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FLIGHT HANDBOOK

SPEED ASTIR II G-104

SPEED ASTIR II B

This handbook is to be kept on board the aircraft at all times.

Registration: Factory Serial Number: 4027

Owner: _____

_____

_____

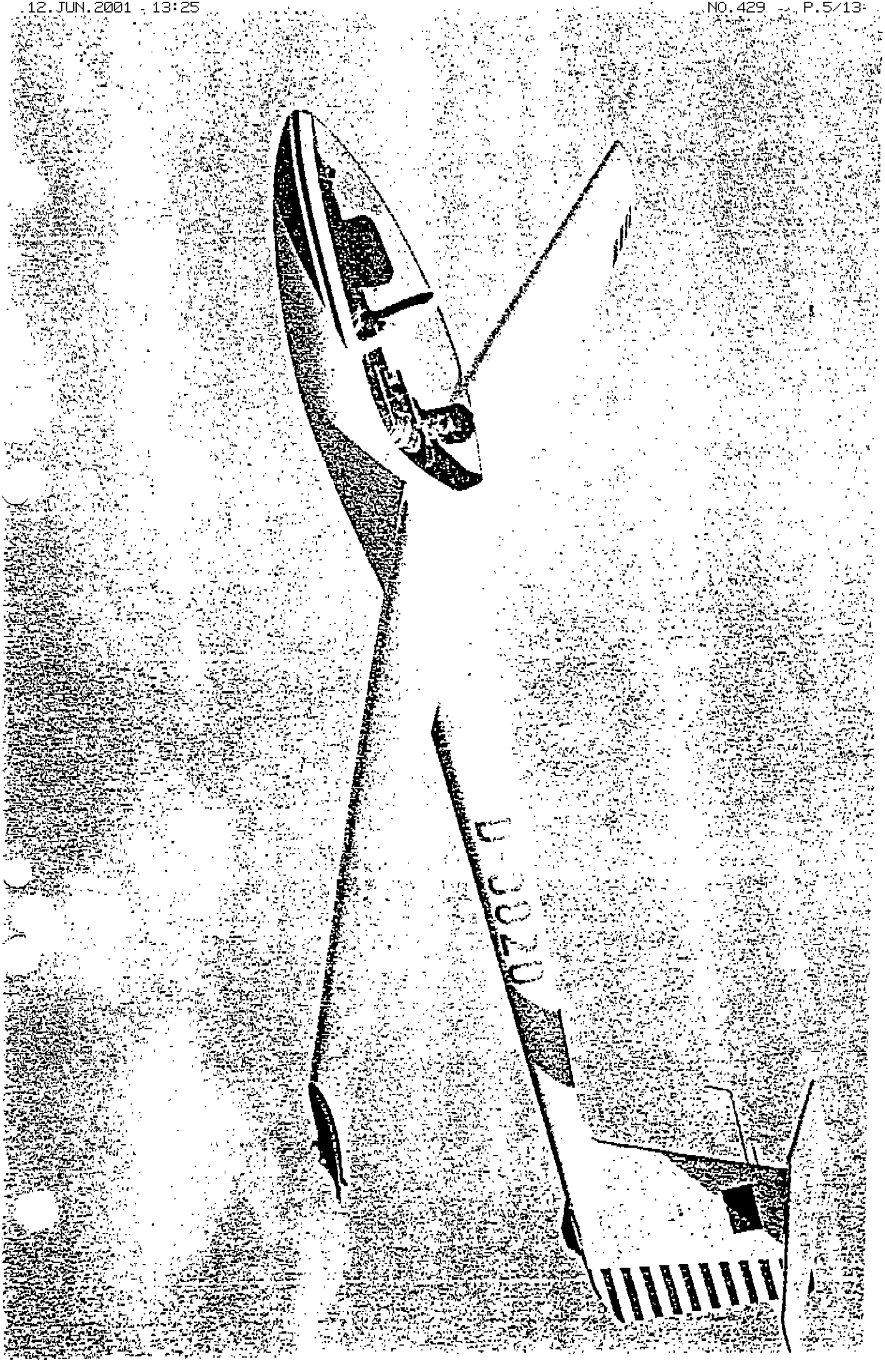
German edition of operating instructions are approved under
§ 12 (1) 2. of LuftGerPO.

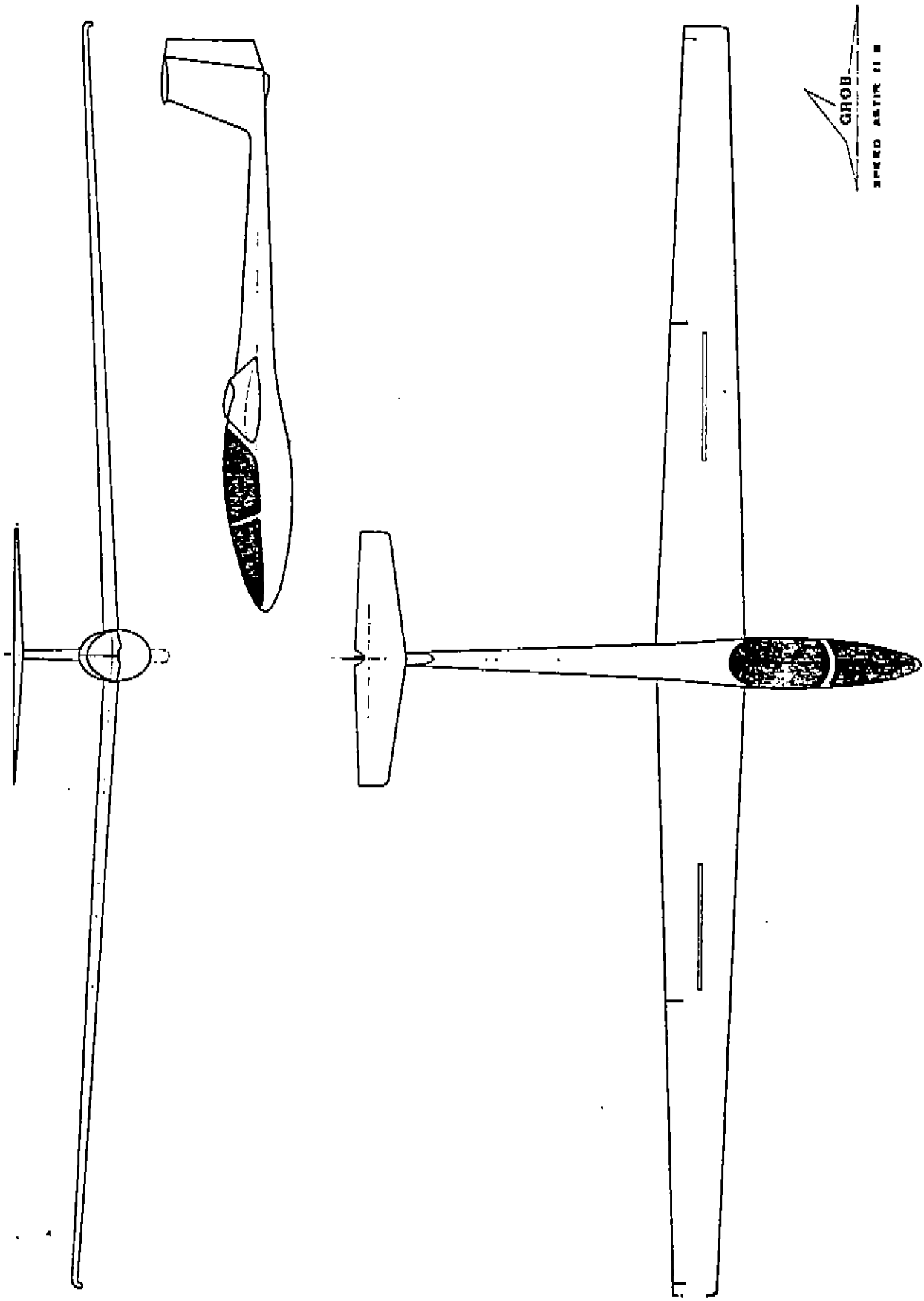
Published October 1979

I. 1 **Updates:**

Current number	Page	Reference	Date	Signature
1	23	Control of tailplane	1. Oct. 80	

I. 2 Contents




GROB
SPEED ASTIR II B

I. 5 Description

The SPEED ASTIR II and II B are single seat high performance gliders for the 15 m flapped class, with a T-tail, retracting undercarriage, ballast tanks in the wings and airbrakes on the upper wing surface.

The glider incorporates the most modern fibre reinforced plastic technology. The spar, fuselage belt and canopy frame are all fabricated from Carbon fibre; all other surfaces and shells are glass-fibre.

Technical Data	SPEED ASTIR II	SPEED ASTIR II B
Wingspan	15.0 m.	15.0 m
Length	6.6 m.	6.8 m.
Height	1.3 m.	1.3 m.
Aspect ratio	19.6	19.6
Wing area	11.5 m sq.	11.5 m sq.
Maximum flying weight	515 kg	515 kg
Maximum wing loading	44.8 kg/sq.m	44.8 kg/sq.m

II. Operating limits

II. 1 Airworthiness group

(U, Utility, LFSM)

The edition of the "Airworthiness requirements for gliders and motor-gliders" (LFSM) which was published on 23. 10. 1975 is the basis for the certification of this model.

II. 2 Operational restrictions

This aircraft is cleared for:

1. Flights under VFR (daytime)
2. Simple aerobatics (loop, stall turn, lazy eight, chandelle, spin)
3. Cloud flying (with suitable instruments - see II. 3)

III. 3 Minimum equipment

1. Air speed indicator reading to 300 km/h (162 knots, 187 mph)
2. Altimeter
3. Four part safety harness
4. Back cushion of at least 3" depth when compressed, or parachute
5. Loading limit plaque
6. Flight limits plaque
7. Flight Handbook

Cloud flying equipment

For cloud flying the following must also be installed:

1. Variometer
2. Turn and slip indicator
3. Magnetic compass (compensated for the aircraft)
4. Radio ready for use

II. 4 **Airspeeds**

Never exceed	VNE	= 270 km/h (146 knots, 167 mph)
Maximum Rough Air	VB	= 200 km/h (108 knots, 124 mph)
Manoeuvring speed	VM	= 190 km/h (102 knots, 117 mph)
Maximum on winch launch	VW	= 120 km/h (65 knots, 74 mph)
Maximum on aerotow	VT	= 170 km/h (92 knots, 105 mph)
Max. speed for use of positive flap	VFE	= 190 km/h (102 knots, 117 mph)

"Rough air" includes the turbulence likely to be encountered in wave rotors, clouds, whirlwinds, and while flying over mountain ridges.

The manoeuvring speed is the maximum speed at which full control deflections are permissable. At VNE only one third of the available movements may be used. True airspeed is higher than Indicated airspeed at altitude. VNE decreases according to following table.

Altitude (ft)	0-6500	10000	13000	16500	19000
VNE (indicated knots)	146	137	130	118	117
(indicated km/h)	270	256	243	230	218

Air speed indicator markings

85 - 190 km/h	45 - 102 knots	53 - 117 mph	Green bow
190 - 270 km/h	102 - 146 knots	117 - 167 mph	Yellow bow
At 270 km/h	146 knots	167 mph	Red line
At 95 km/h	50 knots	59 mph	Yellow triangle (minimum approach speed at max. flying weight)
75 - 190 km/h	41 - 102 knots	46 - 117 mph	White bow (permitted speed range with positive flap)

II. 5 **Flight envelope**

The following g-loads must not be exceeded.

At VM + 5.3 – 2.65 (Airbrakes closed)

At VNE + 4.0 – 1.5

II. 6 Weights

Empty weight	appr.	260 kg	(570 lbs)
Max. permissible without waterballast		400 kg	(880 lbs)
Max. permissible with waterballast		515 kg	(1133 lbs)
Maximum permissible weight of non lifting parts		260 kg	(572 lbs)

II. 7 Center of grafity position

Permitted center of gravity positions in flight lie in the range

from 320 mm (12.60 inches) to 490 mm (19.29 inches) until serial number 4038,
from 265 mm (10.43 inches) to 435 mm (17.13 inches) from serial number 4039,

behind the datum line, equivalent to 27% to 48% of the M.A.C. of the wing.

The datum line is the wing root leading edge.

The permitted center of gravity range will not be exceeded if the loading is carried out according to the loading plan in section II. 8.

II. 8 Loading limitations

Minimum weight in the seat	70 kg	(154 lbs)
Maximum weight in the luggage space	10 kg	(22 lbs)
Maximum weight in the seat	110 kg	(242 lbs)

Pilot weights lower than 70 kg (153 lbs) must be compensated by ballast carried in the seat. A ballast bag which can be attached using the lap straps can be obtained from the manufacturer or his agents. If a ballast box is built in according to TM 104-1 it can be used to carry ballast weights.

The maximum flying weight of 515 kg (1133 lbs) must not be exceeded. Water ballast can only be loaded until this maximum weight is reached (see diagram on side 9a).

Water ballast can not be used to compensate lacking weight in the seat.

Modifications of loading plan

Registration: Serial Number: .

Date of weighing carried out by:	Record of fitting-out. Date:	Empty weight kg (lbs)	Empty C of G (mm behind datum)	Max. Payload

II. 9 **Tow hooks**

For Aerotow: Optional nose hook E 75.
For Aerotow and winch launch: Europa G 73 safety hook (with 1/76 modification only for SPEED ASTIR II).

II. 10 **Weak link in launching cable**

Aerotow and winch launch 500 kg (1100 lbs) ± 10%
(e. g. Weak link no 5, colour code white)

II. 11 **Tire size** 4.00-0 **Tire pressure** 3,5 bar

II. 12 **Crosswinds**

According to the specifications for the type, the maximum crosswind component for take off and landing has been established at 20 km/h (11 knots, 12 mph).

III. **Emergency procedures**

III. 1 **Spin recovery**

Exit from spin can be accomplished by the standard recovery procedure:

- Full opposite Rudder
- Neutralise stick
- Ailerons should be central
- when rotation stops centralise rudder and pull out gently.

III. 2 **Canopy jettison and exit**

The freedom of movement in the cockpit makes exit easy in an emergency. The point to fix the parachute is the red ring on the central tube behind the seatback.

Observe the following procedure:

a) Pull the red knob on the right side of the fuselage and push the canopy upwards.
b) Unlock safety belts.
c) Sit upright and climb out of either side depending on the attitude of the aircraft.

d) If the parachute is manually operated grasp the D-ring and pull firmly to full extent after 1 — 3 seconds.

NB: The emergency canopy jettison can also be used to remove the canopy for cleaning.
For readjusting set the two lining-up bolts in position and press the canopy against the springs, until the fixing bolt may be inserted.

Caution: The canopy hinge is springloaded and will, with jettisoned canopy, turn up very quickly after a slight touch. Danger of injury.

III. 3 Landing with the undercarriage retracted

It is possible to land on soft and hard surface without risk of nosing over.
Approach normally and align in 2 point attitude.
Avoid a high roundout.

III. 4 Miscellaneous

Flying in rain

No noticeable deterioration of flying characteristics is caused by wet or lightly iced wings.
A heavy deposit on the wing raises the speed at which breakaway occurs by about 6 knots: Raise approach speed by 6 knots.

Wing dropping

If the wing drops in a turn or straight flight, leave the stick central and apply rudder against the direction of rotation.

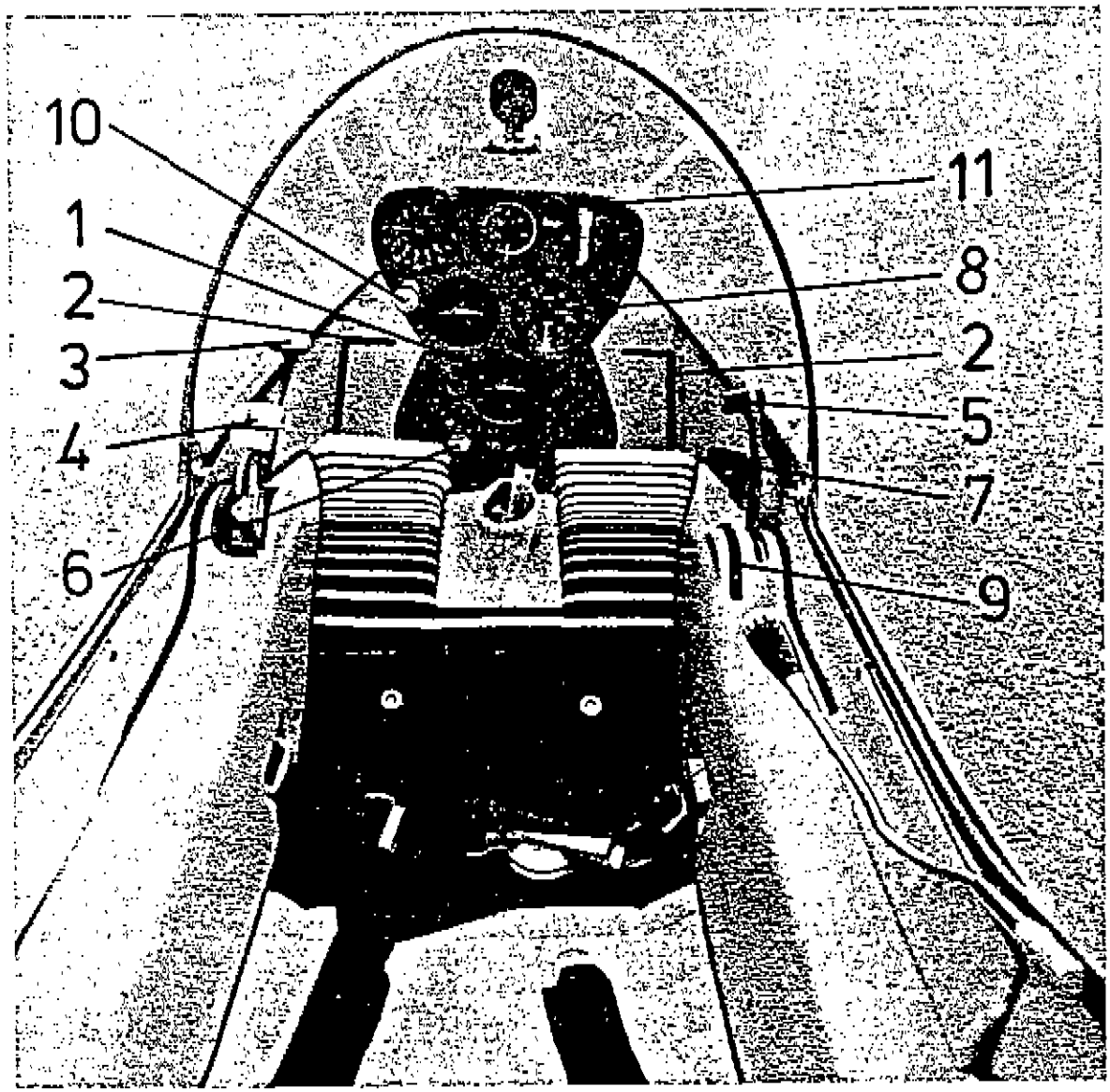
Ground looping

The aircraft is not prone to ground loop on take off.
If one wing touches the ground or the aircraft changes direction by more than 15 degrees, release, immediately.

IV. Normal operating procedure

IV. 1 Cockpit and control layout

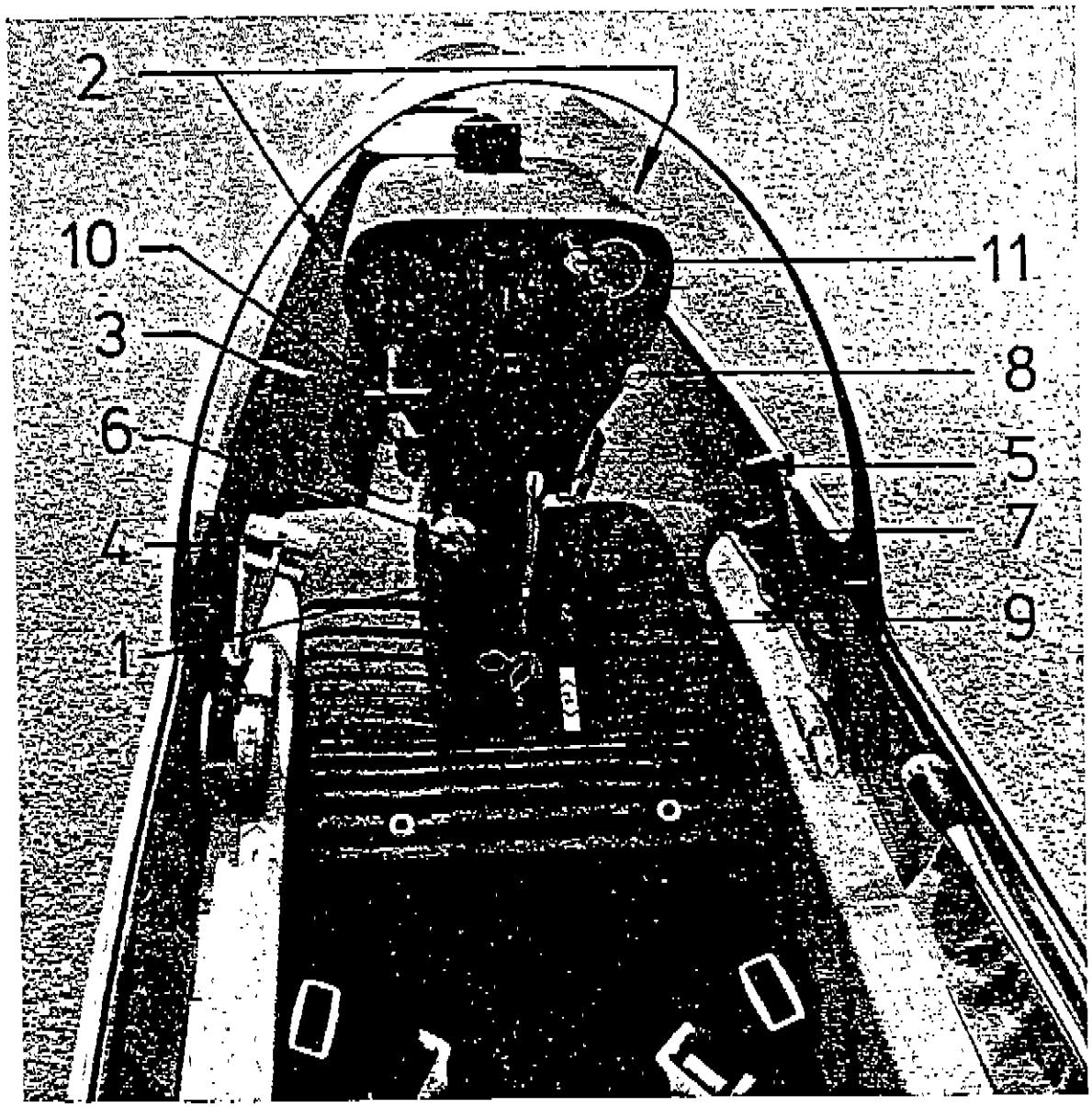
Seat of SPEED ASTIR II



1 Joystick with wheelbrake
2 Rudder pedals
3 Airbrakes
4 Flaps
5 Undercarriage retract
6 Cable release knob
7 Canopy jettison
8 Waterballast jettison
9 Rudder pedal adjustment
10 Trimmer
11 Ventilation

The seatback is adjustable.

Seat of SPEED ASTIR II B



1 Joystick with wheelbrake
2 Rudder pedals
3 Airbrakes
4 Flaps
5 Undercarriage retract
6 Cable release knob
7 Canopy jettison
8 Waterballast jettison
9 Rudder pedal adjustment
10 Trimmer
11 Ventilation

The seatback is adjustable.

IV. 2 Daily inspection

Complete check round aircraft

1. a) Open canopy
   b) Check the 4 wing to fuselage quick locks are secure
   c) Visual check of all control mountings and linkages in cockpit area
   d) Check for loose objects
   e) Check full and free movement of all controls
   f) Check tyre pressure
   g) Check condition of towhooks
   h) Check operation of towhooks and wheelbrake

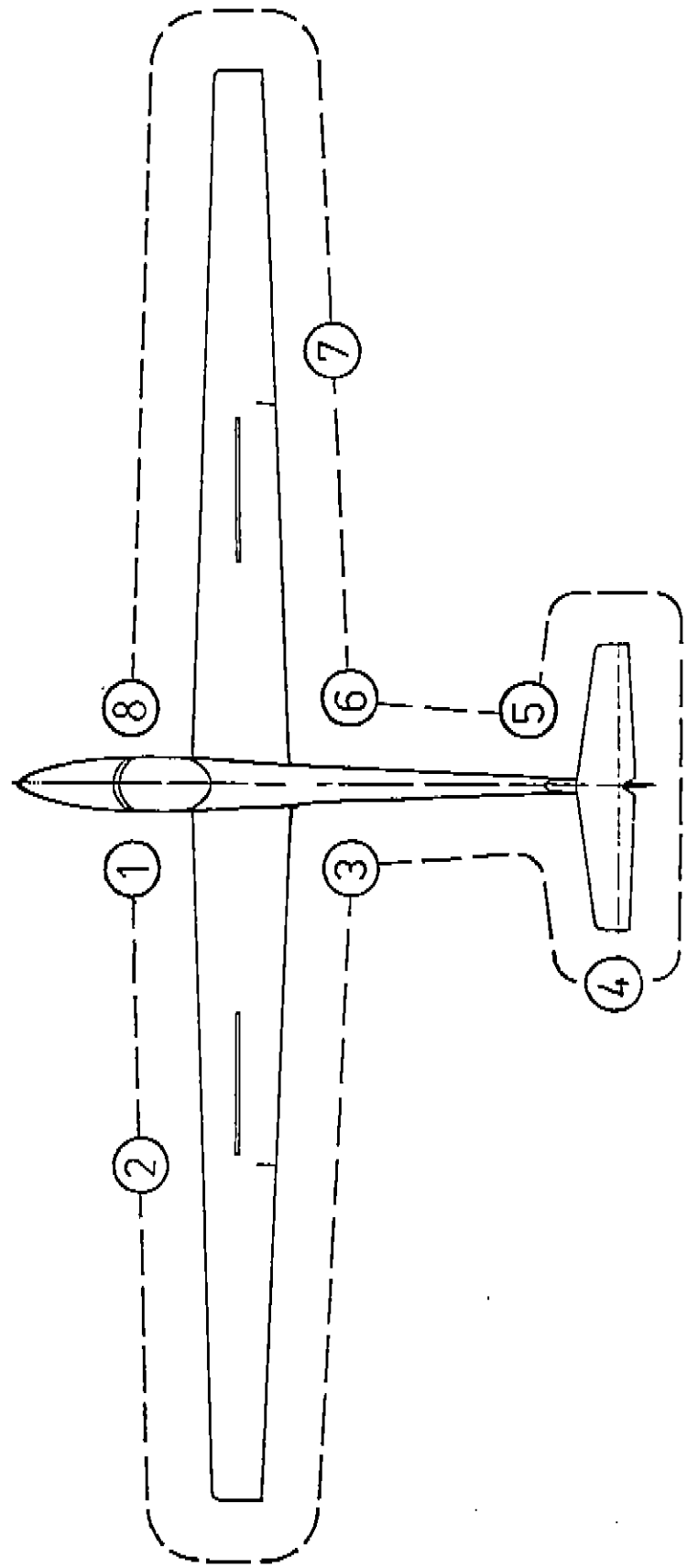
2. a) Check upper and lower wing surfaces for damage
   b) Aileron (Check condition, free movement, play)
   c) Flaps (Check condition, free movement, play)
   d) Airbrakes (Check condition, fit and lock)

NB: The elastic flap hinges will give a slight play at upward and downward deflection of aileron or flap.

3. Check fuselage for damage, particularly on underside
4. Check tailplane for correct mounting and security
5. Check tailskid, pitot and venturi
6. Check static holes are free of obstructions
7. See "2"
8. Check static holes

The aircraft should be checked particularly thoroughly after heavy landings or excessive demands have been placed on it in flight. Remove the wings and tailplane. If damage is discovered an inspector should be called in. The aircraft should not under any circumstances be flown until the damage has been repaired.

Complete check round the aircraft (cf IV. 2)



IV. 3 Pre flight check

1. Wing and T-tail attachments secured?
2. Parachute and safety straps secured?
3. Pedals adjusted?
4. Undercarriage lever locked in fully forward position?
5. Brakes closed and locked?
6. Flaps set for take off?
7. Full and free controll movement?
8. Trim set to neutral
9. Altimeter set to zero or to field elevation?
10. Radio switched on an set to the correct base frequency?

IV. 4 Take off

Trim

- On the left of the instrument panel
- push towards instrument panel: nose heavy
- pull out from panel: tail heavy
- zero is marked on the shaft

Winch launch

Trimmer central or nose heavy if the pilot is light.
Flaps to + 5 degrees.
Maximum winch launch speed is 120 km/h (65 knots, 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.

Aerotow launch

Recommended line length is 40 — 60 m (140 — 200 ft).
Trimmer neutral
Flaps 0 degrees.
Max aerotow speed 170 km/h (92 knots, 105 mph).
Use the nose hook for aerotow if it is installed.

Aerotow from the belly hook presents no problems to experienced pilots. The aircraft can be controlled during the whole ground run by means of aileron and rudder, using full deflections if required. There is no inclination to ground loop, even in a strong cross wind. The aircraft can be lifted off at an IAS of 38 knots; it takes off on its own, with the stick held neutral at an IAS of 40—43 knots. The flaps can be deflected to + 5 degrees to assist it to unstick as soon as the ailerons are effective. The undercarriage can not be retracted during the aerotow. If the aircraft enters the slipsteam of the tug the flaps can be deflected to + 10 degrees to increase manoeuvrability.

The yellow release knob is mounted on the instrument panel and must be pulled right back to release. The undercarriage can then be retracted.

IV. 5 Normal flight

The aircraft can be flown in all configurations throughout the permitted speed range. Full aileron and rudder movements and positive flap settings are only permitted up to the manoeuvring speed of 102 knots (190 km/h). At higher speeds the controls are to be used with corresponding care.

Note: see G-loads II. 5.

IV. 6 Slow flying and stalling

The stall warning is given by a noticeable buffeting of the tailplane. The stalling speed depends on the configuration and weight of the aircraft. The following are appropriate for a flap setting of + 5 degrees:

	Weight	Without brakes	With brakes
Without water ballast	370 kg	70 km/h	75 km/h
	814 lbs	38 knots	41 knots
With water ballast	515 kg	75 km/h	80 km/h
	1133 lbs	41 knots	45 knots

A negative flap setting raises the stalling speed by about 3 knots. On further rearward movement of the stick the aircraft goes into a controllable "mush", which can be controlled with ailerons and rudder. On forward movement of the stick the aircraft at once returns to its normal flying attitude. A swift backward movement of the stick will produce a nose drop; the ailerons will provide lateral control.

IV. 7 High speed flight

The aircraft has no flutter problems in the permitted speed range. Above the manoeuvring speed the controls must be moved no more than one third of the available movement. VNE is not exceeded in a 45 degrees dive with the airbrakes fully extended even at maximum all up weight.

The flap setting appropriate to the airspeed is given on the Air speed indicator and should be observed. Above the manoeuvring speed flap settings between 0 and – 7 degrees should be used.

IV. 8 Cloud flying

The minimum equipment for cloud flying is an Air speed indicator, Altimeter, Variometer, Compass, Turn and slip and Radio. Flight test to date have shown that the ASI system built in is not sensitive to icing. If G forces over 2 g are encountered or if the speed rises above the manoeuvring speed, extend the airbrakes to avoid overstressing. Spinning should not be contemplated as a recovery manoeuvre. In emergency extend the airbrakes and leave the cloud at 190 km/h (102 knots).

Cloud flying should only be carried out by pilots who have the necessary permission. The legal demands of airspace and instrumentation should be observed.

G/F = 30 kg/sq m.

V (knots)	ß
38	10°
44	5°
49	2°
66	0°
82	– 3°
104	– 7°

G/F = 45 kg/sq m.

V (knots)	ß
46	10°
52	5°
60	2°
79	0°
101	– 3°
120	– 7°

IV. 9 Simple aerobatics

Aerobatics may only be carried out without water ballast.

The following aerobatics are permitted:

1. Inside loop

Entry speed	102 knots (190 km/h)
G load	ca. 2 g
Exit speed	98 knots (180 km/h)

2. Stall turn

Entry speed 102 knots (190 km/h)

At 70 knots (130 km/h) slowly apply rudder. Shortly before the stall assist with aileron. In the case of an unintentional hammerhead stall hold the controls firmly central.

3. Spins

Reduce speed slowly to 45 knots (80 km/h): pull the stick back and give full rudder. The aircraft spins slowly at one turn every 5 seconds. The height loss is 220 ft. per turn.

Recovery: opposite rudder, pause, stick forward till rotation stops, recover gently.

4. Chandelle

Entry speed 92 knots (170 km/h)

Pull up to fly turn with 90 degrees bank. During turn decrease speed and exit from turn with rudder and aileron. The chandelle should be complete heading in the opposite direction at minimum speed.

Remarks: All explained aerobatics should be flown with a flap setting of 0 degrees. If the speed of 190 km/h (manoeuvring speed) is exceeded, choose negative flap settings.

IV. 10 **Approach and landing**

Recommended flap setting for landing: + 10 degrees. Lower undercarriage. Set flaps to + 10 degrees.

The approach may be carried out at 44–52 knots (80–95 km/h) according to wing loading. The brakes are powerful enough to carry out steep approaches. They cause a slight nose down trim change, so that the aircraft maintains the chosen airspeed automatically. Fully extending the airbrakes increases the stalling speed: do not extend the brakes fully during the roundout, to avoid heavy landings.

IV. 11 **Flight with water ballast**

The water ballast tanks are situated in the wing leading edge and contain 90 litres in each wing. They are filled through the plugs on the top surface of the wings, which can be removed with a rod.

If the water tanks are partially filled the wings must be kept level prior to takeoff.

Built in baffles ensure that no noticeable movement of the water occurs in flight, when the tanks are partially filled.

Equal amounts of water must be put in each tank to make up the required amount, so that lateral stability is not impared.

Water ballast is dumped through an opening under the fuselage behind the wheel. The valve is opened by pulling the knob at the top of the instrument panel. Dumping of full water ballast takes about 6 minutes. It is strongly recommended that water ballast is jettisoned before landing.

Before longer flights at temperatures around 0° C (32° F) the water must be jettisoned for the danger of freezeing.

V. Rigging and derigging

V. 1 Rigging

The fuselage must be held firmly in an upright position when rigging. It is recommended that a fuselage stand or the trailer fittings are used. The glider can be rigged by 3 people.

1. Wings

Unlock the 4 main wing fittings in the fuselage (a). Unlock the air-brakes on the wings. Set the flap lever to $-7°$. 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 (b). Next guide the left wing into the fuselage. Move the wings 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 fuse-lage fittings and by gently moving the wing tip forwards and backwards they too can be made to snap into place (b).

To lock the fuselage fittings turn so that the pins are engaged in the slots. A slow but firm fore and aft movement of the wing tip will allow the collar to be turned sufficiently. They should not however reach the end of the slot (c).

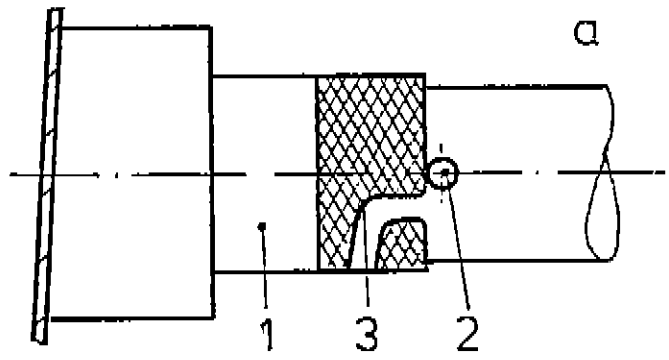
Check — The red rings on the fuselage sides must be covered by the rotating collars. The collars should be finger tight.

In the closed but not secured position (b) the wings cannot be with-drawn.

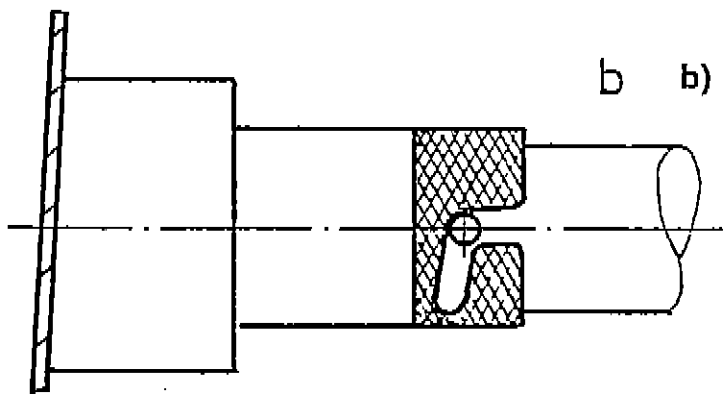
2. The aileron, flap and airbrake connections are behind the spar

The short connecting rods in the fuselage are fitted with quick lock fasteners which must be coupled with the bearings on the end of the linkages that move within the wing.

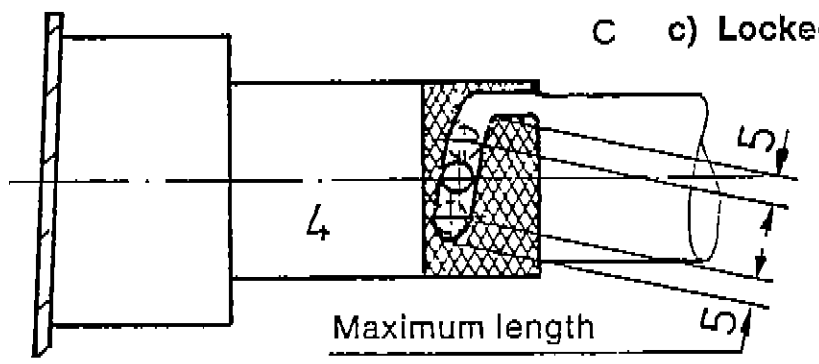
After rigging the following check must be carried out to check the connections are secure:



a) Open



b) Closed



c) Locked

After connecting the quick lock couplings make a visual check that the collar is extended forward over the bearing far enough for the safety pin to engage.

NB: If you consider the space behind the spar to narrow for coupling the quick lock fasteners you may prefer the connection outside the fuselage: Guide the right wing into the fuselage and keep a distance of two inches between wing root and fuselage wall. Plug then the quick lock fasteners to the bearings on the bud of the pushrods of the wings as described under 2.

Having engaged the quick locks check that the safety pin cannot be moved without pressing it down. If it cannot be slid without pressing down the controls are properly connected.

3. Tailplane

Before assembly is commenced the front cover must be opened and the rotating wing bolt pulled out to the limit. **It is important to ensure, that the larger opening of the conical crillings in the inner rings of the horizontal stabilizer spar bearings fall to the rear.** The tailplane can best 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 quick lock on the elevator push rod can be attached to the bearing on the elevator horn. The front of the tailplane can then be pushed back on to 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 for there to be 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 quarter turn to suit. Derigging is carried out in the opposite order and the wing bolt is unscrewed anticlockwise and pulled fully out.

To control the correct mounting of the horizontal stabilizer it is important to ensure that the peaks of the mark-arrows at fin and elevator tabs face each other.

Checks to be made after rigging.

1. Check that the four collars in the fuselage are engaged and secure.
2. Check that the aileron, airbrake and flap connections are engaged.
3. Check the towhooks for correct function and operating forces.
4. Test the operation of the wheel brake and the tire pressure.
5. Check that the tailplane is securely seated, control the 4 markings.
6. Check the elevator is coupled correctly through the clear panel.
7. Check sense and full and free movement of controls with an observer.

Derigging

Derigging is carried out in the reverse order and in 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 Parking

When the glider is stored the canopy should be locked. Use the canopy cover to protect the instrumentation against overheating. Pickets may be attached to the wing tip skids. The rotating tail dolly wheel should be used for ground handling.

Caution: The canopy in opened position may beam the sunlight and cause burns on head rest or luggage space.

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 tyre pressure should be kept at 3,5 atmospheres (49.8 psi).

The wheelbrake is of the drum type. If required the point at which the brake begins to drag can be adjusted. The adjustment is carried out by moving the Bowden cable at the drum end.

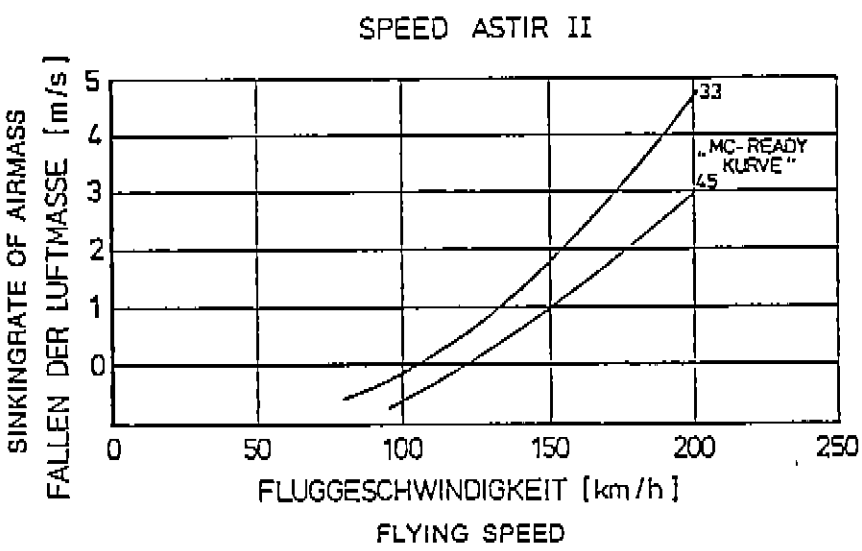
When the main wheel is being taken off for the purpose of cleaning, greasing or changing the tire, the Bowden cable should be disconnected from the brake-lever. Remove the screw cover on one side of the axle and take out the screws and the spindle. Remove the screws that hold the brake-lever in place. Take the wheel out by pulling it downwards. Clean all the parts and before reassembly 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.

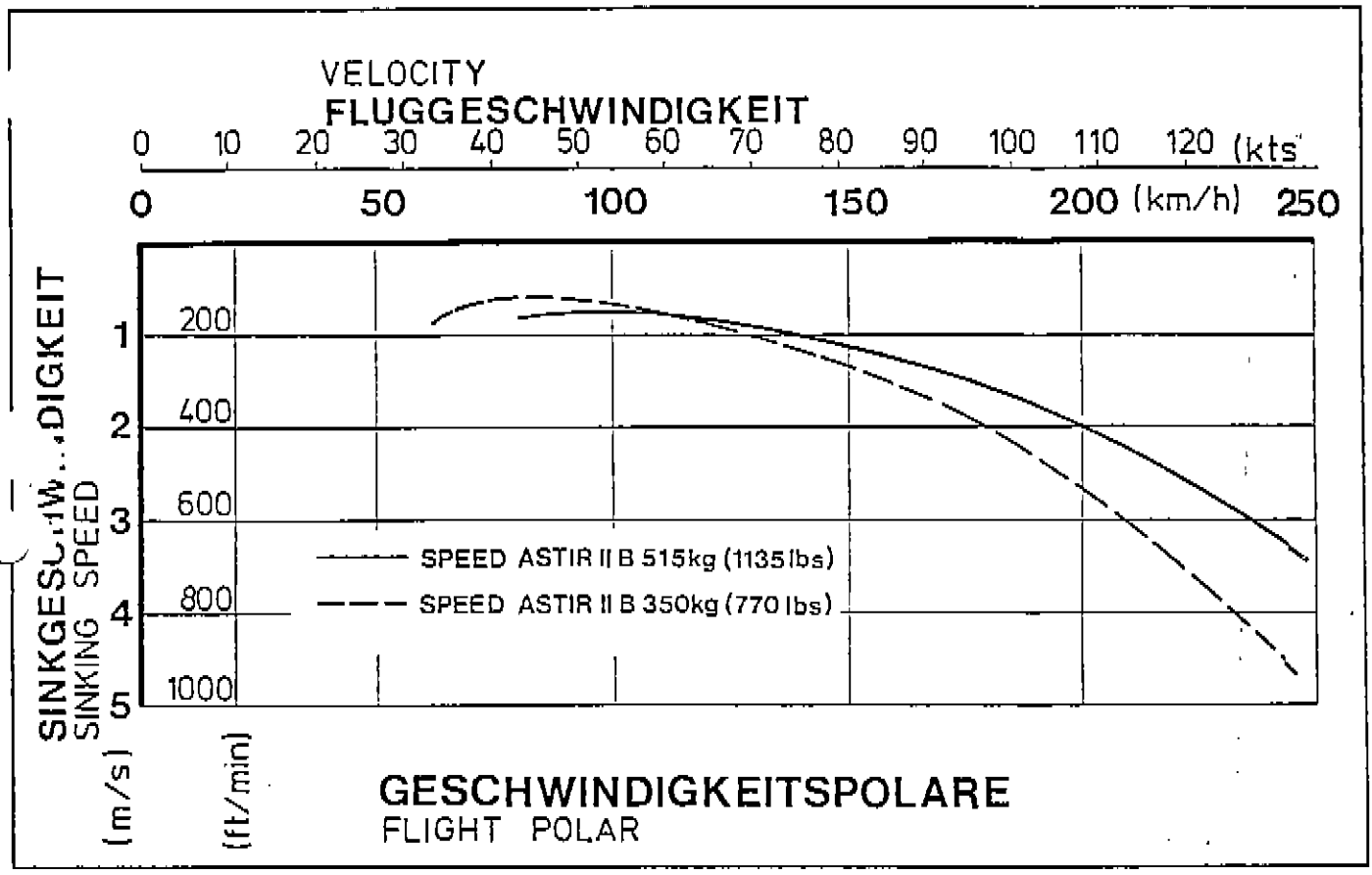
VI. Appendices

VI. 1 Performance

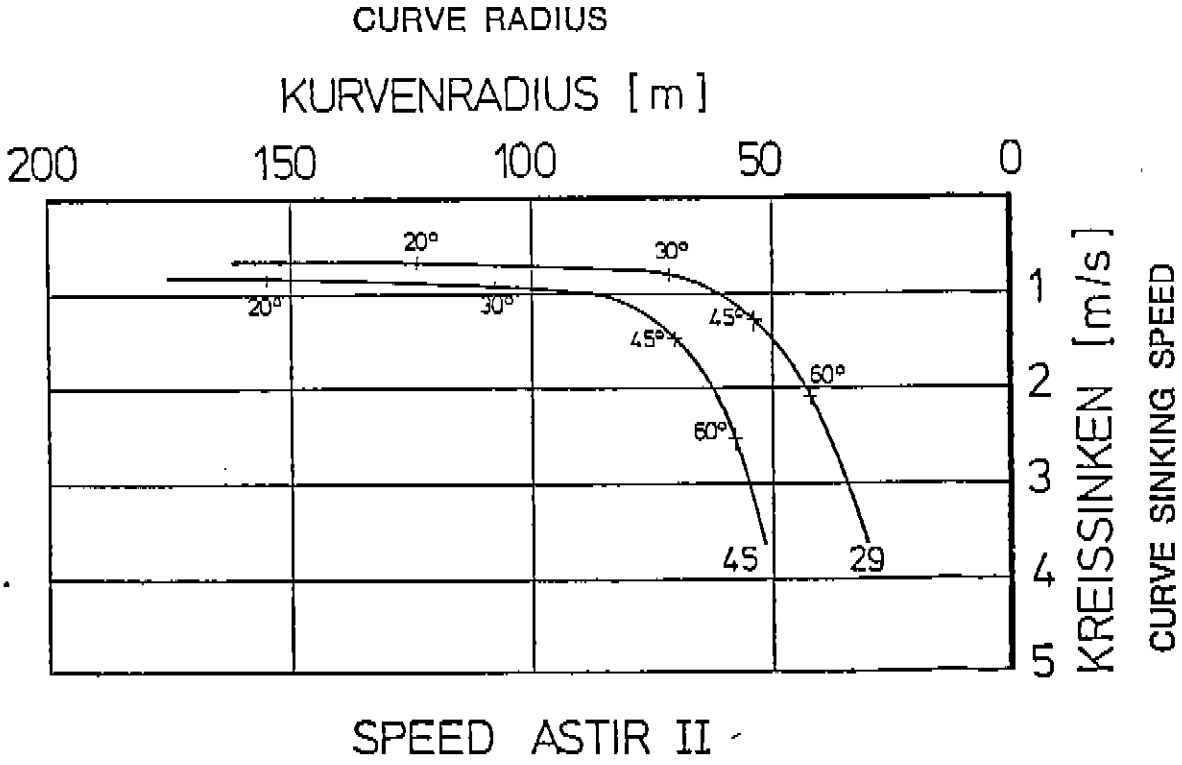
All up weight	345	430	515	kg
Wing loading	30	37,5	45	kg/sq. m.
Best glide angle	40	40.5	41	
at flying speed	105	115	120	km/h
Minimum sink	0,57	0,62	0,67	m/sec
at flying speed	75	82	90	km/h



	G/F=33	G/F=45
SOLLFAHRT	SINKEN	SINKEN
76	0	
80	0,07	
90	0,3	95/0
100	0,6	0,15
110	0,9	0,45
120	1,3	0,8
130	1,8	1,2
140	2,3	1,6
150	3,05	2,1
160	3,8	2,6
170	4,6	3,1
180	5,4	3,7
190	6,3	4,3
200	7,3	5,1
speed	sink	sink



Curve flight polar



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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 birds.

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.

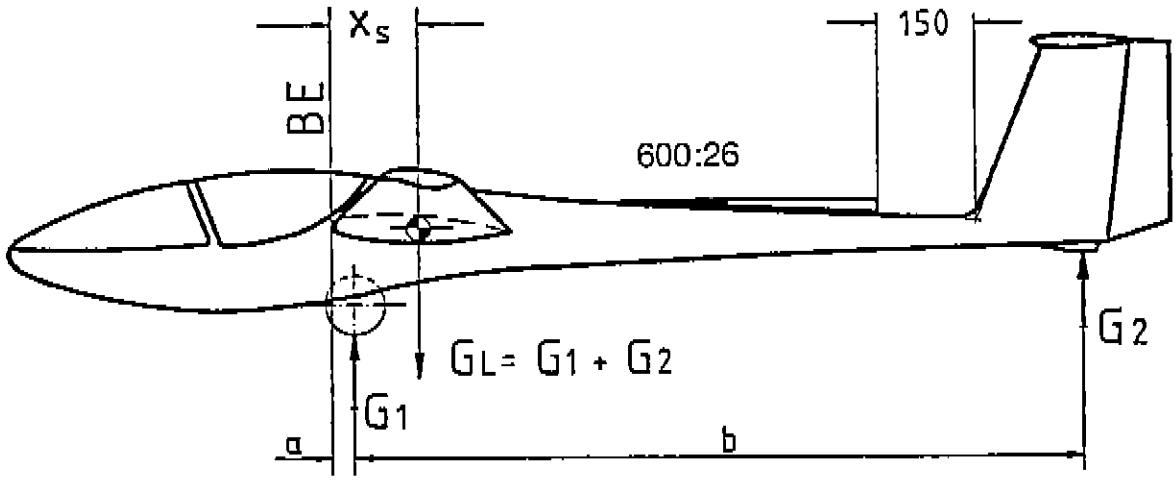
VI. 5 Determination of the Center of Gravity

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 : 26 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.

	SPEED ASTIR II	SPEED ASTIR II B until Serial No. 4038	SPEED ASTIR II B from Serial No. 4039
C. of G. of the pilot in front of datum line	578 mm (22,8 in)	620 mm (24,4 in)	620 mm (24,4 in)
C. of G. of the water ballast behind the datum line	308 mm (12,1 in)	308 mm (12,1 in)	257 mm (10,1 in)

Measurement of Center of Grafity position



Datum Line: Front edge of the wing at the root rib

Level Means: With a 600 : 26 Incidence Board set up horizontal on 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.

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

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 and without removable trimming weigts.

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

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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.

SPEED ASTIR II

Empty Weight kg	Range of C. of G. behind Datum (mm) Serial No. 4001 – 4027	
	Forward	Aft
240	775	801
245	766	794
250	757	788
255	748	782
260	739	777
265	731	771
270	723	766
275	716	761
280	709	756
285	686	752
290	664	747

SPEED ASTIR II B

Empty Weight kg	Range of C. of G. behind Datum (mm)			
	Serial-No. 4028–4038		from Serial-No. 4039	
	Forward	Aft	Forward	Aft
240	759	814	676	743
245	750	807	668	736
250	741	801	659	730
255	733	795	651	725
260	724	789	644	719
265	717	783	637	714
270	709	778	630	709
275	702	773	623	704
280	695	768	616	699
285	688	763	610	694
290	681	758	604	690

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 260 kg (572 lbs) or the maximum load permitted in the fuselage must be cor-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 10 of the Flight Handbook.

2. Authorized materials and suppliers

Resin:	BASF Glycidäther 162 100 parts	or	Rütapox L 20 100 parts
Hardener:	BASF Laromin C 260 38 parts		Rütapox VE 2896 18 parts

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
Elevator, Rudder and Ailerons	Double Twill	276	92 125
	Double Twill	161	92 110

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

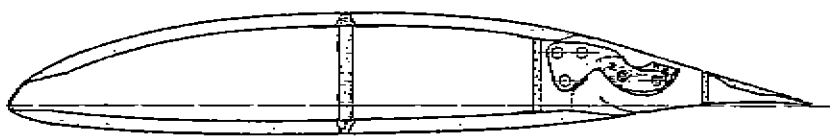
	Supplier:
Glass Fibre Rovings	
EC 10-80-2400 K 43	Gevetex 4000 Düsseldorf Postfach 1205
Foam Material	
PVC-Hartschaum Conticell 60 6 and 8 mm large Spec. Weight 60 kg/m³	Continental AG 3000 Hannover

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. 03-69066 UP-Hardener No. 07-20510 100 Schwabbellack Paint (Gel-Coat) 3 Hardener mix ratio by Weight. Thinner No. 06-30260	Lesonal-Werke 7000 Stuttgart 30 Postfach 30 07 09
Red Paint	
Nitro-Cellulose-Kombilack Orange RAL 2004	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25
Carbon Fibre Rovings:	
KC 20-SDY LN 29964	Fa. Sigri, Elektrographit GmbH D-8901 Meitingen Fa. Far East Mercantile GmbH, Mintropstraße 20 D-4000 Düsseldorf 1
Carbon Fibre Cloth:	
Sigratex KDU/NF 46-7.5 (6000 Filamente)	Fa. Sigri Elektrographit GmbH. D-8901 Meitingen

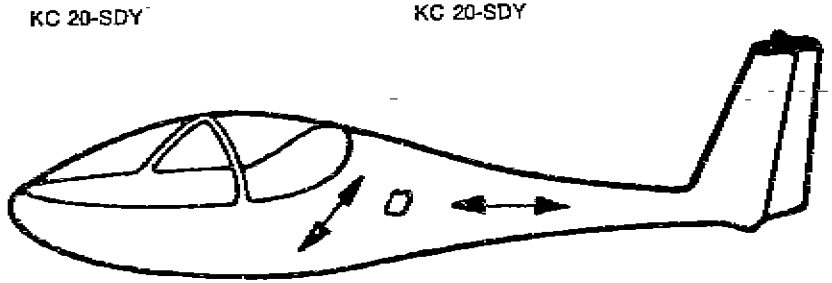
3. Simplified "Texture" plan of SPEED ASTIR

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

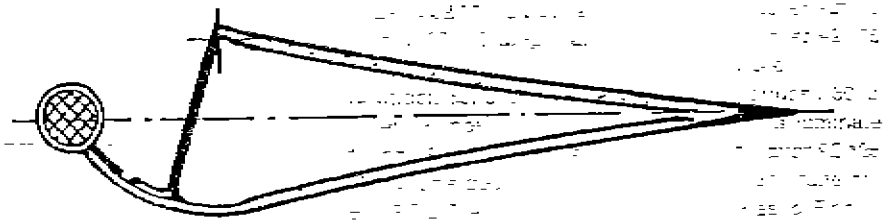
1. Flügel	Wing
Außenlaminat	Outer laminate
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal
1 Lage 92 125 diagonal	1 Layer 92 125 diagonal
Kern	Core
Conticell 60, 8 mm	Conticell 60, 8 mm
Innenlaminat	Inner laminate
1 Lage 92 125 diagonal	1 Layer 92 125 diagonal
Membrane des	Membrane of
ELASTIC Flap	Elastic Flap
2 Lagen 92 110 diagonal	2 Layer 92 110 diagonal
1 Lage 92 110 längs	1 Layer 92 110 lengths
Holmgurt	Spar
Kohlenstoffroving	Carbon fibre
KC 20-SDY	KC 20-SDY



2. Rumpf	Fuselage
von außen nach innen	From outside to inside
1 Lage 92 110 längs	1 Layer 92 110 lengths
1 Lage 92 146 längs	1 Layer 92 146 lengths
3 Lagen 92 140 diagonal	3 Layers 92 140 diagonal
Haubenrahmen	Canopy frame
Kohlenstoffroving	Carbon fibre
KC 20-SDY	KC 20-SDY

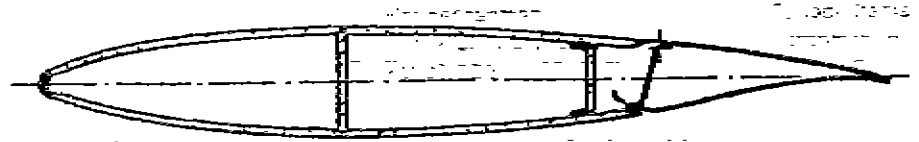


3. Ruder	Controls
Seitenruder rechts und links	Rudder left and right
2 Lagen 92 110 diagonal	2 Layers 92 110 diagonal
Kern Depron 3 mm	Core Depron 3 mm
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal



Höhenruder oben	Elevator above
Höhenruder unten	Elevator below
Querruder unten	Aileron below
Wölbklappe unten	Flap below
2 Lagen 92 125 diagonal	2 Layers 92 125 diagonal

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 creating 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 (Figure 1, Page 9)

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 thoroughly 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.

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 (Figure 2, Page 9)

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).

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 Microballons mixed with Styroporballs. When hardend (app. 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 (hot air). Then the foam with thickened 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 (Figure 3, Page 9)

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 (Figure 4, Page 9)

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 app. 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 an 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.

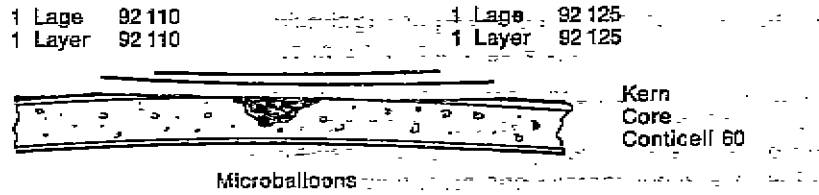


Abb. 1
Fig. 1

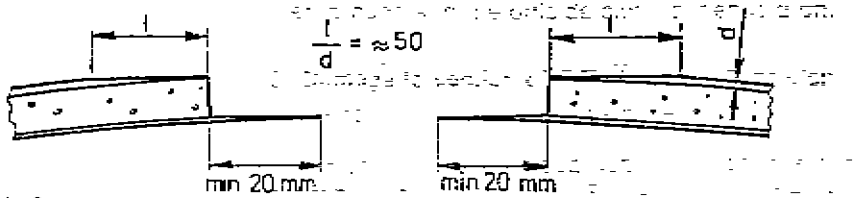


Abb. 2
Fig. 2

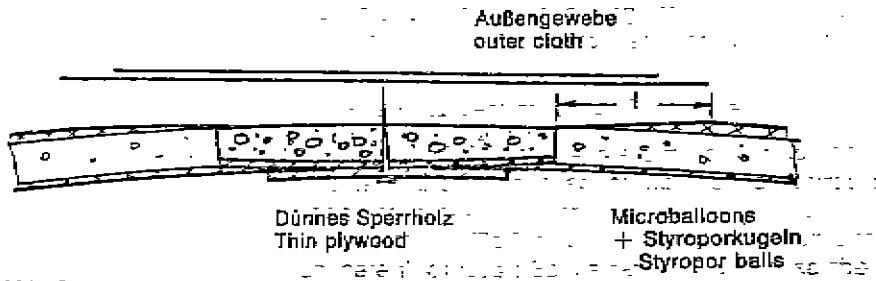


Abb. 3
Fig. 3

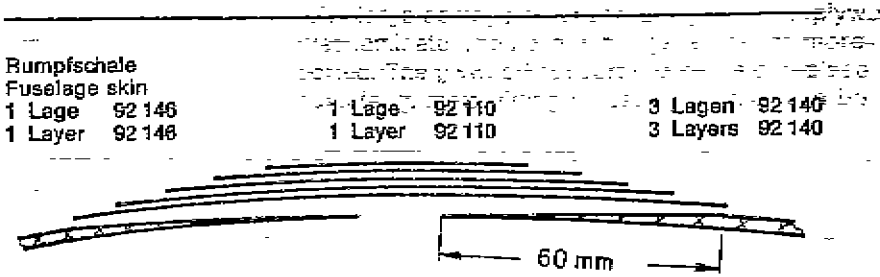


Abb. 4
Fig. 4

8. Damage to parts with Carbon Fibre reinforcement

The canopy surround consists of Carbon fibre rovings. The fuselage and tailplane are reinforced with Carbon fibre tape. Repairs are carried out as described in sections 6 and 7. Here too the depth to length ratio of the scarf must be 1 : 50.

9. Damage to the Membrane of the Elastic Flap

The membrane should be cut out between the wing and the control surface in the damaged area (80 mm wide grey strip). A fresh strip of membrane (about 120 mm wide) should be layed up on a flat sheet (1 layer 92 110 diagonal, 1 layer 92 110 lengthwise, 1 layer 92 110 diagonal). When the new strip is cured it should be scarfed in with the smooth side outwards between the wing and the control surface (scarf width about 20 mm.) and bonded on, fully tensioned using resin. A fine fissure may remain in the chordwise direction to the adjoining undamaged membrane. If necessary this can be stuck down with smooth tape.

10. Damage to Spar Caps

The spar caps are made of Carbon rovings. In the outer wing (starting at 6 mm spread area) they are made of Carbon fibre tapes. Whenever a spar cap is broken it necessitates a major repair (See under section 13). No repairs may be carried out in the area within 4 metres from the fuselage or on the spar root extensions. The depth to length ratio of the scarf must be 1 : 50.

11. 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 foreign 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 (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.

12. 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) 6 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.

d) **Control rods**

The Control Rods are made from:

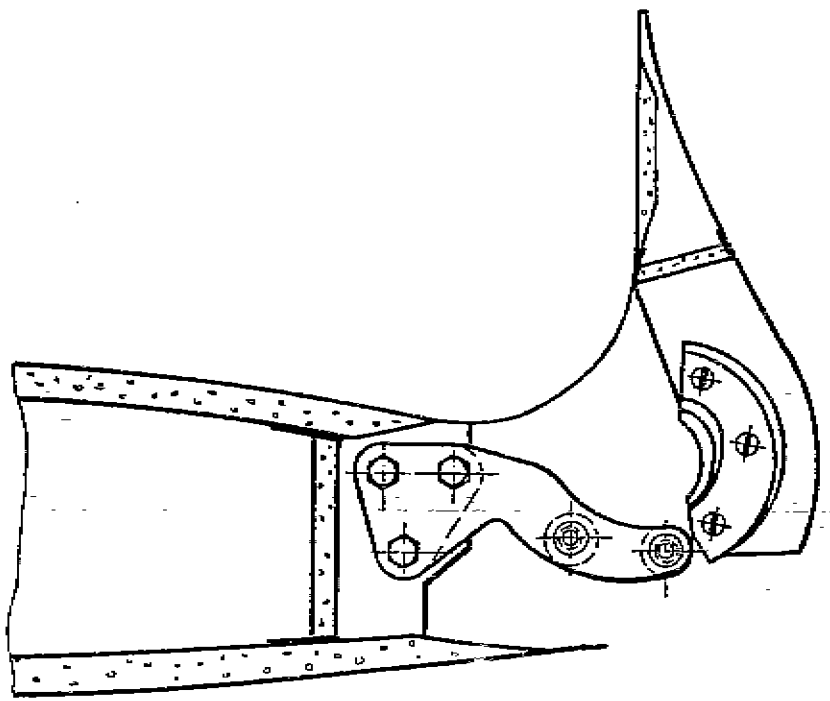
Tube 20 x 1	Type 3.3214.5 or AlMgSi 0,5 F20
Round stock 9 mm O. D.	Type 3.1354.5 or AlCuMg1F35
Round stock 9 mm O. D.	Type 1.1654.7 (115 CrV3)
Square tube 20 x 20 x 2	Type AlMgSi 0,5 F 22

Aluminium control rods that have been buckled kinked or badly bent must not be straightened. Threads on control rods are rolled from 9 mm round stock. Cut threads are not permitted.

8. Regular service

The following schedule of service should be carried out regularly, and at the minimum during the annual airworthiness inspection.

1. The entire glider should be inspected for cracks, dents 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, deformatic and if necessary reconditioned and freshly protected.
4. Ceck that there is no play in the wing and tailplane to fuselage fittings.
5. Remove the control rods for the elastic flaps and bend fully upwards as shown in the sketch (max. ca. 90 deg) so the ball bearings are completely separated. Check all parts in this position.



6. The controls including the brakes should be submitted to a functional test and the control deflections checked.
7. The control linkages (Bearings, stops, horns, hinges and control cables) should be inspected and replaced if there is evidence of bending or corrosion.
8. If the controls do not move freely throughout their range, search for the cause and correct.
9. The undercarriage should be inspected and the wheel and brake checked to be in good condition.
10. Tow hooks should be treated in accordance with their appropriate maintenance manual.
11. Check that the pitot for the ASI is clear and that all tubing to the instruments is in good condition and free of kinks or leaks.
12. The condition and calibration of all instruments should be checked and any other equipment inspected.
13. The wing bending mode has to be established and checked with the figure stated at the approval report (Stückprüfbericht). The glider has to be supported at mainwheel and tail. The tire pressure must be 3,5 atm/50 PSI.
14. Equipment and instruments should be check against the equipment list.
15. After repair or change of equipment, particularly after addition of a radio or Oxygen equipment, the weight table should be updated with the new empty weight and C of G by weighing or calculation.

9. Lubrication chart

Ball bearings

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

Sliding bearings

All the sliding bearings in the control runs need no maintenance or lubrication, except for those in the wing root and fin which should be washed off with petrol when dirty and relubricated.