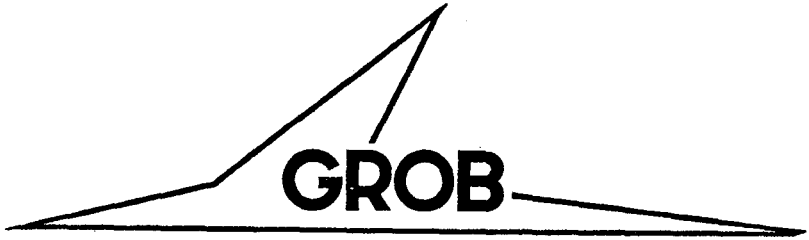


GROB-FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
Telefon 08268/411

FLIGHT HANDBOOK

TWIN-ASTIR

This handbook must be carried on board at all times.

It refers to the TWIN ASTIR Sailplane

Registration: Factory Serial Number:

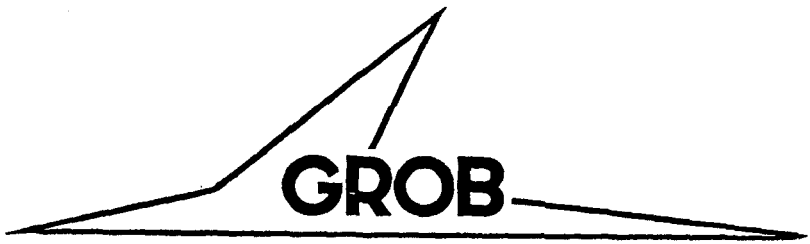
Owner: _____

_____

_____

German edition of operating instructions are approved under § 12/2. of LuftGerPO.

Published 5 June 1978



GROB-FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
Telefon 08268/411

FLIGHT HANDBOOK

TWIN-ASTIR

TRAINER

This handbook must be carried on board at all times.

It refers to the TWIN-ASTIR TRAINER Sailplane

Registration: Factory Serial Number:

Owner: _____

_____

_____

German edition of operating instructions are approved under § 12/2. of LuftGerPO.

Published 5 June 1978

Updates

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4	25	Check of wing	1.10.78		
5	25a	Fittings	1.10.78		
6	1, 28	Service Bulletin 315-50	28.09.92		
7	1, 25, 25a	TM 315-58	04.11.96		
8	1, 7, 11	ASB 315-64 Envelope Limitations	30.06.2003		
9	1, 7, 11	MSB 315-64/3 Revised Limits of Operation	14.09.2004		12. OKT. 2004

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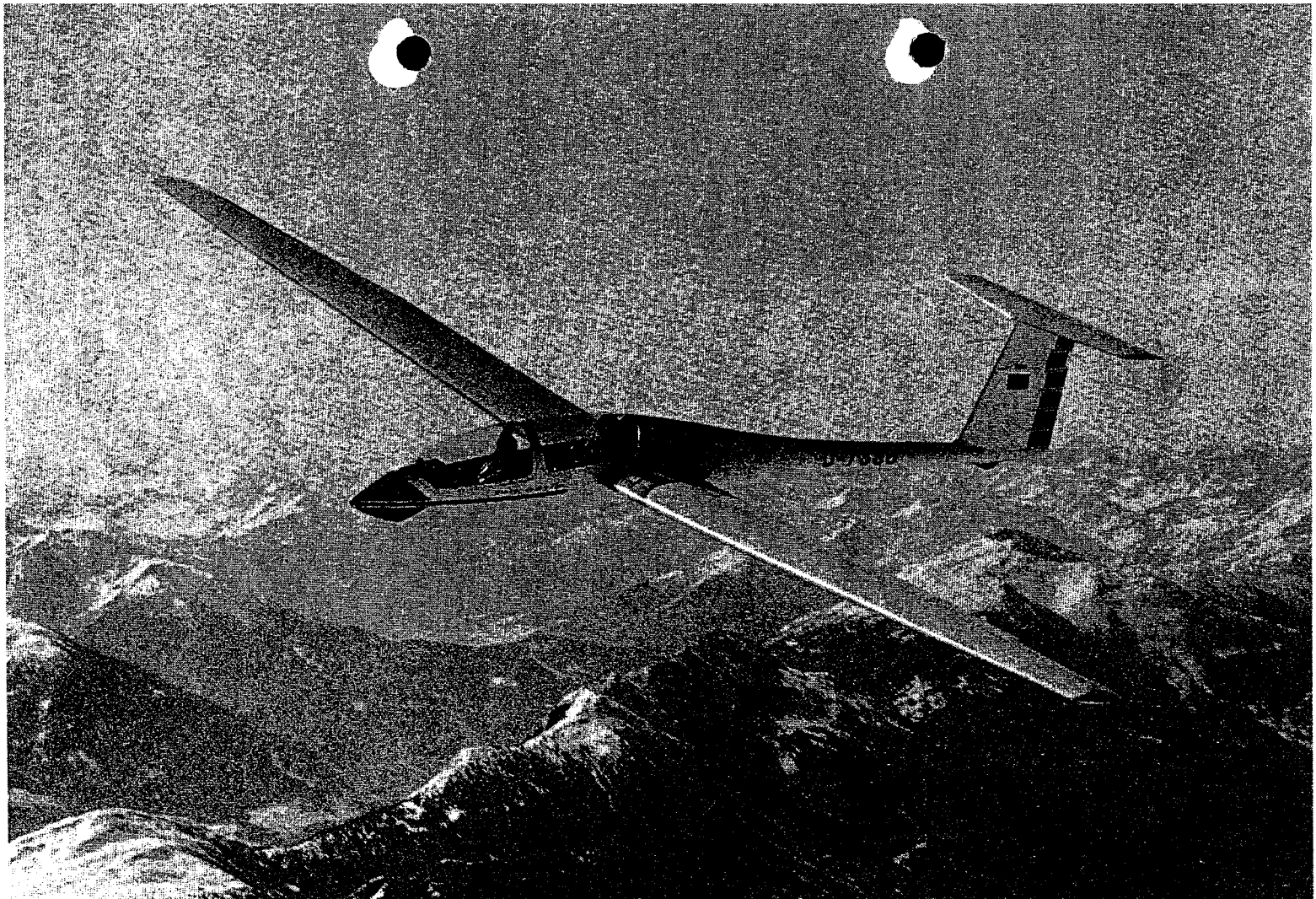

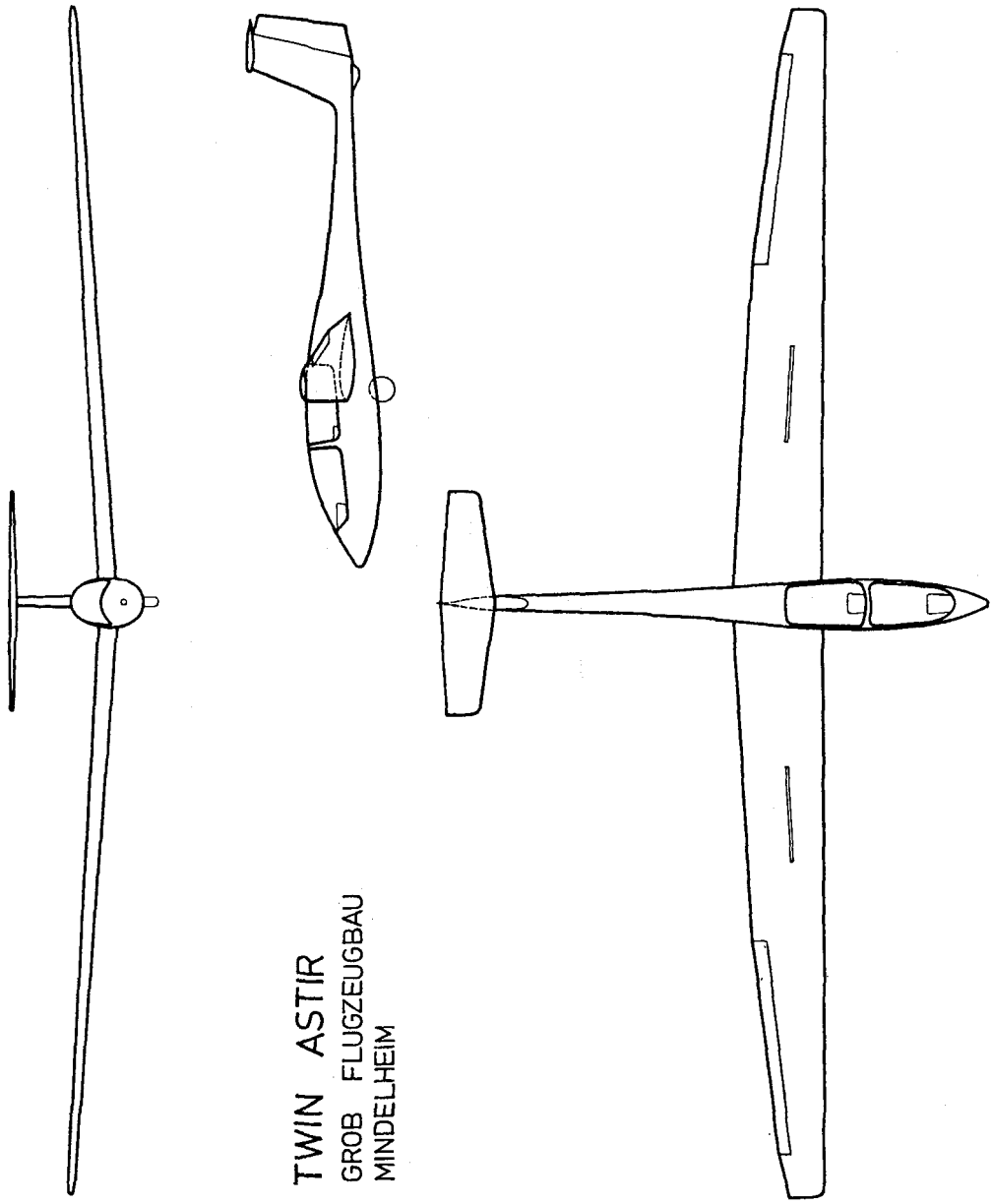
TWIN ASTIR
GROB FLUGZEUGBAU
MINDELHEIM

The sailplane TWIN-ASTIR TRAINER is derived from the TWIN-ASTIR. The differences are fixed sprung undercarriage with disc brake, and the deletion of the wing ballast tanks.

Therefore, the remarks in the flight handbook and the maintenance handbook concerning retractable undercarriage and water tanks do not apply to the TWIN-ASTIR TRAINER.

The wheel brake of the TWIN-ASTIR TRAINER is a disc brake. The brake cylinder with the storage tank for brake fluid is mounted on the undercarriage box.

The marks for minimum and maximum reserve must be observed.
For refilling use brake fluid DOT 3 (amber).

I. 5 **Description**

The TWIN ASTIR is a high performance two seater sailplane with a T-tail, fitted with a retractable undercarriage, upper surface airbrakes and water ballast tanks in the wings.

This sailplane is manufactured using the latest techniques in industrial Glass fibre construction.

It is designed for training, high performance and simple aerobatic flying.

Technical Data:

Span	17.5 m	(57.4 ft.)	Wing Area	17.8 m^2 (191.6 $ft.^2$)
Length	8.1 m	(26.6 ft.)		
Height	1.6 m	(5.2 ft.)	Maximum Flying Weight	650 kg (1435 lbs)
Aspect Ratio	17.1		Maximum Wing Loading	36.5 kg/m^2 (7.84 $lbs/ft.^2$)

II. **Operating Limits**

II. 1 **Airworthiness Group**

(U, Utility, LFSM)

The LFSM (Lufttüchtigkeitsforderung für Segelflugzeuge und Motorsegler) published 23. 10. 1975 are the basic rules and requirements for the licensing of a new type of glider or motor glider in Germany.

II. 2 **Permitted operating conditions.**

The plane is licensed for:

1. Flight in VMC
2. Simple Aerobatics (Loops, Stall turns, Lazy eight, Chandelle and Spin).
3. Cloud flying (When fitted with suitable instrumentation as defined in section II. 3).

II. 3 **Minimum equipment**

1. 2 Air speed Indicators reading to 300 km/hr (162 kts, 187 mph)
2. 2 Altimeters.
3. Full Harness Straps in front and back cockpit.
4. Parachute or back cushion at least 7 cm (3 inch) thick.
5. Loading limit plaque in front and back cockpit.
6. Flight Limits plaque.
7. Flight Handbook.

Cloud Flying.

For cloud flying the additional instruments listed below must be installed.

1. Variometer.
2. Electric turn and slip indicator.
3. Magnetic Compass (Compensated inside the glider).

II. 4 **Maximum Speeds**

Maximum permitted speed in calm air	V_{NE}	= 250 km/h (135 kts, 155 mph)
Maximum permitted speed in rough air . . .	V_B	= 170 km/h (92 kts, 105 mph)
Maximum Manoeuvring speed	V_M	= 170 km/h (92 kts, 105 mph)
Maximum winch launch speed	V_W	= 120 km/h (65 kts, 74 mph)
Maximum Aerotow speed .	V_T	= 170 km/h (92 kts, 105 mph)

Conditions in rough air are similar to those encountered in rotors, clouds, whirlwinds and when overflying mountain ranges.

Manoeuvring speed is the maximum speed at which full control deflections may be used. At maximum speed (VNE) the control deflections should be restricted to 1/3 of the full range.

Air speed indicator markings

51—105 mph =	44— 92 kts =	82—170 km/h	— Green arc
105—155 mph =	92—135 kts =	170—250 km/h	— Yellow arc
at **155** mph =	**135** kts =	**250** km/h	**(MSB315-64/3)** Red line
at 65 mph =	55 kts =	102 km/h	— Yellow triangle (recommended minimum appr. speed)

Position Errors

The airspeed indicator must be connected to the following sources: Pitot head in the tail fin, static vents side of the fuselage between the two seats.

Using a calibrated ASI the position error is not greater than ± 2 km/h or 1 kt or 1.2 mph. A calibration curve is therefore not necessary.

II. 5 ***Flight envelope.***

The sailplane design limit load factors are as follows:

At manoeuvring speed	+ 5.3 — 2.65
At VNE	+ 4.0 — 1.5

(Brakes closed and calm air)

II. 6 **Weight limits**

Maximum permitted weight without water ballast	650 kg (1435 lbs)
Including water ballast	650 kg (1435 lbs)
Maximum permitted weight of non lifting parts .	470 kg (1036 lbs)

II. 7 **Centre of gravity position**

The approved range of centre of gravity positions during flight is 260 mm (10.24 inches) to 460 mm (18.11 inches) behind the reference point, equivalent to 24.7% to 43.6% of the M.A.C. of the wing.

The reference point is the front edge of the wing at the wing root.

The approved centre of gravity range does not get exceeded by the payload distribution specified in the loading plan II. 8.

The exact position of the centre of gravity at flying weight can be calculated according to VI· 5.

II. 8 **Load scheme TWIN ASTIR**

Minimum load in the front seat for all flight . .	70 kg (154 lbs)
Maximum load in the front seat	110 kg (242 lbs)
Maximum load in the back seat	110 kg (242 lbs)
Maximum load in both seats	220 kg (485 lbs)
Maximum load in the baggage compartment .	10 kg (22 lbs)

Ballast must be used on the front seat to compensate if the front seat load is lower than 70 kg (154 lbs).

The maximum flying weight of 650 kg (1435 lbs) must not be exceeded.

Waterballast may only be taken on until the maximum flying weight is reached.

Water ballast can not be used to compensate if the load in the front seat is too low·

Updates

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8	1, 7, 11	ASB 315-64 Envelope Limitations	30.06.2003		
9	1, 7, 11	MSB 315-64/3 Revised Limits of Operation	14.09.2004		12. OKT. 2004

II. 13 Required placards front and rear cockpit

Maximum flying weight

Without Waterballast	650 kp	1435 lbs
With Waterballast	650 kp	1435 lbs

Airspeed limits		km/hr	knots	mph
Never exceed	V_{NE}	**250**	**135**	**155**
In Rough Air	V_B	170	92	105
On Airotow	V_T	170	92	105
On Winch or Auto Launch	V_W	120	64	74
Airbrakes Open	V_{DF}	**250**	**135**	**155**
Manoeuvring	V_A	170	92	105

Payload (Pilot and Parachute)

Minimum in Front cockpit for all flight	70 kg	154 lb
Less must be compensated with ballast secured in the seat		
Maximum load front	110 kg	242 lb
Maximum load back	110 kg	242 lb

Simple aerobatics air speeds

Recommended entry speed	km/hr	knots	mph
Loop	180	97	111
Stall turn	180	97	111
Spin	80	43	50
Chandelle	170	92	105

aerobatics with waterballast is not allowed

Required placards

Check before launch

Full and free movement of controls?
Parachute secured?
Straps tight and locked?
Pedals adjusted and locked?
Brakes closed and locked?
Trim correctly adjusted?
Altimeter adjusted?
Canopy locked?
Cable on correct hook?

Beware: – Crosswind! – Cable break!

Front Cockpit

Canopy Jettison and Emergency Exit

- Pull red handles on right and left of canopy fully back together
- Push canopy up and away with the left hand
- Release safety harness
- Stand up and get out over left or right side depending on the altitude
- When using a manual parachute grip release and pull firmly to full extent after 1–3 seconds

By canopy release front and back

Tire Pressure
39,8 PSI 2,8 atm

Maximum weak link strength
1323 lbs 600 kg

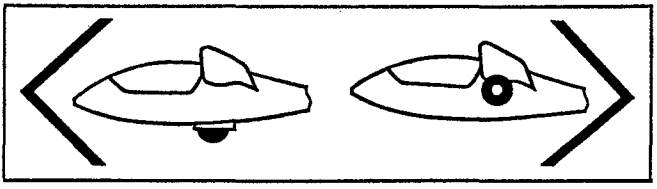
Left undercarriage door.

Baggage maximum

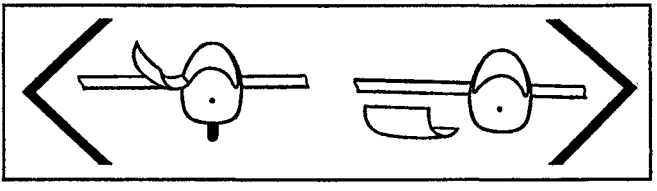
22 lbs 10 kg

Baggage compartment

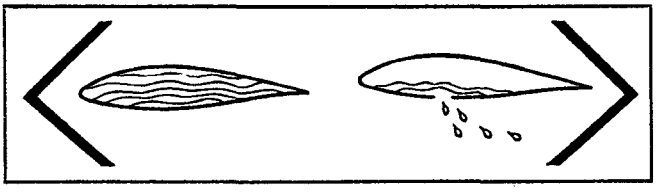
II. 14 **Symbols**



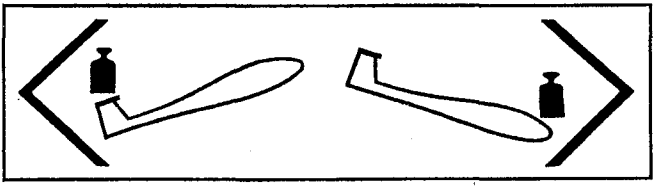
Undercarriage retract



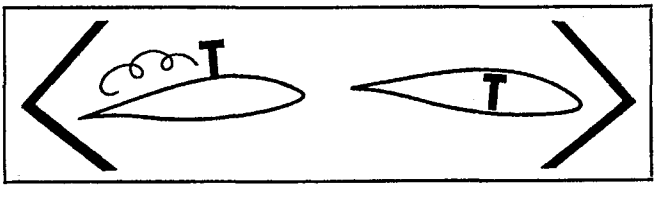
Canopy open
Canopy jetison



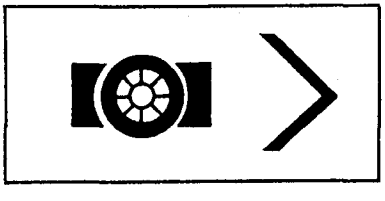
Waterballast jetison



Trim

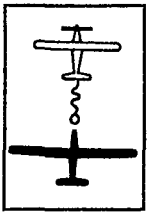


Airbrakes

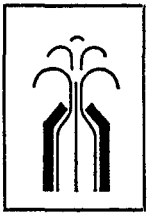


Wheelbrake

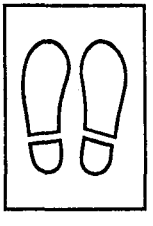
Symbols



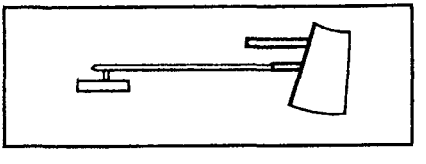
Cable release



Air-vent
Top left of front
instrument panel



Pedal adjustment
Top right of front
instrument panel



Total energy
compensation tube

III. Emergency procedures

III. 1 Exit from a spin

Exit from a spin can be accomplished by

-- Full opposite Rudder
-- Neutralise Stick
— Ailerons should be central
— When rotation stops centralise rudder and pull out gently.

III. 2 Emergency canopy jettisoning and exit.

The spacious cockpit allows unhindered exit in an emergency.
It is advisable to keep to the following order:

a) Pull red handles on left and right back together and push canopy upwards and away with the left hand.
b) unlock safety belts
c) Stand up and get out over left or right side depending on the attitude.
d) When using a manual parachute grip release handle and pull firmly to full extent after 1 — 3 seconds.

III. 3 Landing with retracted undercarriage

It is possible on hard and soft ground without risk of overturning. Approach as normal and touch down on two points.

III. 4 Others

Flying in rain

Wet or lightly iced wings have little noticeable effect on flying. Thick ice deposits on the wing increase the stalling speed by about 10 km/h = 6 kts.

Stall

Stall out of straight flight or a turn: Neutralise stick and opposite rudder to any turn.

Ground Loops

The glider has no tendency to ground loop whilst taking off.
However if a wing touches or the direction changes by more than 15 degrees during a take off release immediately.

III. 5 **Instruments specifications**

Basic equipment: Airspeed

The installation error of an airspeed indicator is not greater than 2 km/h or 1 kt. or 1,2 mph using the pitot tube in the tail fin and the static vents side of the cockpit.

The original certification was carried out using a Winter 6FMS4-2 and a PZL PR 400 S Airspeed indicator.

A similiar FAA approved airspeed indicator to meet TSO C 2 reading to 300 km/h (162 kts, 187 mph) may be used.

Altimeter

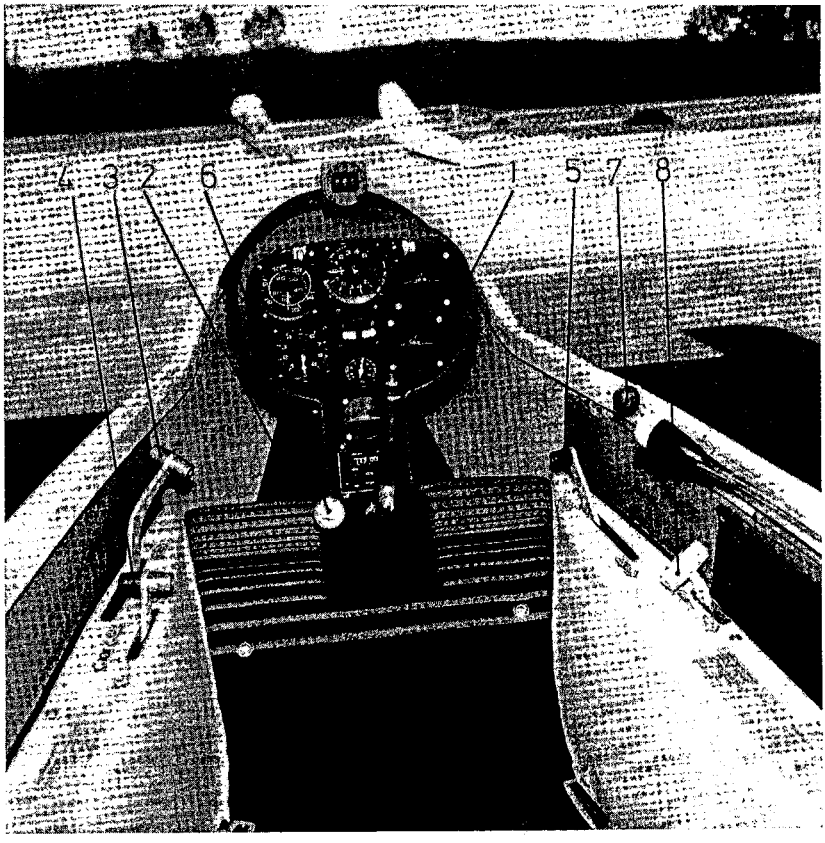
The original certification was carried out using a Winter 4FGH 10 and a PZL 12 S Altimeter.

A similiar FAA approved altimeter to meet TSO C 10 with a range to 35.000 feet may be used.

IV. **Normal operation**

VI. 1 **Cockpit and controls**

Front Seat.

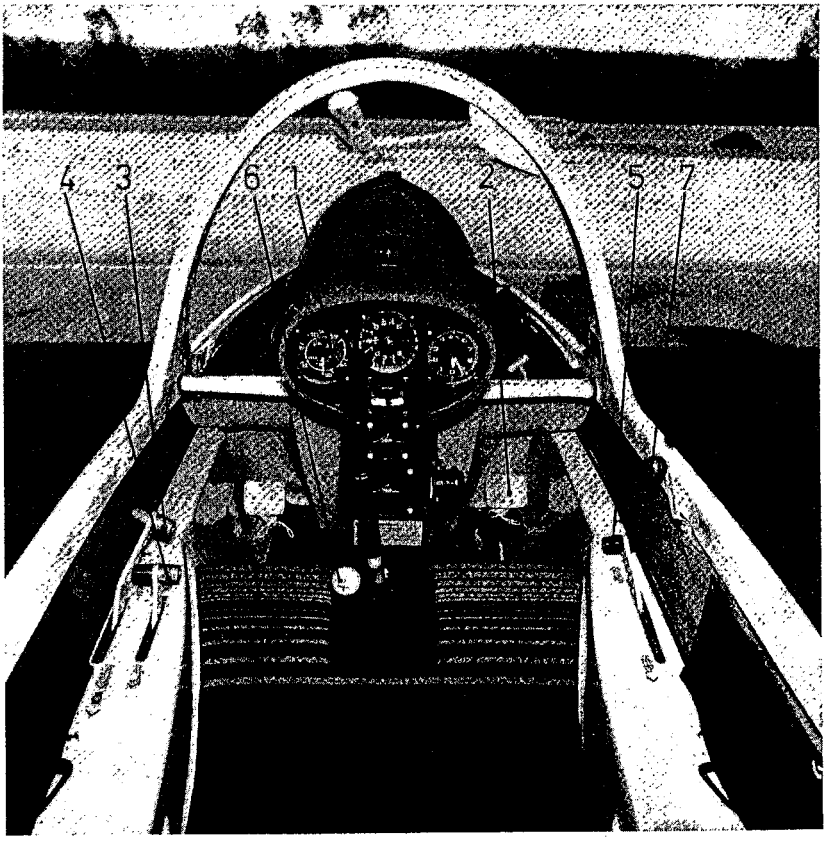


1 Stick
2 Rudder pedals
3 Airbrake lever and wheelbrake
4 Trim lever
5 Undercarriage lever
6 Release knob
7 Canopy jettison
8 Water ballast jettison

Ventilator top of instrument panel left side.
Rudder pedal adjustment top of instrument panel right side.

IV. 1 **Cockpit and controls**

Back seat.



1 Stick
2 Rudder pedals
3 Airbrake lever and wheelbrake
4 Trim lever
5 Undercarriage lever
6 Release knob
7 Canopy jettison

IV. 2 **Daily preflight inspection**

1. a) Open canopy.
   b) Check the 4 wing fastenings inside the fuselage if locked.
   c) Visually check all controls inside the cockpit.
   d) Check for foreign bodies.
   e) Test controls for full and free movement.
   f) Check tire pressure 2.5 – 2.8 atm. = 35.6 — 39.8 PSI
   g) Check condition of both hooks.
   h) Check functioning of releases and wheelbrake.

2. a) Check top and bottom of wing for damage.
   b) Check ailerons for condition, freedom of movement and play.
   c) Check airbrakes for condition, locking and fit.

3. Check fuselage for damage especially on the underside.

4. Check tail unit for correct assembly and that safety lock is in position.

5. Check condition of the tailskid.

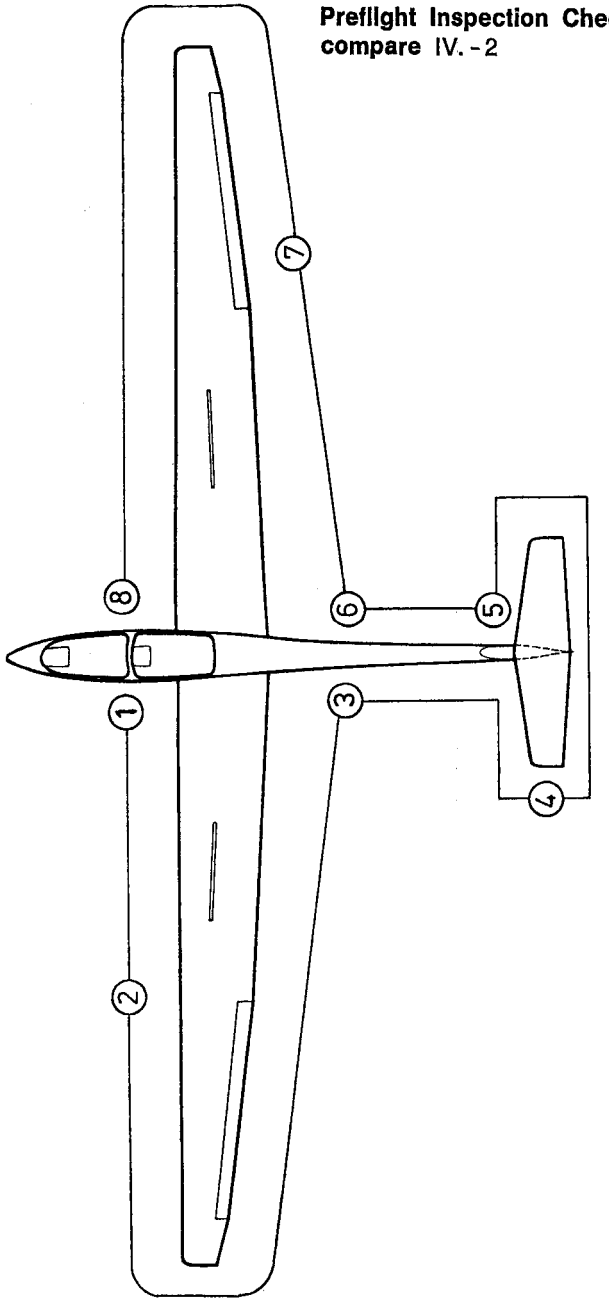
6. Check the pitot tube, total energy venturi and static vents are clean.

7. Repeat step 2 for right wing.

8. Check static vents.

After heavy landings or excessive flight loads the entire glider should be checked. The wings and tailplane should be removed for these checks and if any damage is found an inspector should be consulted. The plane should not be flown before any damage is repaired.

Preflight Inspection Checkpoints
compare IV. - 2



IV. 3 **Control checks before take off**

1. Check all the controls for full and free movement.
2. Check undercarriage lever is fully forward and locked down.
3. Check that the ballast limitations are being adhered to.
4. Check safety straps and parachute are firmly fastened.
5. Check altimeter is adjusted to zero or airfield height.
6. Check that transmitter is switched on and set to airfield frequency.
7. Check trim is neutral.
8. Check canopy is closed and locked.
9. Check airbrakes are closed and locked.

IV. 4 **Take off**

Winch launch

Trim lever should be in central position.
Maximum winch launch speed is 120 km/h (65 kts, 74 mph).
The glider has a release hook in front of the wheel.
Winch launches cause no difficulties at all allowed centre of gravity positions and wing loadings.
The plane has no tendency to balloon up or to swing on the ground.
One should push forward slightly on the stick below about 100 metres (330 ft.) in the case of fast launches from a powerful winch. When the cable slackens pull the release firmly to its limit.
The undercarriage should not be retracted during a winch launch.

Aerotow

Trim lever should be in central position.
Maximum aerotow speed is 170 km/h (92 kts, 105 mph).
Aerotow should preferably use the nose hook.
The recommended length of tow rope is 40 — 60 m (120 — 200 ft.).
The glider can be controlled with coordinated rudder and aileron using full movements if required.
There is no tendency to swing in a strong crosswind.
The glider can be lifted off at about 70 km/h (38 kts, 44 mph).
The glider lifts off without assistance at a speed of about 80 km/h (43 kts, 50 mph) if the stick is kept in the neutral position.
The undercarriage can be retracted during aerotow at a reasonable height.
The yellow release handle is mounted on the instrument panel and must be pulled to its limit when releasing.

IV. 5 **Free flight**

It is possible to fly the glider over the entire speed range in all attitudes.

Full control movements are only allowed up to the manoeuvring speed 170 km/h (92 kts, 105 mph). At higher speeds the controls should be used with the appropriate care.

IV. 6 **Slow flying and stalling**

The glider gives clear warning when about to stall by a distinct shaking of the elevator.

The stalling speed depends on the wing loading and the condition of the plane. The following are guidelines:

Single seater

Weight	Without Airbrakes	With Airbrakes
470 kg = 1034 lbs	66 km/h (36 kts, 41 mph)	75 km/h (40,5 kts, 47 mph)

Double seater

Weight	Without Airbrakes	With Airbrakes
650 kg = 1430 lbs	80 km/h (43 kts, 50 mph)	90 km/h (49 kts, 46 mph)

If the stick is pulled back further the glider goes into a controllable high rate of sink, during which rudder and aileron turns can be flown at up to 15 degrees of bank. When the stick is released the glider returns to a normal flying attitude immediately.
After the stick is pulled back quickly the glider pitches nose down and the bank can still be controlled with aileron.

IV. 7 **High speed flight**

There is no tendency for flutter to develope within the permitted speed range. Above 170 km/h (92 kts, 105 mph) control movements should be restricted to 1/3 of full range. The airbrakes limit the speed to under VNE in a 45° dive even at maximum flying weight.

IV. 8 **Cloud flying**

The minimum instrumentation required for flying in cloud is:

Air speed indicator	Variometer	Turn and Slip
Altimeter	Compass	

Experience to date shows that the ASI does not get affected by icing.

If the manouvering speed is exceeded unintentionally, pull out the airbrakes to avoid overstressing.

In emergency open brakes and leave cloud at about 170 km/h (92 kts, 105 mph).

IV. 9 **Simple Aerobatics**

The glider is licenced for the following aerobatics (no waterballast):

1. Loop

Entry speed *	180 km/h (97 kts, 111 mph)
Maximum g	ca. 3 g
exit speed	ca. 180 km/h (97 kts, 111 mph)

2. Stall turn

Entry speed * 180 km/h (97 kts, 111 mph)

At 140 km/h (76 kts, 87 mph) slowly apply rudder.

Shortly before the top apply opposite aileron.

Note: The stall turn is difficult to carry out because of the high moment of inertia. If a tailslide is accidently initiated during the climb lock all controls in the centre position.

3. Spin (possible in aft c.G. positions only)

Preparation. Decrease speed slowly to 80 km/h (43 kts, 50 mph) pull stick back and give full rudder. Glider spins slowly. Rotation rate is one turn every 3 seconds with a height loss of about 100 m (300 ft.) per turn.

Exit Rudder fully opposite against direction of turn, neutralise stick then pull out slowly after rotation has stopped.

4. Chandelle

Entry speed * 170 km/h (92 kts, 105 mph)

Pull up to fly 90° turn. During turn decrease speed and exit from turn with rudder and aileron. Chandelle should be completed heading in opposite direction.

* NB: For twoseater configuration increase entry speed by 20 km/h (12 mph, 11 kts).

IV. 10 **Approach and landing**

Normal flying practice is to approach at 100 km/h = 54 kts. The airbrakes are sufficiently powerful for steep approaches. The use of brakes causes the glider to be slightly nose heavy, so that the glider holds the required speed by itself.

Avoid changing the airbrake setting during the roundout to avoid heavy landing.

IV. 11 **Flight with waterballast**

The water tanks are in the front of the wings and can hold about 50 l (11 gal.) per wing. The tanks are filled through the openings on the top of the wings. The cap can be removed with a pin. There is no noticeable water movement when the tanks are partially filled because of baffles installed within the tanks. There must always be equal amounts of water in each tank to avoid affecting the stability in roll.

The white lever on the right hand side of the cockpit should be pulled back to empty the tanks. The outlet is underneath the fuselage behind the wheel. It takes about 4 minutes to empty the tanks. It is strongly recommended that the tanks are emptied before landing out of field.

V. Rigging and derigging

V. 1 Rigging

The fuselage must be held firmly in a horizontal position when rigging. It is recommended to use a fuselage stand or the trailer fittings are used.

The glider can be rigged by 4 people.

1. Wings

   Unlock the 4 main wing fittings in the fuselage. Unlock the air-brakes on the wings. Guide the right wing into the fuselage. The safety catches on the fuselage fittings should now be released, and on gently moving the wing to and fro will be heard to snap into place. Next guide the left wing into the fuselage. Move the wing tips up or down so that the pin on the end of the spar stub is lined up with the appropriate hole in the opposite wing root and slide into place. Next release the safety catches on the left hand fuselage fittings and by gently moving the wing to and fro they too can be made to snap into place.

   Original wing-fuselage connection:

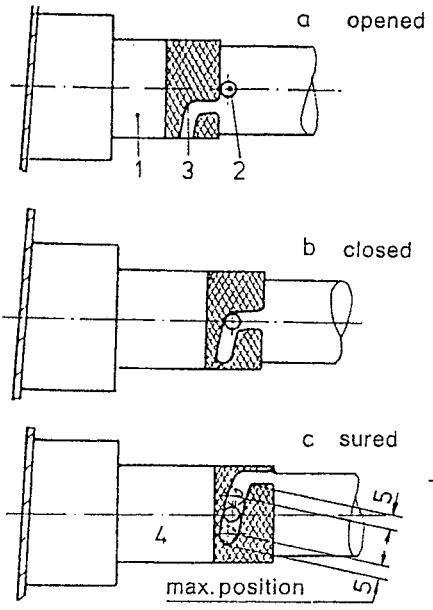
   To secure the wing fittings the safety catches (1) have to be turned so that the pins (2) are pressed to the angled slots.

   Moving the wing tip strongly to and fro enables the safety catches to be sufficiently turned (4). They should be hand tight and should not reach the end of the angled slot.

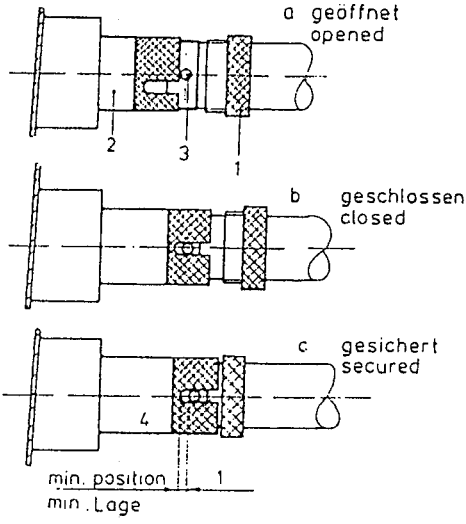
   Wing-fuselage connection according to SB 315-58:

   To secure the wing-fuselage connection in the closes position, the knurled nut (1) must be turned into the threaded socket (2) so that the socket is drawn against the red rings which are held by the guide pins (3).
   By means of moving the wing tips for and aft, the knurled nut can be secured tight (4) while securing the guide pins however, must not strike against the end of the milled selector of the shaft guide.

Original wing-fuselage connection:



Wing-fuselage connection according to SB 315-58:



Check: The red rings at the fuselage connection rods must be covered by the threaded sockets, the socket (or the knurled nut acc. to SB 315-58) must be tightened hand tight.

In the closed, but not secured position (b), the wing bolt cannot be removed from the locking.

2. The aileron and brake connections lie behind the spar.

   The short connecting rods in the fuselage are fitted with quick lock fasteners which must be coupled onto the balls on the linkages that move inside the wings.

   After rigging the connections should be examined to check that the sprung catches are properly inserted so that they project some mm out of the locks.

   Also after coupling the quick-lock fasteners, check that the ball can not be extracted by twisting the lock back and forth. Do this gently with not more than 10 lbs pull. Check all the control connecting rods and locks in a methodical order.

3. Tailplane

Before assembly is commenced the front cover must be opened and the rotating wing bolt pulled out to the limit. The tailplane can be positioned by standing behind the rudder. The tailplane can be rested on top of the fin with the elevator angled upwards so that the snap lock fastener on the elevator push rod can be attached to the ball on the elevator horn. The front of the tailplane can then be lowered and pushed back onto the three pins. It is then necessary to tighten the wing bolt clockwise to secure the tailplane. The assembly is complete when the wing bolt is sufficiently tight that there is no play in any direction. The cover provides a safety measure as it can only be attached with the wing bolt horizontal. If necessary the wing bolt has to be turned a 1/4 turn to suit. Derigging is carried out in the opposite order and the wing bolt is turned anticlockwise and pulled fully out.

Checks to be made after assembly

1. Check that the 4 main wing fittings are locked.
2. Check that aileron and brake quick-actions locks are properly located on the knobs.
3. Ensure that the tow hook is functioning correctly.
4. Test the operation of the wheelbrake and the pressure of the air in the tire.
5. Check that the tailplane is securely seated and that the elevator push-rod is connected.
6. Rudder movement.

Derigging

Derigging is carried out in the opposite order and this case it does not matter which wing is removed first. Excessive fore and aft rocking of the wing tips should be avoided.

V. 2 **Storage**

When the glider is stored the canopy should be locked. To tie down the wing, a rope can be pulled through the wing tip skids.

For ground handling the rotating tail wheel should be used.

V. 3 **Transport**

We recommend the use of a closed trailer for transporting the glider. The parts must be carefully supported and secured so they cannot slide.

1. Fuselage

   A fuselage trolley moulded to the shape of the fuselage and positioned in front of the main wheel. The minimum length of the trolley should be 400 mm and it can be attached to the wing fittings if required. The tail skid should be secured so that it cannot slide sideways.

2. Wings

   The minimum length for the spar support should be 200 mm and should start at the face of the root rib. The mounting must be padded well with foam rubber or felt.

   The mounting under the aileron inboard end should be a shaped mounting block with a minimum length of 300 mm and height of 400 mm. The mounting must be padded with felt.

3. Tailplane

   Either horizontal on padded supports with the upper surface downwards and secured with straps or vertical supported on the leading edge in shaped mounting blocks.

   Profile drawings are available for the manufacture of fuselage, wing and tailplane fittings.

V. 4 **Maintenance of the glider**

The entire surface of the glider is coated with weather resistant white polyester gelcoat.

The greatest care should be taken in maintaining the fibre glass surface of the glider. Luke warm water should be used to wash off dust, grease, dead flies and other dirty marks. More resistant dirt should be removed by using a mild cleaning agent. Only special silicon-free preparations should be used in maintaining the painted surfaces. (1 Z-Spezialreiniger – D 2, Fa. W. Sauer and Co., 5060 Bensberg or Reinigungspolish Fa. Lesonal).

Although very resistant the glider should be protected as much as possible against rain and dampness. Water that has seeped in should be dealt with by storing the glider in a dry place, frequently turning over the dismantled parts.

The most effective way to clean the canopy is to use a special perspex cleaner but if necessary luke warm water can be used. A soft, clean cloth or chamois-leather should be employed to wipe the canopy down. Never rub perspex with anything dry.

The Safety harness should be regularly checked for damage and general wear. The metal parts of the harness should be frequently checked for corrosion.

Because of its position, the winch launch hook is susceptible to getting very grimy and muddy. It must therefore be frequently inspected for damage, cleaned and greased. When the seat-well is removed the hook can easily be taken out. Remove the connecting wire from the lever and take out the retaining screws. For reconditioning, the tow hook should be sent with the record card to the tow hook manufacturer, Tost. For further details the manufacturers manuals should be consulted.

The cables and pulley for the nose and belly hooks should be checked for wear during the yearly inspection. The main wheel tire pressure should be kept at 2.5 to 2.8 atmospheres (36-40 psi).
The wheelbrake is of a drum type (for S/N's 3000-3139 optional as a hydraulic disc brake).
Drum brake: The bowden cable can be adjusted. The adjustment is carried out by moving the Bowden cable at the drum end.
Disc brake: The main brake cylinder and the brake fluid reservoir are located under the rear seat. Use only brake fluid according to specification DOT3/ DOT4.
During removing the main wheel for cleaning, greasing or changing the tire the Bowden cable must be disconnected from the brake lever (drum brake) or the brake cylinder must be removed (disc brake). Do not open the brake fluid hose.

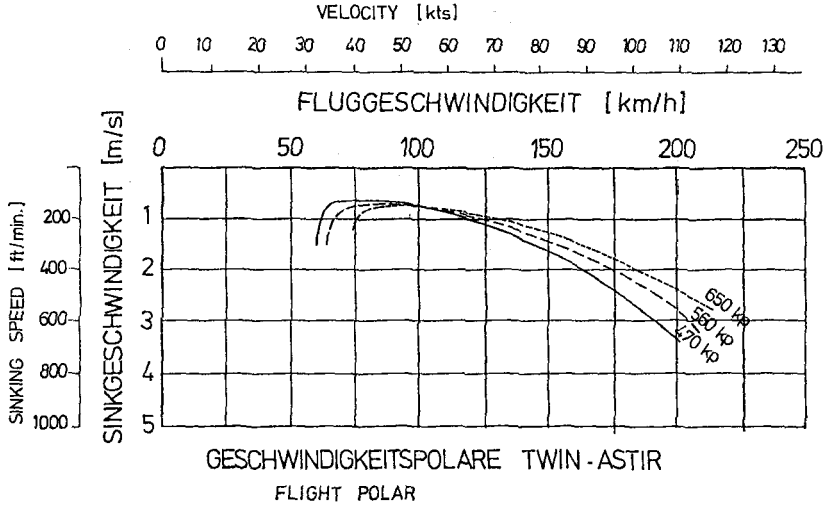
Screw the M 6 threaded special tool onto one side of the axle and take out the screws and the spindle. Remove the screws that hold the brake-lever in place. Take the wheel out by pulling it downwards. Clean all the parts and before re-assembly smear all of them with grease.

Before assembling the glider the pins and sockets at the joints between wings and fuselage, and tailplane and fuselage, should be cleaned and greased.

VI. **Appendices**

VI. 1 **Flight Performance**

Flying weight	470 (1036)	560 (1234)	650 (1435)	kg (lbs)
Wing loading	26.4 (5.4)	31.5 (6.5)	36.5 (7.5)	kg/m² (lbs/ft.²)
Best glide Angle	37.0	37.5	38.0	
at a speed of	95 (51)	105 (57)	110 (60)	km/hr (kts)
Minimum sink	0.62 (2.03)	0.68 (2.23)	0.73 (2.3)	m/sec (ft./sec)
at a speed of	75 (40)	80 (43)	90 (49)	km/hr (kts)



VI. 2 **Service and Maintenance instructions**

Regular service.

The following schedule of service should be carried out every 100 hours or at the annual inspection, which occurs first.

1. The entire glider should be checked for cracks, holes and bumps.
2. All fittings should be inspected for satisfactory condition (play, scores and corrosion).
3. All metal parts should be examined for corrosion, cracks, deformation and if necessary reconditioned and freshly protected.
4. Check that there is no play in the wing and tailplane to fuselage fittings.
5. The control linkages (Bearings, stops, fittings, hinges and control cables) should be inspected and replaced if there is evidence of bending or corrosion.
6. The controls including the brakes should be submitted to a functional test and the control deflections checked.
7. If the controls do not move free throughout their range, search for the cause and correct.
8. The undercarriage should be inspected and the wheel and brake checked to be in good condition.
9. The tow hooks should be treated in accordance with their appropriate maintenance manual.
10. Check the pitot for the ASI is clear and that the tubing to all instruments is in good condition and free of leaks or kinks.
11. The condition and calibration of all instruments should be checked and any other equipment inspected.
12. Equipment and instruments should be checked against the equipment list.
13. Check markings and placards.
14. After repair or change of equipment, the weight table should be updated with the new empty weight and Center of Gravity by weighing or calculation.

After extended storage check accordingly to regular service pos. 1 to 11 and inspect for evidence of rodents and birdness.

VI. 3 **Reference to Repairs**

The attached repair instructions give information for the execution of minor repairs.

Major repairs, in accordance with the glider information sheet are only permitted to be carried out by an authorised aircraft works. Grob will name a company with the appropriate qualifications in any individual case.

VI. 4 **Installation, maintenance and examination of the release hooks**

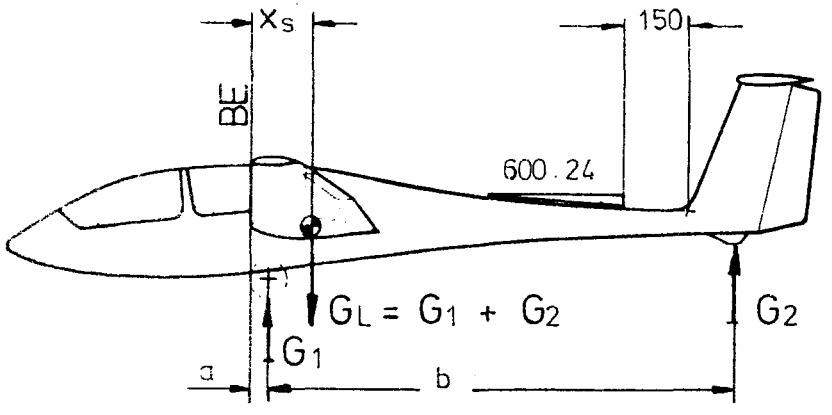
One is bound by the Maintenance Manuals for the nose hooks 'E 72' and 'E 75' published in May 1975 and the Maintenance Manual for the belly hooks 'Europa G 72' and 'Europa G 73' published in May 1975.

VI. 5 **Determination of the Center of Gravity**

The determination of the center of gravity is made with the undercarriage lowered and the glider supported on two scales at heights such that an incidence board of 600 : 24 angle is set horizontal on the back of the fuselage.

The reference plane lies at the front of the wing at the root. The distances a and b are measured with the help of a plumb line. The empty weight is the sum of the two weights G_1 and G_2.

Procedure for determinig C. of G. empty



Datum Line: Front edge of the wing at the root

Level Means: With a 600:24 Incidence Board set up horizontal on the top of the rear fuselage.

Weight on main-wheel	G_1 =	kg / lbs
Weight on tail-skid	G_2 =	kg / lbs
Empty Weight G_L = G_1 + G_2	=	kg / lbs
Distance to main-wheel	a =	mm / inches
Distance to tail-skid	b =	mm / inches

Empty Weight C. of G.

$$x = \frac{G_2 \times b}{G_L} + a = \text{\_\_\_\_\_} + = \quad \text{mm/inches behind Datum Line}$$

The measurements to determine the empty weight, the empty weight C. of G. and the loading limitations must always be taken with the glider empty of waterballast.

	from	to	multiply with
Convertion:	kg	lbs	2,2
	mm	inches	0.0394

If the limits of the empty weight C. of G. positions and the loading limitations chart are adhered to the C. of G. of the loaded glider will be within the permitted range.

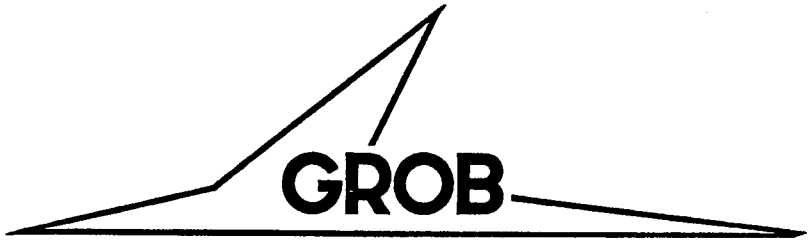
Empty Weight		Range of C. of G. behind Datum			
		Forward		Aft	
kg	lbs	mm	inches	mm	inches
390	860	725	28.54	747	29.41
395	871	719	28.31	744	29.29
400	882	713	28.07	740	29.13
405	893	708	27.87	737	29.02
410	904	702	27.64	733	28.86
415	915	697	27.44	730	28.74
420	926	692	27.24	727	28.62
425	937	687	27.05	724	28.50
430	948	682	26.85	720	28.35

It should be noted that to make use of the maximum load the maximum admissable load for non-lifting parts must not be exceeded.

The weight of the non-lifting parts is the sum of the fuselage, tailplane and maximum load in the fuselage and must not exceed 470 kgs (1036 lbs) or the maximum load permitted in the fuselage must be correspondingly decreased.

The Centre of Gravity should be recalculated after repair, repainting, the installation of additional equipment or when a period of 4 years has elapsed after the last weighing.

The empty weight, empty weight C. of G. position and maximum load, should be recorded after each weighing on page 9 of the Flight Handbook.



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

Maintenance Handbook

This handbook must be carried on board at all times.

It refers to the TWIN ASTIR Sailplane.

Registration: Factory Serial Number:

Owner: _____

_____

_____

German edition of operating instructions are approved under § 12/2. of LuftGerPO.

Published 5 June 1978

Index page

Updates:

Rev.No.	Page	Reference	Date	Signature	LBA - approval
1	19a	TRAINER undercarriage	01.10.78		
2	2, 19	Maintenance of Hotellier-quick-connectors	04.05.81		
3	1, 2, 23	Inspection procedure for increase of service time	30.09.81		
4	2, 16, 22, 23	Extension of service life	11.10.91		
5	2, 21	Envelope limitations ASB315-64	30.06.2003		
6	2, 21	MSB 315-64/3 Revised Limits of Operation	14.09.2004		12. OKT. 2004

I. Technical Data

Wings

Profile Eppler		E 603		
Span	b	= 17,5	m	57.4 ft.
Area	F	= 17,8	m²	191.6 sq. ft.
Aspect Ratio		17,1		

Ailerons

Span	b_{QR}	= 3,1	m	10.17 ft.
Chord inner	ti	= 0,208	m	.68 ft.
outer	ta	= 0,165	m	.54 ft.
Area	F_{QR}	= 1,16	m²	12.486 sq. ft.
% of Wing area		6,45	%	

Fuselage

Length	l	= 8,12	m	26.6 ft.
Width of cockpit	b	= 0,736	m	29 inches
Height of cockpit	h	= 1,06	m	41.7 inches
Height of tailplane	h	= 1,68	m	5.51 ft.
Surface area ca.	F	= 13,3	m²	143.16 sq. ft.

Fin

Height	h	= 1,4	m	4.59 ft.
Area	F	= 1,34	m²	14.42 sq. ft.
Aspect Ratio		1,46		1.46
Chord bottom	tu	= 1,2	m	3.94 ft.
top	to	= 0,8	m	2.62 ft.

Rudder

% of Fin		37,5	%	
Area	F	= 0,525	m²	5.65 sq. ft.

Tailplane

Span	b	=	3,3 m	10.8 ft.
Area	F	=	2,112 m²	22.7 sq. ft.
Aspect Ratio			5,16	5.16
Chord Inner	tI	=	0,815 m	2.67 ft.
Outer	ta	=	0,465 m	1.53

Elevator

Area	F	=	0,576 m²	6.20 sq. ft.
% of Tailplane			27,3 %	

Airbrakes (Grob System)

Area (Each)	F_{BK}	=	0,504 m²	5.425 sq. ft.
Span	b	=	1,4 m	4.59 ft.
Height	h	=	0,17 m	6,7 inches

Weights

Empty weight	ca.	400 kg	882 lbs.
Load Maximum with Waterballast		250 kg	551 lbs.
1. Seat		110 kg	242 lbs.
2. Seat		110 kg	242 lbs
Ballast	ca.	110 kg	220 lbs.
Load Minimum (1. Seat)		70 kg	154 lbs.
Maximum Flying Weight		650 kg	1430 lbs.
Load% of Flying Weight		37 %	
Wing Loading	26,9 – 36,5 kg/²		5.51 – 7.48 lbs./sq. ft.

Maximum weight of non-lifting parts 470 kg 1036 lbs.

II. Description of Components

II. 1 Control Linkages

The control of the TWIN ASTIR is designed as a push-rod system. The stick, bellcranks and horns are made from Aluminium, the pushrods are made of steel tubing with welded connections.

Elevator

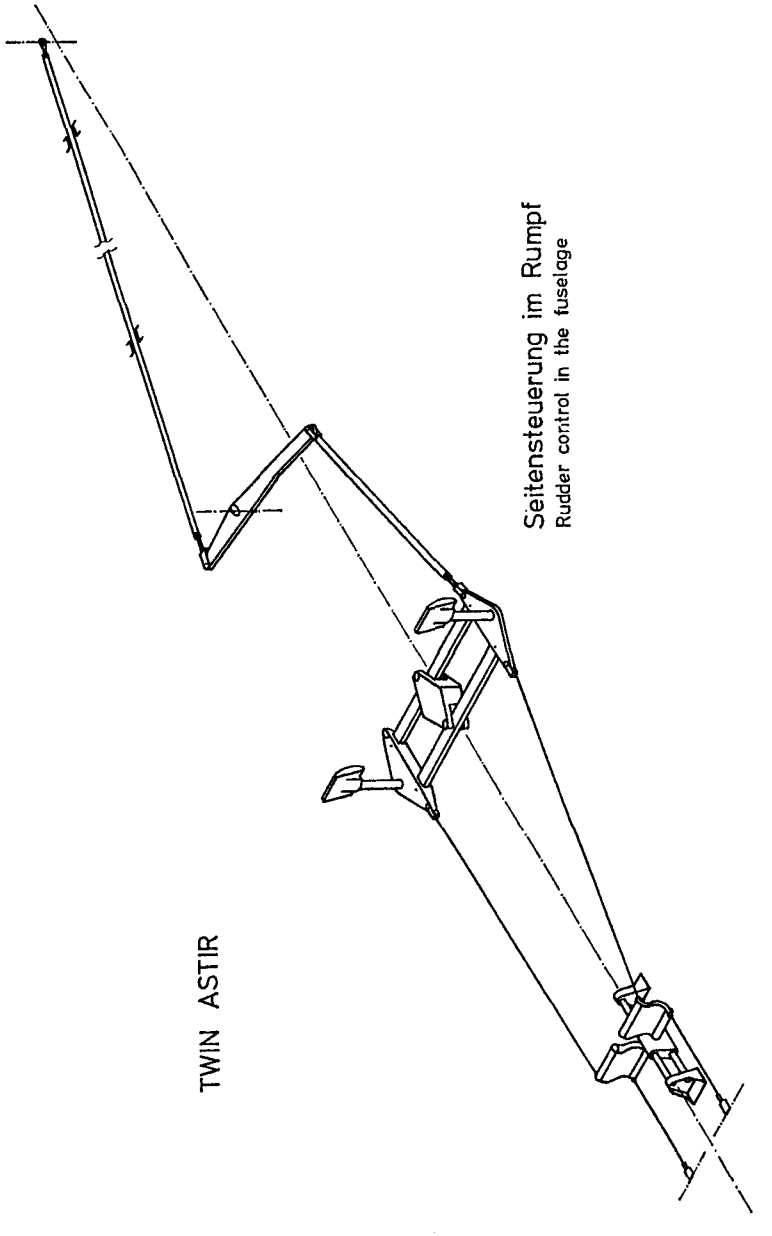
The control stick force is transfered from the control stick via the stick mounting frames to the elevator pushrod. The two control sticks are firmly connected. The rear control stick is detachable and held in place by a retaining nut. A single elevator pushrod leads from the rear stick to the elevator horn in the side fin. A connection rod with snap fastener drives the horn in the elevator. All the compenents in the fuselage may be dismantled. The elevator horn is laminated into the elevator. Stops for the elevator are situated on both stick mounting frames under the seats.

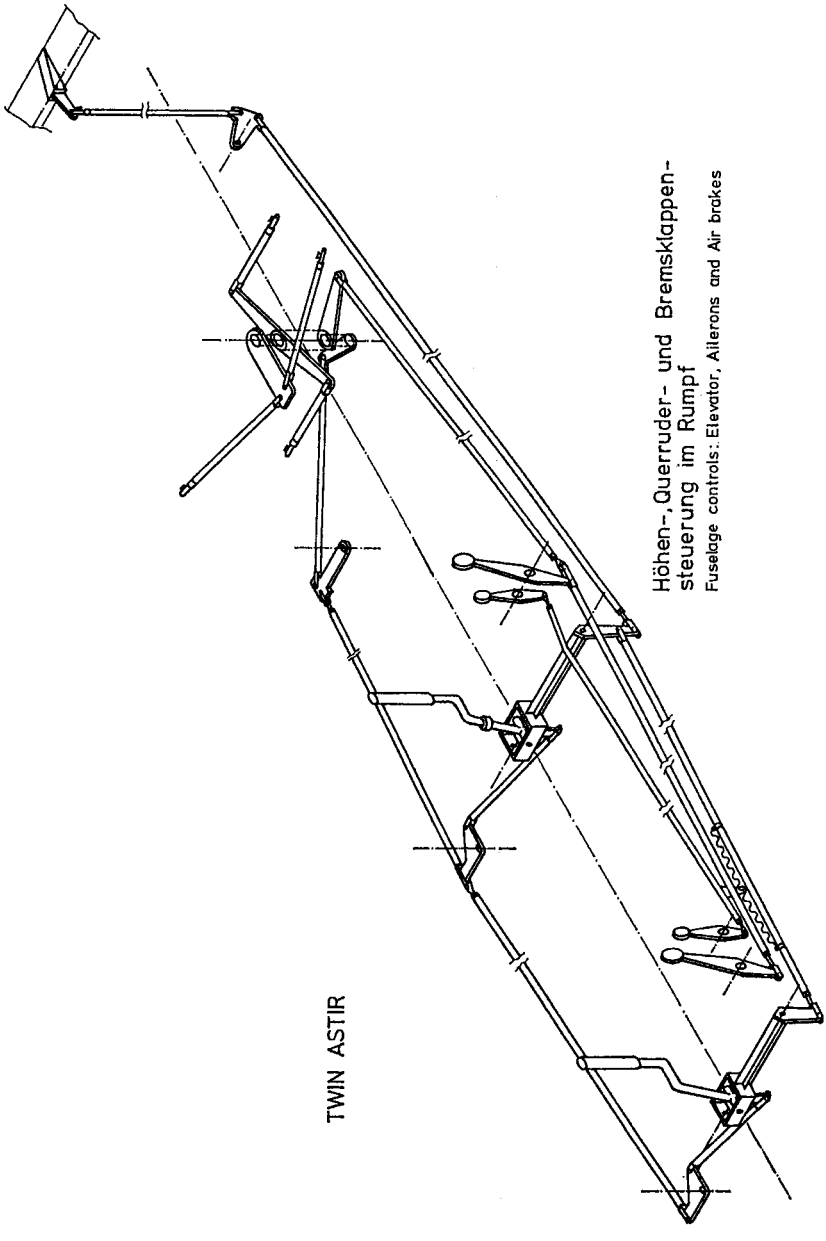
Aileron controls

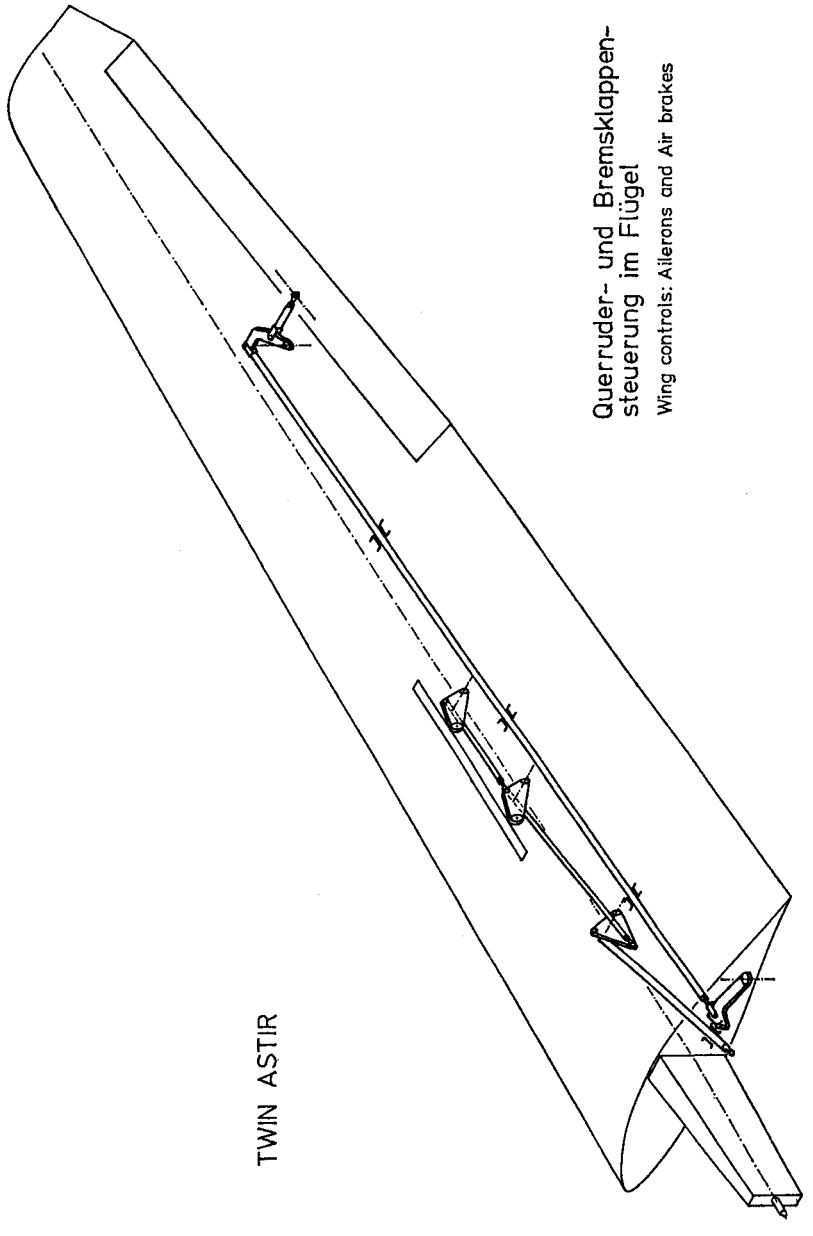
The lateral control force is transfered from the control stick via a short connection rod to the aileron control bellcrank on the side of the fuselage. The aileron control bellcranks for both control sticks are rigidly connected by means of a pushrod. Pushrods lead from the rear crank via an intermediate crank at the wheel box to the lower connection to the linkage assembly in the bottom of the fuselage. The aileron control connection and the pushrods in the wing are driven via the inner drive shaft of the linkage assembly and the upper crank. The outboard aileron control differential lever in the wing drives the aileron directly via a short pushrod. All components of the aileron control system in the fuselage may be dismantled. The aileron control differential lever and the pushrod in the wing may only be dismantled through an opening made in the GFK skin. Stops for the aileron linkage are present on both control sticks.

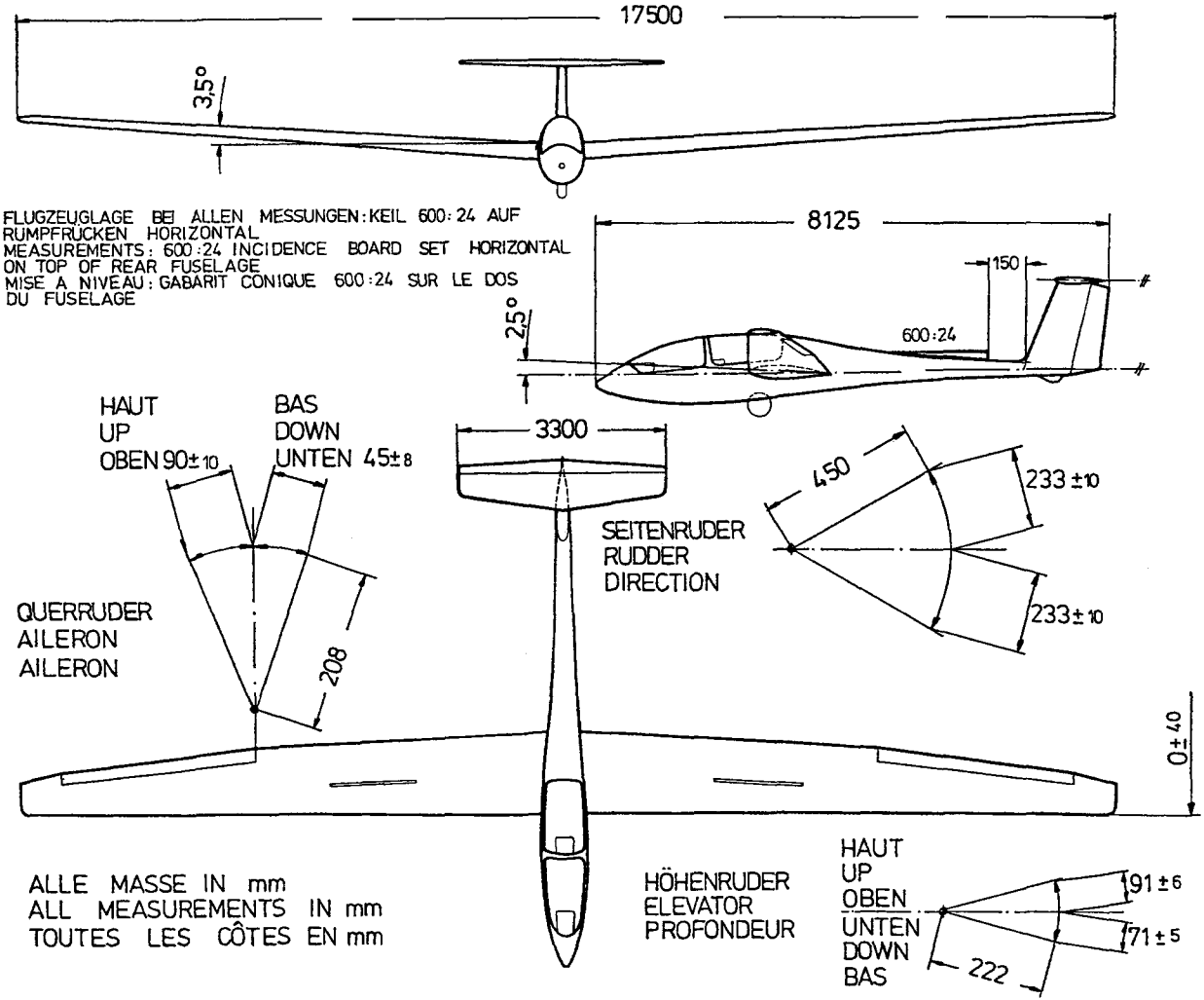
Rudder Linkages

Control cables lead from the front pedal mounting which can be adjusted in steps. The cables lie on the inside of the pedals and lead to the rear pedal controls. From there the main pushrod in the fuselage and the rudder are driven via the intermediate rudder pushrod and the rudder bellcrank at the wheel box. The whole of the rudder linkage system may be dismantled. The Stops for the rudder controls are located on the rear pedal support.


Seitensteuerung im Rumpf
Rudder control in the fuselage
TWIN ASTIR


Höhen-, Querruder- und Bremsklappen-
steuerung im Rumpf
Fuselage controls: Elevator, Ailerons and Air brakes
TWIN ASTIR


TWIN ASTIR
Querruder- und Bremsklappen-
steuerung im Flügel
Wing controls: Ailerons and Air brakes


17500
3,5°
FLUGZEUGLAGE BEI ALLEN MESSUNGEN: KEIL 600:24 AUF RUMPFRÜCKEN HORIZONTAL
MEASUREMENTS: 600:24 INCIDENCE BOARD SET HORIZONTAL ON TOP OF REAR FUSELAGE
MISE A NIVEAU: GABARIT CONIQUE 600:24 SUR LE DOS DU FUSELAGE
8125
150
2,5°
600:24
HAUT
UP
OBEN 90±10
BAS
DOWN
UNTEN 45±8
3300
450
233±10
233±10
SEITENRUDER
RUDDER
DIRECTION
QUERRUDER
AILERON
AILERON
208
0±10
ALLE MASSE IN mm
ALL MEASUREMENTS IN mm
TOUTES LES CÔTES EN mm
HÖHENRUDER
ELEVATOR
PROFONDEUR
HAUT
UP
OBEN
UNTEN
DOWN
BAS
91±6
71±5
222

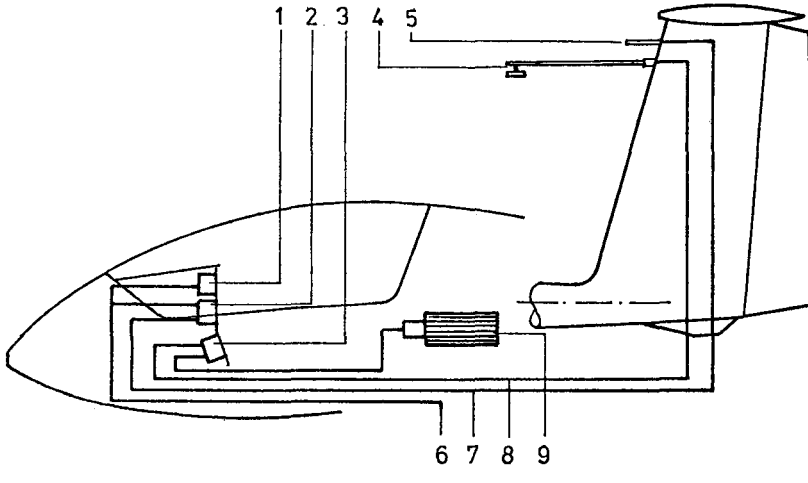
II. 2 **Installation of Radio**

The front instrument panel may be obtained in three layouts and can accommodate a rectangular instrument (60 x 80 mm or 146 x 47 mm) as well as 80 mm diameter instruments. The internal loudspeaker should be mounted on the rear instrument panel. "Swan neck" microphone booms may be mounted to the pilots right on the canopy frame. The shelf under the rear control linkage complex is prepared for fixing a battery. Drawings for the installation of the radio unit can be obtained on request.

II. 3 **Installation of Oxygen**

An Oxygen cylinder may be mounted behind the rear seat. Drawings for the installation of the Oxygen equipment can be obtained on request.

II. 4 **Pressure tubing and connections to the instruments**



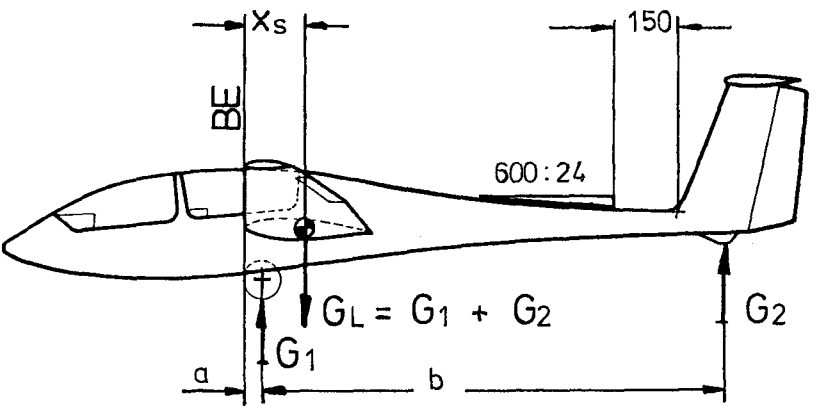
1 Höhenmesser (altimeter)
2 Fahrtmesser (air speed indicator)
3 Variometer (variometer)
4 Kompensationsdüse (total energy tube)
5 Staurohr (pitot tube)
6 Statischer Druck (static pressure) farblos (colourless)
7 Staudruck (pitot pressure) grün (green)
8 Düse (Totalenergy) rot (red)
9 Ausgleichsflasche (flask) blau (blue)

Adjustment	Reference Line	Value	Tolerance
Wing — Incidence angle	Angle between the centre line of the wing and the longitudinal axis of the fuselage	2° 30′	± 15′
Wing — Sweep forward	Distance of line joining the wing tips from the reference line	0	± 40 mm (1.57 in)
Wing — Dihedral	Angle between the top surface of the wing and horizontal	3.5°	± 30′
Tailplane — Incidence angle	Angle between the chord of the tailplane and the longitudinal axis of the fuselage	0	± 15′
Reference line	Front of the wing at the root rib	QE 2980	(117.32 in.)

Control defections	Upwards (right) Value	Upwards (right) Tolerance	Downwards (left) Value	Downwards (left) Tolerance	Measurement point from centre of rotation
Aileron Port	90	± 10	45	± 8	
Aileron Starboard	90	± 10	45	± 8	208 mm (8.19 in)
Elevator	91	± 6	71	± 5	222 mm (8.74 in)
Rudder	233	± 10	233	± 10	450 mm (17.72 in)
Release Hook	Backrelease load 0.5 to 1 kg (1.1 to 2.2 lbs) Maximum pull to release 7 kg (15.4 lbs)				

airbrakes extend: outward end 170 ± 10 mm above wing surface.

V. Measurement of Center of Gravity position



Datum Line: Front edge of the wing at the root

Level Means: With a 600:24 Incidence Board set up horizontal on the top of the rear fuselage.

Weight on main-wheel	G_1 =		kg/lbs
Weight on tail-skid	G_2 =		kg/lbs
Empty Weight	$G_L = G_1 + G_2$ =		kg/lbs
Distance to main-wheel	a =		mm/inches
Distance to tail-skid	b =		mm/inches

Empty weight C. of G.

$$X = \frac{G_2 \times b}{G_L} + a = \frac{\qquad}{\qquad} + =$$

mm/inches behind Datum Line

The measurements to determine the empty weight, the empty weight C. of G., and the loading limitations should always be taken with the glider empty of waterballast.

	from	to	multiply with
Convertion:	kg	lbs	2,2
	mm	inches	0,0394

If the limits of the empty weight C. of G. positions and the loading limitations chart are adhered to the C. of G. of the loaded cylinder will be within permitted range.

Empty Weight		Range of C. of G. behind Datum			
		Forward		Aft	
kg	lbs	mm	inches	mm	inches
390	860	725	28.54	747	29,41
395	871	719	28.31	744	29.29
400	882	713	28.07	740	29.13
405	893	708	27.87	737	29.02
410	904	702	26.64	733	28.86
415	915	697	27.44	730	28.74
420	926	692	27,24	727	28.62
425	937	687	27.05	724	28.50
430	948	682	26,85	720	28.35

It should be noted that to make use of the maximum load the maximum admissable load for non-lifting parts must not be exceeded.

The weight of the non-lifting parts is the sum of the fuselage, tailplane and maximum load in the fuselage and must not exceed 470 kgs (1036 lbs) or the maximum load permitted in the fuselage must be correspondingly decreased.

The Center of Gravity should be rechecked after repair, repainting, the installation of additional equipment or when a period of 4 years has elapsed after the last weighing.

The empty weight, empty weight C. of G. position and maximum load, should be recorded after each weighing on page 9 of the Flight Handbook.

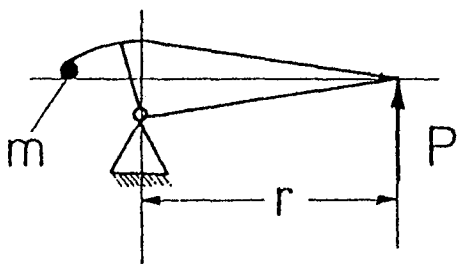
VI. Weights and moments of the control surfaces

Control Surface moments

The moments of the control surfaces must not exceed the following values:

Elevator	25.8 cm kg ± 12%	5.2 kg ± 12%
Rudder	24,9 cm kg ± 12%	6.5 kg ± 12%
Aileron	23.0 cm kg ± 12%	5.7 kg ± 12%

The moments must be measured with the control surfaces removed. To determine the moment M = P.r the surface should be mounted at the hinge line with the minimum friction possible. The force P can be measured, for example, using a letter scale. If these values are exceeded the mass balance should be increased. Before carrying out repairs which for example involve charging the mass balance on a surface the manufacturer or his repair agent should be consulted.



From Serialnumber 3073 the moments and weights of the control surfaces must not exceed the following values:

Elevator	25.8 cm kg ± 12%	5,2 kg ± 12%
Rudder	0–10 cm kg ± 12%	max. 8 kg ± 12%
Aileron	0–6 cm kg ± 12%	max. 8 kg ± 12%

An additional flutter calculation was performed. The results confirmed that the following values are acceptable:

Elevator	200 - 285 Ncm	3,10 - 4,40 kg (without mass balance)

VII. Checks

Check Lists

Daily checks and checks before launch: See Flight Handbook IV-2.

Checks in specific cases.

After a heavy landing:

Check the undercarriage mechanism under the rear seat, check the undercarriage mountings in the wheel box, check the spar and root rib for white patches in the glassfibre reinforced plastics (GFK).

Check the wing fittings in the fuselage and the pins in the root rib.

After a Ground loop:

Check the undercarriage mounting, check the rudder controls rods and bellcranks under the front seat.

Check the GFK tube at the base of the fin.

Check the wing fittings in the fuselage and the connecting pins in the root rib.

VIII. **Regular service** (100 hours and annual inspections)

The following schedule of service should be carried out every 100 hours or at the annual inspection, which occurs first.

1. The entire glider should be checked for cracks, holes and bumps.
2. All fittings should be inspected for satisfactory condition (play scores and corrosion).
3. All metal parts should be examined for corrosion, cracks, deformation and if necessary reconditioned and freshly protected.
4. Check that there is no play in the wing and tailplane to fuselage fittings.
5. The control linkages (Bearings, stops, fittings, hinges and control cables) should be inspected and replaced if there is evidence of bending or corrosion.
6. The controls including the brakes should be submitted to a functional test and the control deflections checked.
7. If the controls do not move free throughout their range, search for the cause and correct.
8. The undercarriage should be inspected and the wheel and brake checked to be in good condition.
9. The two hooks should be treated in accordance with their appropriate maintenance manual.
10. Check the pitot for the ASI is clear and that the tubing to all instruments is in good condition and free of leaks or kinks.
11. The condition and calibration of all instruments should be checked and any other equipment inspected.
12. Equipment and instruments should be checked against the equipment list.
13. Check markings and placards.
14. After repair or change of equipment, the weight table should be updated with the new empty weight and center of Gravity by weighing or calculation.

After extended storage check accordingly to regular service pos. 1 to 11 and inspect for evidence of rodents and birdness.

IX. Lubrication

Ball Bearings

All bearings installed are sealed with a permanent grease filling. Greasing of bearings is therefore unnecessary.

Sliding Bearings

All slide bearings installed on the fixed control linkages do not require servicing or greasing. However, the push rod bearings in the root rib and on the tailplane mounting should be cleaned with petrol and regreased when dirty. The pins and bushes on the wing fittings should be regreased when necessary during rigging.

The pins on the tailplane fittings and the screw thread should be lubricated periodically. The hinge and catch of the cover should be occasionally oiled. Dirty release hooks are best cleaned using a brush and compressed air whilst operating the mechanism. The belly hook is accessible from inside and can be lubricated with Sprayoil or similar.

Maintenance on Hotellier quick-locks must be conducted during each annual inspection or 500 hours which ever occurs first. They are installed at the control-connections of aileron and airbrakes at the wing-fuselage joint and at the elevator connection to the pushrod.

The diameter of the swivel has to be measured at different points by a micrometer with no differences in excess of 0.1 mm (0,004 in.) that means the swivel must still be spheric. If there are larger differences the swivels and the appropriate joints must be replaced.

Swivels and joints should be greased prior to each rigging.

The use of additional safety-pins guided through the holes of the wedge-type slides increases safety. (safety-pins No. 500 3771 from A. Würth, D - 7118 Künzelsau, W.-Germany or manufacturer)

TWIN-ASTIR TRAINER Undercarriage

1. Torque settings of the undercarriage attachment screws.

   Torque to be applied at the side attachments:

   at M 8 screws — 1,2 kpm = 8,7 lbs-ft
   at M 10 screws — 2,6 kpm = 18,8 lbs-ft

2. Installed length of compression washer.

   In order to keep to the design installed length of the compression washer, it is necessary to tighten the M 8. Hex nut at the upper mounting point of the wheel box. The correct installed length is automatically reached as a result. There are 106 compression washers.

3. Changing the brake shoes.

   a) Remove the wheel housing.
   b) Loosen the M 12 Allan key type screws in order to remove the brakes. The brake hose must not be taken off at the same time, otherwise it will be necessary to bleed the system.
   c) Remove the two split pins from outside and change the brake linings. The old brake linings can be used again after cleaning with steel brushes, if their dust grooves are still clearly visible.
   d) Re-install in reverse order.

4. Bleeding the brake system.

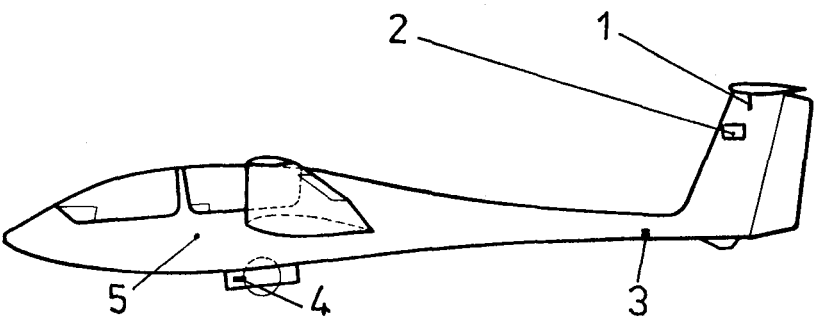
   a) Attach a clear plastic tube to the bleed screw, with the other end dipped in a container of brake fluid.
   b) While using the brake lever to force the fluid through the system via the brake cylinder, loosen the bleed screw.
   c) The bleeding process is completed when no more air bubbles are visible in the plastic tube.

Note

The brake fluid DOT 3 (amber) is available everywhere at garages. It is standardized within Europe.

1. 10. 78

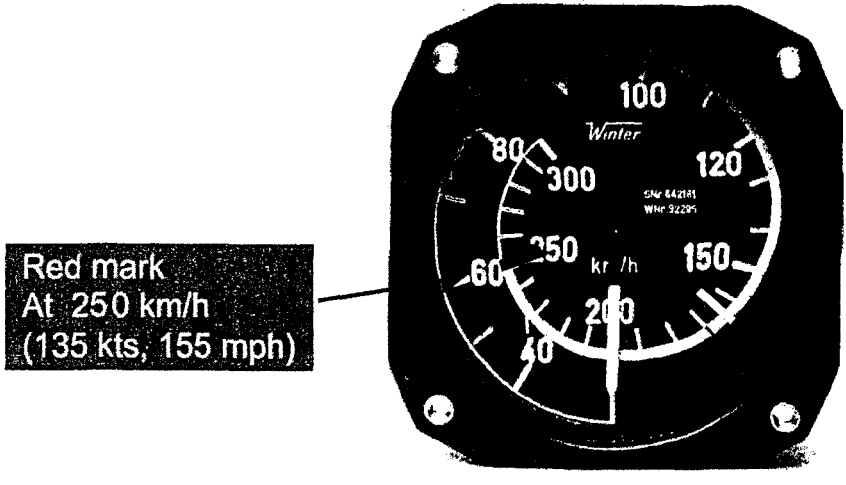
X. Labels and Markings



1. Marking controlling the correct rigging of the tailplane.
2. Label for the total energy tube.
3. Mark to locate the hole for the tail wheel.
4. Label for weak link strength and tyre pressure.
5. Red ring round the static hole.

ASI markings

Speed Mph	Speed kts	Speed km/h	Markierung	Bedeutung
51 - 105	44 - 92	82 – 170	Green Arc	Normal range of flying speed
105 - 155	92 - 135	170 – 250	Yellow Arc	Range of flying speeds to be used with care
155	135	250	Radial red line	Maximum speed (restored with MSB315-64/3)
64	55	102	Yellow triangle	Minimum recommended landing speed at full load



XI. General care

Dampness

As far as possible the glider should be protected from damp. All the metal parts of the glider, with the exception of the wing and tailplane fittings are protected against damp. However, this will not prevent corrosion during extended exposure to moisture. Following any flights in rain any water which has entered the glider should be dried up and the exterior surfaces dried with a chamois leather. Polished metal parts should be regreased. Beware of condensation.

Sunlight

All structural parts of GFK glider should have white surfaces to avoid them heating up in sunlight.

Protection of the Finish

The Gelcoat surface layer is very resistant and can therefore be cleaned using a mild detergent. Ingrained dirt such as grease and dead flies, are best removed with a SILICONE-FREE polish (1 Z Spezial-Reiniger or "Reinigungspolish", Fa. Lesonal, Stuttgart). Sticky tape used for sealing the wing and tailplane joints may be removed using thinners of Petrol (Beware thinners may remove the markings).

Cleaning the Canopy

The canopy should only be cleaned using a soft clean cloth or sponge and a mild soap solution. It should be rinsed with clean water and dried with a chamois leather. "Plexipol" is a suitable polish. Never rub perspex with anything dry.

Parking

Parking sailplanes in the open air should be avoided. The glider should only be stored or parked in well ventilated buildings.

XI. Inspection Procedures for Increase of Service Time

The original service life was established at 3000 operating hours. Within this period the presribed scheduled maintenance ensures airworthiness. Now, by means of special inspections, the service life can be extended step by step to 12000 operating hours:

1. General
   Fatigue tests with wing spars proved that the service life of FRP-gliders and -motorgliders can be increased to 12000 operating hours, if the airworthiness of each aircraft can be proved again by means of a special multistage service life test programme (in addition to the mandatory periodical inspections).

2. Time Limits
   If an aircraft has reached a service life of 3000 operating hours a detailed inspection shall be conducted according to the programme described under Item 3. If the inspection results are positive or after determined defects have been duly repaired the service life of the aircraft is increased by 3000 hours i.e. to a total of 6000 operating hours (1st stage).
   The inspection programme shall be repeated at 6000 operating hours. If the results are positive and the determined defects duly repaired the service life is increased to 7000 operating hours (2nd stage).
   If the glider has reached a service life of 7000 operating hours conduct the prescribed inspection programme again.
   If the results are also positive and the determined defects duly repaired the service life is increased to 8000 operating hours (3rd stage).
   The gradual extension of service life will be performed by steps of 1000 flight hours up to maximum 12000 flight hours at this time (4rd - 7rd stage).
   Additionally at 9500, 10500, 11500 operating hours inspection of the wing connecting bolts and main spar spigots must be performed according to Service Bulletin TM 315-45, action 6.

3. In any case, ask for the latest issue of the inspection record which comprises the latest inspection results.

4. Inspections shall only be conducted by the manufacturer or an authorized repair shop.

5. The inspection results shall be entered into the inspection record provided with a comment on each means. If the inspection is conducted in an authorized repair shop a copy of the inspection record shall be forwarded to the manufacturer for information and evaluation.

6. The annual inspection according to § 27 (1) German LuftGerPO does not fall within the purview of this regulation.

REPAIR INSTRUCTIONS

TWIN-ASTIR

Manufactured by:
Burkhart Grob Flugzeugbau
8939 Mattsies
Flugplatz Mindelheim-Mattsies
West Germany

INDEX

1. Forword

The Glider TWIN ASTIR is constructed from Glass-Fibre reinforced Plastic (GFK). The fuselage consist of GFK laminate. The load bearing surfaces (wings) and the Tailplane consist of GFK laminate with a foam supporting layer (GFK foam-sandwich). The Tail-fin and control surfaces consists of GFK styropor sandwich.

2. Authorized materials and suppliers

Resin: Shell Glycidäther 162 (Epikote 162)
Hardener: BASF Laromin C 260
Mixing: 100 parts Resin - 38 parts Hardener
Ratio by weight

Glass Fibre Cloth
Supplier: Interglas Textil GmbH. Söflinger Str. 246, 7900 Ulm

Use	Cloth	Weight g/qm	Interglas-Nr.
Fuselage	Double Twill	161	92 110
	Double Twill	390	92 140
	Chain Reinforced	433	92 146
Wings	Double Twill	161	92 110
	Double Twill	276	92 125
	Chain Reinforced	433	92 146
Elevator, Rudder and Ailerons	Double Twill	276	92 125
	Double Twill	161	92 110

All Glass-Fibre cloth is Alcholine free. E Glass with Votan-A-Finish or Finish I.550.

Supplier:

Rovings:
EC 10-80-2400 K 43

Gevetex
4000 Düsseldorf
Postfach 1205

Foam Material
PVC-Hartschaum
Conticell 60
8 and 8 mm large
Spec. Weight 60 kg/m³

Continental AG
3000 Hannover

Styropor:

Thermopete 4 mm large Spec. Weight 15 kg/m³	Poron-Werke GmbH 6122 Erbach Brunnenstraße 5
Depron 3 mm large Spec. Weight 15 kg/m³	Firma Kalle 6202 Wiesbaden/Bibrich

Filling Material for Resin

Microballoons Brown	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25
Cotton Flock Type FL 1 f	Schwarzwälder Textil-Werke 7623 Schenkenzell Postfach 12

Paint

PE-Schwabbellack White. No. 03-69120 UP-Hardener No. 07-20510 100 Schwabbellack Paint (Gel-Coat) 3 Hardener mix ratio by Weight. Thinners No. 06-30260	Lesonal-Werke 7000 Stuttgart 30 Postfach 30 07 09

Red Paint

Nitro-Cellulose-Kombilack Blood-Orange RAL 2002	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25

3. Simplified "Texture" plan of TWIN ASTIR

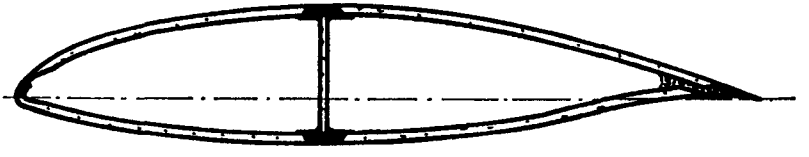
Reinforced regions for special loads and stress conducting are not shown.

1. Flügel

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

Wing

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



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 | **Controls**

Höhenruder oben | Elevator above
Querruder oben | Aileron above
Seitenruder rechts und links | Rudder left and right

1 Lage 92 110 diagonal | 1 Layer 92 110 diagonal
1 Lage 92 125 diagonal | 1 Layer 92 125 diagonal
Kern Depron 3 mm | Core Depron 3 mm
1 Lage 92 110 diagonal | 1 Layer 92 110 diagonal

Höhenruder unten | Elevator below
Querruder unten | Aileron below
2 Lagen 92 125 diagonal | 2 Layers 92 125 diagonal

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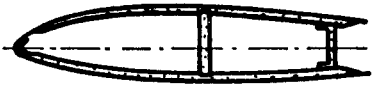
4. Höhenflosse | **Fin**

2 Lagen 92 110 diagonal | 2 Layers 92 110 diagonal
Kern: Conticell 60 6 mm | Core: Conticell 60 6 mm
1 Lage 92 110 diagonal | 1 Layer 92 110 diagonal



4. Repair of GFK material

If the glider is damaged, first examine the outer surface very carefully, frequently other structural parts are involved, fractures can run unseen under the outer surface.

Carry-out repairs with extreme care. As the outer surface of GFK gliders is stressed (loading bearing), failure of this skin can lead to structural failure.

Keep to the Resin-Hardening mixing ratio exactly = 0.5% using a clean mixing pot. The ratio of Glass fibre — to Resin mix is approximately 1 to 1. Grind or splice the repair, before laying damp laminate on it, so that dirt cannot penetrate and stop safe adhesion.

As in plywood, the direction of the fibre glass cloth lay (length or diagonal) is of extreme importance to its strength. It is necessary to know approximately how many fibre and their direction in the damaged part with reference to the simplified texture plan, so it may be restored to the correct wall strength. If a small piece of the damaged laminate is broken off and burnt, the remaining glass-fibres can be counted and identified.

Splicing and grinding are time consuming, to save trouble, grind only as much away as necessary, only to the size of the cloth patch. When it is necessary to shorten the repair time it may be done with a hot air blower to speed the resin hardening time.

Warning. A too high temperature will produce large air bubbles in the cloth. A tent can be built out of foil, through which hot air can be guided, and thereby avoiding local overheating. In making repairs to control surfaces, be careful not to increase their weight as there is danger of reating flutter conditions.

5. Damage to section GFK Foam-Sandwich

(GFK Hard-Foam-Sandwich)

It can appear that only the outer surface (the outside laminate) is damaged but it can also happen that the whole skin (outside and inside hard foam laminate) is destroyed.

a) Important

With a split or fracture, the laminate can become detached from the supporting foam. Start by removing loose laminate until firm laminate is reached. To remove the foam laminate use a grinding disk, grinding block or sharp knife. With a grinding block or sharp knife only remove the cloth around the damage. Splice ratio per cloth covering approximately 20 mm ratio laminate thicknes to splice: approximately 1:50.

After grinding out the splice, the repair must be throughly cleaned. Remove the dirt (also out of the foam pores) with compressed air. Wash the splice with carbon tetrachloride or Acetone, in case it has been contaminated with dirt or grease.

Fill up the pores of the foam with Resin and Microballoons until it is smooth. Then join the laminates with the correct cloth, laying it in the right direction.

Repairs must be dirt and grease free. (Figure 1)

At room temperature the resin will harden in about 8 hours.

The repair can now be ground smooth and be painted.

Warning: Grind only to the edge of the repair.

b) Damage to the whole of the Sandwich

When the inner laminate is destroyed, so there is no binding with the foam, widen the hole so far as foam material is secure, then it is possible to repair the inner laminate. A edge of at least 20 mm must be obtained (retaining laminates thickness : splice ratio approximately 1:50).

The inner laminate must be carefully ground and cleaned.

The outer laminate is repaired as described in section a). (Figure 2)

With „minor" damage a piece of thin plywood support can be glued with Pattex from within on the inner skin, the cloth patch of the inner laminate can then be layed in and the hole filled with resin and Microballoons mixed with Styroporballs. When hardened (ca. 8 hours room temperature) the outer surface can be ground smooth and the outer cloth put on.

The plywood support should remain as part of the repair. When the hole is of large or of long size the plywood support should be held in place with thin nails which can be removed later, by pushing them out from the top surface.

Warning: The plywood support must be well jointed to avoid wrinkles in the cloth. (Figure 3)

With large holes in the sandwich, the weight of the Microballoons filler must be considered. A piece of Conticell hard foam is made before-hand, which exactly fits into the existing hole. The inside pores are closed with resin and Microballoons and laid on the inner cloth to harden, until the foam is just bendable (evtl. hot air). Then the foam with

enthickened resin (cotton flock-Microballoons) can be glued in the hole. Microballoons are used to close the outside pores, the repair is then ground and the outside cloth is then laid on.

6. Damage to section of GFK Styropor-Sandwich

Repair of Styropor damage of section.

The Styropor has a closed upper surface, the cloth is held with pure or lightly thickened resin. Splits in the upper surface pores can be filled. With large damage put a patch inside and allow to harden first before working further. This will stop the structure wrinkling.

Warning: Do not use strong heat to speed up hardening time, or Styropor will develop blisters and the repair must be done again.

7. Damage to section of GFK Laminate

Repairs to GFK laminate are simple. Splice the laminate around the hole, lay the cloth in layers on (largest patch first) and after 2–3 hours, when the resin has partially hardened smooth over with resin and Microballoons. Splice length pro cloth layer ca. 20 mm. Retaining laminate thickness : Splice ratio 1:50. In case the splice is dirty it can be cleaned with Carbon Tetrochloride or Acetone.

With large damage a under laying support (plywood) should be used. Wet laminate should not bridge a gap of more than 20 mm unsupported. The plywood support can be held in place with Pattex glue and nails (e. g. metal fitting in fuselage) which can be removed afterwards. (Figure 4).

8. Paint-work

As soon as the laminate of the repaired section is hard, it can be rough ground with (80 grit) sandpaper. Large uneveness must be filled and smoothed with white polyester filler. Then with fine dry-grinding paper (150 grit) until a moderately smooth outer surface is produced. Before painting, the repaired section must be perfectly cleaned from grinding dust, separated mediums and other forgeign bodies.

For successful painting, with Gel-Coat (Schwabbellack + hardener) a not too large brush should be used, putting on several thin coats, until the laminate can no longer be seen.

The first coat should be allowed to harden and then ground with

1 Lage 92 110
1 Layer 92 110

1 Lage 92 125
1 Layer 92 125

Kern
Core
Conticell 60

Microballoons

Abb. 1
Fig. 1

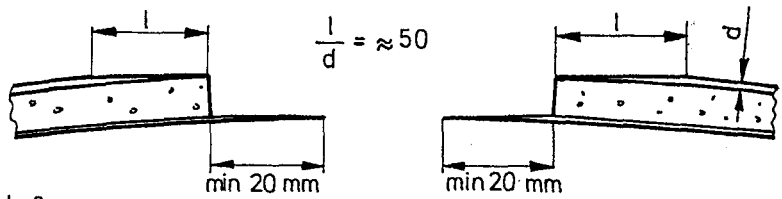
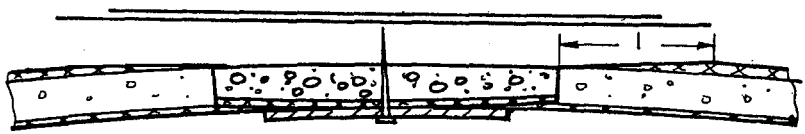


Abb. 2
Fig. 2

Außengewebe
outer cloth



Dünnes Sperrholz
Thin plywood

Microballoons
+ Styroporkugeln
Styropor balls

Abb. 3
Fig. 3

Rumpfschale
Fuselage skin

1 Lage 92 146
1 Layer 92 146

1 Lage 92 110
1 Layer 92 110

3 Lagen 92 140
3 Layers 92 140

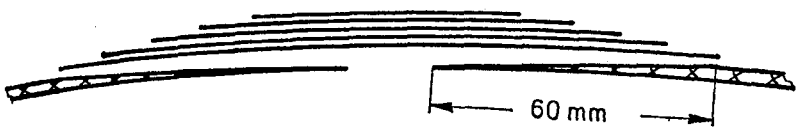


Abb. 4
Fig. 4

(360 grit wet paper) additional coats should then be added and likewise ground.

The final finish should be carried out with 600 grit or 800 grit Wet and Dry grinding paper and then polished with a silicon-free car polish or with hard-wax, using a polishing machine.

9. Repair of Metal Fittings

a) Damage to Steel Fittings

Repair of damage to fittings made of steel should only be accomplished after approved procedures are obtained from the manufacturer.

Welded steel fitting (push rods) out of 1.7734.4 or 1.0308.1 (St. 35.4). Welding only to be carried out with WIG Welding method (Wolfram-Inert-Gasschmelzschweißung) and with welding material 1.7734.2 (for 1.7734.4) and 1.7324.0 (for 1.0308.0 or combination of 1.7734.4 and 1.0308.1)

b) Damage to Aluminium Castings

Repair of Aluminium castings 3.2374.6 (GALSi7 Mgwa) cannot be carried out. Fractured or bent Aluminium castings must be replaced by new ones.

Warning: Bent or chipped Aluminium castings **are not** under any **circumstances** to be straightened.

c) Main Wing and Fuselage fittings

The main fitting between wing and fuselage (4x in the fuselage) 7 steel balls (ø 6 mm) have contained in each fitting. The balls are forced by a sliding cover through the lock shell into a groove in the moveable lateral axis force bolts in the spar caps thus securing the wings.

Faults of one or more balls, the connecting fitting should be changed.

10. Major repairs

Major repairs are only to be carried out by the manufacturer or by an agent (who has the authorization of the manufacturer.).
Major repairs are:

— **Broken** off wing, fuselage, tailplane, control surface, spar stumps (spar caps)

— **Ripped or torn-out** - Main fittings (in fuselage ø 55 x 3, Fitting of the tailplane in fin. In the wing, aileron securing both ø 24 mm, joining bearing GE 25. Spar cap bolts ø 25 mm).

— Destruction of main rib (vertical frame)

— Damage to the GFK laminate (tear, splits, cracks immediately near the main fittings).

11. Construction details of extra equipment attachment fittings

The fittings for the oxygen bottles are built in as standard on the right side of the luggage compartment. Bearing stands and quick action lock can be obtained from the manufacturer.

Other fitting points can be installed by the owner. (Figure 5)

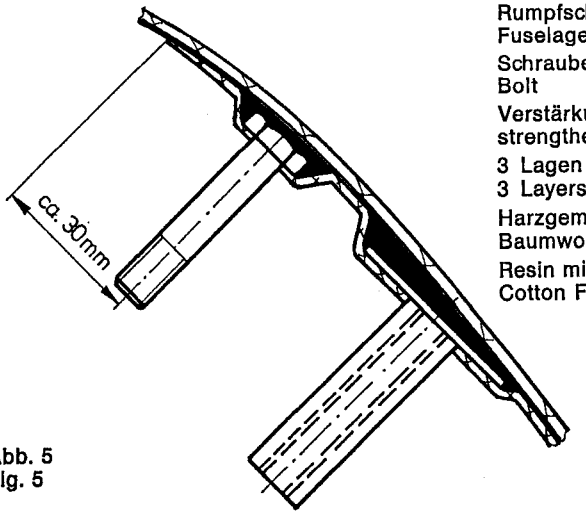


Abb. 5
Fig. 5

The fitting must be made as shown in the drawing so as to take the weight of the additional equipment. Fittings made in this manner must stand a load 10 g without failure.

When additional equipment is fitted the glider must be re-weighed to see whether the C of G is within the permitted limits.

Blueprints for the installation of radio and oxygen equipment are obtainable from the manufacture.