ASTIR CS 77

Flight and Maintainance Manual

For the ASTIR CS 77 glider

Registration: D-7634 Work No: 1705

Re-registered as: British Gliding Association No: 4401

Manufacturer:

B. GROB FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
Telefon 0 82 68 / 4 11

Original Owner:

Luftsportgemeinschaft, Wolfsburg
Amselweg 51, 3180 Wolfsburg 1

Current Owner:

Northumbria Gliding Club Ltd.,
Currock Hill,
Chopwell

LBA recognized edition February 1977

This manual must be carried in the aircraft (German requirement).

1. Addenda

Current number	Page	Reference	Date	Signature
Addenda for ASTIR CS				
1	3,4,5, 7,8	changed	22. 5. 76	
2	3,4,5,6 14,16,17	changed	3. 1. 77	
3	25a	new page	1. 6. 77	
4	20	new page	26. 7. 79	
5	3,28	changed	4. 5. 81	
6	2,3,29	changed and new page	30. 9. 81	
7	3,26a	Inspection of the airbrake locking lever	25.3.85	
Addenda for ASTIR CS 77 and ASTIR CS Jeans				
1	4,5,7,8, 9,11,12 13,19,26	Remarks for retractable gear and waterballast deleted for ASTIR CS Jeans	1. 6. 77	
2	25a,	new page	1. 6. 77	
3	25	changed	1. 8. 77	
4	20	new page	26. 7. 79	
5	3,28	changed	4. 5. 81	
6	2,3,29	changed an new page	30. 9. 81	
7	3,26a	Inspection of the airbrake locking lever	25.3.85	

Disclaimer

This English version of the manuals has been translated with reasonable care by John R. Greenwell and is accurate to the best of his knowledge. However in all offical matters the original German text is the authoritative and definite document.

Modifications to Manual:

Issue No	Pages	Description	Date	Signature
Valid for ASTIR CS				
1a	3,4,5,7,8	Exchanged in the flight manual	22/5/76	
1b	3,4,4a,4b ,5	Insert photo-copies in the flight manual	22/5/76	
2	3,4,5,6,1 4,16,17	Exchange (valid from Serial No 1438)	3/1/77	
3	25a	Insert (sketch of wing quick-lock mechanism)	1/6/77	
4	20	Insert (information on hinge moments)	26/7/79	
5	3,28	Exchange (maintenance of Hotellier connectors)	4/5/81	
6	2,3,29	Exchange/new (increase in operating time)	30/9/81	
Valid for ASTIR CS 77 and ASTIR CS Jeans				
1	26	Exchange (horizontal tail unit assembly	5/5/77	
2	4,5,7,8,9, 11,12,13, 19,26	References to water ballast operation and colour coding (valid for ASTIR CS Jeans)	1/6/77	
3	20	Insert (information on hinge moments)	20/2/78	
4	3,28	Exchange (maintenance of Hotellier connectors)	4/5/81	
5	2,3,29	Exchange/new (increase in operating time)	30/9/81	

Note: the page numbers refer to the original German documentation, the pagination in this translation is different.

OPERATING LIMITS

Airspeed Limits (IAS)

Maximum permitted speed	245 km/h	(132kt)
Maximum manoeuvring speed	170 km/h	(92kt)
Maximum speed on winch/auto launch	120 km/h	(65kt)
Maximum speed on aerotow	170 km/h	(92kt)

Airspeed indicator markings:

60 -170 km/h	(32 – 92kt)	green sector
170 - 245 km/h	(92 – 132kt)	yellow sector
245 km/h	(132kt)	radial red line

Weights:

Empty weight approx.		270kg (595lb)
Maximum weight	without water ballast	380kg (838lb)
	with water ballast	450kg (992lb)
Maximum weight of non-lifting parts		240kg (529lb)

Weak Link in launching cable: 500 ± 30kg (1102 ± 66lb)

Cloud flying and simple aerobatics:

Permitted without water ballast, see pages 11 and 13.

LFS Airworthiness Group:

Normal glider (N)

Centre of Gravity Position in Flight:

Aircraft Attitude:	Slope 1000:40 tail down from horizontal measured on the upper surface of the fuselage 300mm forward of fin -2.2906 degrees -2d 17m 26.196s
Datum:	Wing leading edge at root rib
Forward Limit:	310mm aft of datum
Rearward Limit:	480mm aft of datum

Loading limitations of the ASTIR CS 77

For the empty weight, all up weight and cockpit load limitations of this particular aircraft refer to the C of A document or the cockpit Loading Placard.

Minimum cockpit load 70kg (154lb)

The permitted maximum all up weight may not be exceeded:

Without water ballast	380kg (838lb)
With water ballast	450kg (992lb)

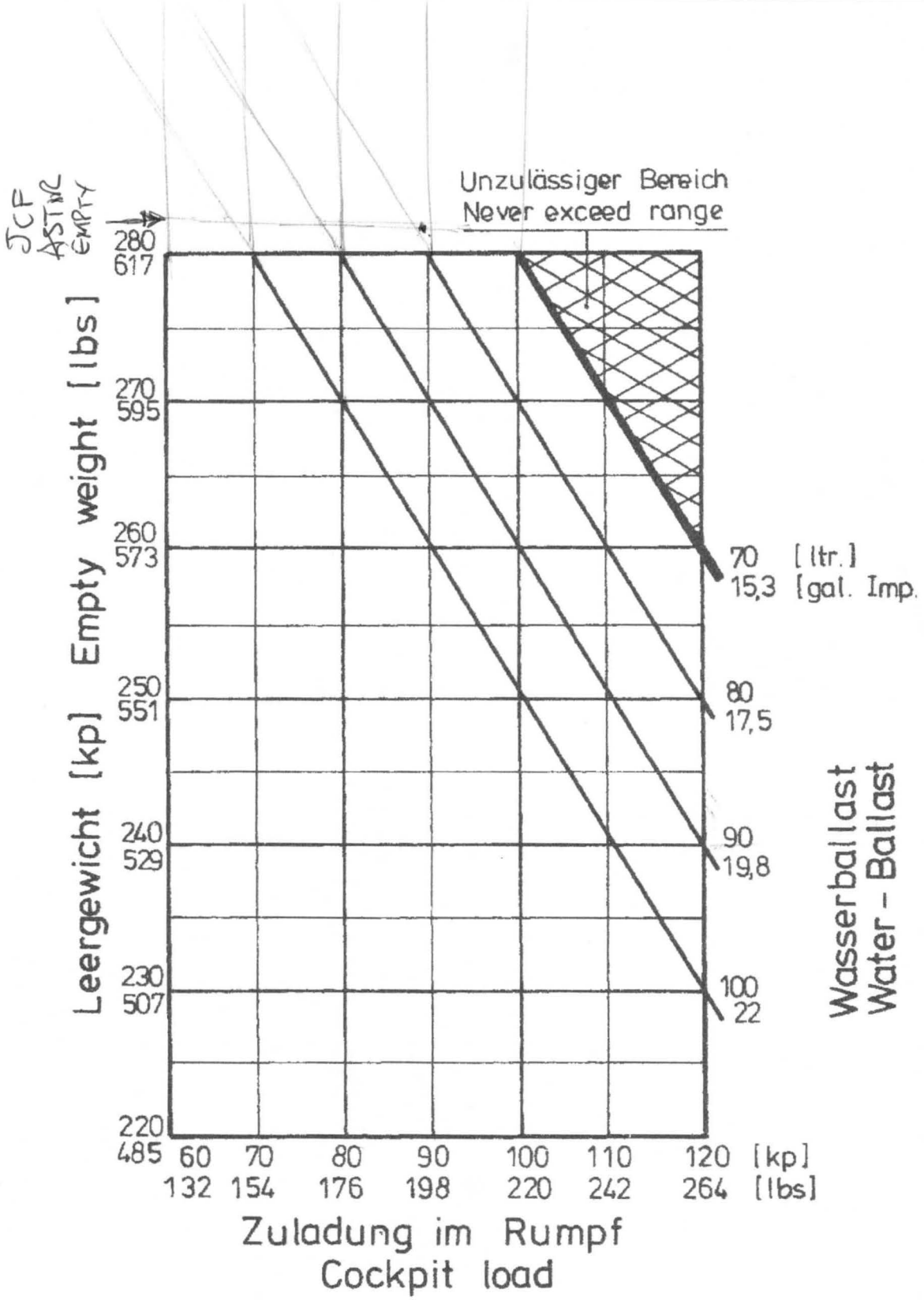
For the additional loading limitations with water ballast as a function of the cockpit load (pilot with parachute and luggage), see the Figure on the next page.

Pilots below the minimum cockpit weight limit must use ballast in the seat to adjust the loading to be within the placarded limits.

The moment arm of the pilot with parachute is 485mm forward of datum.

Centre of Gravity Position in Flight:

Forward Limit:	310mm aft of datum
Rearward Limit:	480mm aft of datum


JCF
ASTIR
EMPTY
Unzulässiger Bereich
Never exceed range
Leergewicht [kp] Empty weight [lbs]
280
617
270
595
260
573
250
551
240
529
230
507
220
485
70 [ltr.]
15,3 [gal. Imp.
80
17,5
90
19,8
100
22
Wasserballast
Water - Ballast
60 70 80 90 100 110 120 [kp]
132 154 176 198 220 242 264 [lbs]
Zuladung im Rumpf
Cockpit load

DATA AND PLACARDS IN THE COCKPIT:

Maximum flying weight

Without water ballast	380kg	(838lb)
With water ballast	450kg	(992lb)

Maximum Permitted Speed

Absolute never exceed	245 km/h	(132kt)
Rough Air	245 km/h	(132kt)
Aerotow	170 km/h	(92kt)
Winch or Autotow Launch	120 km/h	(65kt)
Airbrakes Open	245 km/h	(132kt)
Maximum manoeuvring speed	170 km/h	(92kt)

Cockpit Load (pilot and parachute)

The maximum weight may not be exceeded.

Minimum cockpit load: 70kg (154lb)

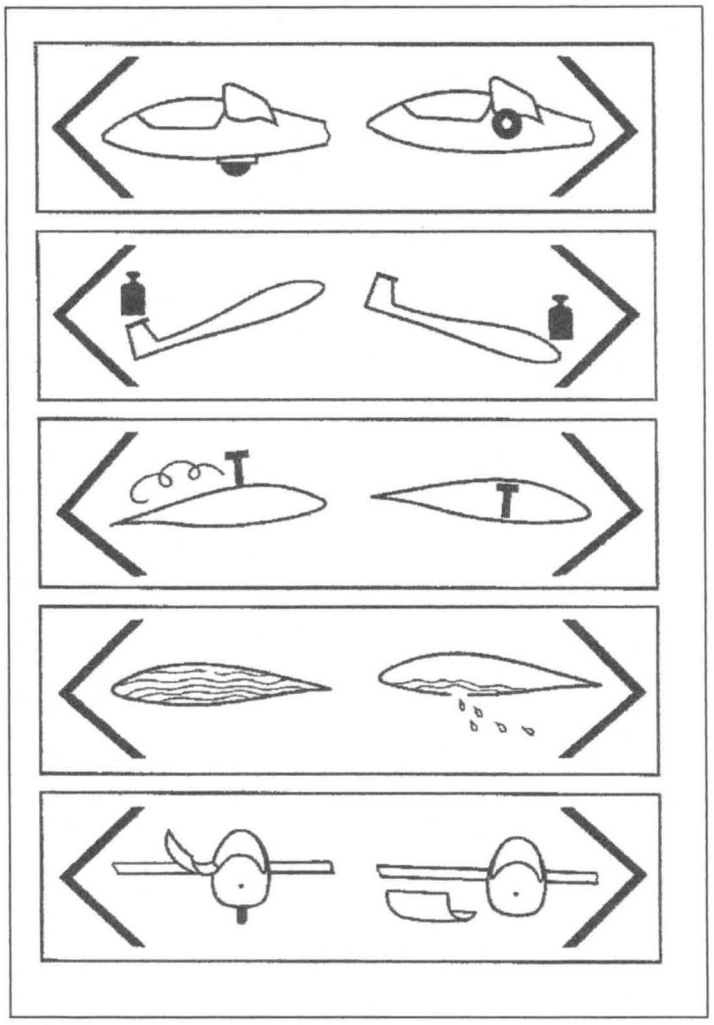
Missing weight is to be supplemented by ballast in the seat.

Placard at the main wheel door:

WHEEL 2.5 atmospheres (2.53 Bar, 37 psi)

Weak Link Maximum 500kg (1102lb)

Cockpit Labelling of Controls



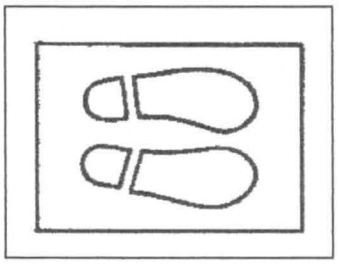
Undercarriage
BLACK handle
seat pan right

Trim
GREEN lever
seat pan left

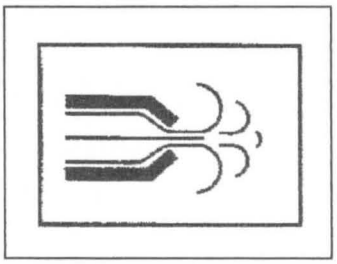
Airbrakes
BLUE handle
seat pan left

Water Ballast
WHITE lever
seat pan right

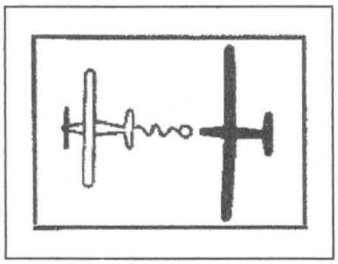
Canopy
RED knobs on the canopy frame
left button: open
left and right button:
Emergency jettison



Pedal adjustment
BLACK plastic grip
Top right of instrument panel



Ventilation
BLACK button
Top left of instrument panel



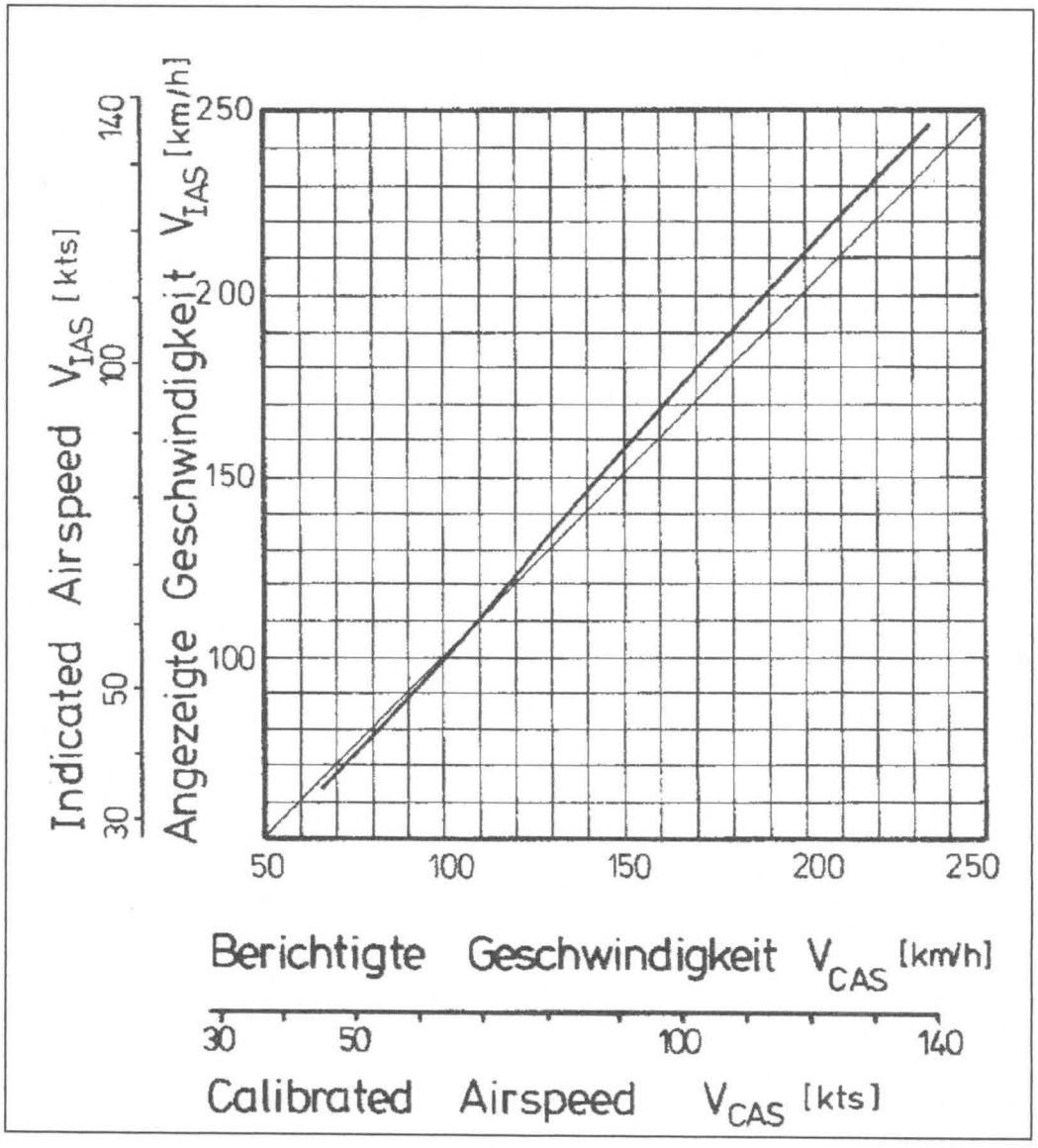
Cable release
YELLOW grip
Bottom left of instrument panel

Relationship between indicated and calibrated air speed

From this diagram the airspeed error can be obtained. This is due to the positioning of the static vents.

Pitot Pressure Input: Pitot tube near the top of the vertical fin

Static Pressure Input: Fuselage side in front of the wing root



NORMAL FLYING OPERATION PROCEDURES

Winch Launch

Maximum speed: 120 km/h (65kt).

The glider has a cable release in the landing gear well in front of the landing wheel.

Winch launches can be accomplished at all permitted centre of gravity positions and flying weights without difficulty. The glider has no tendency to pitch up or veer sideways. With powerful winches, or during rapid acceleration, the glider rate of climb should be limited until a height of 100m (330ft) is reached.

Aerotow Launch

Maximum speed: 170 km/h (92kt).

The towrope can be attached at either the nose hook, or the release hook in the landing gear bay.

On the ground run the glider can be controlled with rudder and aileron deflection (up to maximum deflection if necessary). There is little tendency to veer even in strong cross winds. At an airspeed of approx. 65 km/h (35kt) the glider can be taken off. At an airspeed of 70 – 75 km/h (38 – 40kt) the glider will take off itself if the control stick is held in a neutral position.

If the nose hook is used, after a safe height is achieved, the wheel can be retracted during the launch.

The yellow release knob is located at the bottom left of the instrument panel and must be pulled fully out to release the cable.

To adjust the rudder control pedals

To adjust the pedals, release and hold the pedal locking pin clear, by pulling the pedal lock handle at the top right of the instrument panel, while at the same time pressing the pedals forward with your heels. The pedals can then slid back under spring tension, or can be pushed forward with your heels. After adjusting the pedals, check that the pedal locking pin has engaged in the new position by releasing the pedal lock handle and pressing firmly forward on the rudder pedals with your heels.

Canopy

The one-piece Plexiglas canopy with emergency D-V panel and ventilation flap is hinged on the right side of the glider. The handle to open the canopy is on the left side of the canopy frame. The handle for jettisoning the canopy is on the right fuselage side.

Retractable landing gear

The operating handle for the undercarriage is on the right side of the seat pan. The undercarriage must be locked in either the extended or retracted position.

Airbrakes

The operating handle for the airbrakes is on the left side of the seat pan. Check the brakes are locked before launching. Because of the high rate of descent the brakes should not be further extended when rounding out during a landing.

Wheelbrake

The wheelbrake lever is on the control stick.

Trim

The trim control is on the left front edge of the seat pan. At mid-point cockpit loading it is possible to trim for airspeeds of approximately 60 – 180 km/h (32 – 97kt).

Flight with water ballast

Flying at maximum cockpit load with full water ballast, the glider has a gross weight near that of the normal two-seater glider.

The slow-speed flight and take-off behaviour of the glider fully loaded therefore differs somewhat from the behaviour of the glider flown without water ballast. The take-off speed rises to approximately 70 km/h (38kt). For correction of the flight attitude larger control deflections are necessary. The loaded wing will tend to drop a tip near the ground, but with rapid application of normal control movement this can be corrected. Slow-speed flight, and stalling with full additional load, should be practised by the pilot at a safe height.

The water tanks are in the wing leading edge, extending from the root rib and contain approximately 50 litre/wing (11 gallons/wing).

Filling the containers is done through the covers on the upper side of wing. The covers can be lifted out with a pin.

During flight with partly filled tanks no noticeable water movement arises because of the inserted bulkheads.

The desired quantity of water ballast must be distributed evenly between both wing tanks, so that the lateral stability is not affected.

Discharging takes place via an opening in the lower fuselage side behind the undercarriage bay. To open the drain valves on the tanks the white lever on the right side of the seat pan must be pushed to the rear. Draining the tanks takes about three minutes.

The draining of the water ballast tanks takes place via an overflow pipe, which ends in the fuselage fairing under the root rib. This pipe must not be masked with tape. During a flight with water ballast, the wing-fuselage junctions on the lower surface under the overflow pipe should not be masked with tape; this will avoid the leakage of water into the fuselage.

With long flights in air temperatures around 0°C (32°F) the water must be completely discharged because of the danger of freezing.

Before 'off-field' landings the water ballast should be completely discharged.

When 'parking up' the glider, the water tanks should be emptied in principle, in order to prevent freezing.

When derigging the glider the tanks empty themselves automatically through the tube end in the root rib.

With long tow-outs on uneven ground the tanks should be emptied to reduce the wing bending loads.

Stalling behaviour

The stall warning occurs at 60-70 km/h (32-38kt), depending upon wing loading, and is indicated by strong vibration of the horizontal tail unit.

When the control stick is pulled hard back the glider settles into a controllable flight attitude in which, with aileron and rudder, turns of up to 20° bank can be flown.

When the control stick is released, the glider immediately returns to the normal flight attitude. When the stick is pushed forward, the glider tips nose down, and the bank can be controlled with the aileron.

Flight at high speeds

The glider does not have a tendency to flutter in the permitted speed range. Starting from 170 km/h (92kt), maximum permitted deflections of all flying controls are reduced gradual to be 1/3 of full deflection at maximum permitted speed.

In a 45° dive at maximum flying weight, with fully open airbrakes, the maximum never exceed speed (VNE) is not exceeded.

Approach and landing

The approach can be flown at 90km/h (50kt) normally.

The airbrakes are sufficiently powerful for steep approaches to be made.

The airbrakes give some nose-down trim, so the glider will automatically maintain the pre-set trimmed speed when the brakes are opened.

Sideslip

The sideslip is easily controllable and can be used as an additional landing aid. However, it is effective only with a large sideslip angle and should be terminated at sufficient height.

Note: Landing preparation: - at the correct position, at a height of approx. 150 m (500ft), airspeed of 90 km/h (50kt), undercarriage down and locked.

Flight in rain

Past experience with wet or slightly frozen wing surfaces indicates that there is no noticeable degradation of the flight characteristics. With a thick layer on the wing surface the stalling speed increases by approximately 5 km/h (3kt) and the stalling and landing behaviour remain unchanged. Increase the approach speed by approx. 10 km/h (5kt).

Aerobatics

Certified figures and entry velocities:

Loops	Forbidden
Turn	180 km/h (97kt)
Lazy Eight	120 km/h (64kt)
Chandelle	150 km/h (81kt)

Spin:

After a slow complete stall, cross the rudder and aileron controls to full deflection and keep the elevator pulled back. Centralising or releasing the controls stops the spin. The

height loss is about 70m (230ft) per revolution. The recovery speed about 160km/h (86kt).

The execution of aerobatics and flight conditions, which would give negative loading, are not permitted.

Advanced aerobatic manoeuvres are likewise illegal.

Spinning

With the centre of gravity between 415 and 480mm aft of datum, the glider can be held in a spin. The control stick must be held fully back, and the rudder and aileron controls crossed to full deflection. The glider spins in the direction of the rudder deflection and with rearward centre of gravity positions will settle into a constant rate spin with a slow rotation speed and a flat fuselage attitude.

Recovery from the spin does not require critical control movement. It is sufficient to release the backpressure on the stick and at nearly all centre of gravity positions and wing loading the glider will return to normal flight.

A more rapid recovery (without further turning of the glider) is achieved if all controls are returned to the central position. The height loss up to the recovery from the spin is approximately 70 meters (230ft) per revolution.

The glider can be held within the flight envelope at all certified positions of the centre of gravity and flying weights. With full up elevator, crossed aileron and rudder control, at rearward positions of the centre of gravity; the glider will enter a spin. This can be terminated quickly by centralising all controls.

Immediate recovery is achieved by the "standard recovery method":

1. Apply opposite rudder against the direction of the spin
2. Pause
3. Ease the control column forward until the rotation ceases and the airflow is restored.
4. Centralise the rudder and pull gently out of the resulting dive.

During the high-speed recovery, pay attention to keeping the airspeed within the permitted range.

Avoid large control deflections at high speeds.

EMERGENCY PROCEDURES

Emergency exit

The freedom of movement in the roomy cockpit ensures an unhindered emergency exit. The following sequence is to be observed:

a) Grasp the red knobs on the left and right sides of the canopy frame and simultaneously pull both rearwards. With the left hand force the canopy upwards.

b) Loosen the seat harness belts.

c) Stand up and depending upon flight attitude step out to the right or left.

d) With a manually operated parachute, grasp the release, and after 1 - 3 seconds pull the release.

Cloud Flying

Minimum equipment for cloud flying:

Airspeed indicator, altimeter, rate of climb indicator, compass, turn and slip indicator,

spirit level, radio.

(Past experience indicates that the pitot – static system is insensitive to freezing up)

To avoid high airspeeds (over approx. 170km/h (92kt)), the airbrakes should be opened promptly.

Note: Aerobatics and cloud flying are to be performed only by pilots who have the appropriate authorisation. The legal regulations still apply!

Minimum equipment

1. Airspeed Indicator to 300 km/h (162kt)
2. Altimeter
3. Four point seat harness
4. Packing cushions, at least 7 cm thick under load, or parachute
5. Weight / loading placard
6. Flight limitations placard
7. Flight and maintenance manual

WEIGHTS AND THE CENTRE OF GRAVITY POSITION

When additional equipment is fitted, or after repairs, or a new gel/paint finish or any other weight change of the glider, the empty weight and centre of gravity position is to be determined.

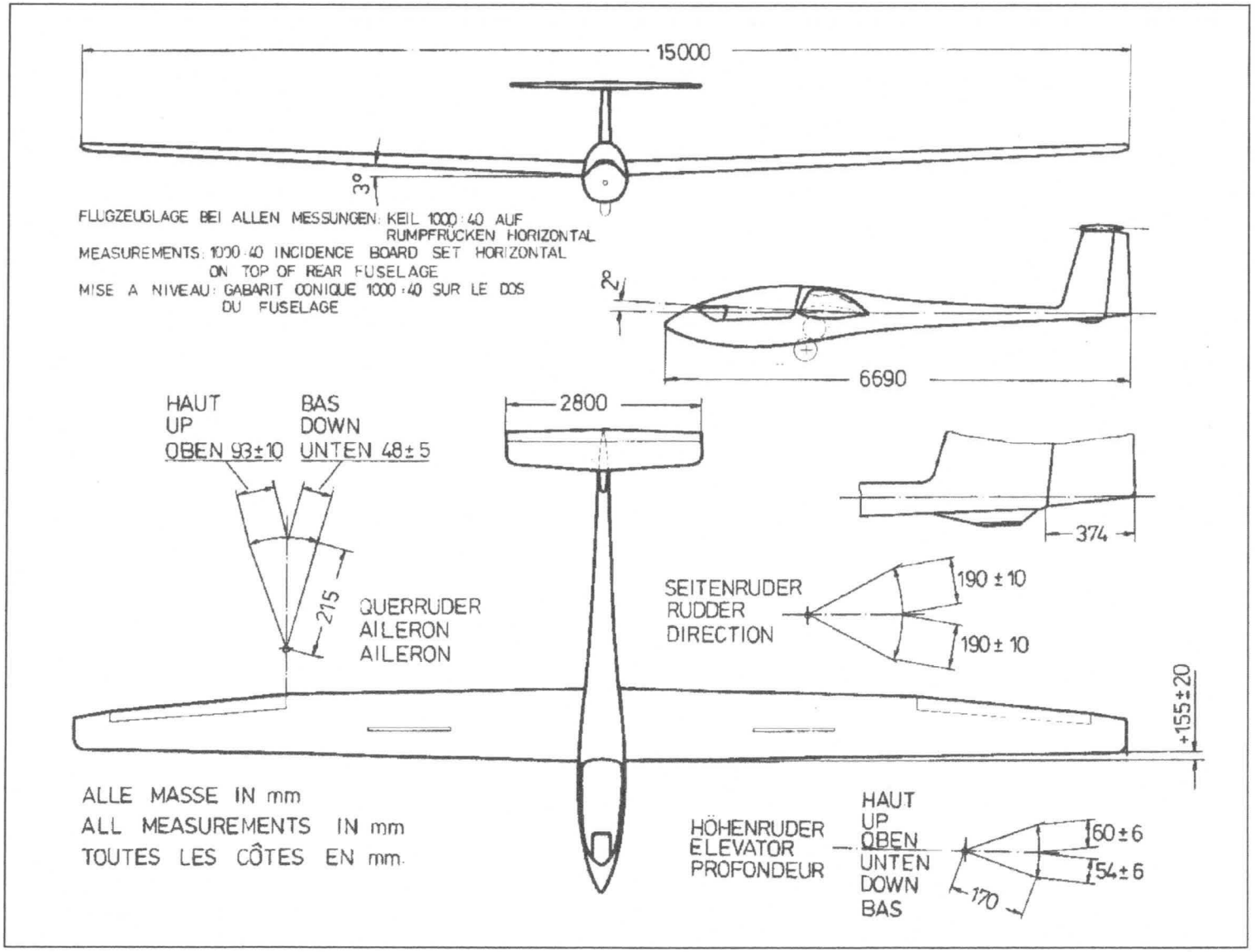
If the ranges of the empty weight, and the centre of gravity position (table below), and the cockpit loading limits, are satisfied, the flying weight limitations will be in the permitted range.

Unloaded weight (kg)	CG range (mm aft)
245	697 – 756
250	690 – 750
255	683 – 745
260	675 – 740
265	654 – 735
270	633 – 730
275	612 – 726
280	593 – 721
285	574 - 717

CONTROL DEFLECTIONS – RIGGING ANGLES

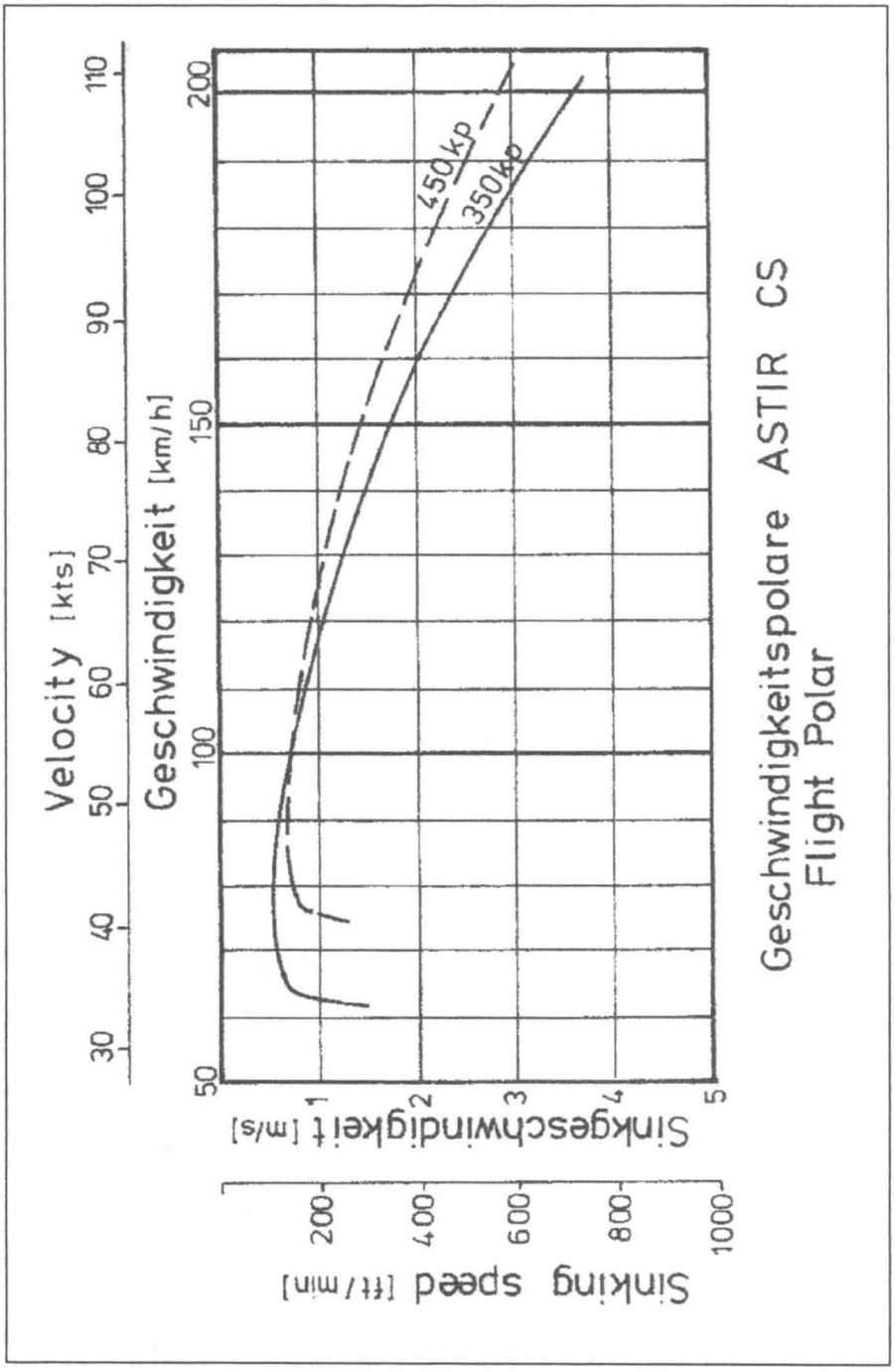
Glider wings level, with fuselage upper surface at a slope of 1000 : 40 tail down from the horizontal, measured 300mm forward of fin.

Elevator	Up	60 ± 6mm
	Down	54 ± 6mm
Rudder	Left	190 ± 10mm
	Right	190 ± 10mm
Aileron	Up	93 ± 10mm
	Down	48 ± 5mm
Rigging Angle	wing chord to fuselage longitudinal axis	2 degrees
	Tail chord to fuselage longitudinal axis	0 degrees

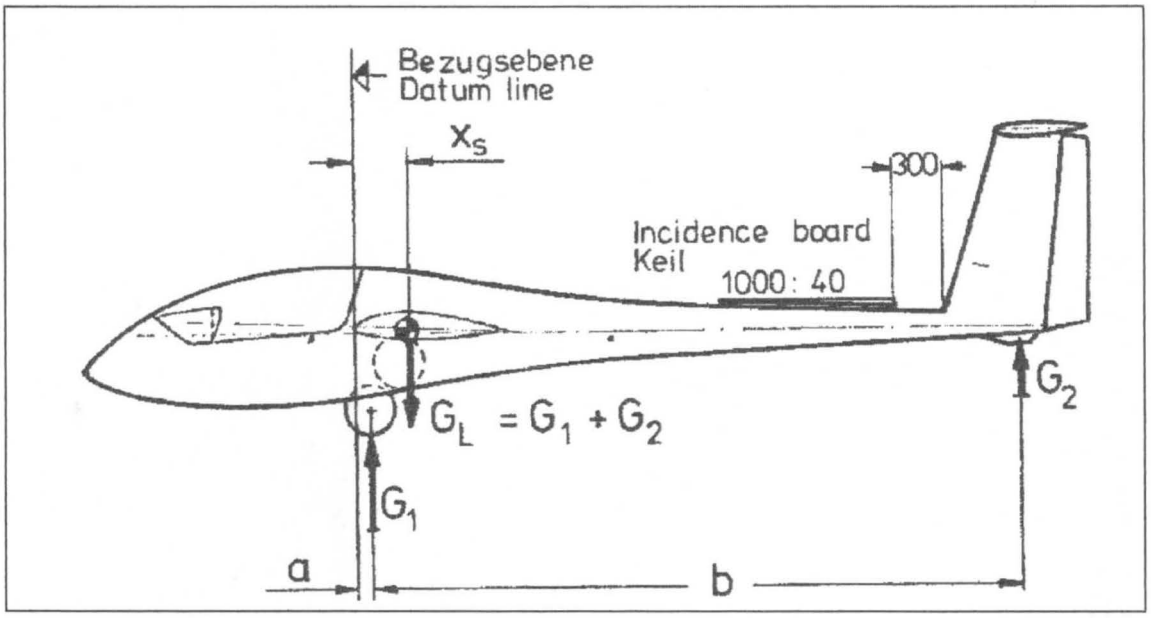

15000
3°
FLUGZEUGLAGE BEI ALLEN MESSUNGEN: KEIL 1000:40 AUF RUMPFRÜCKEN HORIZONTAL
MEASUREMENTS: 1000:40 INCIDENCE BOARD SET HORIZONTAL ON TOP OF REAR FUSELAGE
MISE A NIVEAU: GABARIT CONIQUE 1000:40 SUR LE DOS DU FUSELAGE
2°
6690
HAUT
UP
OBEN 93±10
BAS
DOWN
UNTEN 48±5
2800
374
215
QUERRUDER
AILERON
AILERON
SEITENRUDER
RUDDER
DIRECTION
190 ± 10
190 ± 10
+155±20
ALLE MASSE IN mm
ALL MEASUREMENTS IN mm
TOUTES LES CÔTES EN mm
HÖHENRUDER
ELEVATOR
PROFONDEUR
HAUT
UP
OBEN
UNTEN
DOWN
BAS
60±6
54±6
170

FLYING PERFORMANCE – GLIDE POLAR CURVE

FLIGHT PERFORMANCES	350kg	450kg
BEST LIFT/DRAG RATIO	37.3 at 95km/h (51kt)	38 at 105km/h (57kt)
MINIMUM SINK (m/s)	0.6 at 75km/h (40.5kt)	0.7 at 85km/h (46kt)
THERMALLING SPEED	80-85km/h (43-46kt)	90-95km/h (49-51kt)



WEIGHING SHEET



Datum Line: Wing leading edge at the root rib

Glider Attitude: Fuselage upper surface at a tail down slope of 1000:40 measured 300mm forward of the fin.

Weight at the landing wheel	G_1 =	kg
Weight at the tailskid	G_2 =	kg
Empty weight	$G_L = G_1 + G_2$ =	kg
Datum to landing wheel	a =	mm
Datum to tailskid	b =	mm

Centre of gravity of Empty Glider

$X = (G_2 \times b / G_L) + a =$ mm Aft of Datum

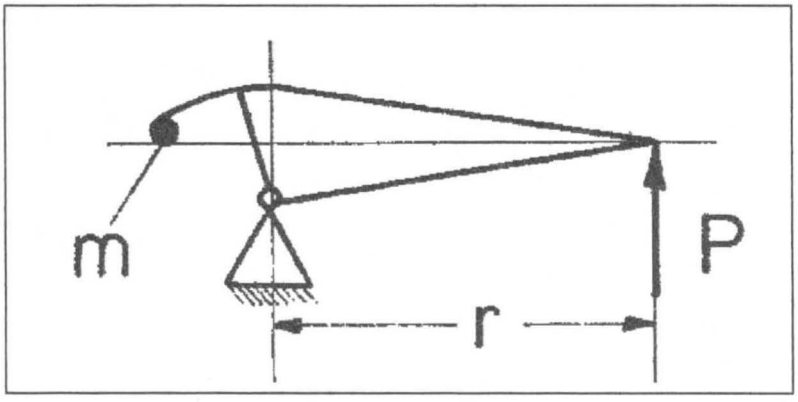
The determination of the empty weight and the centre of gravity are always determined without water ballast.

MASS AND RESIDUAL MOMENT LIMITS OF THE CONTROL SURFACES

After repainting or a repair the hinge moments and weights may not exceed the following values:

ASTIR CS (S/N 1002 - 1536)		
Elevator:	10.0 to 15.0kgcm	2.40 to 3.25kg
Rudder:	13.65kgcm ± 10%	3,2kg ± 10%
Aileron:	16.0kgcm ± 12%	4,1kg ± 12%
ASTIR CS 77 (S/N 1601 - 1698)		
ASTIR CS JEANS (S/N 2001 - 2092)		
Elevator:	10.0 to 15.0kgcm	2.40 to 3.25kg
Rudder:	16.5kgcm ± 10%	4,5kg ± 10%
Aileron:	16.0kgcm ± 12%	4,1kg ± 12%
ASTIR CS 77 (starting from S/N 1699)		
ASTIR CS JEANS (starting from S/N 2093)		
Elevator	10.0 to 15.0kgcm	2.40 to 3.25kg
Rudder	0 to 5kgcm	max.6.0kg
Aileron	0 to 1kgcm	max. 6.0kg

For the measurement of the hinge moments the controls must be removed from the glider. For the determination of the hinge moment (M = P.r) the control hinge should be as friction free as possible. The force P can be measured with a spring balance. If the values are exceeded, then the balance weight should be increased. Before a repair of the control surfaces and/or a replacement of the balance weight, the manufacturer is to be contacted.



RIGGING THE GLIDER

Rigging the glider can be accomplished by three persons.

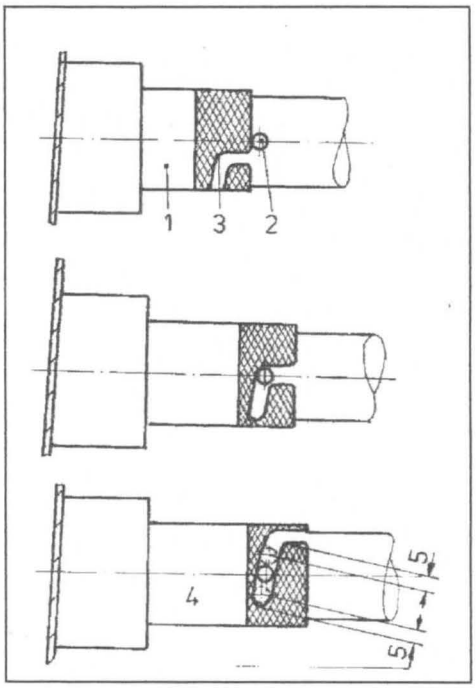
1. Wing

Open the four spigot lock rings in the fuselage, and unlock the airbrakes in the wing and at the brake control lever. Insert the right wing into the fuselage. Rotate the two right wing lock rings so that the guide pins are located in the guide slots.

Gently move the wing until there is an audible click as the lock rings engage.

Next insert the left wing into the fuselage and, by appropriate movement of the wing tips; engage the two spar end spigots in the bearings in the wing root ribs. Rotate the two left wing lock rings to locate the guide pins and engage the lock by back and forward movements of the wingtip. To safety lock the wing to fuselage connection rotate the lock rings until they are firmly held by the guide pins.

Wing socket lock rings



A. OPENED 1. Lock ring
2. Guide pin 3. Guide Slot

B. CLOSED

C. SECURITY LOCKED Note the 5mm spacing of the guide pin in the guide slot.

2. Controls

The push connector sleeves must cover the red rings on the control rods.

The connections for ailerons and airbrakes lie behind the main spar.

The short connecting rods in the fuselage are fitted with quick-locking mechanisms, which must be coupled to the ball connections on the wing control push rods.

To ensure the security of the connection the following check must be carried out.

When the connecting rods are assembled, visually check that the locking wedges are sufficiently engaged so that they stand out some millimetres from the catches. Then, by slight rotation and pushing and pulling, try to pull the connecting rods from the ball connections. If the connections remain fixed under a load of approximately 5kg the controls are correctly attached.

3. Horizontal tail unit

Before rigging, the leading edge cap fairing on the elevator must be opened and the enclosed wing nut assembly pulled forwards. Balance the tailplane on the top of the fin. Stand behind the fin/rudder and lift the elevator to maximum up deflection. Connect the elevator control rod to the connecting ball on the elevator. Test for security of the connection. Now align the bearings in the tailplane with the three pins on the top of the fin and push the tailplane backward to engage the pins. To secure the tailplane engage the thread on the wing nut assembly and rotate clockwise. Tighten until there is no free play on the tailplane. The tailplane leading edge cap fairing locks the wing nut. If necessary tighten or loosen the wing nut by ¼ turn so that the cap can be closed.

Disassembly is achieved by reversing the order of the instructions above, by turning the wing nut anti-clockwise until it can be pulled clear of the thread, easing the tailplane forward off the pins, then disconnecting the control connector.

4. Checks after rigging

1. Check the four ring locks on the wing fuselage spigots are in the locked position.
2. Check the aileron and airbrake control connections are secure (see page 19 for description of check method).
3. Check the operating load and correct function of the cable releases.
4. Check the tyre pressure and operation of the wheel brake.
5. Check the tailplane for any free play in the elevator/fin seating.
6. Check the elevator and rudder operation.

5. Checks before take-off

1. Have all controls free and full movement?
2. Are the airbrakes locked in?
3. Is the undercarriage handle in the forward position and engaged in the lock notch towards the fuselage side panel?
4. Is the trim position correct?
5. Is the canopy locked?
6. Are the seat belts and parachute harness fastened and tight?
7. Is the altimeter set to field altitude or ZERO?
8. Is the radio switched on and set to the airfield frequency?

MAINTENANCE AND SERVICING

Take great care over the surface finish of the glider. All contaminants such as dust, grass seed, insect debris, etc. should be washed off with lukewarm water and a sponge. In the case of strong contamination, a mild cleaning agent can be added to the water. Do not use silicone-containing products on the gel coat. Scratches should be carefully fillered and the finish made good.

Wetness and Humidity

The glider is not sensitive to, but if possible it should be protected from, wetness and high humidity. Remove any water penetration by dry storage of the disassembled components. Turn the components over frequently.

Cleaning the canopy

Clean the canopy with 'Plexiklar' or a similar cleaning polishing agent approved for use on Plexiglas. If necessary wash the canopy with lukewarm water. Use either a chamois leather or other approved material. NEVER rub Plexiglas with a dry cloth.

The safety belts

The seat belts should be examined regularly for any signs of damage and wear. The metal parts of the harness should be checked for corrosion.

The cable releases

The 'winch hook' is exposed to strong contamination due to its location in the wheel housing. It must be examined for signs of damage, cleaned and lubricated regularly. Remove the seat pan to facilitate the inspection of the winch hook. To remove the winch hook disconnect the cable from the bellcrank and remove the two fixing bolts. For a complete overhaul, the hooks should be sent to the manufacturer Richard Tost. In all other respects, the manufacturer's mandatory service instructions for the release hook applies.

It is to be noted that during the annual inspection the operating cable for the nose hook must be checked for wear.

The tyre pressure

The tyre pressure of the main wheel is 2.5 atmospheres (2.53 Bar, 37psi).

The wheel brake

The wheel brake is a drum brake. The bowden cable operating the brake should be aft of the main undercarriage leg. The bowden cable mounting plate on the drum can be adjusted to achieve this positioning.

Main Wheel removal

Before dis-assembling the main wheel for cleaning, lubrication, or a tyre change, remove the bowden cable from the brake lever. Remove the split pin from the M6 castellated nut on the end of the axle and slacken the nut. Remove the brake lever retaining screw. Slide the wheel down and out. Clean all parts and coat with grease before assembly.

Main pins and bearing surfaces.

The pins and bearing surfaces of the tail and wing attachments should be cleaned and greased before rigging.

Major repairs

Repairs which exceed the remit of normal maintenance and servicing should be carried out by the manufacturer:- Burkhart Grob Flugzeugbau, 8939 Mattsies, Flugplatz Mindelheim-Mattsies.

Details are in the workshop manual for the ASTIR CS glider, August 1975.

New gel coat

It is essential that all surfaces exposed to sunlight are covered with a white gel coat layer.

After repairs and/or a new gel coating

After repairs and re-gelling the empty weight and centre of gravity position must be determined.

Hotellier quick release control connectors

The maintenance schedule of the Hotellier connectors must be adhered to at each annual check and at every 500 hours. They are at the control connections for aileron and airbrakes at the fuselage/wing junction and for the elevator at the tail unit junction.

To determine the amount of wear, measure the diameter of the ball with a micrometer at several places. The differences in the measured diameters may not exceed 0.1mm; i.e. the connecting balls must be spherical. If larger differences are detected, the ball joints and associated connectors must be replaced.

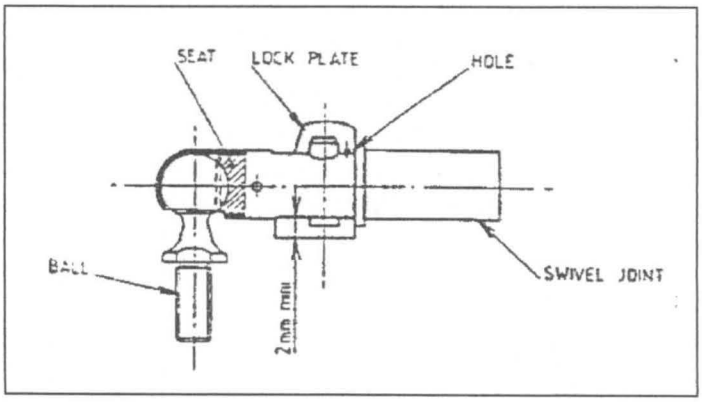
Before each assembly, the ball joints and connectors must be cleaned and greased. The connectors can be double secured by a spring cotter pin (safety pin or locking wire) inserted through a hole in the wedge slide lock of the connector. Part No. 500 30771 from A. Würth, 7118 Künzelsau (also available from Burkhart Grob).

Additional Information on Hotellier Ball and Swivel Joints

Prior to rigging everyone should be familiar with the functioning of the Hotellier ball and swivel joints.

The swivel must be slid completely over the ball with the lock plate pressed down. During locking the lock plate moves back slightly so that in a correct joint the hole on the narrow edge of the lock plate becomes visible.

The safety pin is to be inserted in this hole thus securing the ball and swivel joint.



Warning: Unsecured ball and swivel joints may open automatically in flight.

EXAMINATION FOR THE INCREASE OF SERVICE LIFE

1. General information

The results of fatigue tests on wingspar sections have demonstrated that the service life of GRP gliders and powered sailplanes may be extended to 6000 hours, if for each individual aircraft the airworthiness is demonstrated according to a special multi-step inspection program, particularly with regard to the service life.

2. Periods

When the glider has reached a service time of 3000 hours, an inspection must be carried out in accordance with the inspection program mentioned under section 3. If the results of this inspection are positive and/or if any defects found have been duly repaired, the service time of the glider is extended by another 1000 hours to a total of 4000 hours (Stage 1).

The above inspection must be repeated when the glider has reached a service time of 4000 hours. If the results of this inspection are positive and/or if any defects found have been duly repaired, the service time of the glider is extended by another 1000 hours to a total of 5000 hours (Stage 2).

When the glider has reached a service time of 5000 hours, the above inspection must be repeated. If the results of this inspection are positive and/or if any defects found have been duly repaired, the service time of the glider is extended by another 1000 hours to a total of 6000 hours (Stage 3).

For service times exceeding 6000 hours, procedures have yet to be laid down.

3. The Inspection

For each inspection obtain the latest information from the manufacturer. The test program is updated to incorporate information obtained from previously completed inspections.

4. The Inspector

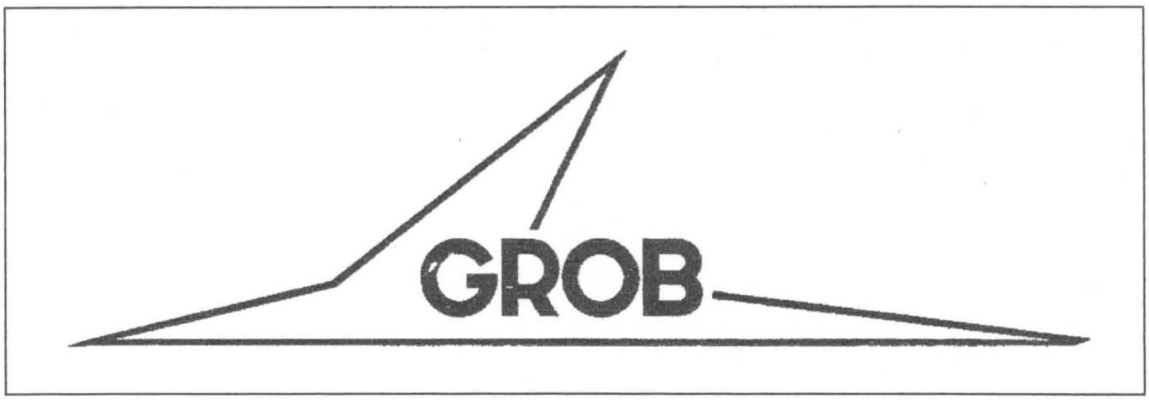
The inspection must only be done by the manufacturer or by a licensed repair station or inspector.

5. Reporting

The results of the inspections have to be recorded in an inspection test report wherein comments are required for each inspection instruction. If the inspections are done outside the manufacturer's facilities, a copy of the records must be sent to the manufacturer for his evaluation and information.

7. The Annual Inspection

This service life inspection program does not affect the annual inspection.



Repair manual for the ASTIR CS glider

Manufacturer:

B. GROB FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
Telefon 0 82 68 / 4 11

LBA recognised, edition August 1975

REPAIR MANUAL FOR THE ASTIR CS GLIDER

1. Preface

The " ASTIR CS " glider is made of glass-fibre reinforced plastic (GRP). The fuselage and the control surfaces consist of pure GRP skin (laminate). The wing and tailplane surfaces are a GRP foam sandwich and the fin is a GRP Styropor sandwich.

2. Materials and sources of supply.

Resin: Shell Epikote of 162

Hardener: BASF Laromin C 260

Mixing ratio: 100 parts by weight resin - 38 parts by weight hardener

Glass fibre fabric:

Manufacturer: Interglas Textil GmbH, 7900 Ulm, Söflinger Str. 246.

Use	Structure	weight	Interglas-Nr.
Fuselage	Double Layer	161	92 110
	Double Layer	390	92 140
	Strengthening Rovings	433	92 146
Wings	Double Layer	161	92 110
	Double Layer	276	92 125
	Strengthening Rovings	433	92 146
Fin and Rudder	Double Layer	276	92 125
	Double Layer	276	92 125
Ailerons	Double Layer	161	92 110

All glass cloth is alkali free E-Glas with Volan-A-Finish or Finish I 550.

Rovings:

EC 10-80-2400 K 43 Gevetex, 4000 Düsseldorf, Postfach 1205

Foam material:
Conticell 60 Continental AG, 3000 Hannover
6 and 8mm thick
Weight specification 60kg/m^3

Styropor:

Thermopete Poron-Werke GmbH, 6122 Erbach, Brunnenstraße 5
4mm thick
Weight specification 15kg/m^3

Resin Fillers:

Brown microballoons Lackfabrik Bäder KG, 7300 Eßlingen, Schließfach 25

Cotton Flock Schwärzwalder Textil-Werke, 7623 Schenkenzell, Postfach 12
Type FL 1f

Gel coat:

PE Schwabbellack, White Resin 03-69120 / Hardener 07-20510

100 parts of resin to 3 parts of hardener (Strength 06-30260)

Lesonal-Werke, 7000 Stuttgart 30, Postfach 30 07 09

Red Paint Finish:

Nitro cellulose Kombilack / Colour range spec RAL 2002

Lackfabrik Bäder KG, 7300 Eßlingen, Schließfach 25

3. Simplified fabric construction layout for the ASTIR CS

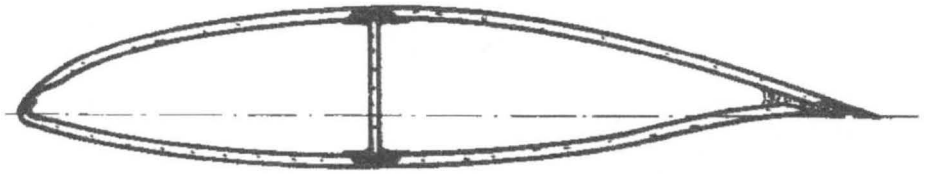
Reinforcement within highly stressed areas and large load areas are not specified.

1. Flügel

Außenlaminat
1 Lage 92 110 diagonal
1 Lage 92 125 diagonal
Kern
Conticell 60 8 mm
Innenlaminat
1 Lage 92 125

Wing

Outer laminate
1 Layer 92 110
1 Layer 92 125
Core
Conticell 60 8 mm
Inner laminate
1 Layer 92 125



2. Rumpf

Von außen nach innen
1 Lage 92 110 längs
1 Lage 92 146 längs
3 Lagen 92 140 diagonal

Fuselage

From outside to inside
1 Layer 92 110 lengths
1 Layer 92 146 lengths
3 Layers 92 140 diagonal

3. Ruder

Höhenruder
Seitenruder
Querruder
2 Lagen 92 125 diagonal

Controls

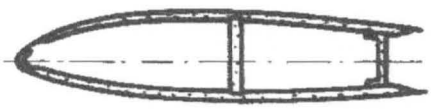
Elevator
Rudder
Aileron
2 Layers 92 125 diagonal

4. Höhenflosse

2 Lagen 92 110 diagonal
Kern: Conticell 60 6 mm
1 Lage 92 110 diagonal

Fin

2 Layers 92 110 diagonal
Core: Conticell 60 6 mm
1 Layer 92 110 diagonal



4. Repair of units constructed from GRP

If you notice any damage to your glider, you should at once determine the extent of the damage. It is often found on inspection that the break extends much further than the damage visible on the surface.

Accomplish repairs with great care. With GRP gliders the outer skin is load bearing; a failure of its structural integrity can lead to a crash.

Maintain the resin : hardener mixing proportion as correct (± 0.5%) and use clean containers. The weight of glass to the weight of resin mixture should be approximately 50 : 50. Abrade and clean the repair joint surface immediately before applying the wet laminate so that no contamination can occur to limit the adhesion.

As with plywood, the direction of the fibres in the fabric layers (lengthwise or diagonal) is of great importance in the integrity of the structure. A guide to the number of laminations required to re-establish the structure of the damaged area can be inferred from the simplified fabric construction diagram. In any case measure the thickness of the damaged laminate. Remove a piece of the damaged laminate and incinerate it. The resin burns and the glass fibre structure remains. You can identify the fabric weight, number and direction of the laminations from this sample.

Repair work is time consuming. Take care to cut the fabric patches accurately so that when they are laminated into the structure they do not stand out from the required profile. They will then not have to be sanded/ground down before restoring the surface finish.

The resin hardening time can be shortened, by increasing the ambient temperature with a heater.

Caution: A high temperature will cause bubbles to develop in the resin. To minimise the build up of local hot spots, construct a 'tent' from foil and direct the hot air jet into the tent.

Ensure that when a control surface is repaired, the weight does not increase, otherwise there is the danger of flutter. Check the mass balance of controls after repairs.

5. Damage to GRP – foam structures

It may appear that only the surface (external) laminate is damaged, but it is often the case that the whole structure, outside and inside laminate and the foam core is damaged.

a) Simple surface lamination repair. (fig. 1 page 30)

Around a crack you often have separation of the surface laminate from the supporting foam core. You can determine the extent of this foam separation by tapping. Remove the laminate separated from the foam (grinding wheel, sanding block or sharp knife).

With a sanding block or flat plane cut a splice in the laminate around the damaged area, splice width a minimum of 20mm. Correct splice angle laminate thickness to splice length 1:50.

After the preparation of the repair, thoroughly clean the area – remove the abraded dust with compressed air (also clean from the foam pores) – wash the splice surface with carbon tetrachloride or acetone if there is any grease or oil contamination.

Filler the damaged foam space, and the exposed surface pores of the foam with a resin/microballoons mix. Now lay up the correct number of glass laminations.

Important: - Insert the glass cloth in the correct alignment and with the largest patch inserted first. It is essential that the work is dust and grease free.

At ambient temperature the resin hardens in approximately 8 hours. The damaged area can then be primed, painted and polished.

b) Damage to the entire glass-foam Sandwich (Fig 2, Page 30)

Even if the interior laminate is damaged, first remove the external laminate that is not firmly attached to the foam. Now extend the hole in the foam/top laminate by removing material that is not firmly attached to the inner lamination. So that you can make a repair in the inner laminate you must now remove a ring of the supporting foam so that you have a clear edge of the inner laminate of at least 20mm sufficient for the splice (laminate thickness to splice width 1:50 ratio).

Prepare the splices on the inside and outside laminations using the method described above in **section a**. For small damaged areas you can stick a thin plywood former onto the inside surface of the hole using Pattex. Lay-up the fabric to repair the inner laminate, then fill the hole in the foam with a resin, microballoons and polystyrene balls filler mix. After the resin has hardened (approximately 8 hours at ambient temperature) clean up the surface contour of the filler and lay-up the external laminate.

It is easy to introduce the plywood former into the inside of the structure if the repair hole has an oblong form. If one or more thin nails are inserted into the ply former before it is inserted, they can be used to manipulate the ply and pull it up to the inner surface.

Important: The ply former must be a good fit all round the edge of the hole to avoid steps in the laminate layer.

For larger holes and for weight reasons it is better to use a shaped foam insert rather than the filler mix of resin, microballoons and polystyrene balls. Prepare a piece of foam which fits exactly into the existing hole. Coat the inside surface with a resin and microballoons mix to fill the pores in the foam, then lay-up the inner laminate. Allow this to harden. After hardening this foam with laminate on one side can still be bent slightly by using heaters. Now stick the foam patch into the hole with a thickened resin mix (cotton flock and/or microballoons). Bed in around the edges of the foam patch, and seal the foam pores with a resin/microballoons mix then lay-up the external laminate.

6. Damage to polystyrene foam -supported GRP (fig. 3 page 30)

The repair is accomplished in the same way as for PVC foam except that as the polystyrene has a sealed/closed surface structure, the laminate can be applied direct with pure or slightly thickened resin to the surface. Filling the pores is not required. With large damaged areas wait for the first laminate to harden before laying-up the second laminate. This will avoid wave formation in the repair patch.

Caution: If you apply too much heat to accelerate the hardening process, the polystyrene will develop blisters and you must then repeat the repair.

7. Damage to solid GRP structures (fig.4 page 30)

This is a simpler repair. Prepare a clean edge in the laminate and cut a splice as described above. Lay-up the repair laminate (largest patch first). After 2-3 hours, if the resin has thickened, you can filler the surface with a resin and microballoons mix. The splice width should be a minimum of 20mm, a ratio of laminate thickness to splice length of approximately 1:5. If the splice surface is dirty or greasy, clean it with carbon tetrachloride or acetone.

With large damaged areas a former (plywood) must be used. Wet laminate should not freely bridge over a gap greater than 20mm. Attach the ply former to the inside surface

with Pattex. Use nails in the ply patch as handles to manoeuvre the patch and pull it into firm contact with the inner surface (e.g. on rear fuselage tube).

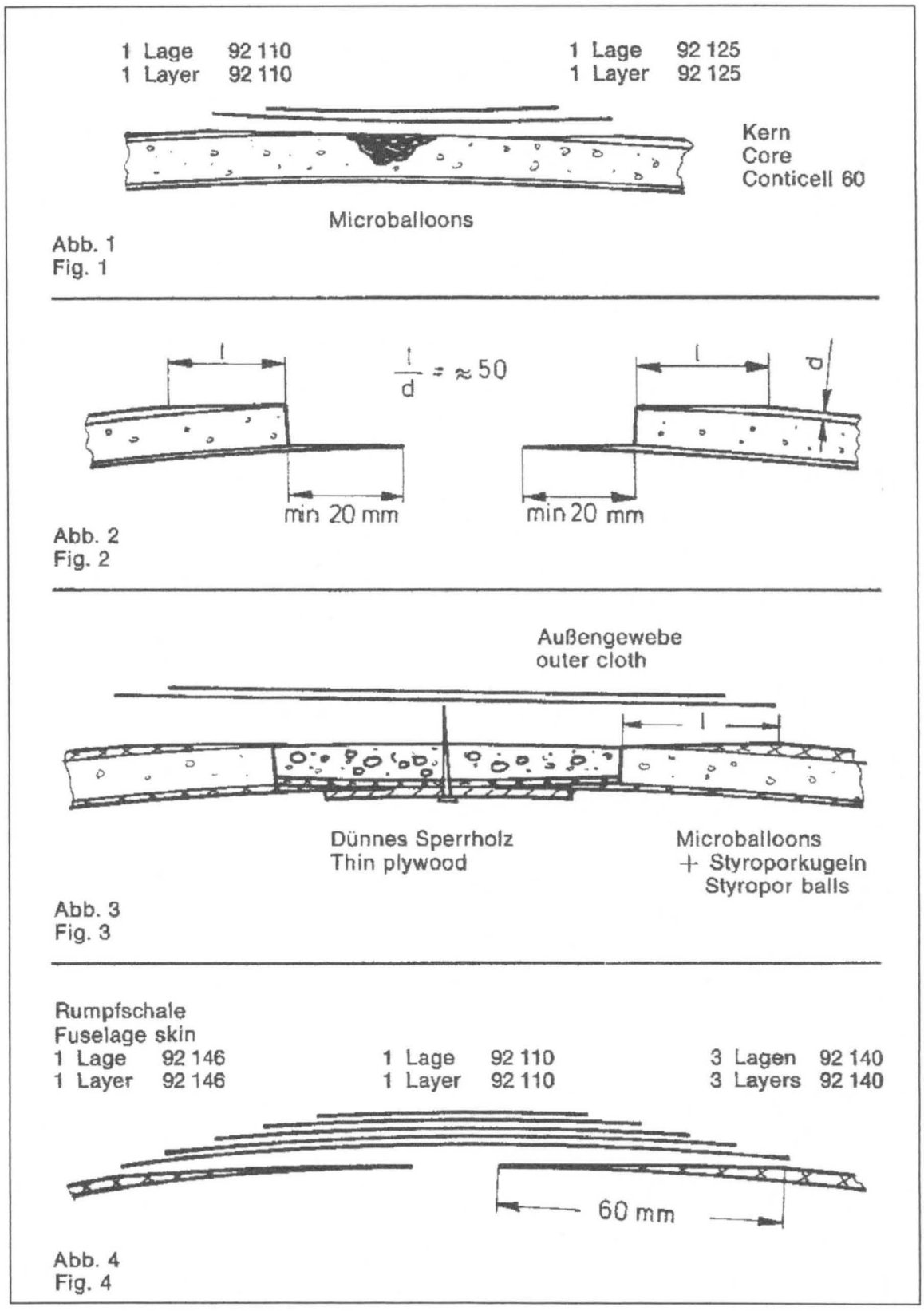


Abb. 1
Fig. 1

Abb. 2
Fig. 2

Abb. 3
Fig. 3

Abb. 4
Fig. 4

8. Gel coat

As soon as the laminated patch repair is hard it can be profiled by sanding with 80-grade paper. Fill the larger surface faults with white polyester putty. Finish the preparation with 150 grade paper to yield a surface which is levelled and evenly abraded to improve gel adhesion.

Before applying the gel coat the repair must be cleaned of all traces of abrasive dust, releasing agents and other foreign bodies.

The gel coat should be applied with a soft brush and built up in several layers until the laminate does not shine through. The individual layers should harden, and each layer be rubbed down with 360 grade wet and dry so that one can see where an additional gel coat is required.

The final surface finishing is done with 600 or 800 grade wet and dry paper. Finish off with polish.

9. Repair of fittings

a) Steel Fittings

Repair of steel fittings should, in principle, only take place after consultation with the manufacturer.

Welded fittings are of steel specification 1.7734.4 and/or 1.0308.1 (St. 35.4). Welds should be made only using the tungsten inert gas fusing welding process with the welding material 1.7734.2 (for 1.7734.4 alloy) and 1.7324.0 (for 1.0308.0 and/or junctions of 1.7734.4 and 1.0308.1 alloys).

b) Aluminium casting fittings

Aluminium casting fittings (alloy 3.2374.6: GA1Si7Mgwa) cannot be repaired. Cracked or bent aluminium cast parts must be replaced by new components.

Note: Bent aluminium castings cannot be straightened. They will be brittle at the deformation site, which is not permitted.

c) Wing - fuselage spigots.

The spigot lock (4 off in the fuselage) between the wings and fuselage is made by six steel balls of 6mm diameter, which are pushed by the locking ring on the fuselage fitting into the groove in the spigot pins on the wings. If one or more balls are missing, the fuselage spigot lock must be replaced with a new fitting.

10. Larger repairs

Larger repairs are to be carried out by the manufacturer or other recognised repair shops (according to data supplied by the manufacturer).

Larger repairs include for example:

- broken off wings, snapped fuselage, tail units, rudder, wing main spar damage

- pulled out main wing fittings in the fuselage or wing, damage to the tailplane/fin fittings, damage to the mid fuselage section linking undercarriage to wing fittings.

- damaged GRP laminates (showing white areas, or delamination) in direct proximity to the main fittings.

11. Installation of additional equipment

The mounting plate for an oxygen cylinder is built in to the right fuselage side in the current series of aircraft. Clevis mounting and clip fittings can be obtained from the manufacturer.

Other equipment can be fastened as follows:

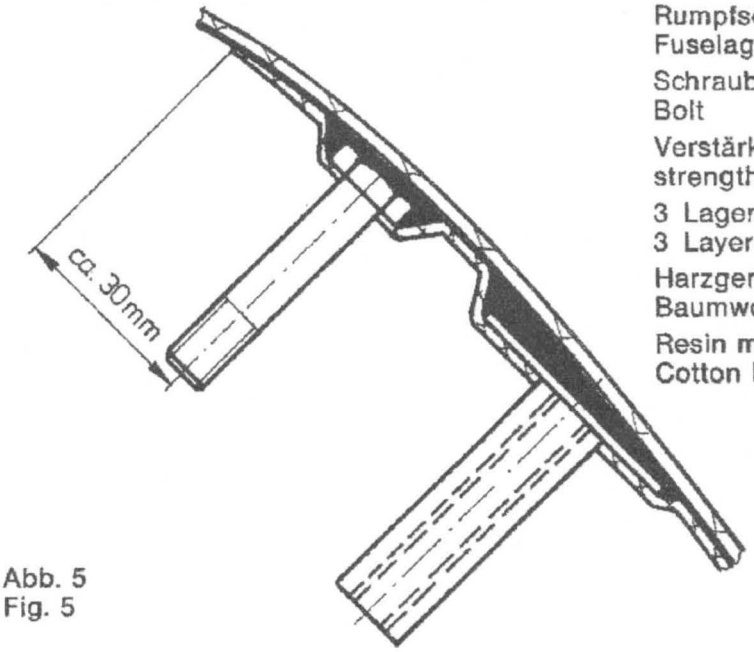


Abb. 5
Fig. 5

The reinforcement is to be designed in such a way that it can take the weight of the additional equipment. It should withstand loads of 10G without falling off or tearing loose.

With each addition of equipment, the empty weight and the position of the centre of gravity must be determined to ensure that they lie within permitted limits.

Installation drawings for radio and oxygen equipment can be obtained from the manufacturer.

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