may occur at places where filler putty has been used, such as the leading edge and wing root joints. These are usually unimportant and only if such a crack suddenly grows should it be examined fully by removing the paint and gel coat and looking for signs of damage in the fibre glass.



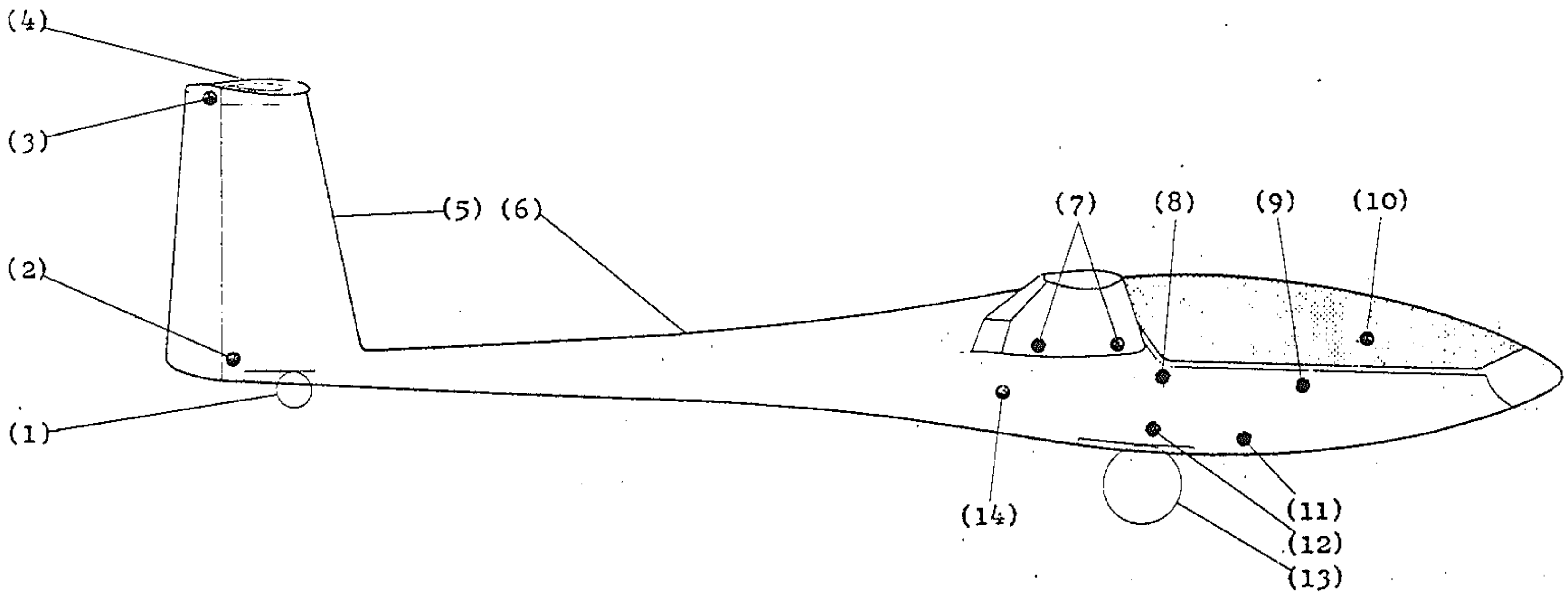
2.2.2 Fuselage Check Procedure

GENERAL

Fibreglass damage is mainly seen as cracked paint and gel coat and white blushes in the glass cloth. White blushes will show as dark patches when light is shone through single skin laminate. Check all hinges and attachments for free play and difficult movement or assembly.

KEY

(1) Tailwheel - check for wear
(2) Rudder drive
(3) Rudder hinge
(4) Tailplane attachments - check for free play
(5) Fin joint line
(6) Fuselage joint line
(7) Wing pick up points
(8) Harness
(9) All controls - check freedom, free play and mountings
(10) Instruments - check for correct operation
(11) Harness attachment
(12) Wheel box - check fibreglass around moulding
(13) Undercarriage - check thoroughly after heavy landing
(14) Roving array in centre fuselage skin - check for general fibreglass damage



2.2.3 Repairs Necessitating Manufacturer Liaison

This section describes particular areas of damage where liaison with the manufacturer is required before a satisfactory repair can be made.

Non Repairable Areas - The non repairable areas relevant to this particular glider are illustrated overleaf. In these areas only very minor repairs, e.g. small skin punctures, etc., may be made by a non approved repairer. Any other repairs must be referred to the manufacturer.

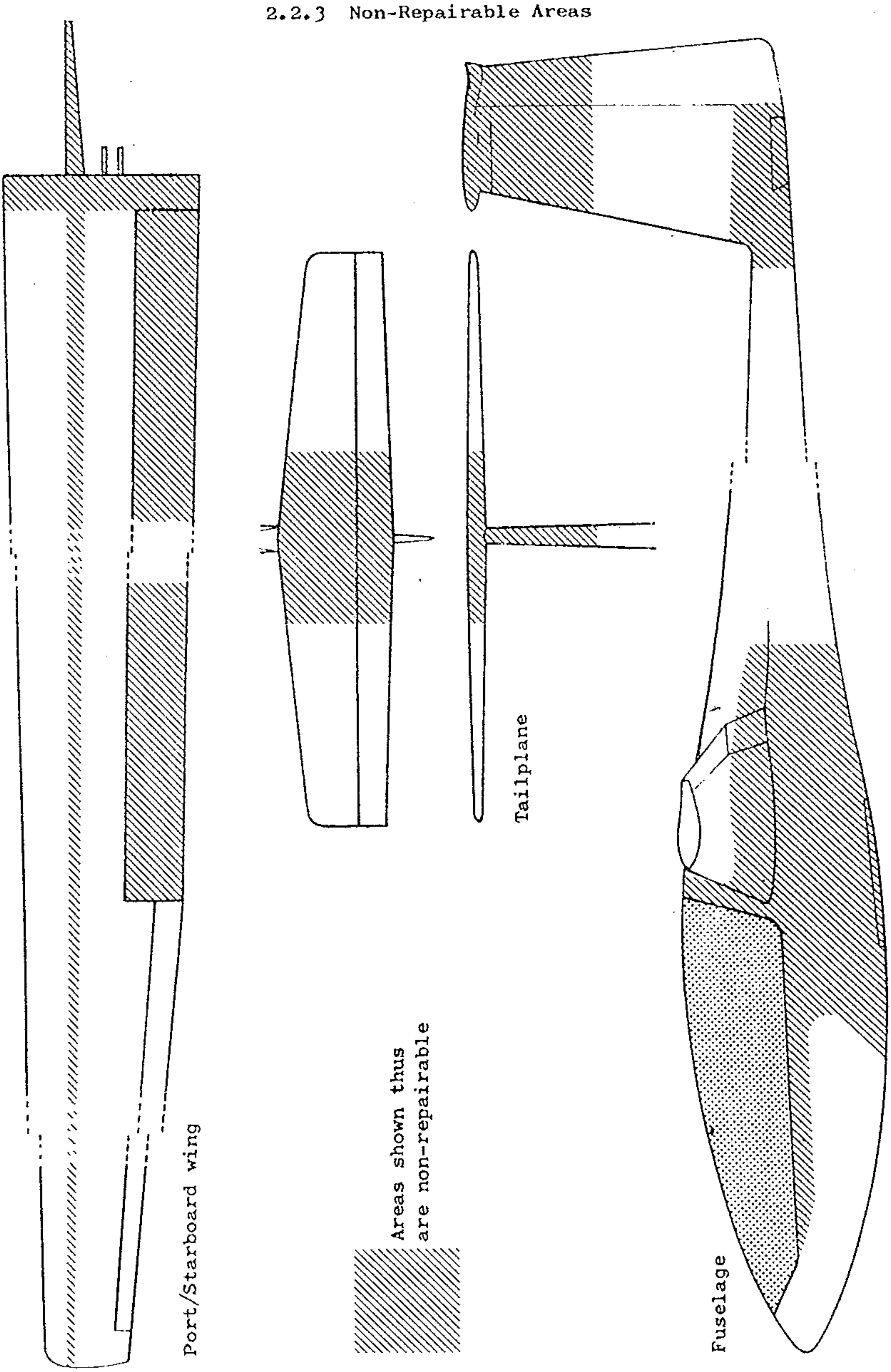
Extensive Skin Repair - If large areas of skin require repair, it will be difficult to reform the correct surface profile without proper rigid moulds. Also the structure may be weakened by the extensive removal and repair of load bearing skin.

Repairs Involving Fabricated Glass Fibre Components - In a repair of this nature, manufacturer's drawings of the area involved should be obtained.

Repairs, Involving Glass Fibre Rovings - Generally these areas may be repaired by the manufacturer only. To determine the repairability and exact method of construction full details should be submitted to the maker.

Fittings Requiring Jigging for Positional Location - Fittings that are torn from position may require special jigging to ensure they are correctly located relative to neighbouring components.

2.2.3 Non-Repairable Areas



2.2.4 Strength Considerations of Glass Fibre Repairs

The strength of a glass fibre repair is generally dependent upon the bond strength of the repair to the original structure. Since the repair receives its working loads through this bond it is imperative that every effort is made to ensure a perfect connection.

Correct surface preparation of the bond area is vital. Section 2.2.6 gives details of the necessary procedure.

Local areas of poor bond strength within a larger bond area give rise to stress concentrations which can initiate failure of the bond. For this reason no air bubbles must be trapped between the adhering surfaces. If the first layer of a patch is oversize and no attempt is made to trim it down (ref. section 2.2.7 para. 6) a poor bond area may exist at its boundary. This can be serious, since the resulting stress concentration may initiate a peeling failure which would quickly propogate throughout the bond.

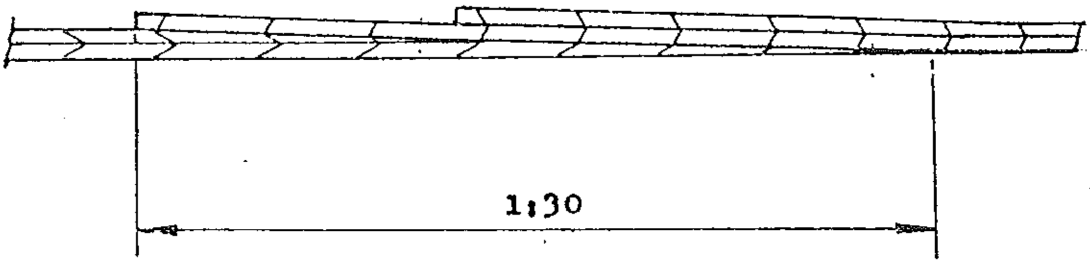
A patch repair that is much stiffer than the surrounding structure will also generate a peeling stress on its bond boundary. To minimise this effect the edges must be feathered off and the patch thickness built up gradually. Correct splicing and smoothing of the repair will ensure that this happens. Repairs to sandwich structures should have matching core materials between the replacement and the original in order to prevent any large differences in stiffness. For the same reason the number of cloth layers in a repair should be similar to the original.

Splicing of glass fibre joints is necessary to reduce stress concentrations and limit the bond tensile stress. The minimum splice angle is 1:30 (Fig. 1). At the corners of a spliced joint oversize patches can cause resin rich areas to occur (Fig. 2) which may initiate bond failure. A correctly trimmed patch does not have any tendency to form these resin rich areas (Fig. 3).

A study of the repair sections will show that one layer of cloth is recommended to finish most repairs. This extra layer of cloth is used to reinforce the edge joint and also provides allowance for any damage to the surface fibres when finish-sanding the surface. 90070 or similar thin cloth should preferably be used for this layer, so that when the repair is finished with gel coat, the slight hump due to the extra layer cannot be detected.

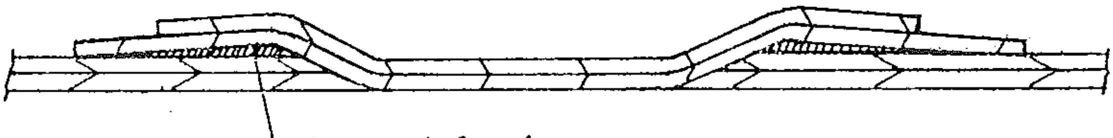
Joints between pieces of cloth in the same layer should be overlapped by at least 30 times the layer thickness. If laps of this type occur in successive layers, they should be staggered to prevent two occurring together.

2.2.4 Jointing Techniques



Correctly Spliced Joint

Fig.1

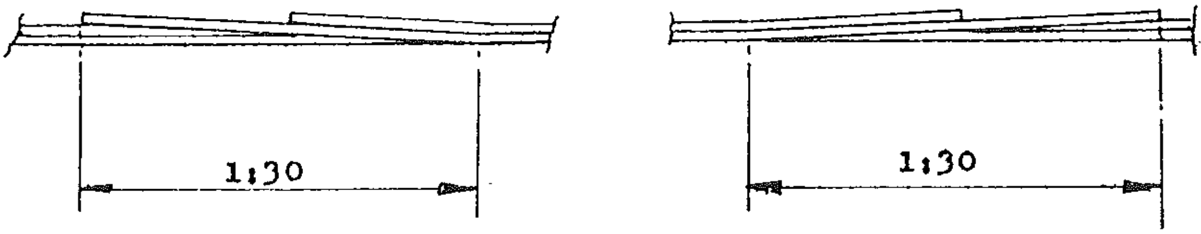


Oversize patch gives
resin rich area

Bad Jointing Technique

A. Oversize patch
B. Incorrect splice angle

Fig.2



Good Jointing Technique

A. Patch is no larger than chamfered area
B. Cloth edges correctly staggered
C. Correct splice angle

Fig.3

2.2.5 Preparation of Glass Fibre Repairs

This section describes the preparatory steps which are common to most types of repair.

1. The location of the repairs should be noted and their relationship to non repairable areas. If anything other than a minor repair is required in these areas the manufacturer should be consulted.

   Cracks in the paint/gel coat finish indicate severe straining of the glass fibre structure at that point. To determine whether the glass fibre is damaged, it is necessary to remove the paint and gel coat by grinding it away or carefully chiselling and peeling off. If the glass fibre shows signs of over-straining, (white cracks in the structure) the affected area should be cut out and the damage treated as a hole.

2. The structure type to be repaired, should be ascertained, also whether the area is accessible from both sides. The relevant sections describing the repair may now be selected.

3. Small samples of material from a known position on the damaged area are now analysed to determine the structure of the original laminate. The samples are fired on one edge with a match or cigarette lighter. This burns off the resin and allows the individual fabric layers to be separated. The weight and fibre direction of each layer may now be

determined and related to the parent laminate. Notes should be taken so that the repair will be identical to the original laminate. If the structure utilises a core material, the type and thickness should be noted. The core material will normally be a rigid acrylic foam which is white in colour.

4. The damaged area should be cleaned and then cut back until sound material is reached. No evidence of whitening or cracking must be allowed to remain, and the hole to be repaired should have no sharp corners.

5. The presence of internal controls, fittings or structure in the damage area should now be noted. Any control linkages, bearings, etc., should be taped to keep out glass dust and surplus resin, etc.

6. The patch edges are now prepared according to the repair section being followed. Any surface that will have glass fibre bonded to it must be prepared according to section 2.2.6 section A. When preparing a chamfered edge the sanding direction should be towards the tip. The prepared edges should be examined for any signs of delamination, which must be removed by further sanding.

7. The inside of the structure should now be cleaned out and any loose pieces of glass fibre or accumulations of dust removed.

8. The repair should now continue according to the particular repair section being followed.

2.2.6 Surface Preparation for Glass Fibre Laminates

Surface preparation to ensure a good bond - Section A

Fibre Glass Surfaces

1. Degrease the area to be worked upon. Thoroughly abrade the area to remove any gel coat, paint, etc., and expose a fresh surface. The principle of this abrasion is to remove the top film of resin from the glass and slightly roughen the glass fabric such that it becomes whiskery. Care should be taken to ensure that too much of the glass reinforcement is not abraded away.

2. Remove any dust with a clean cloth.

3. Degrease the newly exposed surface to remove any possible traces of wax or grease. A clean cloth saturated with clean Acetone should be used to wipe the surface.

4. The Acetone must be allowed to evaporate off from the surface. Careful use of an hot air blower is recommended to drive off any traces of Acetone that may be trapped in the surface fibres.

5. Having cleaned the surface it should be used as soon as possible.

Metal Surfaces

1. Degrease the surfaces to be bonded.

2. Roughen the surface with a file or very coarse clean glass paper. The ideal is to grit blast just before bonding.

3. Degrease the surface with Acetone, just before bonding.

Surface preparation to ensure a good release - Section B

1. The moulding surface should be undamaged and free from surface imperfections, chips, etc.

2. The surface should be polished with a non-silicone wax polish (see section 2.3.7).

3. Release agent is then carefully brushed or sponged on and allowed to dry.

4. If required, activated gel coat is now brushed onto the mould surface and allowed to become just dry.

5. The mould is now ready for laminating.

WOODEN SURFACES.

1. THE WOOD SHOULD BE CLEAN & FREE FROM GREASE, PAINT, POLISH, ETC., AND SHOULD BE ABRADED WITH COARSE GLASS PAPER TO LEAVE A ROUGHENED SURFACE.

2.2.7 The Technique of Laminating Glass Fibre

This section describes the best technique of laminating with glass fibre.

1. Using shaped paper templates all the requisite pieces of cloth are cut out.

2. The workshop temperature must be at least 23°C and relative humidity not more than 65%.

3. The bonding surface must be prepared according to section 2.2.6 Section A.

4. The quantity of resin required should be estimated and the correct proportions (ref. section 2.3.2) of hardener and resin mixed together in a clean container. There must be no possibility of the container contaminating its contents. For this reason unwaxed paper cartons are recommended. Until experience is gained the maximum quantity of resin mixed at once should be limited to 150 gms. If the resin is for structural repair work a small sample (about 1 cc) of the mixed resin is now cast into a container fashioned from aluminium foil. The sample should be labelled and placed aside to cure for inspection later (ref. section 2.2.9).

5. Brush a coat of resin onto the prepared surface, place the first layer of cloth upon it and stipple the cloth into the resin, ensure that all air bubbles are worked out and that the cloth weave pattern is not disturbed. If the brush is

very slightly wet with resin during these stippling actions it will be found that the cloth will wet out quickly, will not stick to the brush and the resulting slight surplus of resin will be enough for the next layer. Beware of using too much resin since this results in a heavy repair. Ideally there should be just enough resin in the laminate to wet out the cloth. When glass cloth is correctly wet out the glass fibres are almost invisible.

6. The edges of the cloth must be trimmed to ensure that the patch only covers the correct area. To trim the patch, lift the edges and remove the excess with a sharp pair of scissors. Re-stipple the edges down again.

7. Each subsequent layer of cloth is then positioned and stippled into the preceding layers, (trimming if necessary) until the laminate is complete.

8. When laminating has finished, the repair must be allowed to cure without any further disturbance.

2.2.8 Pre-Wetting Glass Fibre

(A) Cloth

There are a few laminating jobs on glass fibre gliders where the use of pre-wetted cloth is expedient. Glass cloth is laminated on flat cellophane or plastic film (up to four layers may be laminated at once). The pre-wetted cloth is then transferred to the job and stippled in place, the plastic film being peeled off as stippling proceeds.

Pre-wetted cloth simplifies the job of laying cloth in awkward places, but it must be done with care and the following points noted.

1. Care must be taken to ensure that the pre-wetted cloth will have a good bond to the parent material. The bond area must be prepared according to section 2.2.6 section A, and just prior to laying up should be wet with resin.

2. The plastic backing film should be peeled off as the cloth is being laid, because with it in place the cloth laminations cannot assume a double curvature or irregular shape.

3. It is not easy to see if air bubbles are below a number of layers of cloth but it is important to ensure that none are trapped.

4. The edges of the cloth layers must be staggered so that there is not an abrupt end to a number of layers.

(B) Unidirectional Rovings

In a number of repairs glass fibre ropes are used where high loads are carried (e.g. around bearing housings and cut-outs).

Ropes are usually made up of a number of rovings. The number of individual rovings which go to make the ropes will be called up on each individual repair.

1. The required number of rovings are cut to their correct lengths.

2. The rovings are laid up on a sheet of flat polythene or formica. Hold one end of one roving and stipple along the length of the roving with a resin impregnated brush. Take hold of an end of the next roving, keeping hold of the first roving. Stipple this second roving with a resin impregnated brush.

3. Pull the two rovings between the finger and thumb of the right hand to squeeze out any excess resin and to keep the fibres of the rovings together.

4. Add a further roving to the rope and impregnate it in the same way as before. Squeeze out the excess resin.

5. Repeat this process, adding rovings to the rope until the desired number has been reached.

2.2.9 Inspection of Glass Fibre Repairs

Whenever freshly laminated glass fibre has set hard it should be inspected for defects before any further work is done upon it. This section describes the points to be checked.

1. The laminate must have cured hard in the correct period of time. If the laminate has not set, incorrect mixing proportions or too low an ambient temperature will be the cause.

2. There must be no air voids in the laminate, particularly at the bond between the original structure and the repair laminate.

3. The laminate must show no signs of insufficient wetting out, i.e. no white fibres visible in the laminate.

4. The resin cast samples associated with the repair should have cured hard in the correct period of time. After 8 hours post curing at 54°C the resin samples should be hard and brittle. If they are still rubbery the resin was mixed incorrectly.

If any of the above defects are present the laminate must be rejected and carefully stripped from the original structure ready for a fresh attempt at the repair.

2.2.10 Finishing Glass Fibre Repairs

In general, most repairs will not have a moulded surface and require painting with gel coat/paint and polishing to match the surrounding surface. The sequence of operations is as follows:-

1. The rough edges of the repair should be sanded off and blended in with the surrounding surface.

2. The laminate surface is now abraded. Care must be taken not to damage too many of the surface fibres. Laminated glass cloth has a rough surface texture due to the fabric weave. To eliminate the weave texture, polythene film may be smoothed over the finishing laminate whilst it is still wet. When the laminate has hardened and the cellophane is removed it will be found that a smooth surface results which may be lightly abraded without damage to the surface fibres.

   If it is necessary to remove any humps caused by cloth creases, etc., then it is likely that the fibres will be completely cut through and in this case a further repair to the cloth damage is required.

FOR PAINTED SURFACE 3.A THRU 8

3.A A thin layer of activated gel coat is now painted over the abraded surfaces and allowed to ~~cure hard.~~ JUST DRY. # SEE 3B

4. Preferably all repairs should now be post cured. However, if the repair is only of a minor nature post curing is unnecessary.

FOR GELCOAT FINISHES 3.B

3.B. A SECOND COAT IS NOW BRUSHED ON AND ALLOWED TO CURE HARD. NOW SAND GEL COAT SMOOTH, LEAVING SURFACE FREE FROM IMPERFECTIONS AND WITH A GOOD DEPTH OF COLOUR. IF FURTHER COATS ARE REQUIRED REPEAT FROM 3.A AFTER LIGHTLY ABRADING IF A CURED SURFACE IN ORDER TO PROVIDE A KEY.

NOTE. ALL REPAIRS SHOULD BE "POST CURED." UNLESS OF ONLY A MINOR NATURE

FINALLY. POLISHING SURFACE COMPARABLE WITH SURROUNDING UNDAMAGED AREA

5. If required, a cataloy type filler can now be applied to the repair area to bring it level with the surrounding surface. The gel coat surface should be lightly abraded prior to applying the filler.

6. The epoxy primer can now be brushed over the repair area and allowed to dry.

7. Apply the finishing coat of acrylic paint with a brush.

8. Normal polishing operations can now be applied, e.g. 'T' cut compound.

2.2.11 Single Skin Repair

This section describes the repair techniques for single skin damage, where the damage is accessible from one side only.

1. Work through section 2.2.5.

   The edges around the hole to be repaired should be chamfered at an angle of 1:30 minimum.

2. To provide support for laminating the patch, the hole must have a backing piece attached to the non-accessible side. The backing piece is cut from thin plywood or rigid foam and if possible should be about 25-50 mm larger all round than the hole. It is passed through the hole and bonded with cotton flock to the "blind" side of the laminate as shown in Fig. 1.

   Plywood will not conform to any compound curve without treatment, so rigid foam sheet should be used for the backing piece if the area has compound curvature. In cases of severe compound curvature shaped balsa blocks or a preformed backing piece must be used. A preformed backing piece can be made from the glider by using the opposite symmetrical position as a mould. A single layer of cloth is laminated on the opposite symmetrical position to the damaged area and when this is released and turned inside out it becomes the required preformed backing piece. If the single layer is lacking in stiffness extra layers of cloth may be laminated onto the preform but care must be taken not to distort it from the true shape; and in this case the edges should be chamfered at an angle of 1:30 before bonding it in place.

3. When the cotton flock has cured the clamping wires and supports are removed.

4. The repair is now laminated as described in section 2.2.7. Only the same number of layers as the original are laminated at this stage, (Fig. 2).

5. The repair is inspected according to section 2.2.9.

6. The patch is now prepared for the finishing layer as follows:-

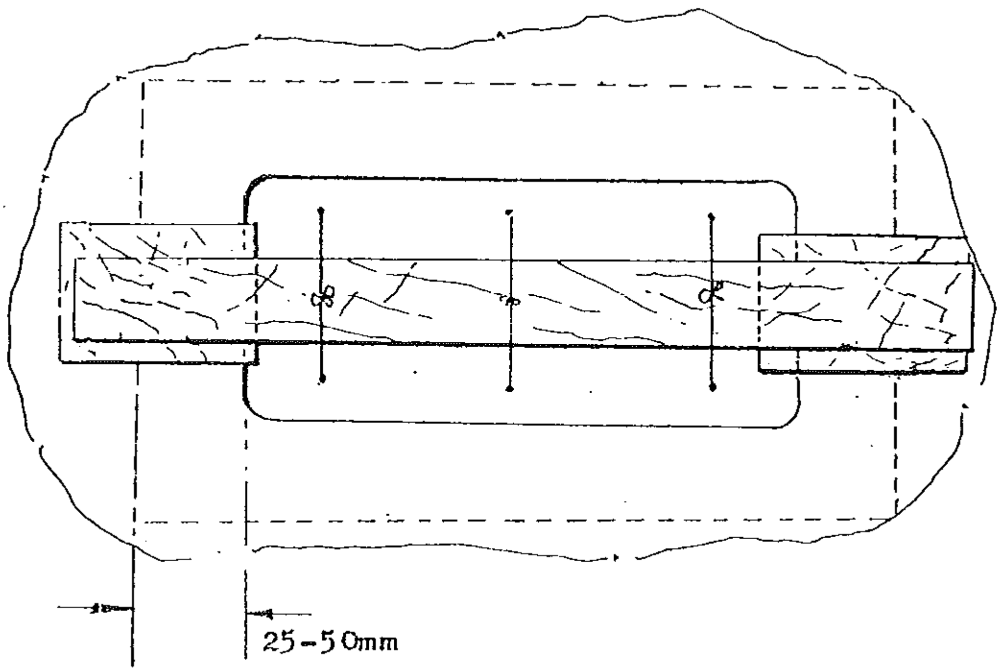
   (i) Rough edges sanded flush.
   (ii) Surface abraded ready for further laminating.
   (iii) Surrounding 50 mm gel coat ground off.

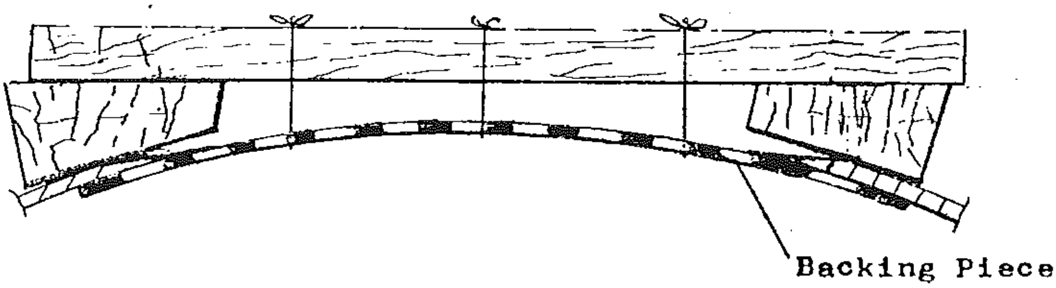
7. The finishing layer of cloth is now laminated as shown in Fig. 3 and polythene smoothed over the wet surface. The finishing cloth should be 90070 or similar thin cloth. A heavier cloth will require more work to produce a smooth invisible repair.

8. When the finishing layer has hardened, remove the polythene and inspect according to section 2.2.9.

9. The repair is now finished according to section 2.2.10.

2.2.11 Single Skin Repair - Accessible from one side only



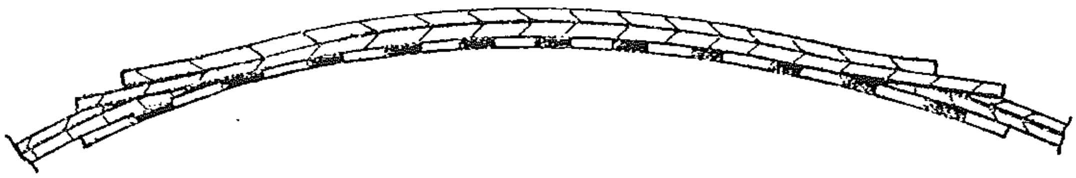


Bond Backing piece
Using Cotton Flock

<u>Single Skin Repair</u>

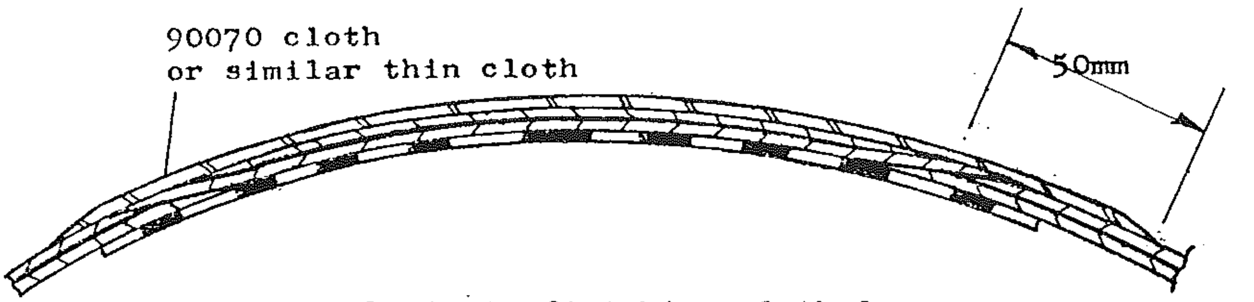
Fig.1

2.2.11 Single Skin Repair - Accessible from one side only



Laminate cloth patches
Same number of layers as original

Fig.2



Laminate finishing cloth layer
smooth polythene over

Fig.3

2.2.12 Single Skin Repair

This section describes the repair of single skin damage when it is readily accessible from both sides.

A satisfactory repair could be made exactly as described in section 2.2.11. However, because of the easy accessibility the repair may be laminated up from the inside against a backing piece that is removed after the repair has hardened. This method of repair can give a smooth moulded finish to the external surface.

1. Work through section 2.2.5.

   The edges around the hole to be repaired should be chamfered at an angle of 1:30 minimum. Note that in this repair the inside edges are chamfered since the repair is made from the inside, (see Fig. 1).

2. The repair backing piece is made directly from the glider by using the opposite symmetrical position as a mould. Two layers of 90070 cloth are laminated on the opposite symmetrical position to the damaged area, (Fig. 2) and before release the surface is sanded smooth and finished with fine carborundum paper. When the lamination is released and turned inside out it becomes the required backing piece.

3. The moulded backing piece is wax released, positioned over the damage hole and bonded to the surrounding area with impact adhesive, Fig. 3.

4. If the repair area is large, the backing piece may be gel coated before laminating any cloth. This means that only the edges of the repair will require finishing with gel coat. One gel coat should be brushed on and should be just dry before laminating begins. The gel coat should stop approximately 10 mm from the hole edge to avoid any chance of contaminating the edge chamfer.

5. Working from the inside, the repair is now laminated as described in section 2.2.7. Only the same number of layers as the original are laminated at this stage.

6. When cured the repair is inspected according to section 2.2.9.

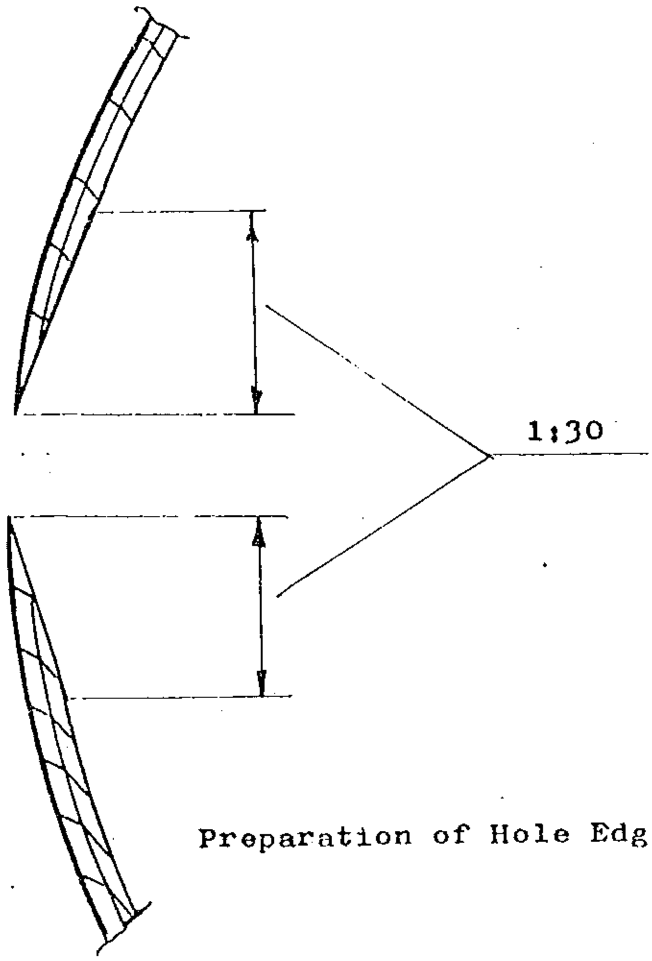
7. The repair edges are now sanded flush, and the patch surface and surrounding 50 mm abraded ready for laminating.

8. A final layer of cloth (92110 or similar) is now laminated as shown in Fig. 4, and allowed to cure.

9. Inspect the final cloth layer according to section 2.2.9.

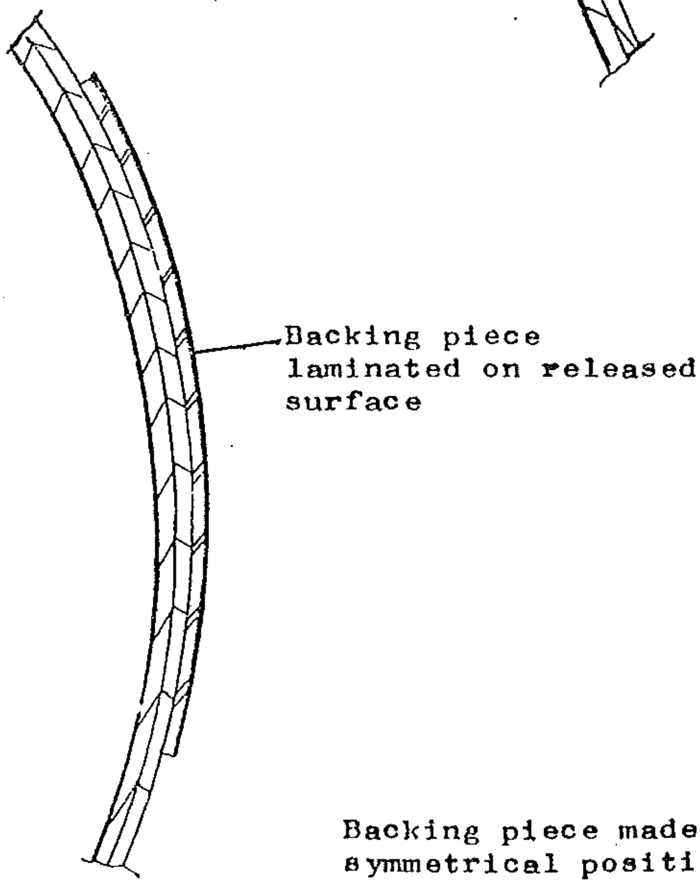
10. The backing piece is now released and the repair finished according to section 2.2.10 paragraph 4 onwards.

2.2.12 Single Skin Repair - Accessible from both sides



Preparation of Hole Edges

Fig.1



Backing piece made from the opposite symmetrical position to the repair

Fig.2

2.2.12 Single Skin Repair - Accessible from both sides

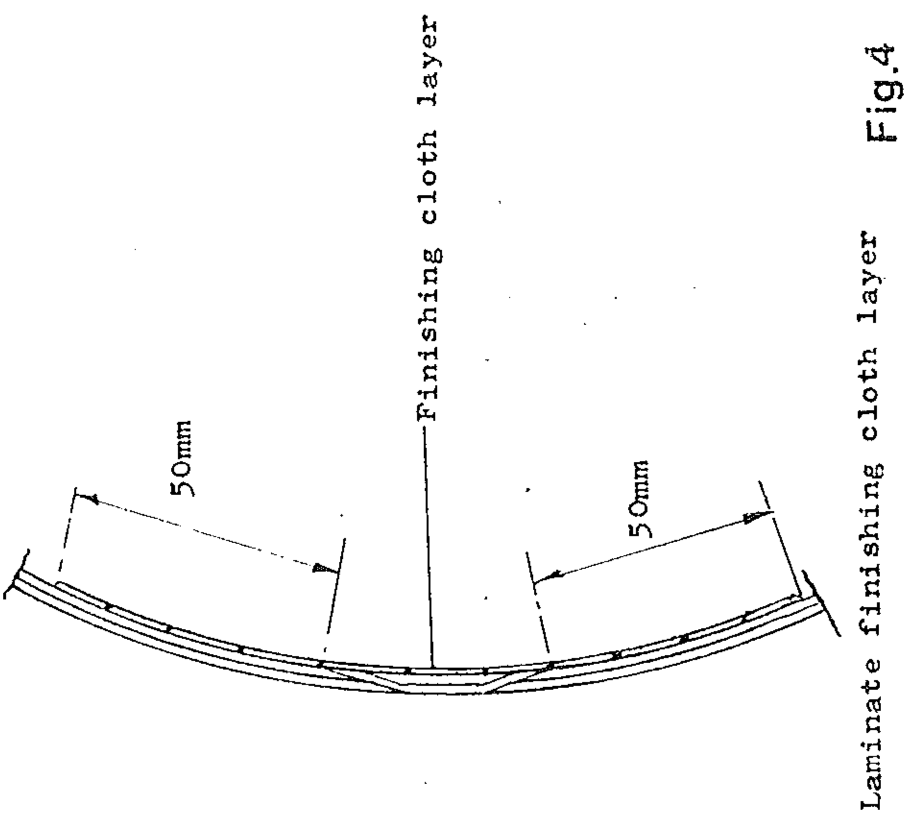


Fig.4

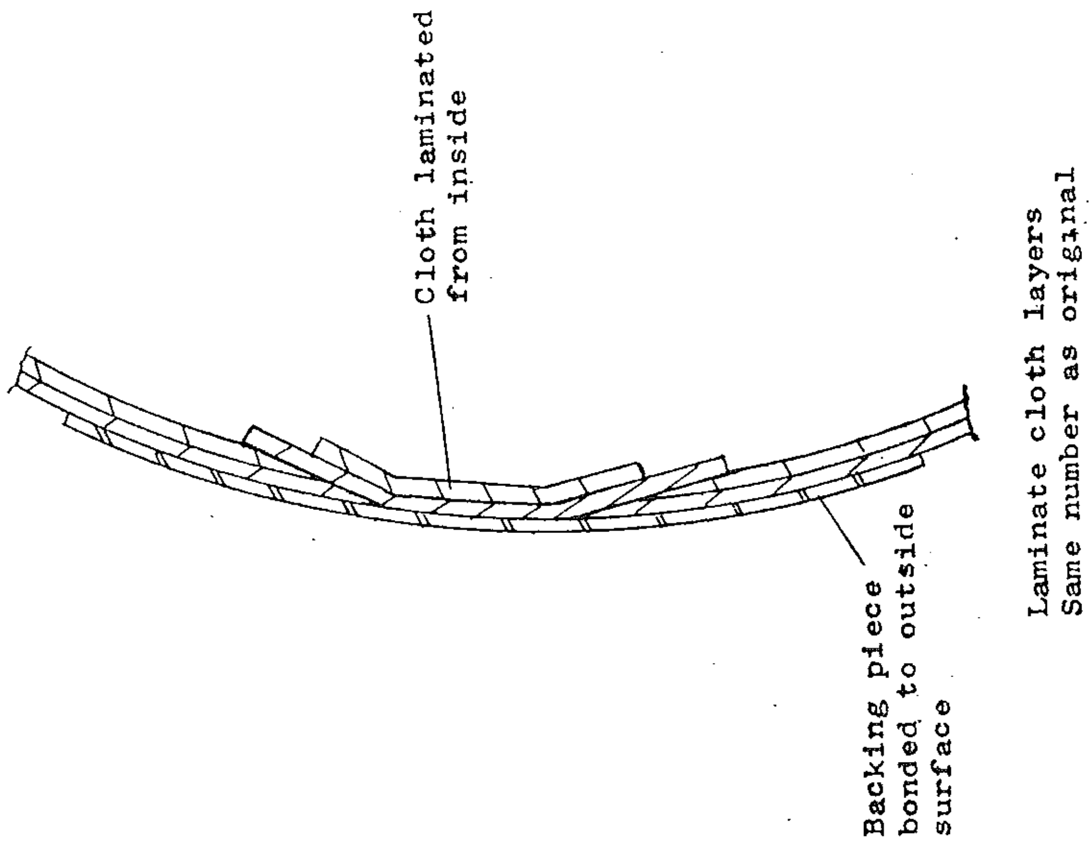


Fig.3

2.2.13 Sandwich Structure Repair

Damage to Outer Skin Only

This section covers the repair of damage to the outer skin of a sandwich structure (Fig. 1).

1. Work through section 2.2.5.

   The damaged glass fibre should be cut back and also all core damage cut out (Fig. 2).

2. The damaged core is replaced with microballoon filler as shown in Fig. 3. Note that this filler will be heavier than the core it is replacing. If the core damage is extensive, a plug of similar material should be carved to fit the damage hole and padded with microballoons when it is set in position.

3. The core plug is now sanded flush and the skin edges chamfered to an angle of 1:30 minimum using a sanding block as shown in Fig. 4. Care should be taken not to sand the core material substantially below its original depth.

4. Glass cloth is now laminated over the core and chamfered edges according to section 2.2.7. Only the same number of layers as the surrounding skin should be laminated at this stage (Fig. 5).

5. When hard the repair is inspected according to section 2.2.9.

6. The patch is now prepared for the finishing layer as follows:-

   (i) Rough edges sanded flush.

   (ii) Surface abraded ready for further laminating.

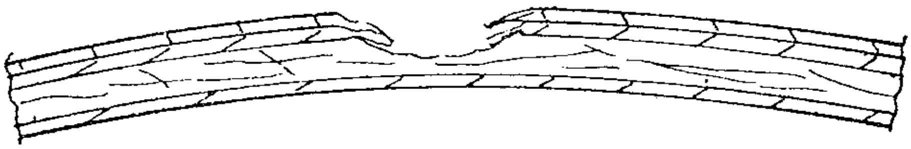
   (iii) Surrounding 50 mm gel coat ground off.

7. The finishing layer of cloth is now laminated over the repair and if required polythene smoothed and fastened over the wet laminate (Fig. 6). The cloth should be 90070 or similar thin cloth. A heavier cloth will require more work to produce a smooth invisible repair.

8. When the finishing layer has hardened, remove the polythene and inspect according to section 2.2.9.

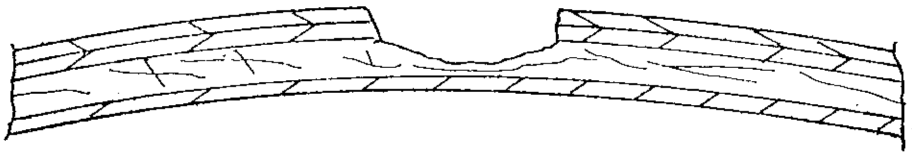
9. The repair is now finished according to section 2.2.10.

2.2.13 Sandwich Structure Repair - Damage to outer skin only



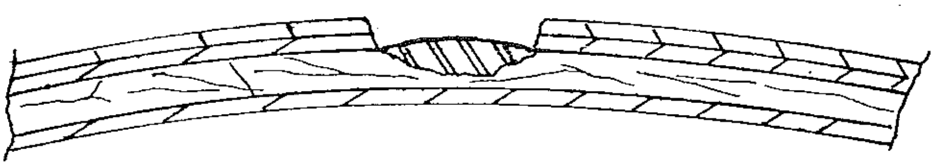
Typical damage to outer skin

Fig.1



Damaged glass fibre cut back

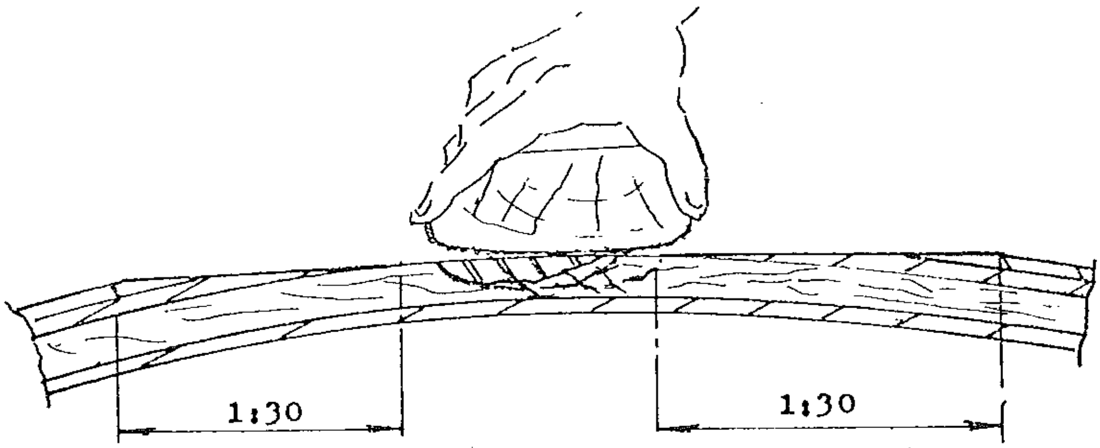
Fig.2



Damaged core replaced with filler

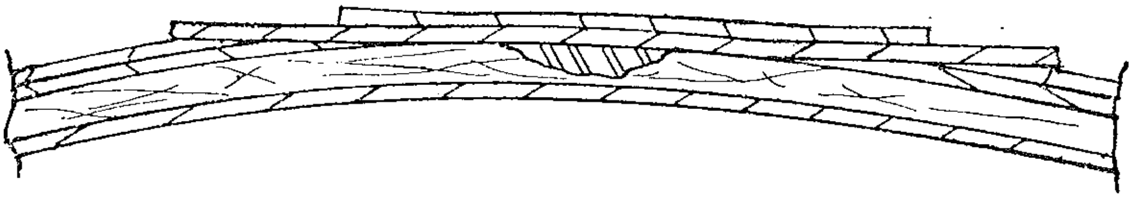
Fig.3

2.2.13 Sandwich Structure Repair - Damage to outer skin only



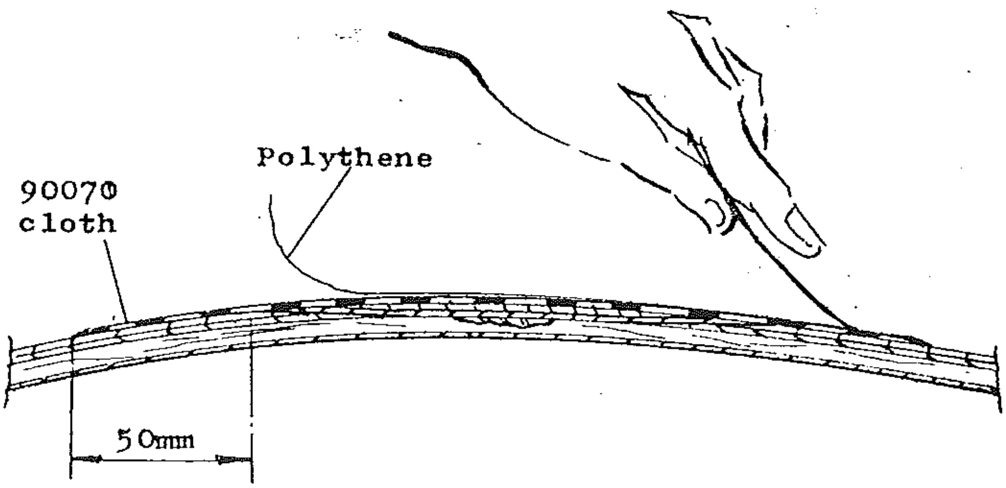
Core filler sanded, flush and
Skin edges prepared

Fig.4



Laminate cloth patches
Same number of layers as original

Fig.5



Laminate finishing cloth layer

Fig.6

2.2.14 Sandwich Structure Repair

Minor Damage to Both Skins

This section describes the method of repair to a sandwich structure when both skins have only minor damage, (Fig. 1).

1. Work through section 2.2.5.

   The damage to both skins must be cut away until sound material is reached. The hole edges should be chamfered at 1:30 minimum (see Fig. 2) and the core cavity prepared as shown in Fig. 3. Note that although the cavity is regular and straight sided, the hole in the inner skin has radiused corners. If the inner skin is very thin a 1:30 chamfer will be impossible to achieve. In this case a reduced chamfer is acceptable but the cavity must be made large enough to expose a portion of the inner skin surrounding its hole so that there is an overlap of not less than 30:1.

2. The core replacement plug should now be carved to fit the cavity. The plug should be fractionally smaller to allow the inner skin patch to lay between the plug and surrounding core.

3. The required pieces of cloth are now cut to shape.

   Note that the inner layers must be large enough to reach up the cavity walls.

4. The sides of the plug are now painted with resin and a $\frac{1}{2}$ mm layer of cotton flock spread over its bottom face. The requisite pieces of cloth for the inner skin are pre-wet out on polythene sheet and then gently positioned over the cotton flock and plug sides. The polythene is now peeled off, (Fig. 4).

5. The inner skin and core cavity is painted with resin, the plug positioned, and then pushed firmly home. This will make the cotton flock layer on the plug squeeze up and push the wet cloth into the hole to form a good bond, (Fig. 5). The plug should be held down with weights until the resin has hardened.

6. The plug surface is now sanded flush with the surrounding core surface and outer skin glass fibre edges chamfered to 1:30 minimum.

7. The outer skin layers are now laminated as described in section 2.2.7. Only the same number of layers as the surrounding skin should be laminated at this stage, (Fig. 6).

8. The repair is inspected according to section 2.2.9.

9. The patch is now prepared for the finishing layer as follows:-

   (i) Rough edges sanded flush.

   (ii) Surface abraded ready for further laminating.

   (iii) Surrounding 50 mm of gel coat sanded off.

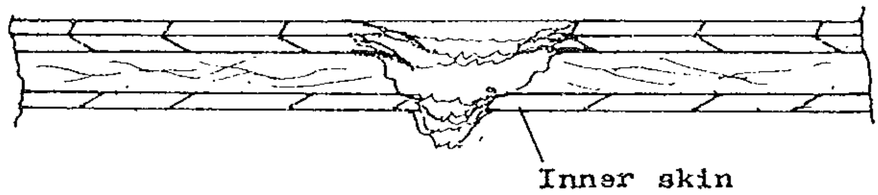
10. The finishing layer of cloth is now laminated over the repair and polythene smoothed over the wet laminate, (Fig. 7).

The cloth should be 90070 or similar thin cloth. A heavier cloth will require more work to produce a smooth invisible repair.

11. When the finishing layer has hardened, remove the polythene and inspect according to section 2.2.9.

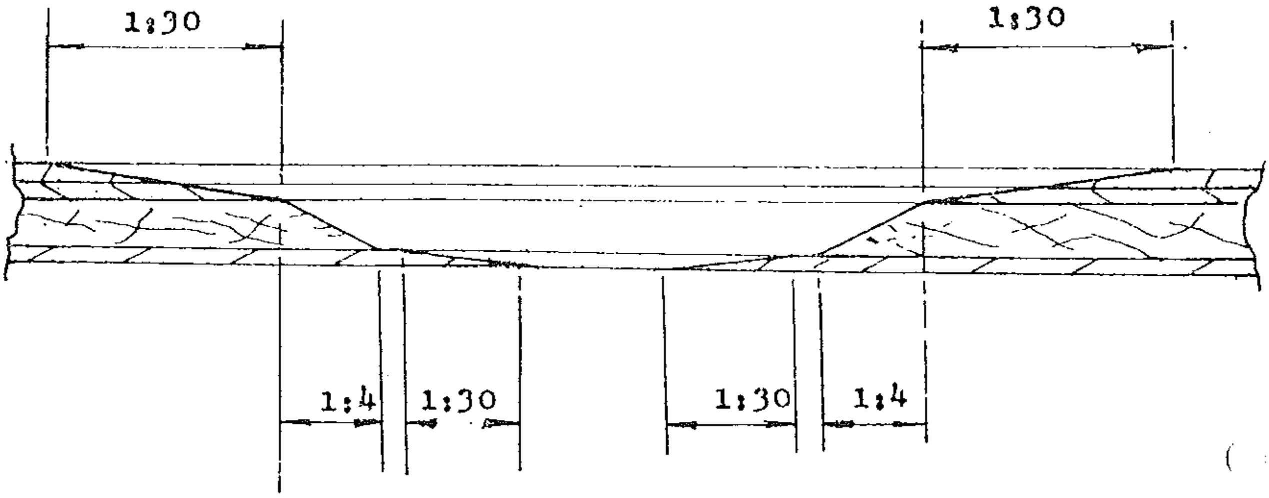
12. The repair is now finished according to section 2.2.10.

2.2.14 Sandwich Structure Repair - Minor damage to both skins



Typical Damage

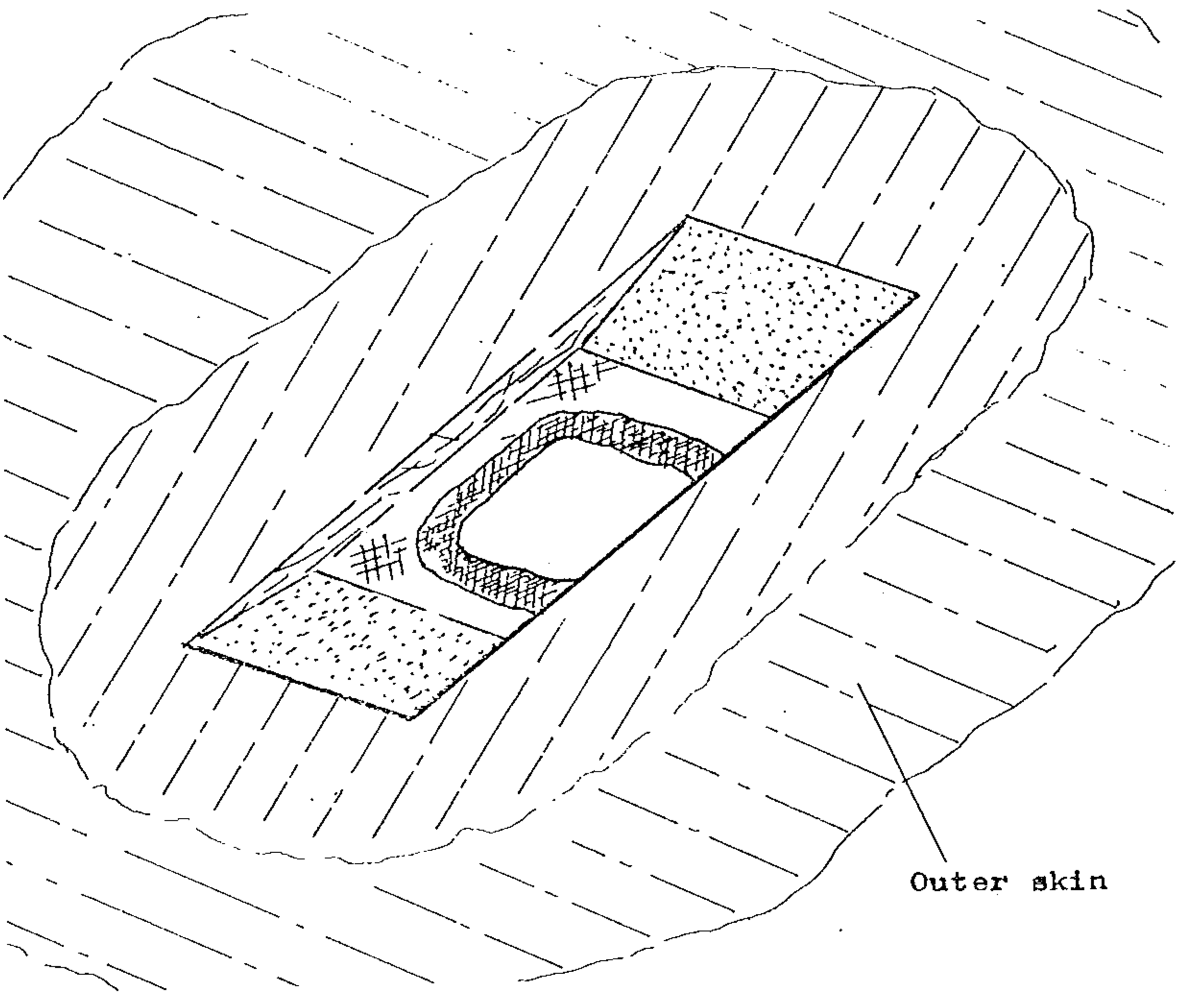
Fig.1



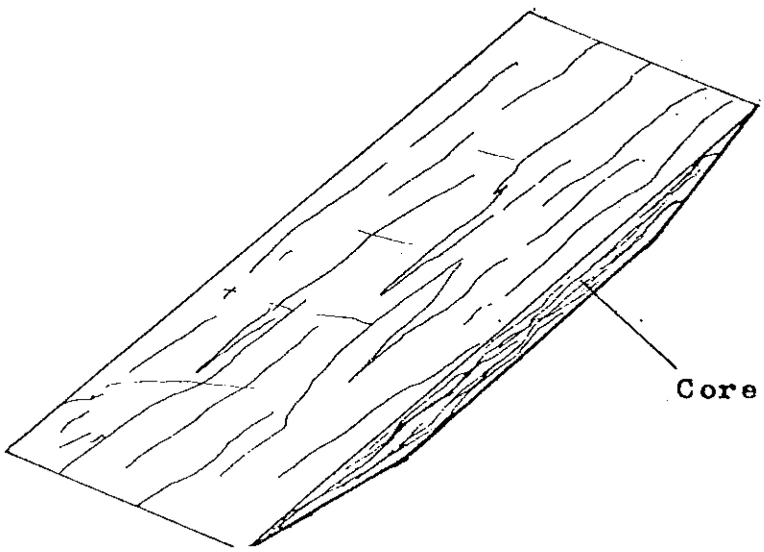
Preparation of Hole Edges

Fig.2

2.2.14 Sandwich Structure Repair - Minor damage to both skins



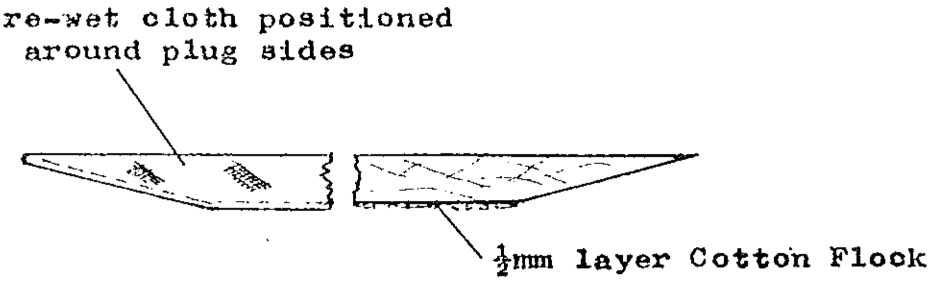
Cavity runs parallel to core grain (if Balsa)



Preparation of core cavity

Fig.3

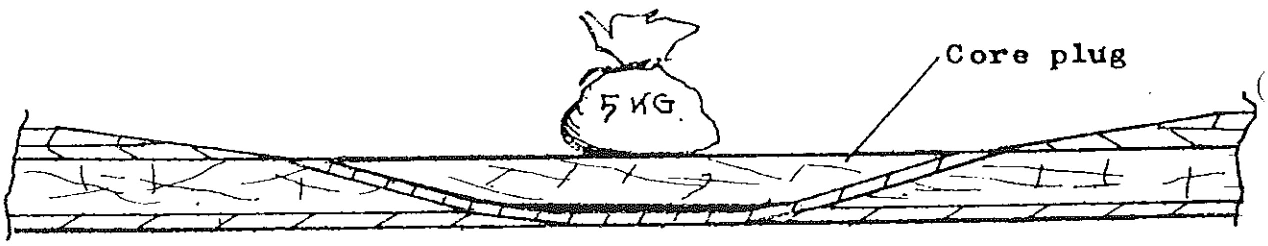
2.2.14 Sandwich Structure Repair - Minor damage to both skins



Positioning of cloth around plug

L/H side shows an external view
R/H side shows a section through the centre line

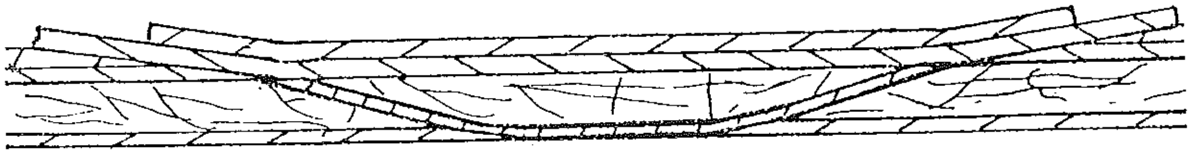
Fig.4



Plug inserted in core cavity

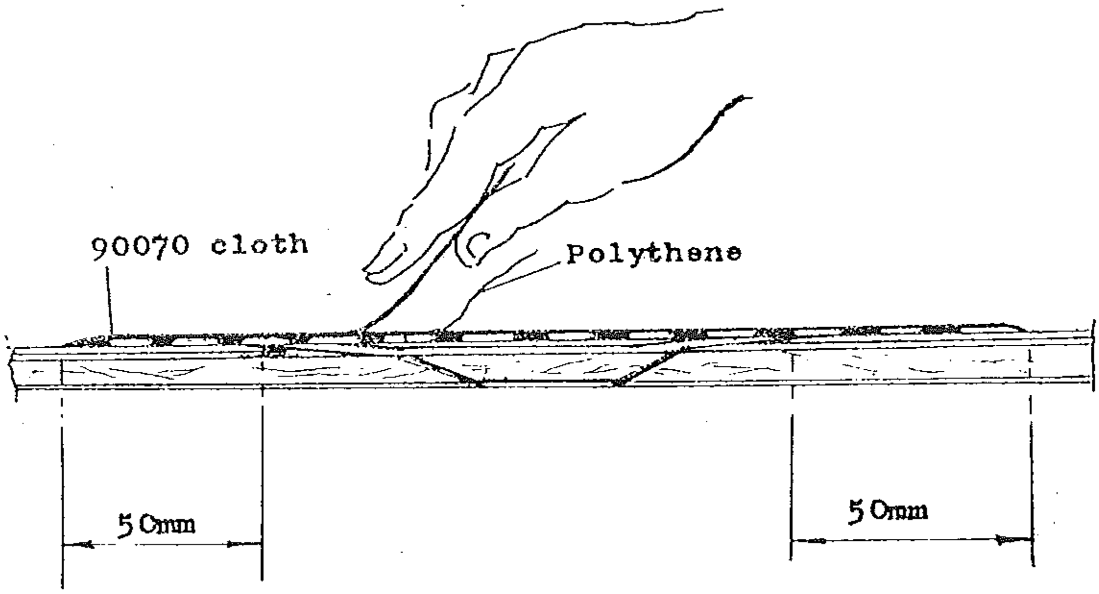
Fig.5

2.2.14 Sandwich Structure Repair - Minor damage to both skins



Laminate cloth patches
Same number of layers as original

Fig.6



Laminate finishing cloth layer

Fig.7

2.2.15 Sandwich Structure Repair

Major Damage to Both Skins

This section describes the method of repair to a sandwich structure when both skins have major damage.

1. Work through section 2.2.5.

   The damage to both skins must be cut away until sound material is reached. The hole should be prepared as shown in Fig. 1, and the core cavity prepared as described in section 2.2.14 paragraph 1.

2. A backing piece must be used to enable a repair to be made that conforms to the original structure curvature. The backing piece is cut from thin plywood, rigid foam, or similar and if possible should be about 25-50 mm larger all round than the inner skin hole. It is passed through the hole and bonded with cotton flock to the "blind" side of the inner skin as shown in Fig. 2.

3. When the cotton flock has cured the clamping wires and supports are removed.

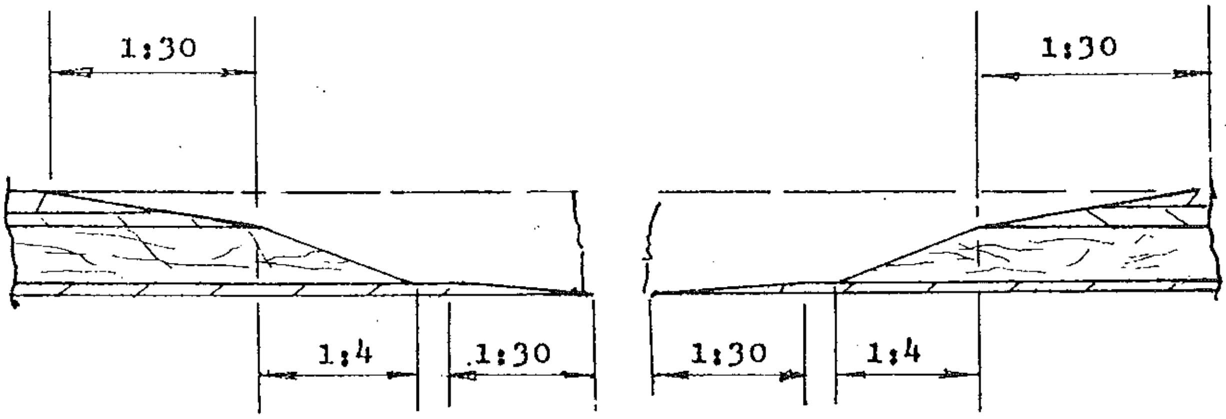
4. The core replacement plug should now be carved to fit the cavity. The plug should be fractionally smaller to allow the inner skin patch to lay between the plug and surrounding core.

5. The required pieces of cloth are now cut to shape.
   Note that the inner layers must be large enough to reach up the cavity walls.

6. The inner skin layers are now laminated in place according to section 2.2.7. A thin layer of approx. $\frac{1}{2}$ mm of cotton flock is smeared over the plug bottom and chamfered faces, and resin is painted on the vertical faces. The plug is now pushed firmly down into the cavity, Fig. 3, and held to the curvature with weights until the resin has cured.

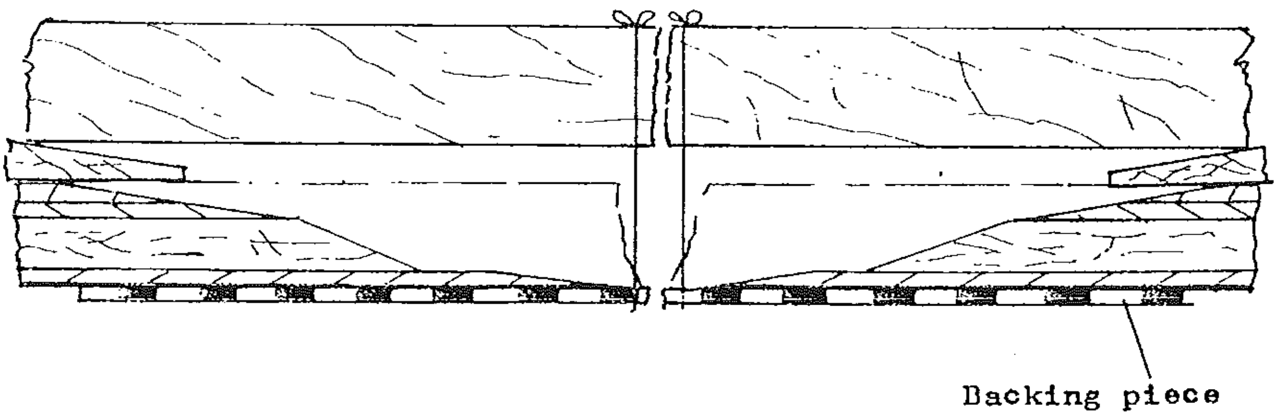
7. (See Figs. 4 & 5). The repair is now completed as described in section 2.2.14 paragraphs 6 - 10.

2.2.15 Sandwich Structure Repair - Major damage to both skins, Method No. 1



Preparation of hole edges

Fig.1

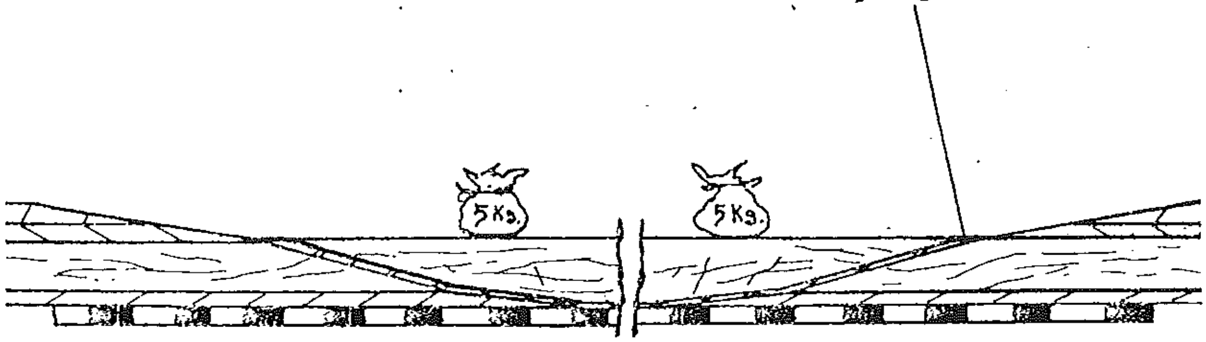


Bond backing piece
Using Cotton Flock

Fig.2

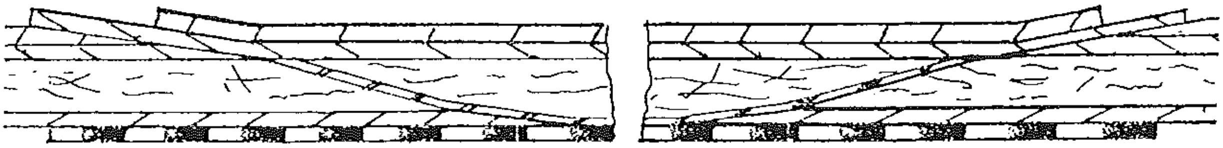
2.2.15 Sandwich Structure Repair - Major damage to both skins, Method No. 1

Inner skin cloth
between plug and core



Core replacement plug inserted in cavity

Fig.3



Laminate Outer skin layers
Same number of layers as original

Fig.4

2.2.15 Sandwich Structure Repair - Major damage to both skins, Method No. 1

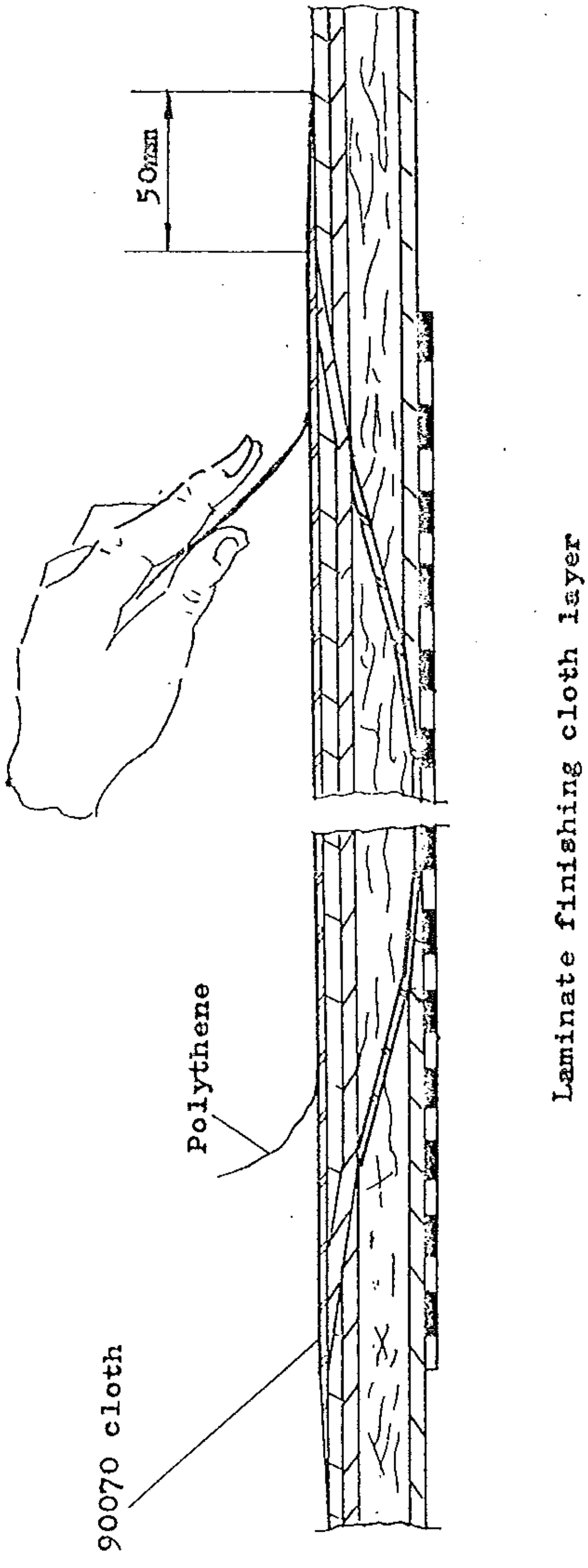


Fig.5

2.2.16 Sandwich Structure Repair

Major damage to both skins - Alternative to section 2.2.14

1. Work through section 2.2.5.

   The damage to both skins must be cut away until sound material is reached. The hole should be prepared as shown in Fig. 1. The edges should be chamfered at 1:30 minimum and 25 mm of the inner skin inner surface around the hole lightly abraded. A 1:30 chamfer will be impossible to achieve if the inner skin consists of only one layer of cloth. In this case a reduced chamfer is acceptable but the overlap must not be less than 30:1.

2. A backing piece of thin plywood or rigid foam is cut to the inner hole size plus 25 mm all round.

3. The inner skin patch pieces are now cut to shape and should be the same size or slightly smaller than the backing piece (weave direction matching the original).

4. The patch pieces are now laminated, (according to section 2.2.7) onto one side of the backing piece.

5. Using a small brush through the hole, resin is painted on the prepared surfaces of the inner skin. The backing piece complete with laminated wet cloth is passed through the hole and pulled up to the skin as shown in Fig. 2.

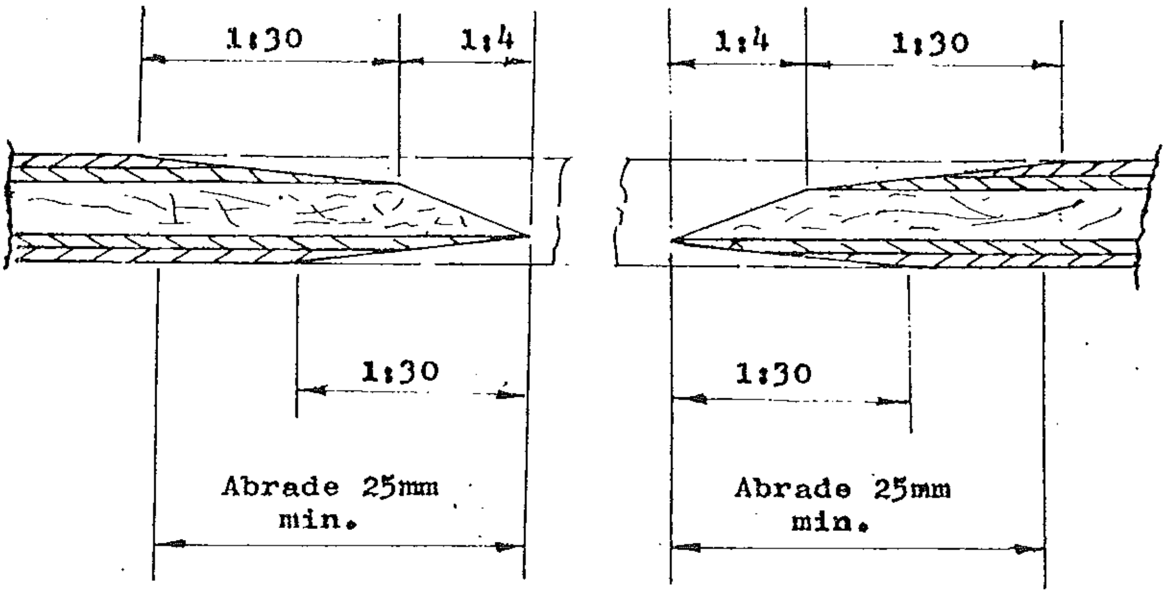
6. When the inner patch as cured the clamping wires and supports are removed. The joint between the replacement cloth and the original skin should be inspected. If any gaps are apparent the patch is unsatisfactory and should be carefully stripped off before a fresh attempt is made.

7. A core replacement plug is now carved to fit the cavity, and the new inner skin surface lightly abraded.

8. The plug is now fitted into the cavity using microballoon bonding paste as a padding material. Weights are used to hold the plug down until the microballoon mix has set.

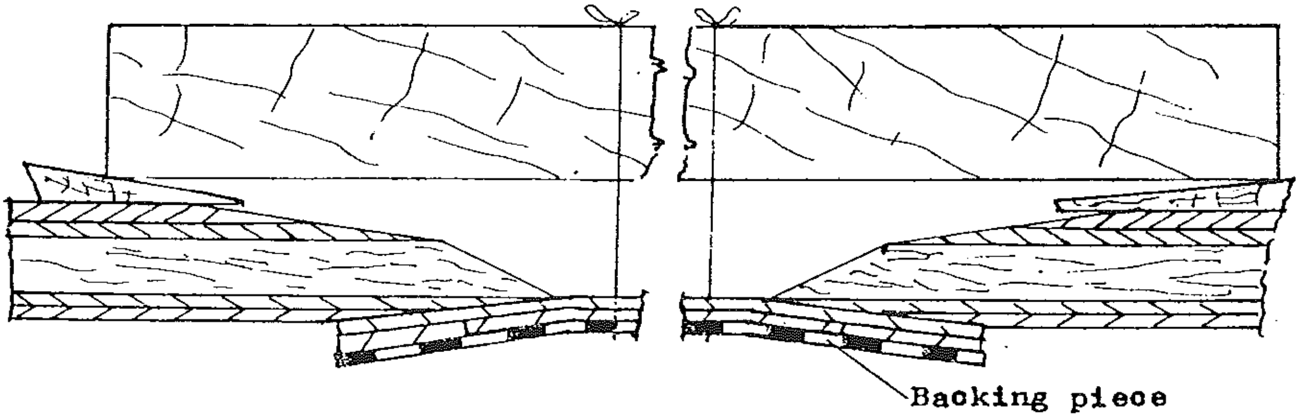
9. The repair is now completed as described in section 2.2.14 paragraphs 6 - 10.

2.2.16 Sandwich Structure Repair - Major damage to both skins, Method No. 2



Preparation of hole edges

Fig.1



Backing piece and inner skin
Patches secured in place

Fig.2

2.2.17 Repair of Damaged Trailing Edges

This section outlines the repair of damaged trailing edges on ailerons or flaps.

The trailing edge may split cleanly open. If the split is less than 15 mm the two halves should be prised apart a little and resin squeezed into the gap. The two sides are then clipped together until the resin has set.

If the split is greater than 15 mm the two halves are opened and the mating surfaces abraded. Resin is painted on both surfaces and a thin layer of cotton flock spread on one surface. The joint is then clipped together until the resin has set.

If a piece of the edge is missing but the two halves are still jointed together (Fig. 1) then the edge must be rebuilt with cloth as follows:

1. Cut back all damaged glass fibres from the edge.

2. Grind away the gel coat and chamfer the surrounding skin towards the damage (Fig. 2). Grind the damage to a feathered edge if possible but do not remove any more material than is absolutely necessary.

3. Fix a backing piece across the trailing edge gap, and laminate cloth over the damage. Laminate extra cloth layers over the trailing edge so that the missing portion of the trailing edge is nicely built up level and leave to cure, (Fig. 3).

4. The backing piece is now removed and the repair inspected according to section 2.2.9.

5. The repair is now prepared for the finishing layer as follows:

   (i) Rough edges sanded flush.

   (ii) Surface abraded ready for further laminating.

   (iii) Surrounding 30 mm of gel coat sanded off.

6. The finishing layer of cloth is now laminated over the repair and polythene smoothed and fastened over the wet laminate.

7. When the final layer has hardened, remove the polythene and inspect according to section 2.2.9.

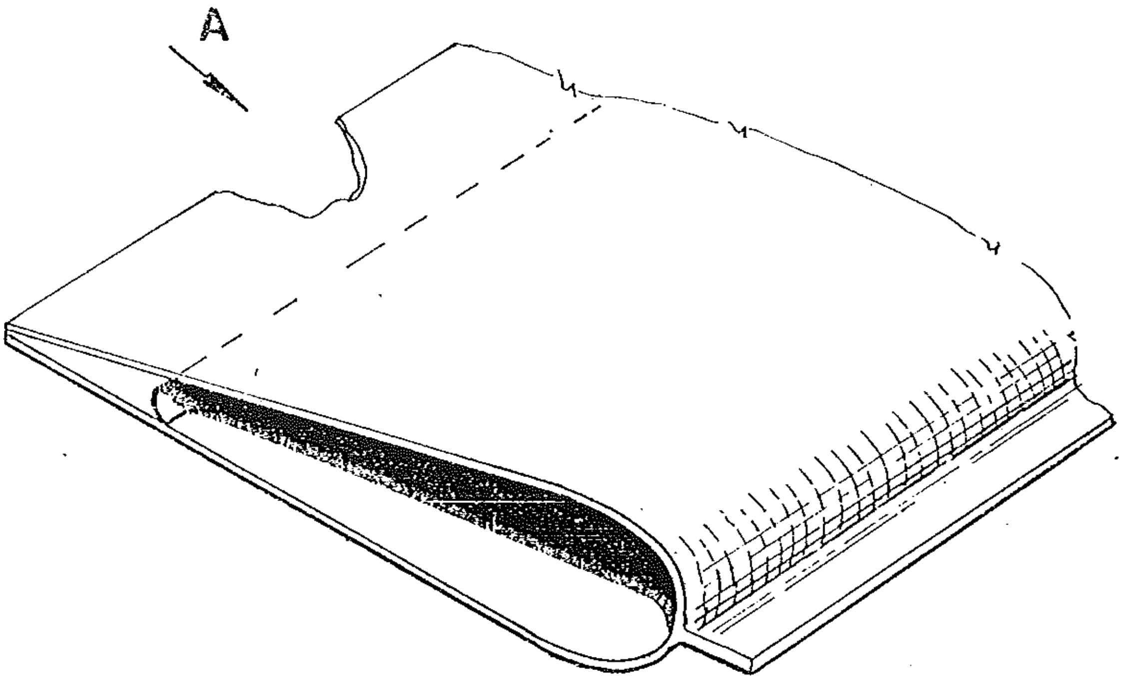
8. The repair is now finished according to section 2.2.10.

If the trailing edge damage extends beyond the bond line and the structure has single skin surfaces the skin repair is made in a similar manner to that described in section 2.2.11.

Control surfaces with sandwich structure skins which have damage extending beyond the bond line into the skins are repaired in a similar manner to section 2.2.15.

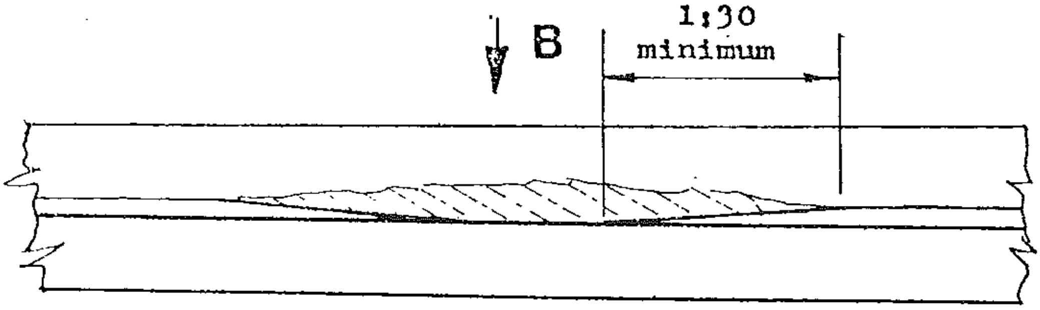
Note that the balance of control surfaces may be disturbed if too much extra weight is added to their trailing edges.

2.2.17 Repair of Damaged Trailing Edges



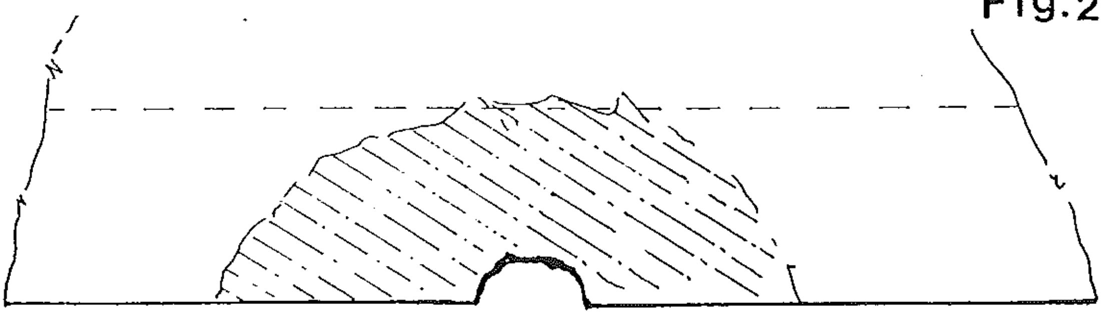
Trailing edge damage

Fig.1



Preparation of damage
View on Arrow A

Fig.2



Preparation of damage
View on Arrow B

Fig.2a

2.2.17 Repair of Damaged Trailing Edges

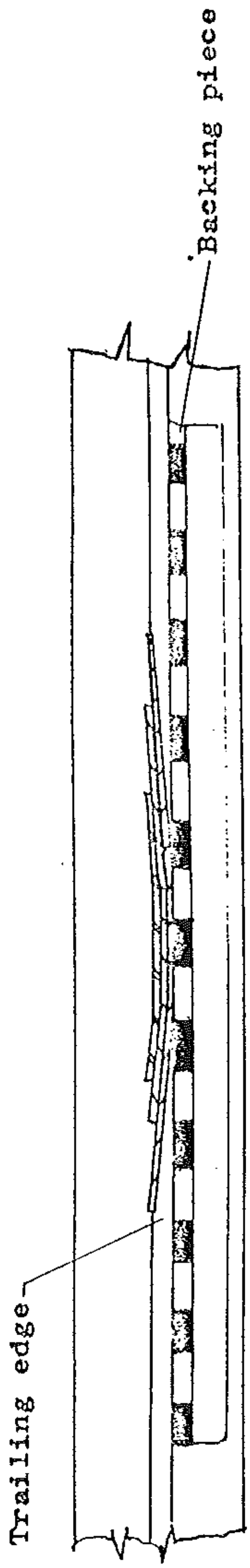


Fig.3

Lamination of patch layers
(View on Arrow A Fig. 1)

2.2.18 Repair of Damaged Fittings

Load bearing fittings which are damaged or torn from their location are generally reset only after the surrounding structure has been repaired. Unidirectional rovings are often used to secure fittings. On any repair, care must be taken to ensure that the fitting is secured in exactly the same manner to that before damage. Jigging of the fixture to ensure correct position may be required.

Most fittings will be irrepairably damaged if torn from their mountings. New parts should be obtained from the manufacturer, who will also prepare a possible repair scheme if requested.

2.2.19 Replacement of Canopy Transparencies VEGA

1. The gel coat and paint on the external surface of the canopy frame must be removed to enable the screws to be located. Care should be taken not to cut into the canopy frame ropes when removing the gel coat and paint. This will now expose small areas of filler (normally grey in colour) placed over the screw holes during the original fitting operation.

2. Remove the filler on the screw heads and remove all 99 x G.K.N. 4007 screws which are on a 50 mm pitch; remove the damaged transparency.

3. Clean out any remaining microballoon mix from the recess in the canopy frame.

4. Lock the canopy frame in position on the fuselage and fit the new transparency to it; trimming as required. Great care should be taken during this operation or else large areas of glass flock filling will be required. Ensure the transparency is seated well.

5. Drill one hole at the front and back of the transparency (on the aircraft centreline) and fit the two screws.

6. Proceed around the moulding drilling and countersinking alternate holes in the transparency and fitting a screw as each hole is drilled.

7. Remove the two screws fitted at 5. and countersink the holes. Re-fit the screws.

8. Drill and countersink the remaining holes and fit the screws as each hole is drilled.

9. Put a strip of masking tape on the inside of the transparency to protect the surface during bonding and remove the transparency.

10. Abrade the contact areas of the canopy frame and transparency and degrease the areas using detergent solution. Leave to dry.

11. Cover the canopy surround on the fuselage with Sellotape to prevent the canopy becoming bonded to the fuselage at operation 12.

12. Fix the canopy frame to the aircraft again and spread a thin layer of microballoon mix onto the canopy frame recess and screw the transparency on. Leave to cure (12 hours at 20°C).

13. Make good any edges using glass flock resin mix and fill the screw holes using cataloy filler or similar.

14. Finish in accordance with section 2.2.10.

2.2.20 Repair of Damaged Rigging Bushes

This section describes the method of replacing badly damaged rigging bushes in the wing tangs. This repair is concerned entirely with primary structure, the utmost care must therefore be exercised at all stages. If during the repair any further damage is caused to the main wing spar member or to the root rib, the manufacturer should be contacted before proceeding.

If the bushes are damaged on the inside face only, with no damage to the surrounding cloth, or if the damage to the surrounding cloth affects only the top few layers of cloth, the repairs may be effected by using sections 2.2.4, 2.2.11 and 2.2.23.

This repair should not be attempted by any person who is not fully conversant with glass fibre glider repairs.

1. With a sharp chisel carefully remove the glass fibre bandaging (Fig. 1) from the port and starboard wing tangs and also the side cloths from each side of the wing tangs (6 layers each side of the tang on each wing, as shown in Fig. 3). A note should be kept of how many layers have been removed and care should be taken to ensure that no more than the specified number are removed. If more are removed, then further repair work cannot be carried out on the wing.

   Drill out the damaged bushes and abrade the tangs with aluminium oxide paper ready to receive the lay-up as described in section 2.2.6 - A.

2. The cloth used throughout the repair is Interglas 92125, as described in section 2.3.4. Before laying up, cut the cloth to the correct size to fit along the sides of the tangs. Care should be taken when cutting cloth not to stretch the material or distort the weave of the fabric. To obtain the correct size of glass cloth, the best method is to make paper templates of the area which is to be covered, lay them on to the roll of cloth and cut round them leaving about half an inch extra to allow for any stretching of the cloth when laying up. The cloth lay-up should always be at 45^{o} to a free edge as shown in Fig. 4, therefore, special care should be taken to ensure the correct fibre direction at the cloth cutting stage.

Note: Under certain lighting conditions there will appear to be a definite grain in the cloth; this does not follow the direction of the fibres and should be ignored.

3. Lay-up the side cloths as shown in Fig. 3 as described in section 2.2.7. The resin mix used is Glycidyl Ether 162 (section 2.3.2). Special care must be taken to ensure that the fibres of material are laid up at 45^{o} to the edges of the tangs as described above. The finished lay-up should be cured at room temperature for 24 hours and the lay-up inspected with reference to section 2.2.9. The excess cloth can then be trimmed off using a rotary grinder and the sharp edges rounded off using a sanding block.

4. A new bush can be obtained from the manufacturers (1 off Part No. 65A-20-21). The correct position for the bush can be obtained by rigging the aircraft and marking the position of the rigging pin on the tangs.

Note: Great care must be taken to ensure that the wings are fully rigged, i.e. all the locating pins at the ends of the tangs are fully home in their sockets.

Carefully drill a one inch clearance hole through the tangs using a stand drill. The new bush should be degreased and abraded as described in section 2.2.6 - A, and then glued into position with a cotton flock mix (section 3.9). To ensure that the bush is aligned correctly the wings should be rigged together with the rigging pin (Part No. 65A-00-10) until the cotton flock has cured for 24 hours at room temperature.

5. The rigging pin can now be removed and the rigging bush cut in half mid-way between the two tangs.

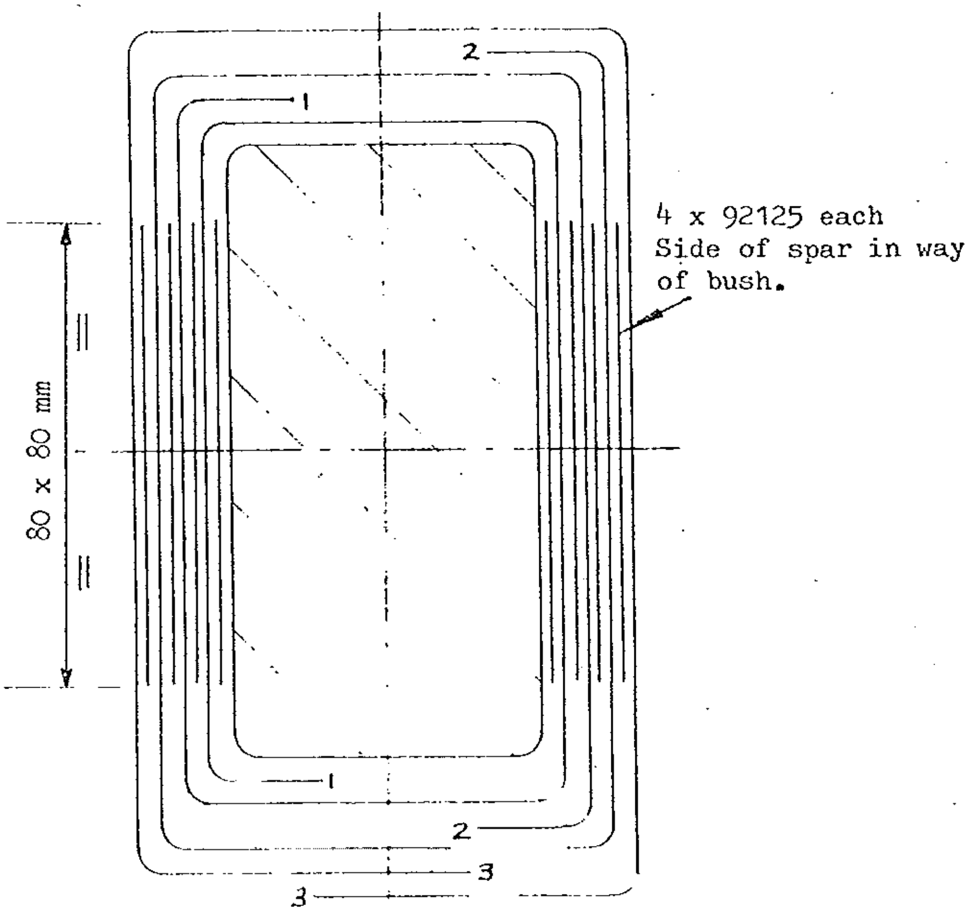
6. The surface of the tangs can now be abraded prior to the bandaging lay-up. The lay-up of the bandaging and intermediate squares is shown in Fig. 1. The best method for cutting these cloths to the correct size is to cut strips of cloth 660 mm wide from the roll (Fig. 2). These strips can then be cut to the correct length during the laying up procedure. These cloths must also be laid up with the cloth fibres at 45^{o} to the edges of the tangs as shown in Fig. 4. The resin used for the lay-up is Glyciyl Ether 162

(section 3.3.2) and the glass fibre cloth is Interglas 92125 as described in section 2.3.4. The cloth is laid up around the tangs as shown in Fig. 1 with 80 x 80 mm square cloths laid up around the bushes after each bandaging layer. A sharp implement, such as the point of a pair of scissors is used to carefully displace the fibres of the cloth around the bush and rigging fixtures. All the layers, bandaging and intermediate squares are arranged around the bushes as described above. When the lay-up has been cured (24 hours at room temperature) all the sharp edges are removed with a sanding block and the lay-up is inspected as described in section 2.2.9.

7. The repair can then be finished according to section 2.2.10 if required.

8. The whole repair scheme should then be post-cured for eight hours at 54°C.

2.2.20 Repair of Damaged Rigging Bushes



DIAGRAMMATIC METHOD OF BANDAGING
THE PORT AND ST'BD TANGS

Fig. 1

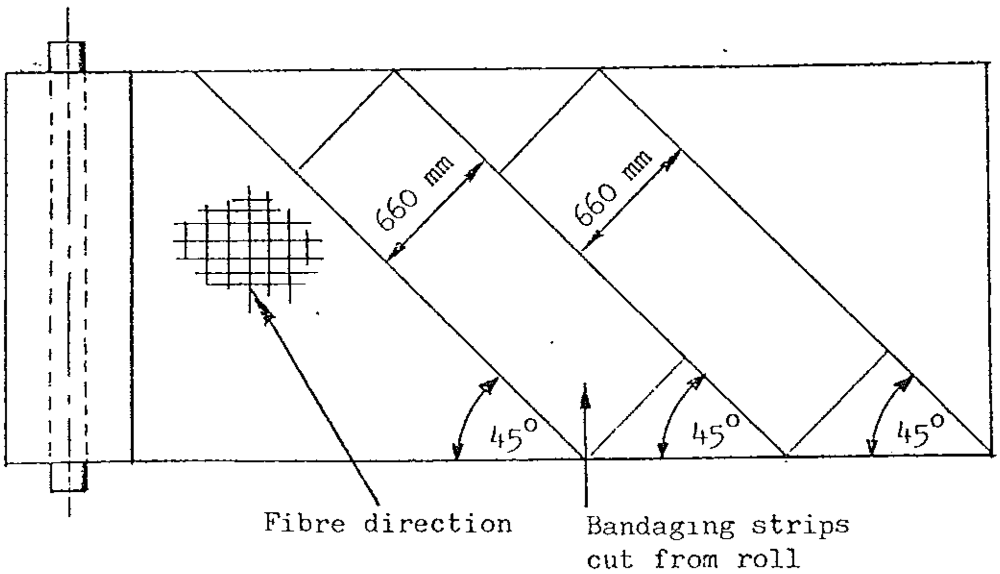


Fig. 2

2.2.20 Repair of Damaged Rigging Bushes

Fig. 3 Dimensions of wing tang side cloths

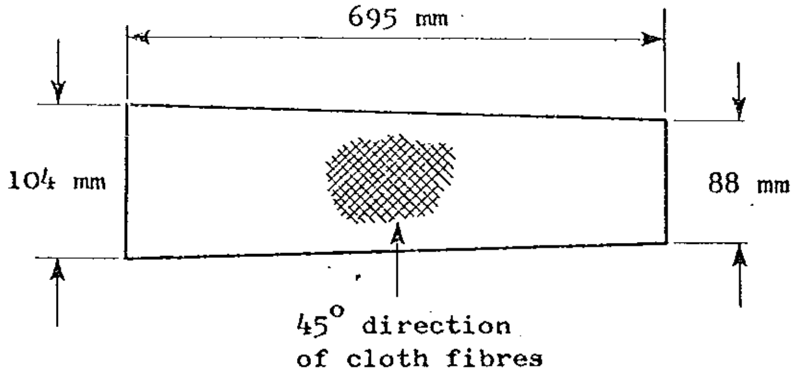
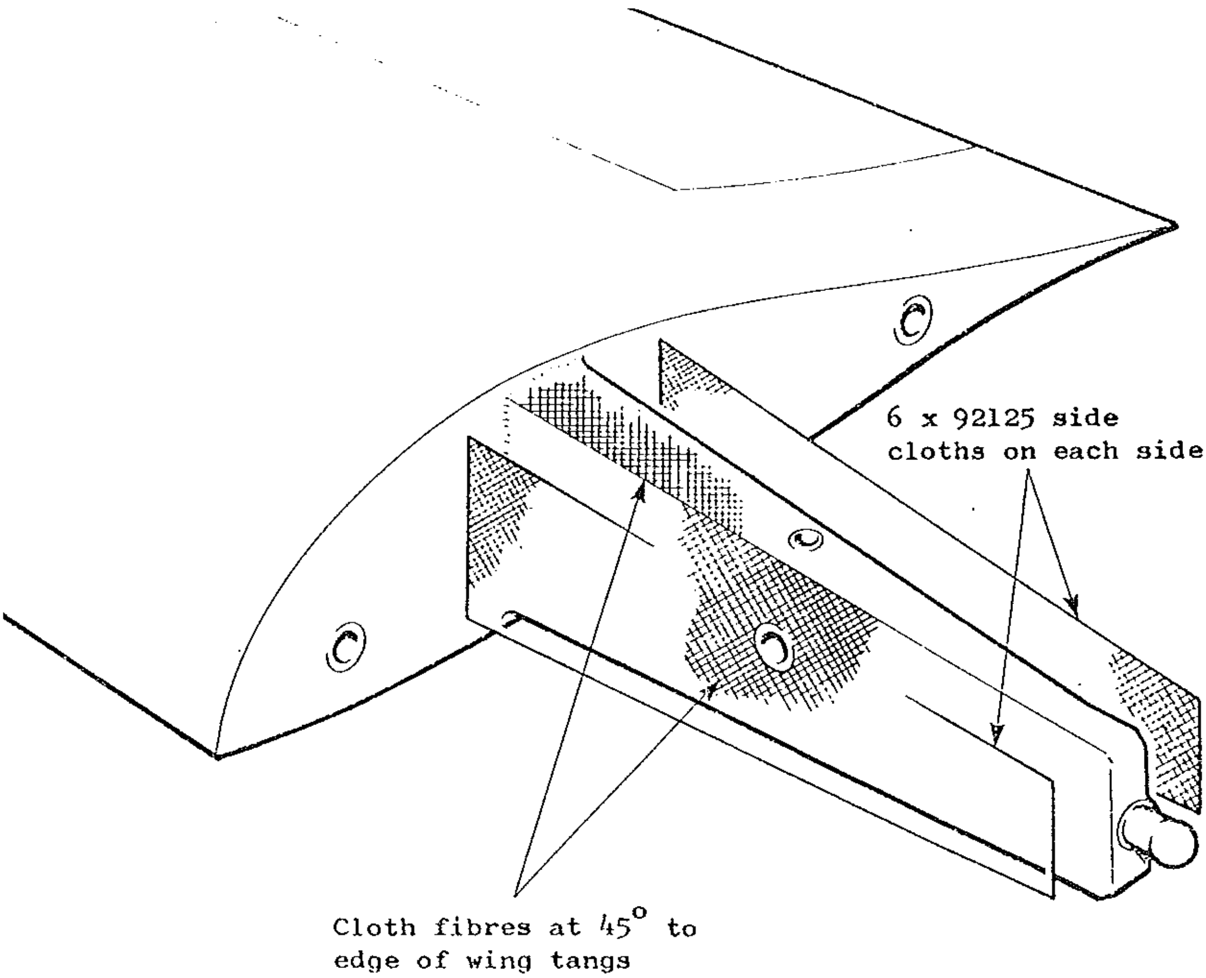


Fig. 4 Direction of cloth lay-up of wing tangs



2.2.21 Removal and Installation of Aileron Control Surface Hinges

1. Remove ailerons using instruction shown in section 3.2.3.

2. Remove aileron hinges and securing cloth using a flat chisel, being particularly careful not to damage the spar. See section 2.1.3.

3. Clean all relevant surfaces. See section 2.2.6.

4. Temporarily fix the replacement hinges in position on the aileron pins using plasticine. The hinges should be fixed at an angle allowing the aileron to move through its full arc. See Fig. 1, also rigging diagram.

5. Fill the aileron hinge 'V channels with cotton flock mix in accordance with section 2.3.9.

6. Position the aileron and hinge assembly to the wing. Fully support the aileron weight and leave the flock mix to cure.

7. After curing, the plasticine can be removed and the aileron checked for:-

   (a) Freedom of movement.

   (b) Full arc of movement.

   Extreme caution is needed when checking the aileron for movement as the weak cotton flock bond may be broken.

   If either (a) or (b) are not satisfactory operations 6. and 7. must be repeated.

8. The aileron should now be removed from the wing. Care should again be exercised when performing this operation.

9. For each hinge cut two oversize pieces of 92125 cloth, with a cut-out for the cloth to fit over the lug. See Fig. 2.

10. Lay up one layer of 92125 cloth to cover the area shown in Fig. 3; and in accordance with section 2.2.7 and 2.3.2.

11. Cut "lay-up" cloth to dimensions shown in Fig. 3.

12. Lay-up second layer of 92125 cloth as operation 10. See section 2.2.7.

13. Cut second "lay-up" cloth to dimensions shown in Fig. 3.

14. Allow the laminated cloth to cure and inspect according to section 2.2.9.

15. Clean up the laminated area. See section 2.2.10.

16. Finally, check operation No. 7. AFTER REPLACING AILERON.

2.2.21 Removal and Installation of Aileron Control Surface Hinges

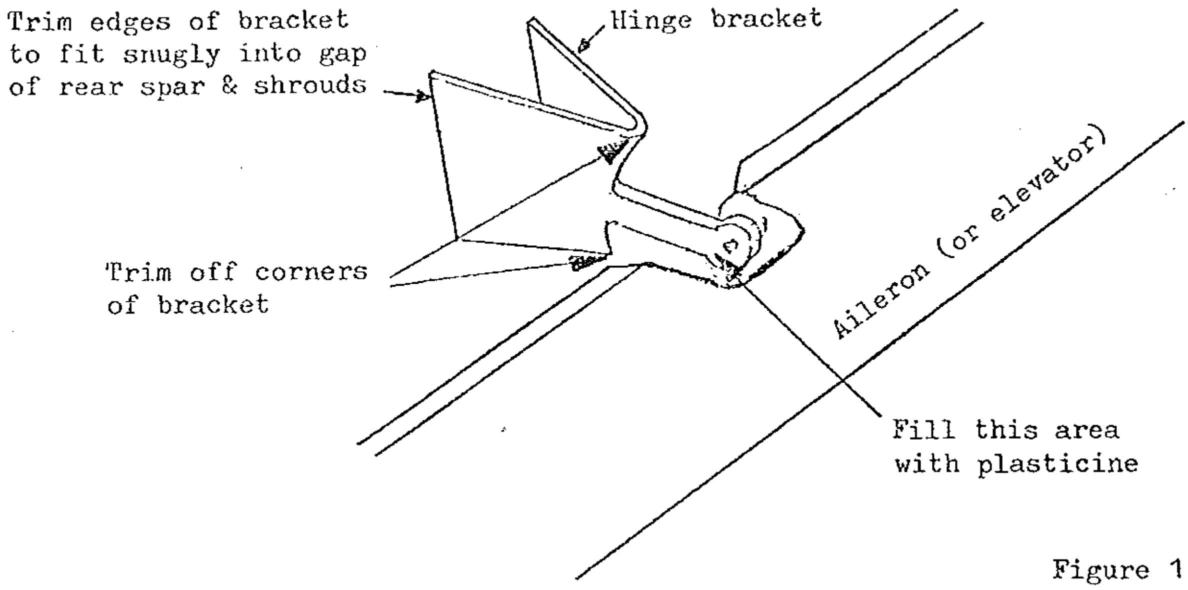


Figure 1

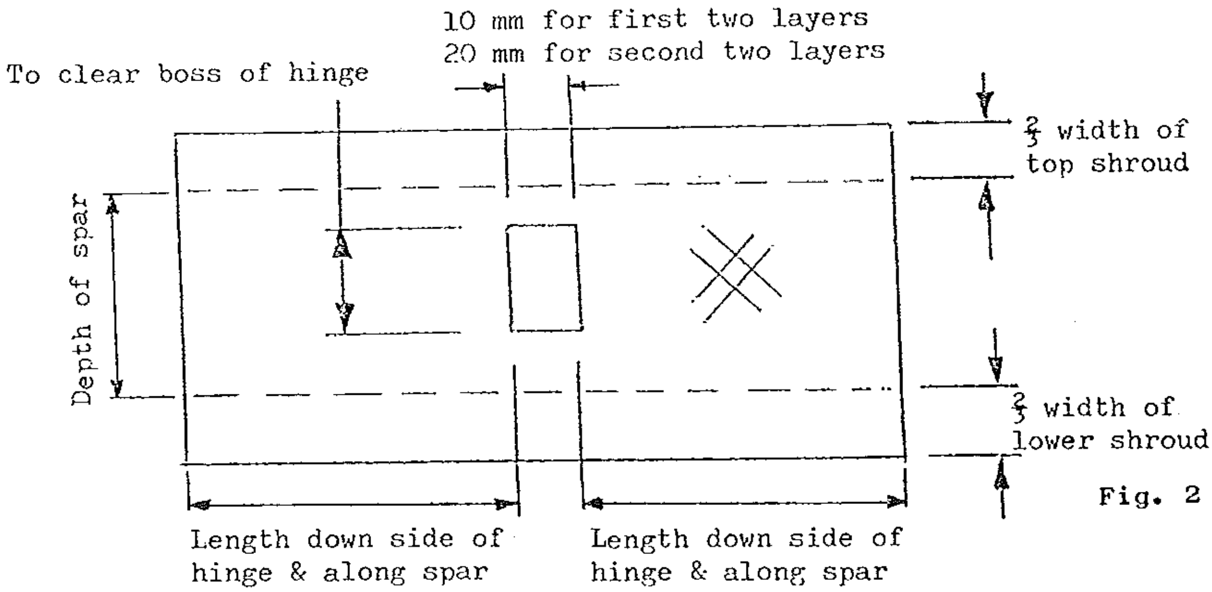


Fig. 2

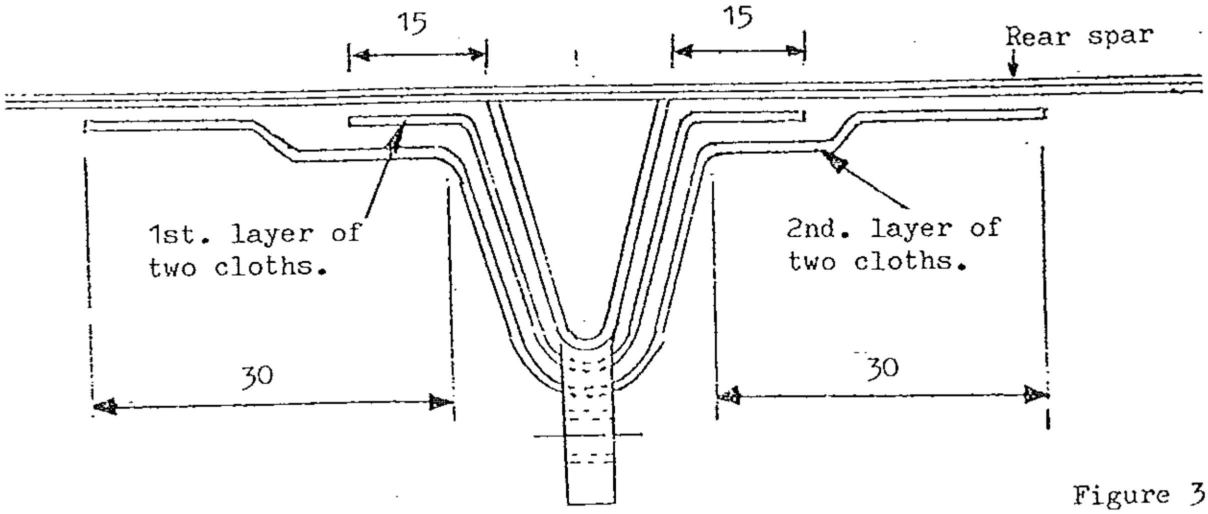


Figure 3

2.2.22 Installation and Removal of Roller Box Assemblies

This section applies to all roller box assemblies.

1. Remove roller box assembly and securing cloth using a sharp chisel, being particularly careful not to damage the parent cloth.

2. Clean the general area on which the roller box assembly is to be fitted, according to section 2.2.6.

3. Position the roller box assembly by sliding the relevant pushrod through the rollers and assembling complete. Adjust the roller box to give equal clearance either side of the pushrod and draw a pencil line around the box assembly.

4. Fix the roller box assembly in position using a small amount of cotton flock, according to section 2.3.9, and allow to set hard.

5. Check position of pushrod relative to rollers and, if necessary, repeat operations 3. and 4.

6. Cut 8 pieces of 92125 cloth as per Fig. 1 (2 on each face).

7. Lay-up cloth layers as shown in Fig. 1, according to section 2.2.7.

8. Allow the laminated cloth to cure and inspect, according to section 2.2.9.

9. Check the pushrod control for full and free movement.

2.2.22 Installation and Removal of Roller Box Assemblies

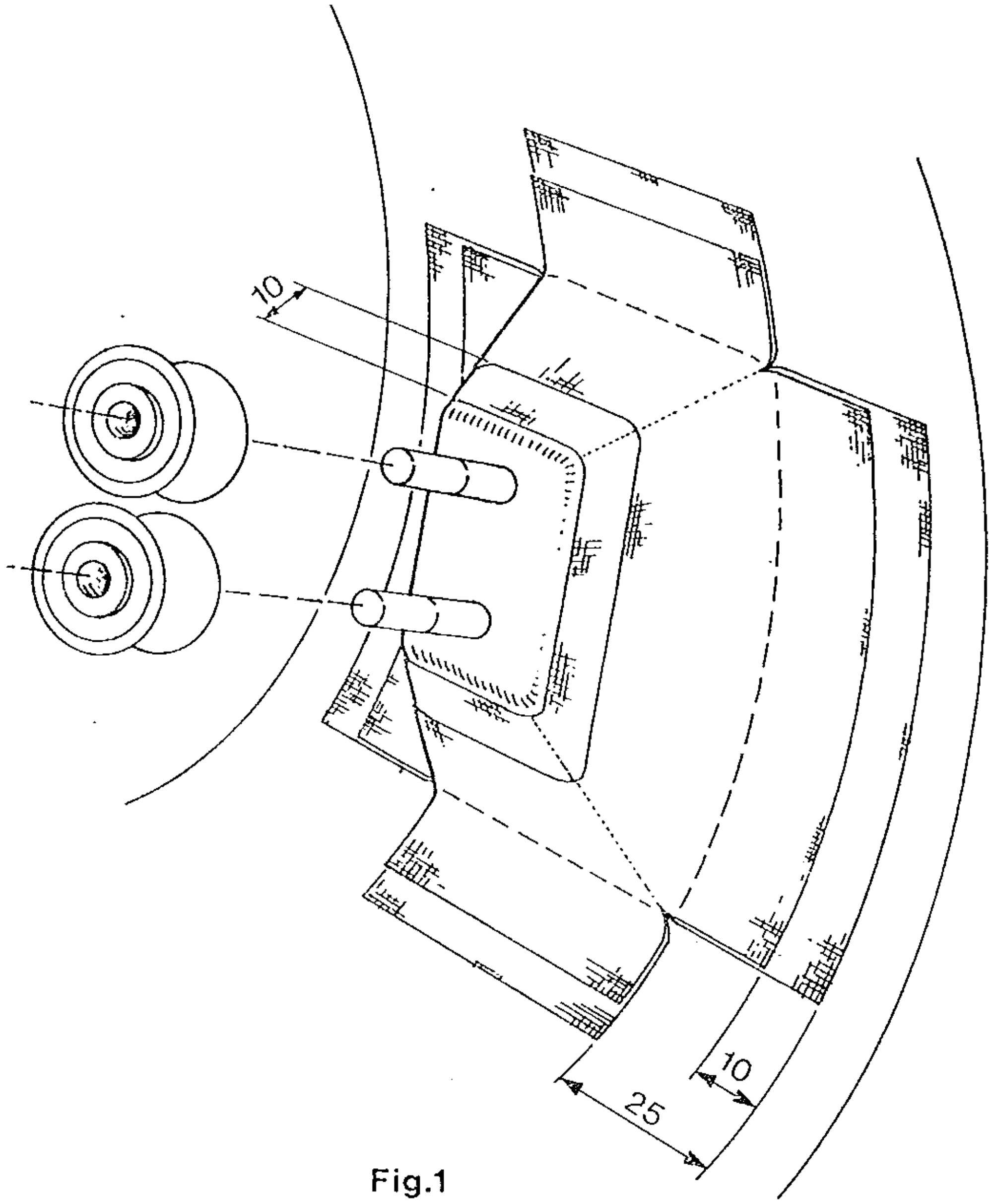


Fig.1

2.2.23 Repair of Worn Bushes

Worn bushes may be rebuilt using a resin based filler material which has good bearing properties.

If the bush carries a non-moving part its material will have a neutral glass fibre colour and the filler mixture required is as specified in section 2.3.11.

Depending upon the degree of wear there are two alternative repair methods as follows:

A. The bush is rebuilt around an undersize mandrel which is removed after the resin has set. The resulting hole is then reamed out to size. This method is used when the amount of wear is slight and only a very thin layer of filler is required to bring the bush back to size.

B. The bush is rebuilt exactly to size around the actual bearing member (or a mandrel of identical size). This method is used when the thickness of filler required is fairly larg(

The general repair technique is as follows:-

1. Set bush axis vertical.

2. Degrease and abrade the bore as described in section 2.2.6 - A.

3. Blank off the lower end of the bush with a backing piece (Fig. 1).

4. If the mandrel is tubular, blank off one end.

5. Wax release the mandrel surface.

6. Estimate the quantity of filler required. Mix it gently to avoid stirring in air, if possible leave to stand for 10 minutes, and then pour it into the bush hole (Fig. 2).

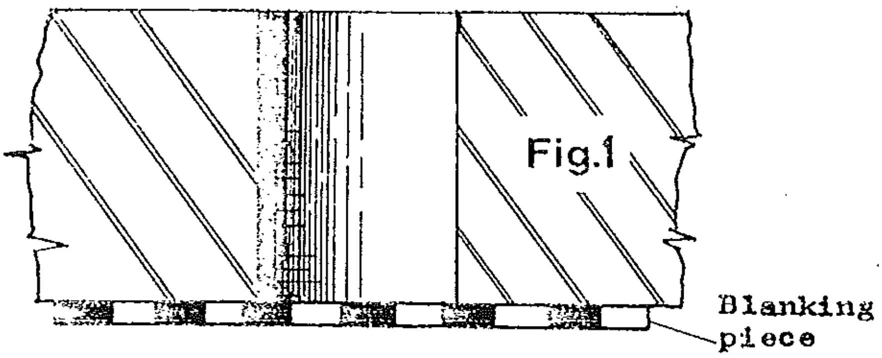
7. Gently push the mandrel to the bottom of the bush. This forces the filler up the annulus and any surplus out of the top.

8. If the bush has an opposite mate, the mandrel must be aligned with it and secured until the filler has set (Fig. 3).

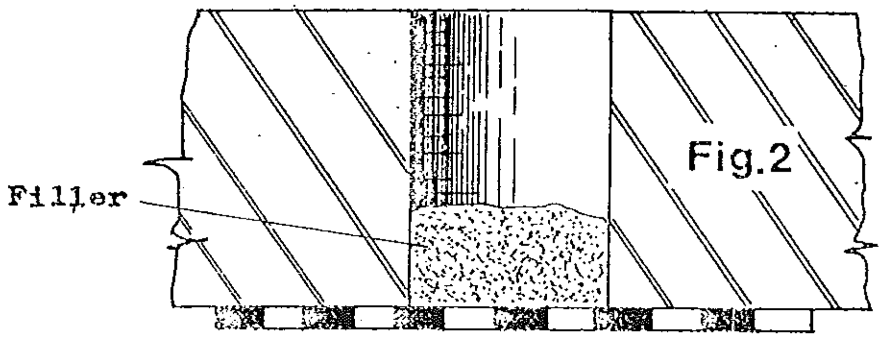
9. The mandrel is now removed, and if required, the bush is reamed to size.

10. The bush surface should be examined and must be found void free. If any voids are present the effective bearing area is reduced and the filler strength lowered. In this case, the filler must be completely removed and a fresh attempt made.

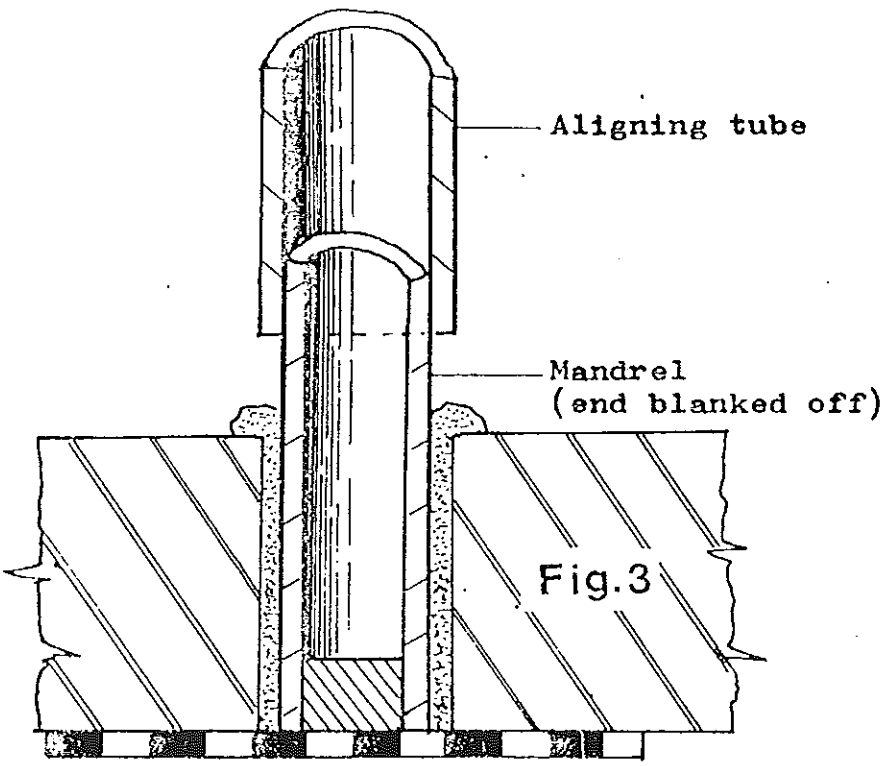
2.2.23 Repair of Worn Bushes



Lower end of bush blanked off



Filler poured into bush hole



Mandrel pushed into bush bore and aligned
with opposite mating bush

2.2.24 Renewal of Wing Tang Spigot

Damage occurring to the rigging pins; in the form of scoring on the pin which makes rigging difficult or which is on the stressed portion of the pin, may necessitate the fitting of new pins. (See diagram).

This work must be carried out with great care throughout as delamination of the binding cloth around the root fitting will require a more major repair.

1. From the diagram mark the position of the hollow rivet holding the pin into the root fitting. Drill through the fibre glass on one side of the tang towards the centre of the hollow rivet using a $\frac{1}{8}$" dia. drill. Similarly, drill from the other side.

2. Mark the boundary of cloth to be removed by scribing a 15 mm dia. circle with the pilot hole as a centre.

3. Using a pointed rotary file gradually open up the pilot hole to the scribed mark and expose the full rivet head. (See diagram).

4. Drill off the rivet head and extract the 8 mm dia. rivet.

5. Drill a $\frac{1}{4}$" dia. hole in the pin to enable a tommy bar to be pushed through, and using the tommy bar remove the pin.

6. Fit the new pin, assembling with anti-fretting compound. (Duralac, Celloseal, etc.).

7. Fit the new rivet supplied.

8. Using coarse emery cloth abrade the metal parts at the base of the hole and the fibre glass around it. Degrease the hole using Acetone or MEK and allow to dry (at least one hour in warm conditions).

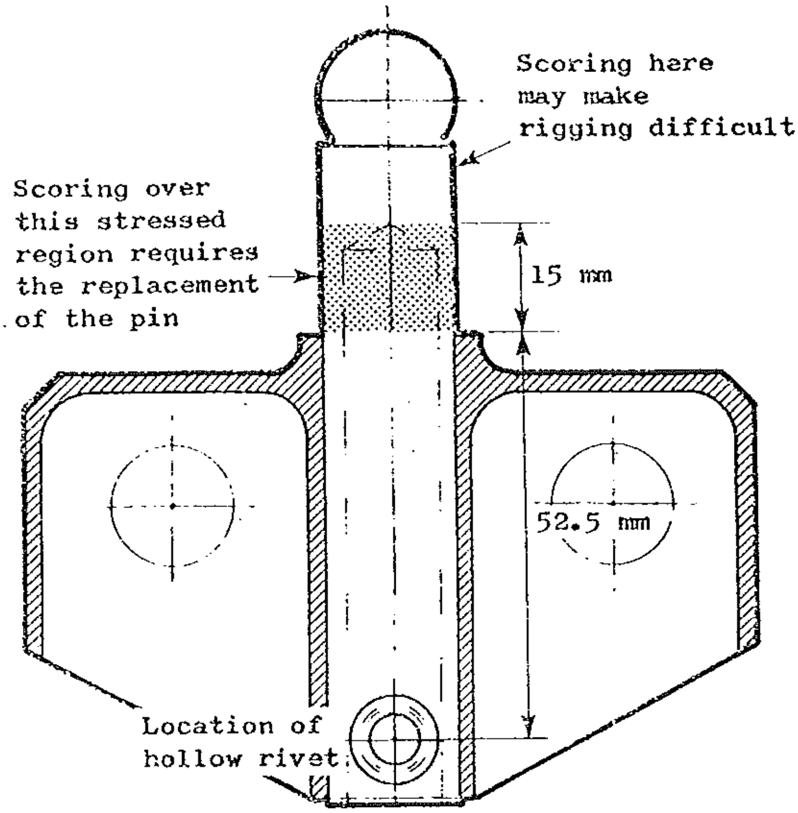
9. The hole must now be inspected to show that delamination of the fibre glass around the hole has not occurred. (See diagram). If it has delaminated beyond the limits indicated a further repair must be tackled, and reference <u>must</u> be made to Vickers-Slingsby for further information.

10. If the hole is acceptable prepare glass flock according to section 2.3.10.

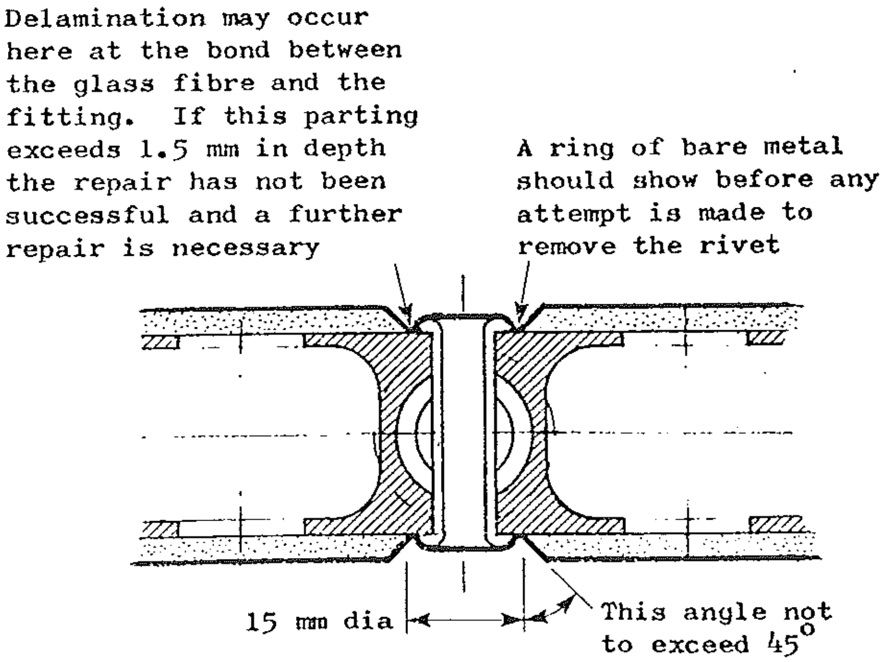
11. Fill the holes with glass flock starting by smearing all the surfaces inside the hole with the glass flock mix. Leave the flock standing proud of the hole and finally clamp two pieces of wood (covered in sellotape or polythene) over the flock compressing the flock and squeezing out the resin. Leave for 12 hours in warm conditions to cure.

12. Finally, dress the repair.

2.2.24 Renewal of Wing Tang Spigot



Section through fitting
(typical for both fittings)



Section through hollow rivet
showing size of cut-out in cloth

2.3 MATERIALS SECTION

2.3.1 Some Do's and Don'ts

DO refer to the manufacturer in any case of doubt.

DO remove all damage back to solid glass fibre laminate.

DO remove all gel coat from any bonding surfaces.

DO stagger all layers of cloth and use the correct splice angles.

DO mix the resin well and in the correct proportions.

DO use clean working surfaces and tools.

DO check all control movements after completion of the repair.

DO NOT contaminate the repair with oil, wax, grease, etc.

DO NOT use dirty mixing pots or brushes.

DO NOT use oversize patches.

DO NOT lay the cloth in a different direction to the original.

DO NOT disturb the repair until the resin has cured.

DO NOT use waxed pots.

DO NOT forget to check the soundness of the repair before flying the glider again.

DO NOT leave dust, tools, chippings, sandpaper, etc., in the glider.

2.3.2 Laminating Resin - Glycidyl Ether 162

This section gives details of Glycidyl Ether 162 which is the currently recommended laminating resin.

Storage	As section 2.1.2. Shelf life unlimited.
Safety Precautions	As section 2.1.4.
Hardener	Shell Epikure 113
Mixing Proportions	By weight: 100 parts resin to 38 parts hardener. By volume: 2 parts resin to 1 part hardener.
Cure Cycle	Mass 100 g - Pot life at 23°C = 50-60 min. Mass 500 g - Pot life at 23°C = 15-25 min. After the resin has hardened it must be post cured for 8 hours at 54°C before its full strength is obtained.

2.3.3 Gel Coat Resin - Lesonal Werke

This section gives details of the gel coat which is currently recommended.

Manufacturer's Details	Lesonal Werke (Germany) Gel coat (polyester) - part number 3.6912 Catalyst (hardener) - part number 7.2051
Storage	As section 2.1.2. Shelf life - 6 months.
Safety Precautions	As section 2.1.4.
Mixing Proportions	100 g of resin to 2 cc of catalyst.
Colour	White
Application	The gel coat should be applied with a brush, as evenly as possible and will dry to a tacky surface (ready for laminating) within 60 minutes at 23°C. The surface must always be just dry before any laminating is attempted or any further coats are applied. Any laminating must be done within 24 hours of gel coat application.

2.3.4 Glass Fibre Fabric - Interglas

This section gives details of recommended glass fibre reinforcement materials.

Four types of glass fibre fabric are in current use.

Manufacturer's	Approx. resin weight reqd. for one metre² of cloth	Dry Weight (gm/m²)	Weave Type	Approx. Laminate Thickness (mm)
90070	52	78	Plain	.08
92110	107	160	Twill	.17
92125	187	280	Twill	.29
92145	140	210	Unidirectional	.22

Manufacturer Interglas (West Germany)

Storage As section 2.1.2.

2.3.5 Glass Fibre Unidirectional Rovings - Silenka

Manufacturer's Part No.	1055 - 2400 tex
Dry Weight	2.4 g per metre length.
Manufacturer	Silenka (Holland)
Storage	As section 2.1.2.

2.3.6 Rohacell Foam

Manufacturer's Part No's.	Rohacell 31	- Density 30 kg/m^3
	Rohacell 51	- Density 50 kg/m^3
Colour:	White	
Manufacturer	Cornelius Chemical Co. Ltd.	

2.3.7 Release Agents

This section gives details of the release agents recommended for glass fibre repairs.

Scott Bader Crystic Release Agent No. 1*

Furane Resin (Borden Chemicals).*

Either of the above release agents may be used to seal timber mould surfaces.

Simonize Wax Polish (not with Silicone modification)

Used for polishing mould surfaces.

Scott Bader Crystic Release Agent No. 2 (PVAL)

Liquid release agent to be brushed or sponged onto the mould surface. Allow to thoroughly dry before gel coat application.

*These two release agents are only suitable for sealing timber mould surfaces and are not to be used for releasing glass fibre from mould surfaces.

2.3.8 Microballoon Epoxide Bonding Paste

This section gives details of the microballoon bonding paste and filler which is currently recommended.

Mixture	Glycidyl Ether 162	- 100 parts by weight
	Epikure 113 hardener	- 38 parts by weight
	Microballoons	- 30 parts by weight
	Aerosil	- 0-2 parts by weight

Do not mix more than 500 g at once.

Use within 30 minutes of mixing.

Curing time - 24 hours at 23°C.

2.3.9 Cotton Flock Epoxide Bonding Paste

This section gives details of the cotton flock bonding paste which is currently recommended.

Mixture	Glycidyl Ether 162	- 100 parts by weight
	Epikure 113 hardener	- 38 parts by weight
	Cotton flock	- 20-40 parts by weight depending upon desired thickness

Do not mix more than 500 g at once.

Use within 30 minutes of mixing.

Curing time - 24 hours at 23°C.

2.3.10 Glass Flock Epoxide Mix

This section gives details of the glass flock epoxide mix which is currently recommended.

Mixture	Glycidyl Ether 162	- 100 parts by weight
	Epikure 113 hardener	- 38 parts by weight
	Glass flock	- 50-70 parts by weight depending upon desired thickness

Do not mix more than 500 g at once.

Use within 30 minutes of mixing.

Curing time - 24 hours at 23°C.

2.3.11 Bush Filler Material

This section gives details of the bush filler material mentioned in section 2.2.23. for rebuilding bushes carrying non-moving parts.

Mixing Proportions	Glycidyl Ether 162	- 100 parts by weight
	Epikure 113 hardener	- 38 parts by weight
	Marble Flour	- 360 parts by weight
Cure Cycle	Pot life approx. 45 minutes. The filler must be cured for 8 hours at 54°C before its full strength is obtained.	

3. SERVICE MANUAL

INTRODUCTION

This section details the minimal amount of work required to maintain the Vega in prime flying condition throughout its 'life'.

3.1 CLEANING THE SAILPLANE

3.1.1 Painted Surfaces

Washing the external painted surfaces of the Vega regularly with soap and water to remove grit, dust, etc., will help to maintain its excellent finish. On no account should abrasive detergents be used to clean the external surface.

A final rinse with clean water followed by drying with a soft cloth or chamois is recommended.

A good quality car-type wax may now be used to polish the external surfaces. On no account should a wax containing silicon be used.

3.1.2 Canopy Perspex

The perspex can be washed and rinsed in the normal manner. Never clean the perspex with a dry cloth.

3.1.3 Cockpit Interior

A small portable vacuum cleaner is ideal for removing accumulated dust from the interior.

Interiors having painted surfaces throughout can be washed and rinsed in the normal manner and dried with a soft cloth or chamois.

Fabric interiors can be freed of accumulated mud with a soft brush and the resultant dust removed with a vacuum cleaner.

3.2 REMOVAL AND REPLACEMENT OF CONTROL SURFACES

3.2.1 Removal and Replacement of Elevators

Sequence of operations:-

1. Remove the tailplane from the aircraft in reverse to the manner described in the Flight Manual section on "Rigging the Sailplane".
2. Support the tailplane vertically leading edge down.
3. Remove the split pin and washer at the centre hinge position.
4. Slide the elevator to port and lift it clear of the tailplane
5. Replacement is carried out in the reverse order to the above
6. Check controls for free and full movement, ref. P.33 and 34.

N.B. Renew all used split pins.

3.2.2 Removal and Replacement of Rudder

Sequence of operations:-

1. Remove the tape covering the access holes at the bottom of the rudder.
2. Remove the bolt, washer and nut assembly using a box type spanner.
3. Remove the rudder shroud from the top of the rudder by pressing the shroud arms inwards. The shroud can now be withdrawn passed its hinge pins in the rudder.
4. The rudder can now be withdrawn by the combined action of pulling aftwards at the bottom and lowering the rudder top hinge out of its unibal housing.
5. Replace the rudder by reversing the sequence of operations given above.
6. Check controls for free and full movement, ref. P.33 and 34.

3.2.3 Removal and Replacement of Ailerons

Sequence of operations:-

1. Support the wings.
2. Open the airbrakes.
3. Remove the detachable inboard end of the aileron by unscrewing the two socket head screws.
4. Slide the aileron inboard approximately ¾" and lift away from the wing and actuator.
5. Replace the ailerons in reverse sequence to their removal.
6. Check controls for free and full movement, ref. P.33 and 34.

N.B. If sealing tape is fitted this must be removed before the ailerons are removed.

3.2.4 Removal and Replacement of Flap/Airbrake Assembly

Sequence of operations:-

1. Support the wing.
2. Open the airbrake fully.
3. Disconnect the drive to the flap at the inboard end by removing the headed pins and split pin.
4. Disconnect the drive to the airbrake at the point where the forked pushrod attaches to the triangular shaped swinging link. Do this by removing the split pin, washer and headed pin at three positions along the airbrake.
5. Rotate the airbrake further open and remove the screws retaining the ten airbrake hinge pins.

N.B. These are held in position with Loctite and may be difficult to remove.

6. Remove these airbrake hinge pins and lift away the flap/ airbrake assembly complete.

7. Replacement is carried out in the reverse order to the above. Use Loctite 636 to lock the pin retaining screws.

8. Check controls for free and full movement, ref. P.33 and 34.

3.2.5 Balancing Requirements for Control Surfaces

Control Surface	Maximum Allowable Unbalance (lb ins) (kg mm)	Maximum Allowable Free Play* (ins) (mm)	Maximum Mass (lbs) (kg)
Rudder	15.00 173.00	±0.12 ±3.00	4.10 1.85
Aileron	5.00 58.00	±0.08 ±2.00	4.50 2.05
Elevator	6.00 69.00	±0.08 ±2.00	3.30 1.50
Flap	N/A	±0.08 ±2.00	) 17.50
Airbrake	N/A	0.08 2.00	) 7.95

*Measure the free play at the trailing edge adjacent to the actuator position/s with the control surface in the neutral position, except for the airbrake which should be fully open.

3.3 LUBRICATION

3.3.1 Prior to Rigging the Aircraft

Thoroughly clean and grease the areas detailed below:-

(i) Wing root end spigots and unibal bearings.

(ii) Wing to fuselage flap drive coupling faces.

(iii) Tailplane attachment points.

3.3.2 Every 100 Flying hours or 6 Months

The areas defined below should be thoroughly cleaned and greased every 100 flying hours or 6 months, whichever occurs first:-

(i) Aileron, rudder, elevator, flap/airbrake hinge assemblies.

(ii) Rear undercarriage.

(iii) Main undercarriage and control circuit.

(iv) Aileron, elevator, rudder and flap/airbrake control circuits complete.

N.B. The recommended grease for all applications is Aeroshell grease.

3.3.3 Tow Hook Release Mechanism

The tow hook release mechanism is situated on the under carriage front leg because of this the item requires frequent inspections.

The actual frequency of inspection will depend on how often water ballast is discharged and the gliding site being used. The following minimum maintenance is required:

Every Three Months or 100 Hours Flying

Remove the quick release from the aircraft and clean off excess dirt with an airline. The release should then be examined as follows:

1) Examine the attachment holes for wear

2) Examine the two springs for wear, corrosion and slackness

3) Examine the ring carriage for excessive wear marks, freedom of movement and wear on the pivot bolt exceeding .010"

4) Examine the hook for excessive wear marks and free play which should not exceed .025" sideways or fore/aft.

5) Examine the release cable attachment point for wear.

If any of the above conditions are present the unit should be serviced and the worn parts replaced.

If the inspection was satisfactory the unit should be greased as follows:

1) Remove the bolt attaching the ring carriage and hook and allow the hook and carriage to slide from the housing. Take care to preserve the four thin washers on this pivot. The nut may be reused since it is captive in the Vega installation being prevented from falling off by the attachment plates on the under carriage.

2) Apply grease liberally around the pivot and on the link ends.

3) It will not normally be necessary to remove the second bolt holding the operating quadrant to grease the top pivot. If it is desired to inspect more thoroughly the bolt may be removed and the quadrant together with the hook and link arrangement can be withdrawn Take care to preserve the two distance tubes which lie on the quadrant bolt inside the springs. The nut may be reused since it is held captive by the attachment angles.

4) Having thoroughly greased all parts of the mechanism replace the components in the reverse order.

5) Check for full and free operation with a cable ring.

6) Refit the release unit to the Vega.

3.4 HANDLING AND TRANSPORTATION

The greatest care should be taken when man-handling GRP sailplanes because the slightest impact or rubbing action with harder than GRP materials can easily ground the aircraft at the most inconvenient of times.

Transportation of the Vega sialplane should be done using a Vickers-Slingsby trailer which will have been specifically designed for this purpose. Failing this the following points should be observed when transporting the sailplane:-

(i) Support the wings via the root tangs and at the tip, being sure at the latter position to use a foam cushion inside the strapping device to protect the delicate wing skin. Fix all the control surfaces and rigidly attach the wing supports to the trailer.

(ii) The fuselage can be supported on its wheels and/or by the wing pick-up pins.

(iii) The tailplane and elevator assembly should be clamped in a suitably cushioned trestle and rigidly attached to the trailer.

Finally, double check the components are rigidly fastened down and that no movement can occur during transit.

In the case of an open trailer the sailplane should be completely covered with a waterproof sheet which will not scratch the canopy or paint.

TECHNICAL INSTRUCTION

TITLE T65 'VEGA' Canopy Jettison Mechanism

T.I. No. 105/T65

CLASSIFICATION C.A.A. Mandatory

COMPLIANCE Inspection to be carried out before next flight, unless LTO 'Elevator & Canopy Jettison Mechanism', 20th August has been carried out.

OBJECTIVE

To ensure the canopy will jettison during flight if required.

JUSTIFICATION

A malfunction of the canopy emergency jettison mechanism during flight prevented the pilot from abandoning the aircraft.

APPLICABILITY

All Slingsby T65A, C, D gliders, expanding on CAA Airworthiness Directive No. 006-09-82 (LTO 'Elevator & Canopy Jettison Mechanism', 20th Aug).

CONSEQUENTIAL LIMITATIONS

ACTION

Inspection must be carried out on receipt of this T.I.

1.1 Remove the canopy from the fuselage.

OK 1.2 Ensure the two bolts (indicated in Fig 1, Item 2) are tight.

OK 1.3 Inspect the front portion of the release pushrod (Fig 1, Item 1) and ensure the pushrod is not bent. The release pushrod should slide easily through the guides by pulling on the canopy jettison handle.

1.4 Inspect the pitot tube for damage where the tube is routed under the channel sectioned arm of the canopy. If damage is apparent replace the pitot tube and re-rout the tube on the outer surface of the channel securing the tube as previously (refer Fig 3). DONE

2. Before further flight modify, and check the operation of the canopy release mechanism as follows :-

DONE 2.1 Cut the tube on the release pushrod to a height of 15mm (refer Fig 1).

DONE 2.2 Paint a white line on the canopy arm marking the position of the tube (Fig 1) on the release pushrod in the locked position.

PARTS REQUIRED

ISSUED BY: B Mellers

for and on behalf of **SLINGSBY ENGINEERING LIMITED**
Kirkbymoorside, York YO6 6EZ, England. Tel.0751 31751 Telex 57911

Date 22 Sept 82

VEGA MANUAL

AMENDMENTS

Amendment No.	Amendment Date	Pages Affected	Incorporated by
1	April 1978	(4 Issue 2 (10 Issue 2 (11 Issue 2 (14 Issue 2 (15 Issue 2 (17 Issue 2	
2	May 1978	(6 Issue 2 (31 Issue 2 (33 Issue 2 (34 Issue 2 (35 Issue 2	
3	June 1978	(1 Issue 2 (2 Issue 2 (3 Issue 2 (4 Issue 3 (5 Issue 2 (9 Issue 2 (10 Issue 3 (11 Issue 3 (13 Issue 2 (15 Issue 3 (17 Issue 3 (18 Issue 2 (19 Issue 2 (20 Issue 2 (21 Issue 2 (22 Issue 2 (23 Issue 2 (26 Issue 2 (27 Issue 2 (28 Issue 2	

VEGA MANUAL

AMENDMENTS

Amendment No.	Amendment Date	Pages Affected	Incorporated By
4	June 1978	(Contents Issue 2 (3 Issue 3 (4 Issue 4 (11 Issue 4 (29 Issue 2 (30 Issue 2 (31 Issue 3 (130 Issue 2 (131 Issue 2 (132 Issue 2 (133 Issue 2 (134 Issue 1 (135 Issue 1	
5	July 1978	(3 Issue 4 (3a Issue 1 (11a Issue 1 (11b Issue 1 (31 Issue 4 (31a Issue 1	

VEGA MANUAL

AMENDMENTS

Amendment No.	Amendment Data	Pages Affected	Incorporated by

VEGA T65 MANUAL AMENDMENT - T65-17L These pages are to inserted into the back of the Vega Manual.

5.2 T65-17L

The T65-17L differs from the standard Vega in that removeable wi extensions are fitted at WS 7395 which increase the wingspan to metres. Fittings are provided to enable the origional wingti to be refitted (15 metres wingspan). Adequate strength margins the 17 metre configuration are maintained by built-in mass balan within the extensions to provide wing bending inertia relief, a by avoiding carriage of water ballast. In the 15 metr configuration the glider reverts to T65A or T65D (as appropriate as described in previous parts of this manual. CG limitations a unchanged when in the 17 metre configuration. Never exceed spee reduces to 125 knots and there is a small increase in max AUW other flight limitations are unchanged.

The following sections of the manual are amended :

1.3.1 Wing	Vega T65-17L
Area	10.67 sq m
Span	17.00 m
Aspect Ratio	27.1
Standard Mean Chord	0.627 m
Chord at WS 7395	0.370 m
Chord at WS 8350	0.270 m
Aileron area	0.381 sq m
Aileron chord/wing chord	0.17 out to WS 7395, then increasing linearly to 0.23 at WS 8350
Aileron span	3.38 m

1.3.6 Weights

Max AUW without water ballast	377 kg (830 lbs)
Max landing weight	377 kg (830 lbs)

Water ballast : NOT to be carried

1.4.3.1 Rigging the sailplane : Fitting the wingtip extensions

Remove the 15 m tips by ~~rotating the retaining pin head out of i detent~~, pulling the pin out forwards, and sliding the tip off Slide in the tip extensions, ensuring that the aileron extensio pins engage in the last 15 mm of travel. Insert the retaining pi ~~and rotate the head into its detent when~~ fully home. The junctio between the wing and wing extension must be sealed using 25 m wide PVC tape. The junction between the aileron and its extensio must not be sealed with tape.

Operating Limitations - T65-17 L

1.5.1 Weights

Max take off weight
(No water ballast) 377 kg (830 lbs)

1.5.2 Speeds

Flap operating range 41-125 knots (76 - 231 km/h)

Max speed airbrakes open: 125 knots (231 km/h)

125 knots (231 km/h) to be marked by red radial line on ASI.
106 to 125 knots (197 to 231 km/h) to be marked by yellow arc on A

SAILPLANE SERVICES

Telephone: 0362 693898

Proprietor: J H Odell
BGA Senior Inspector
1/C/111 ME

24 Neatherd Moor
Dereham
Norfolk
NR20 4AX

Invoice Number :

Date: 16 Mar 89

Name: C Clarke

	£	p
To supply of Vega wing extensions, and modification of Vega BGA 2496 to T65-17L standard.	1875	00
Total	1875	00

24 Heatherd Moor
Dereham
Norfolk
[illegible]

Telephone: [illegible]

[illegible]

Invoice Number : 003

Date: 16 Mar 89

Name: C Clark

[illegible]

Total [illegible]

Paid with thanks

[signature]

I look forward to meeting you on 16th March 1989.

Sincerely

Jerry Odell

J H Odell

SAILPLANE SERVICES

Proprietor : J H Odell

Tel : 0362 693898

Sailplane Services
24 Neatherd Moor
Dereham
NORFOLK
NR20 4AX

Mr G J Clarke
Woodcroft
Frome Park Road
Stroud
Glos.

20th February 1989

MOD 27 17.1.80.

Dear Chris

Thank you for your deposit of £200 for the modification kit to bring your Vega to T65-17L standard. Please confirm that your glider is a T65A, has Mod 27 or 28 embodied, and does not have Mod 20 or 34 embodied, and has the white acriylic finish, rather than the optional gell coat.

I confirm that I have booked in your glider for the week beginning 13th March 1989 and I would be grateful if you could deliver it to me on Thursday 16th March after 5pm, rather than Tuesday 14th March as we tentatively agreed. You will be able to see your wing extensions then, and if you are not satisfied with the product then you can have your deposit back and cancel the deal.

The glider should be ready for collection by the following Sunday, although I would be able to park the glider and trailer elsewhere for you until after Easter. However I would not be able to accept liability for the glider and I ask for confirmation that the glider will be covered by your insurance whilst in my custody, including whilst I am towing it; you will need to clear this with your insurers. You will also need to advise your insurers of the modification, which changes the type designation of the glider, and which will be a material fact to the policy, as well as increasing the hull value by £3000!

The total price for the modification is now £1,875, including painting, but not including BGA certification (£25). Please bring with you a bankers draft or Building Society cheque to £1,675 payable to Sailplane Services, and a separate cheque payable to the BGA : the terms are cash on delivery.

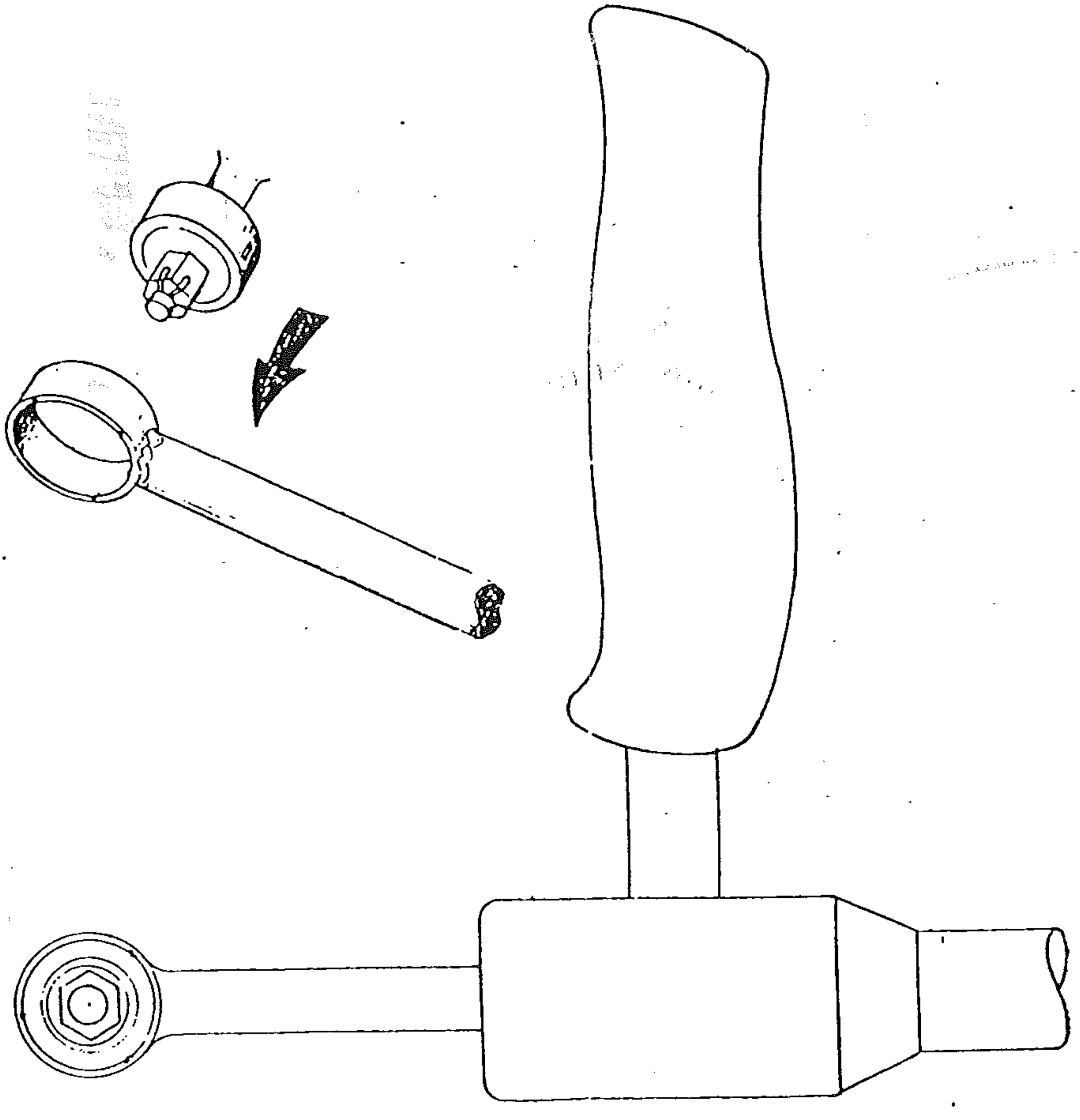
I am now in discussion with a packaging company who are designing me a container for the wingtips, suitable for screwing to your trailer wall. I will advise price and availability of this container in due course : please let me know if you are interested.

Vega Undercarriage Lever.

Failure of rod-end bearing assembly resulting in undercarriage collapse on takeoff.

The unibal race is a light interference fit in in a steel eye welded to the rod end. Retention is assisted by three light peening marks impressed into the eye. The eye detached from the bearing and fell free into the cockpit releasing the undercarriage lock. The assembly *may* have been weakened by operation of the lever from outside and across the cockpit when fitting the belly trolley.

Re-fitting the unibal race with heavier peening and Loctite 'Bearing Fit' 641, available in 5ml packs from Bearing Services, plus greater care in ground operation should prevent further problems.



Tony Moss. Borders Gliding Club, Galewood Airfield, Wooler, Northumberland.

Slingsby T.65A.

SLINGSBY T.65A - VEGA MANUAL.

G-BGCU

This manual complies with British Civil Airworthiness Requirements Chapter A6-2 and A6-7, the technical content of this manual has been verified and certified correct.

Signed ....

R. Sanders
Chief Designer.

Date: 13TH JUNE '78

C.A.A. Approval No. DAI/2243/46

....

G.E. Burton
Managing Director

DWG/MS
March, 1978

TECHNICAL INSTRUCTION

TITLE	
T65 'VEGA' Canopy Jettison Mechanism	T.I. No. 105/T65

✓2.3 For the canopy to jettison, the pitot tube must disconnect relatively easily from the instrument panel. Therefore the connector must not have the tubes wired or retained in any manner, but only have the pitot tubes pushed into position, utilising a connector similar to that shown in Fig 2.

✓2.4 The canopy hinge beam may require the area 'A' (Fig 1 & Fig 3) to be filed away giving a smooth radiused profile to prevent a foul occuring when the canopy is jettisoned.

✓2.5 OK. With the canopy in the closed position and locked, pull the canopy jettison handle and simultaneously lift the canopy at the fwd end. The canopy should now lift off hinging about the aft latching point.

FIG 1 T65 Canopy Jettison Mechanism

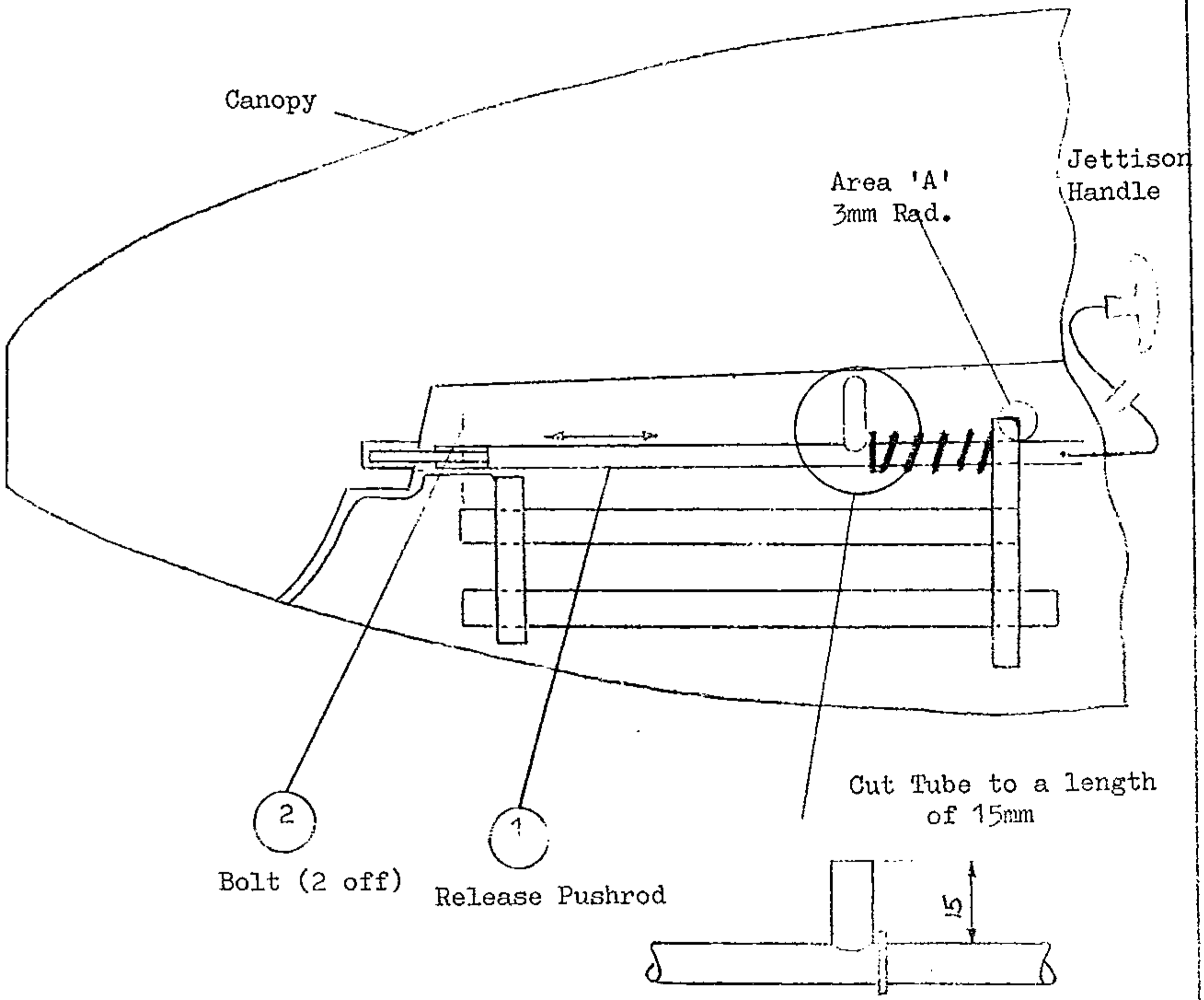


FIG 2

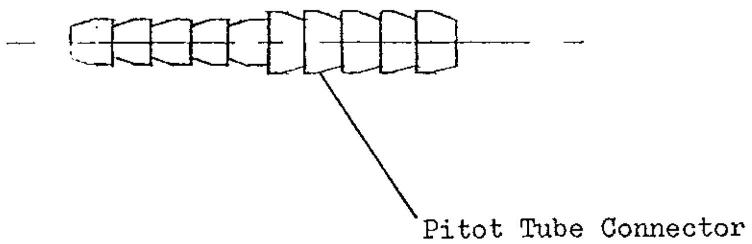
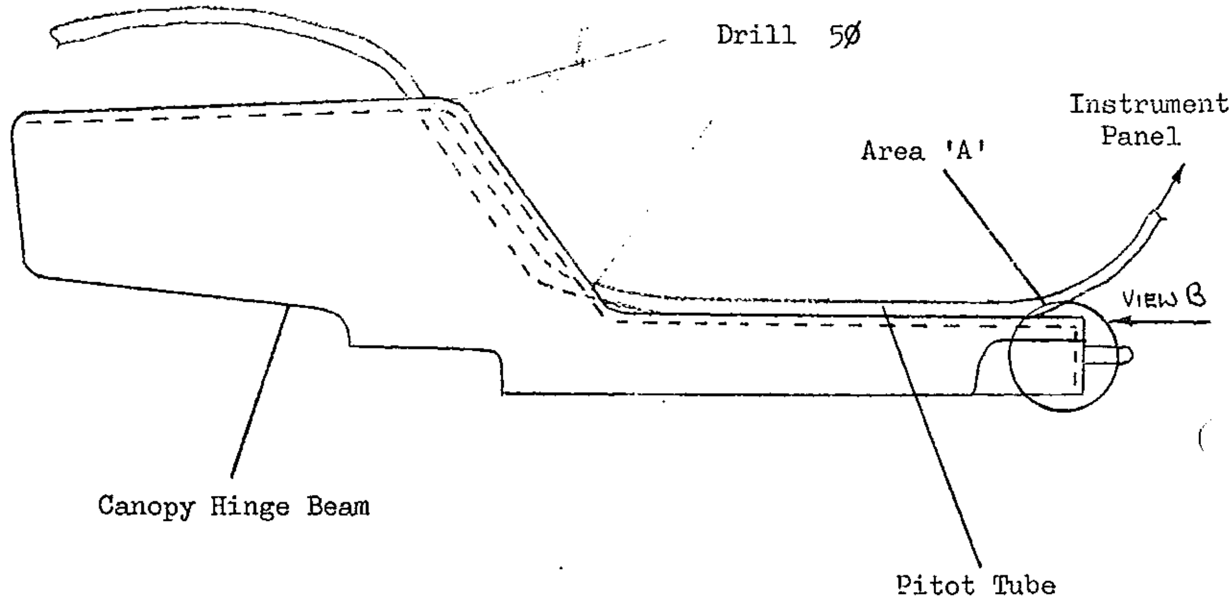
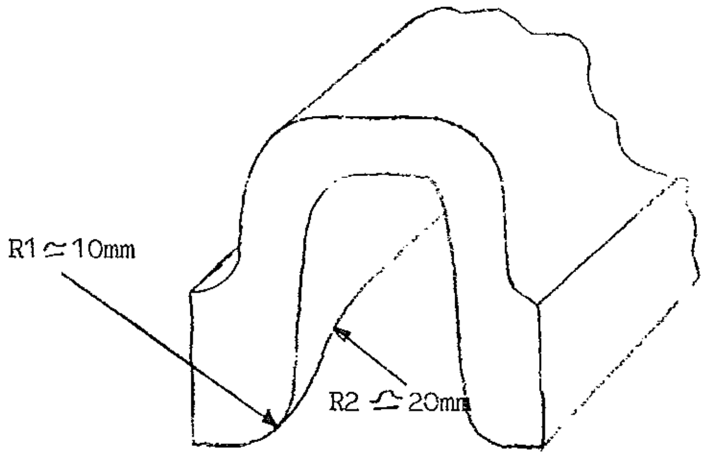


FIG 3

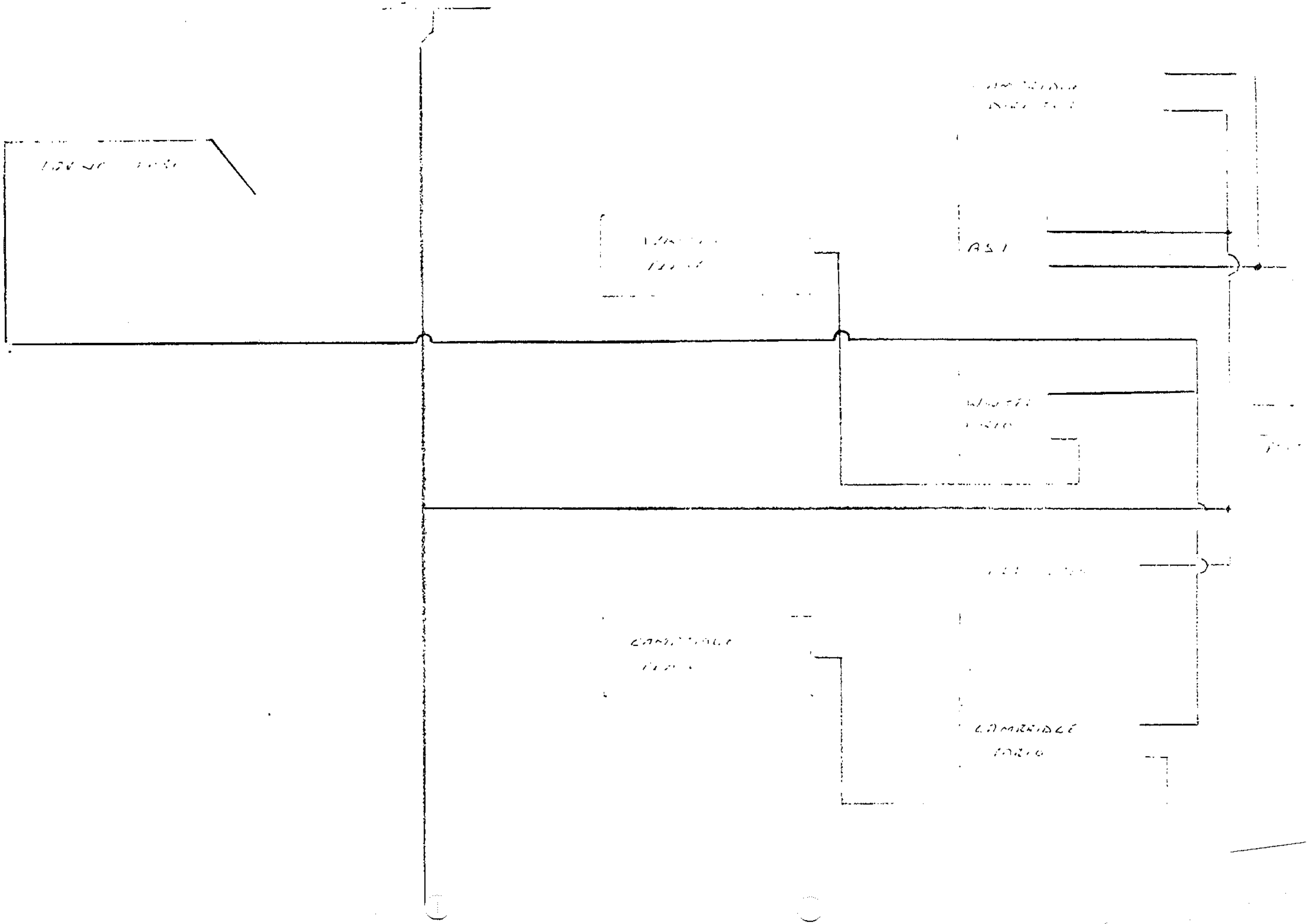


VIEW B



Radius the corners (R1 & R2)

BM.



SLINGSBY ENGINEERING LIMITED

Kirkbymoorside, York YO6 6EZ, England

Telephone 0751 31751 *Telex 57911*

Aircraft Type T65A Vega Constructors No. 1893

Registration No. G-BGCU Airframe Hours:

Certificate of Compliance

Work carried out to Slingsby Engineering Limited Sales Order Vega 9. Recorded and signed for on Slingsby Engineering Limited Work Sheets REP/C 1816.

The following Modifications and Technical Instructions have been carried out:

1. MANDATORY	MOD 12	Flap Airbrake Control Handle. Intro "Lock over" (TI85) TI82 restriction removed.
	MOD 27	Vega Wing Repair (TI88)
	MOD 30	Increased strength tail wheel top support tube.
	TI 83	Wings Deflocked.
	TI 84	Mandatory inspection of Aileron Circuit.
	TI 86	Water Ballast warning placards fitted.
	TI 89	Inspection of Stiff Anchor Nuts.
2. NON-MANDATORY	MOD 11	Flap Airbrake Lever in cockpit. Fwd attachment is now Universal Joint.
	MOD 15	Extendable Canopy Catch.
	MOD 23	Tubular fairing for rear u/c retraction cable.
	~~DOI T65A 606~~	~~Rigging bar bushes - 0.01" removed from faces.~~

The aircraft has been re-weighed and new placards fitted. New Empty weight is 576lbs and revised C of G is 21.01" AOD. Max. pilot weight is 199lbs. Min pilot weight 143lbs.

Duplicate inspection peffomed on Aileron, Flap/Airbrake and Undercarriage controls in accordance with the requirements of British Civil Airworthiness Requirements Chapter A4-3.

1st Sig: .... DAI/2243/46 Authority ...17.JAN.1980... Date

2nd Sig: .... DAI/2243/46 Authority ...17.JAN.1980... Date

I hereby certify that the inspection/overhaul/repair/replacement/modification specified above has been carried out in accordance with the requirements of Chapter A4-3 of British Civil Airworthiness Requirements.

Signed: .... Date: 21.JAN.1980

DAI/2243/46 Authority
Deputy Chief Inspector

For and on behalf of
Slingsby Engineering Limited

Issue: 1
19.2.80

Slingsby Engineering Limited

Kirkbymoorside

YORK. YO6 6EZ

TECHNICAL INSTRUCTION No. 91

SLINGSBY T65A VEGA

PREFLIGHT INSPECTION AND REPLACEMENT OF ELEVATOR ACTUATOR PIVOT PLATE PIN

Introduction

A case has been recently reported of the circlip that holds the pivot pin in place, being knocked off during rigging. This instruction requires a pre-flight inspection and later replacement of pin and circlip with a new pin to take a split pin and washer.

Applicability

All T65A Vega gliders fitted with circlip retained pin. Works Nos 1885 to 1920 inclusive.

Compliance

This instruction has been made mandatory by the C.A.A. A pre-flight inspection is required until modification action has been embodied. A new pin is to be fitted within three months of receipt of this instruction and log book marked T.I.91 satisfied.

Procedure (Pre-Flight Inspection)

Determine whether the glider has the circlip retained pin fitted. If so please inform Slingsby Engineering Limited who will provide a new pin free of charge. The pin is to be found on top of the fin rear spar and holds the elevator actuator plate onto fin post fitting. Note position of circlip, i.e. port or starboard. Carefully rig tailplane into position, deflect the rudder fully opposite to the side of circlip, with the aid of a torch, look up through a small gap in the elevator actuator plate and check that circlip is in position. If circlip is not in position remove tailplane and replace circlip. Repeat above procedure.

Procedure (Replacement Pin)

Remove circlip and pin. Fit in new pin from stbd side add washer and split pin. Rig tailplane and check for free movement in elevator.

Parts Required (to be supplied, on demand, by Slingsby Engineering Limited)

1 off T65A-45-136 (Iss 2 or subsequent) pin
1 off SP126/E Washer (thin)
1 off SP90/B4 Split pin.

DETAILS OF FINAL ASSEMBLY AND RIGGING

CONSTRUCTORS NO: ....1893........ REG. MARKS: ...G-BGCU........ DATE: ....18.1.80..............

	REQUIRED TO DRAWING T65A-00-2	ACTUAL MEASUREMENTS PORT	STBD.	CONCESSION REMARKS
PLANE INCIDENCE	30' ± 20'	NO CHANGE		
PLANE DIHEDRAL	2°30' ± 10'			
T DIAGONAL	EQUAL ± 40mm			
DIAGONAL	EQUAL ± 15mm			
RON MOVEMENT NEUTRAL FLAP	UP 23° ± 1°	23°	24°	
	DOWN 10° ± 1°	10°	9°	
RON MOVEMENT FLAP UP 8°	UP 7°30' ± 1°	7°	7°	
RON MOVEMENT FLAP DOWN 8°	DOWN 9° ± 1°	9°	9°	
MOVEMENT AIRBRAKE CLOSED	UP 8° ± 1°	8°	8°	
	DOWN 8° ± 1°	8°	8°	
MOVEMENT FULL AIRBRAKE	DOWN 40° ± 2°	41°	41°	
RAKE AT W/STN 4080	83mm MIN (48° MIN)	85m/m	85m/m	
ER	EACH WAY 25° ± 2° 125mm ± 10mm	NO CHANGE		
ATOR MOVEMENTS	UP 24° ± 1°30'			
	DOWN 16°30' ± 1°30'			

RAFT RIGGING POSITION. FUSELAGE RIGGING PINS HORIZONTAL.