



GROB

GROB-WERKE GMBH & CO. KG

- Unternehmensbereich

Burkhart Grob Flugzeugbau

8939 Mattsies

Am Flugplatz

Telefon 08268/411

Telex 539 623

FLIGHT MANUAL

GROB G 103 »TWIN II«

This manual must be carried on board of the sail-plane at all times.

This Flight manual is FAA approved for U.S. registered gliders in accordance with the provisions of 14 CFR Section 21.29. and is required by FAA Type Certificate Data Sheet No. G 39 EU.

Registration: Factory Serial No.: ...

Owner: Cypress Soaring 33986-K-219

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

Published September 1981


LBA approved

Date 17th march 1982.

Approval of translation has been done by best knowledge and judgement - in any case the original text in German

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(*) only for GROB G 103A TWIN II ACRO

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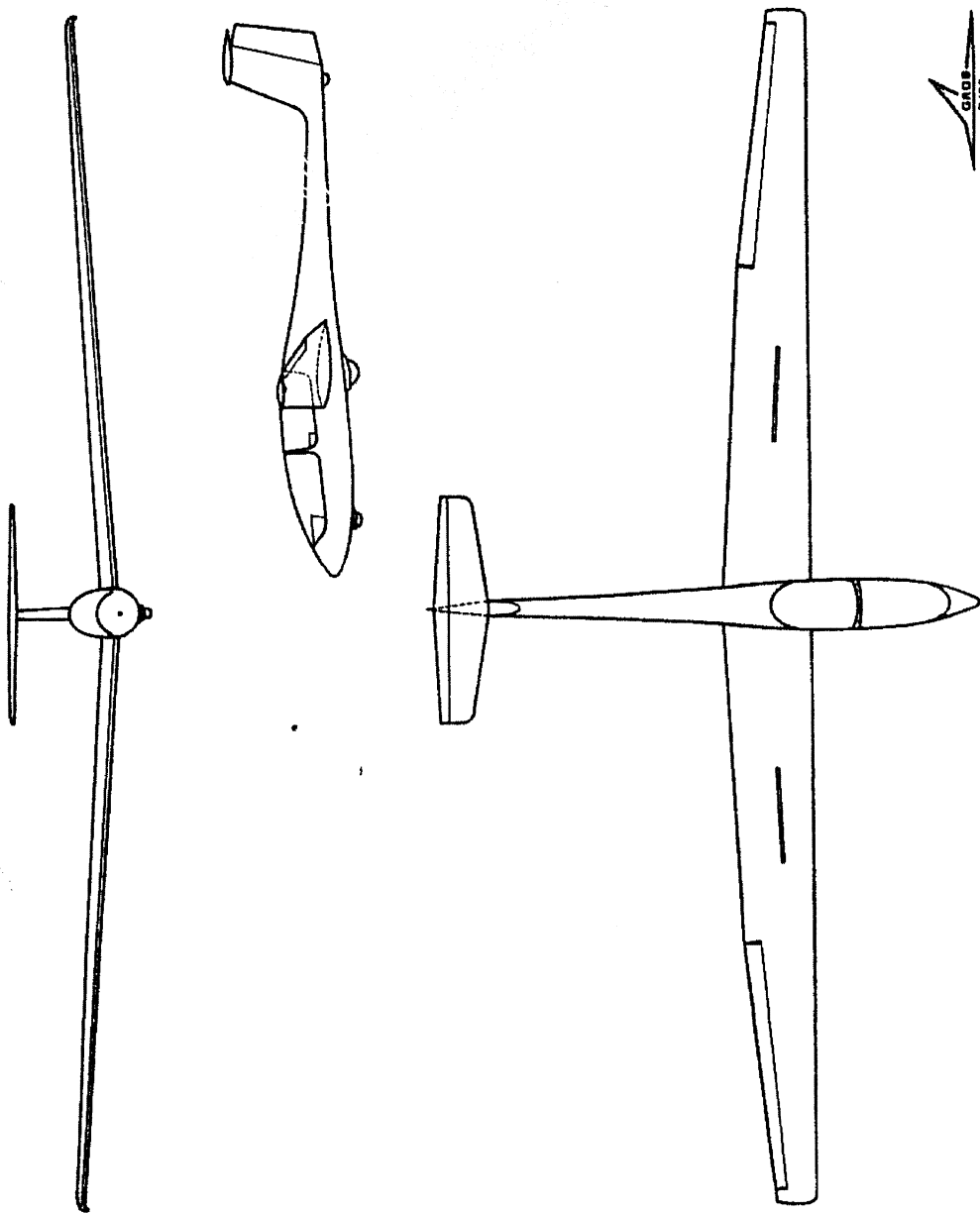
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If the fuselage reinforcement according to OSB 315-65 had not been performed the following is applicable:

The glider GROB G 103A "TWIN II ACRO" is derived from the GROB G 103 "TWIN II". Due to structural reinforcements the "TWIN II ACRO" is approved in the category "Acrobatic". According to MSB 315-65 only "simple aerobatics" (Loop, Turn, Lazy Eight, Chandelle, Spin) is approved (refer to II.2 and IV.9)

The
Flight Handbook for Aerobatics
GROB G 103A "TWIN II ACRO"
Edition February 1984
LBA approved

is invalid according to MSB 315-65 and must be removed from the Flight Handbook.

If the fuselage reinforcement according to OSB 315-66 had been performed the following is applicable:

The glider GROB G 103 A "TWIN II ACRO" is derived from the GROB G 103 "TWIN II". Due to structural reinforcements the "TWIN II ACRO" is approved and certified for acrobatics in conjunction with the following valid operating instructions:

Flight handbook for aerobatics,
GROB G 103 A "TWIN II ACRO",
edition February 1984,
LBA approved.

These operating instructions must be added to the flight manual and contain special instructions valid for acrobatic operations. Main modifications to the "normal" flight manual are contained in the following sections:

- | | |
|--|--------|
| - Airworthiness group (II. 1) | page 6 |
| - Permitted operating conditions (II. 2) | page 6 |
| - Minimum equipment (II. 3) | page 6 |
| - Maximum speeds (II. 4) | page 7 |
| - Flight envelope (II.5) | page 7 |
| - Load scheme (II. 8) | page 8 |

The following items were modified in the maintenance handbook with respect to the acrobatic version:

- Weights and moments of control surfaces (VI)

References to the flight handbook for aerobatics are shown on the affected pages of the "standard" flight manual.

I. 5 Description

The "TWIN II" is a high performance two seater sailplane with a T-tail, fitted with a nonretractable tandem undercarriage and upper surface airbrakes.

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	8,18m (26,8ft)		
Height	1,55m (5,1ft)	Maximum Flying Weight	580 kg (1279 lbs)
Aspect			
Ratio	17.1	Maximum Wing Loading	32, 6 kg/m ² (6, 68 lbs/ft. ²)

II. Operating limitations:

II. 1 Airworthiness Group

Certification Basis: 14 CFR Sections 21.23 and 21.29 effective 1 February 1965; and Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes (JAR-22), dated 1 April 1980.

II. 2 Permitted operating conditions.

The plane is licensed for:

1. VFR Day
2. Simple Aerobatics (Loops, Stall turns, Lazy eight, Chandelle and Spin).

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 for each occupant.
5. Loading limit plaque in front and back cockpit.
6. Flight Limits plaque.
7. Flight Manual

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II. 4 Maximum Speeds

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

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.

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)	135	128	121	115	109
(indicated km/h)	250	237	225	213	202

Air speed indicator markings

77-170 km/h=42-92 kts=48-105 mph	- Green arc(normal range)
170-250 km/h=92-135 kts=105-155 mph	- Yellow arc(caution range)
at 250 km/h=135 kts= 155 mph	- Red line(max. Speed)
at 95 km/h= 51 kts= 59 mph	- Yellow triangle
	(recommended minimum appr. speed)

Installation 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 $\pm 2 \text{ km/h}$ 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)	

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II. 6 Weight limits

Empty weight about 380 kg(838 lbs)
Maximum flying weight . . 580 kg(1279 lbs)
Maximum permitted weight of non lifting parts 400 kg(882 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 datum line, equivalent to 24.7% to 43.6% of the M.A.C. of the wing.
A/c attitude: incidence board of 600:24 angle.
The datum line 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 II“

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 the baggage compartment . . . 10 kg (22 lbs)

The maximum flying weight of 580 kg (1279 lbs) must not be exceeded.

Trim weights must be used at the suspensions in front of stick bulkhead to compensate if the front seat load is lower than 70 kg (154 lbs). See page 14.

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Date of weighing: carried out by.	Equipment list used for weighing (date)	Empty (Weight) kg/lbs	Position of cg empty behind refe- rence mm/inches	Maximum total payload kg/lbs

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II. 9 Tow hooks and cable length

For Aerotow: Nose hook "E 75" with modification 1-79.

For Winch launch: Safety back release hook "G 72" or "G 73".

Minimum aerotow cable length 40 m (130 ft)

Minimum launch cable length 600 m (1970 ft)

II. 10 Weak link strength

Winch launch and aerotow max 754 daN , max 1662 lbs

II. 11 Tire Pressure

mainwheel	6.00-6	2,5-2,8	bar
nosewheel	260x85	2,5	bar
tailwheel	210x65	2,5	bar

II. 12 Crosswinds

The maximum crosswind component approved for take off and landing, is 20 km/h (11 kts, 12 mph).

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II.13. Placards, control markings and instrument markings

Maximum flying weight		580kg 1280lbs		
Airspeed limits		km/hr	knots	mph
Never exceed	V_{NE}	250	135	155
In Rough Air	V_B	170	92	105
On Aerotow	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

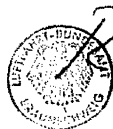
both cockpits

Payload (Pilot and Parachute)		
Minimum in Front cockpit for all flight	70kg	154 lb
Less must be compensated with ballast secured in the seat		
Maximum load front	110kg	242lb
The maximum weight must not be exceeded		

both cockpits

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

Required placards (front and back cockpit)



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Altitude (ft)	0-6500	10 000	13 000	16 500	19 000
VNE (KIAS)	135	128	121	115	109

near speed ind.

both cockpits

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
36 PSI 2,5 atm

mainwheel
nosewheel
tailwheel

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Elevator quick lock connected
 Markings notice
 Rotating knob turned in
 Tailplane secured (cover closed)

Rudder fin (until s/n 3877)

Markings notice
 Rotating knob turned in
 Tailplane secured (cover closed)

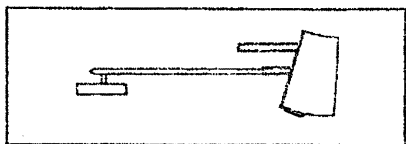
Rudder fin (from s/n 33879)

Baggage maximum
 22 lbs 10 kg

Baggage compartment

Dont push or
 lift here

Rudder



Total energy
 compensation tube
 (until s/n 3836)

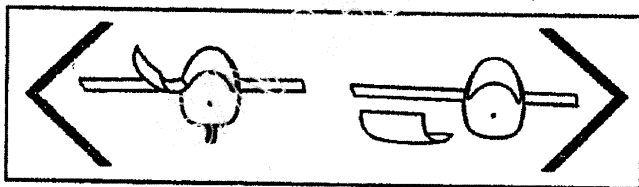
FUR	N	30	60	O	120	150
FLIEGE						
FDR	S	210	240	W	300	330
FLIEGE						
DATUM						ASTIR

near magnetic direction
 indicator

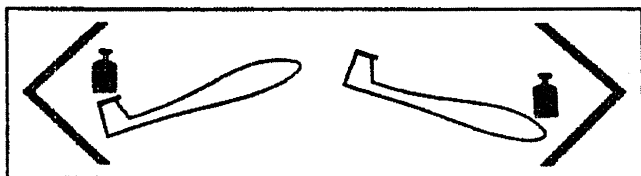
26th sept. 1984 (AM 315-14/2)



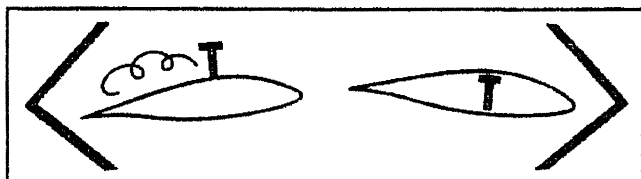
Approved by LBA
 24. OCT. 1984



Canopy open
Canopy jettison



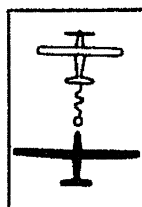
Trim



Airbrakes



Wheelbrake



Cable
release



Pedal adjustment
Top right of front
instrument panel



Air-vent
Top left of front
instrument panel

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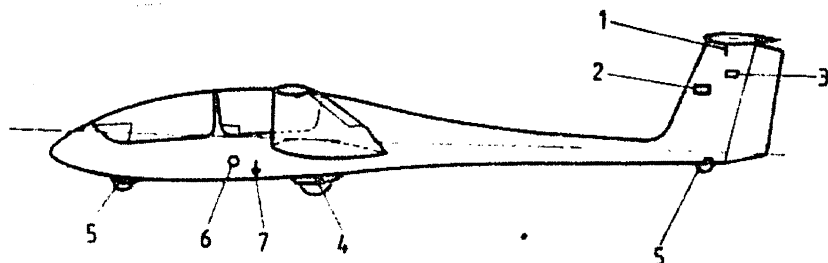


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TRIM WEIGHTS				
Pilotsweight including parachute	kg	55-62,4	62,5-69,9	70-110
	lbs	121-137	138-153	154-242
Number		2	1	0
1 Trim weight: 5,6kg (12,3 lbs)				

front cockpit

Labels and Markings outside of the fuselage



1. Marking controlling the correct rigging of the tailplane.
2. Label for the total energy tube.
3. Label for tailplane security
4. Label for tyre pressure
5. Label for tyre pressure
6. Red ring round the static pressure port
7. Marking to find the belly hook

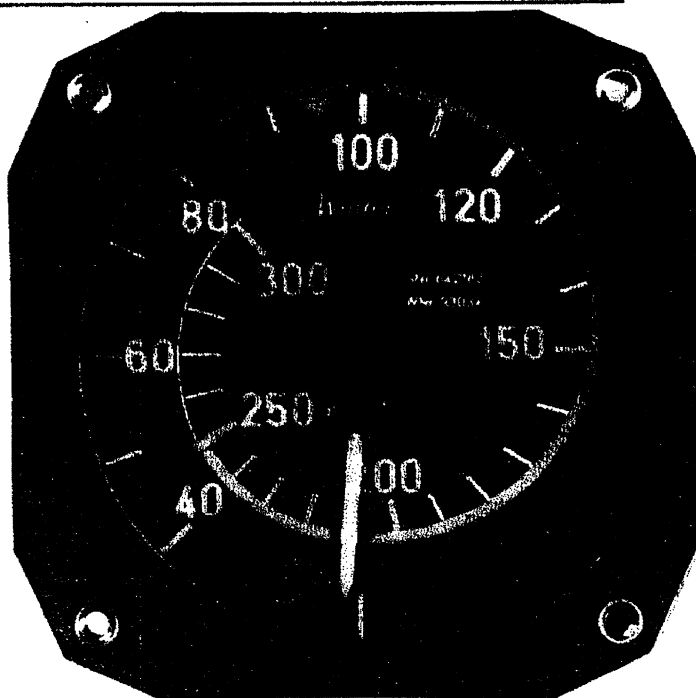
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ASI Markings

mph	Speed		Mark	Significance
	knots	km/h		
48-105	42-92	77-170	Green Arc	Normal range of flying speed
105-155	92-135	170-250	Yellow Arc	Range of flying speeds to be used with care
at 155	135	250	Radial Red Line	Maximum Speed
at 59	51	95	Yellow Triangle	Minimum recommended landing speed at full load



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III. Emergency procedures

III. 1. Recovery from the spin

Recovery spin can be accomplished by the standard recovery procedure:

- Full opposite rudder
- Neutralize stick
- Ailerons should be neutral
- When rotation stops neutralize rudder and pull out gently,

III. 2. Emergency canopy jettison and exit

- Pull red handles on right and left of canopy full back simultaneously.
- 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 attitude.
- When using a manual parachute grip release and pull firmly to full extend after 1-3 seconds.

III. 3. Miscellaneous

Flying in rain, iced wings

There is a noticeable deterioration of flying characteristics by wet or lightly iced wings, which raises the stall speed by about 6 knots:

Increase take off and approach speed by 6 knots.

Wing dropping

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

Groundloops

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



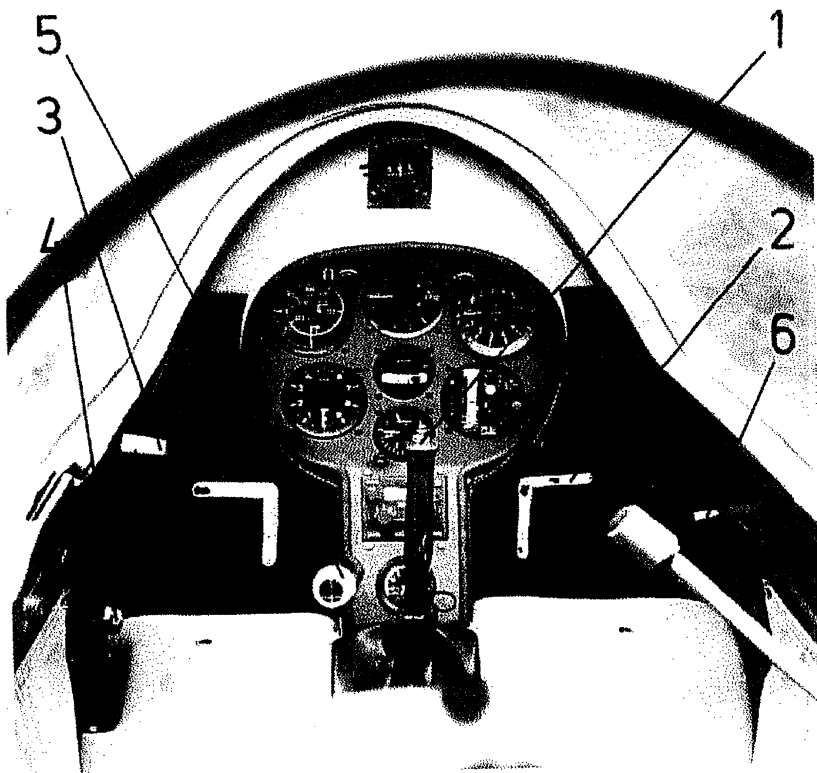
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IV. Normal procedures

VI. 1 Cockpit and controls

Front Seat.



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

Ventilator top of instrument panel left side

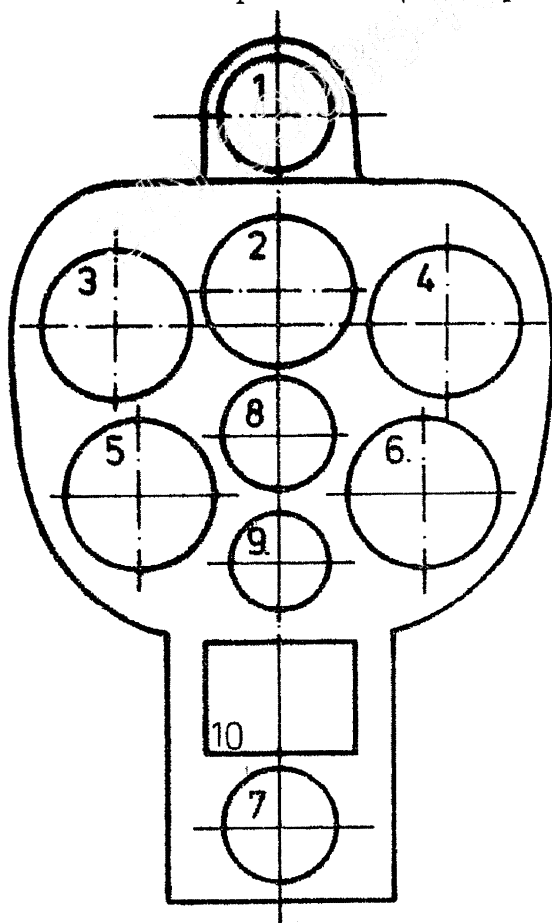
Rudder pedal adjustment top of instrument panel right side.

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Standard instrument positions (front panel)

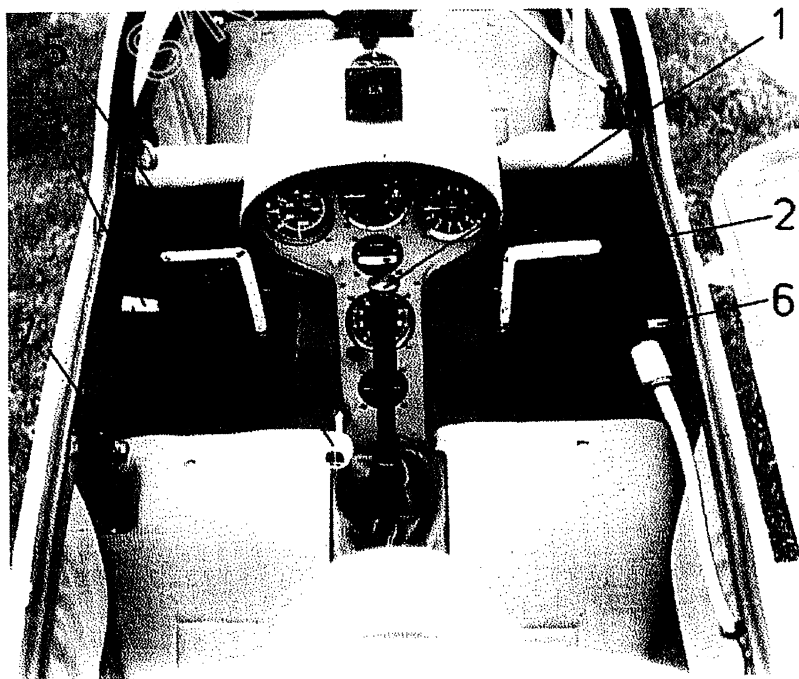


- 1 Magnetic compass
- 2 Electrical vario indicator (optional)
- 3 Airspeed indicator
- 4 Variometer
- 5 Altimeter
- 6 Electrical vario control (optional)
- 7 G-Meter or variable
- 8 Ball
- 9 Temperature (outside) or variable
- 10 Radio

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Rear seat



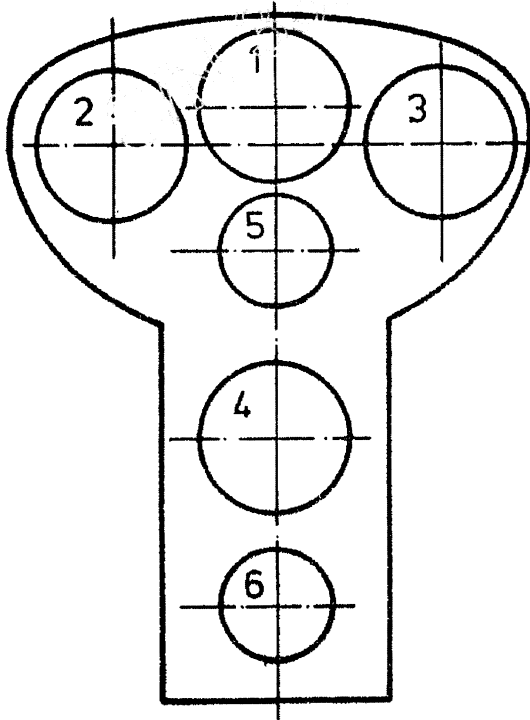
- | | |
|---------------------------------|-------------------|
| 1 Stick | 4 Trim lever |
| 2 Rudder pedals | 5 Release knob |
| 3 Airbrake lever and wheelbrake | 6 Canopy jettison |

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Standard instrument positions (rear panel)



- 1 Altimeter
- 2 Airspeed indicator
- 3 Variometer
- 4 Electrical vario (optinal)
- 5 Ball
- 6 Variable

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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 including landing gear and undercarriage suspension.
4. Check tail unit for correct assembly and that safety lock is in position.
5. Check condition of the tail wheel.
Check the pitot tube, total energy venturi and static vents are clean.
6. Repeat step 3 for right side of fuselage.
7. Repeat step 2 for right wing.
8. Check condition of the nose wheel.

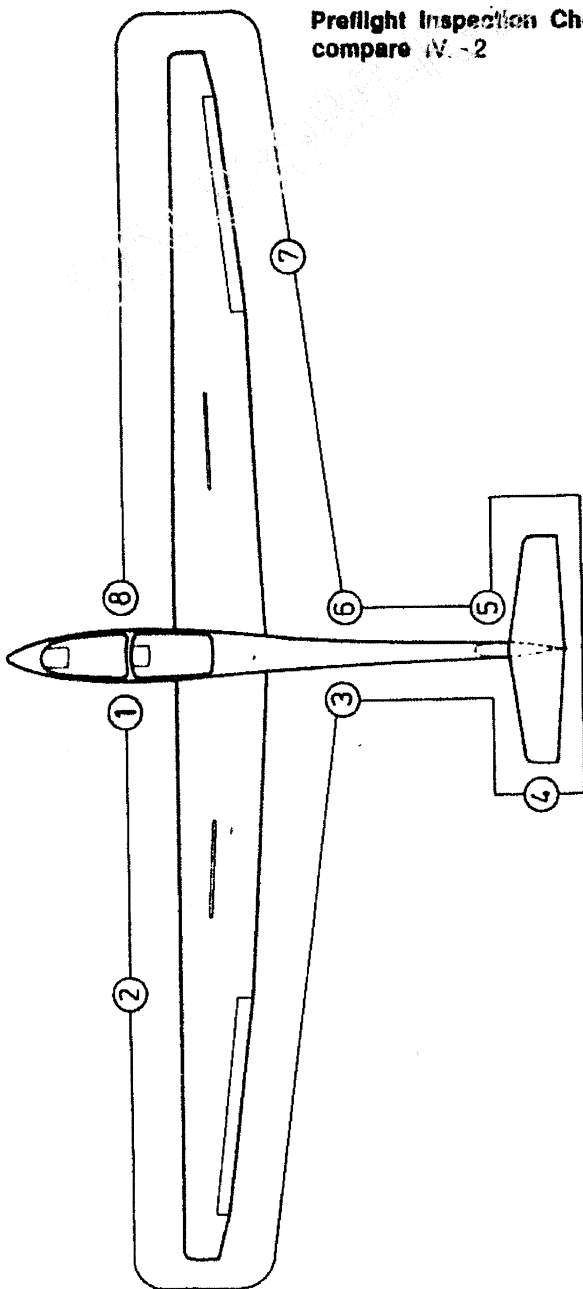
After heavy landings or excessive flight loads the entire glider should be checked. The wings and tailplane should be removed for these checks and if any damage is found an inspector should be consulted. The plane should not be flown before any damage is repaired.

26th sept. 1984 (AM 315-14/2)



Approved by LBA

24. OKT. 1984

**Preflight Inspection Checkpoints
compare IV.-2**

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IV. 3 Control checks before take off

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

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 yellow release handle is mounted on the instrument panel and must be pulled to its limit when releasing.

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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 stalls

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 = 1036 lbs	66 km/h (36 kts, 41 mph)	75 km/h (40,5 kts, 47 mph)

Double seater

Weight	Without Airbrakes	With Airbrakes
580 kg = 1279 lbs	75 km/h (40,5 kts, 47 mph)	85 km/h (46 kts, 53 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 develop 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.

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IV. 8 Simple Aerobatics

The glider is licenced for the following aerobatics

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 accidentally initiated during the climb holdall controls in the centred position firmly.

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 apply full rudder. Glider spins slowly. Rotation rate is one turn every 3 seconds with a height loss of about 80 m (262ft.) per turn. The glider has no tendency to turn into a spiral dive.
Recovery : opposite rudder, neutralise stick and recover gently.

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4. Chandelle

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

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

5. Lazy Eight

Entry speed 140 km/h (76 kts, 87 mph)

IV. 9 Approach and landing

Normal flying practice is to approach at 95 km/h = 51 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.

Caution note:

Fully extended the airbrakes increase the stalling speed: do not extend the airbrakes fully during the roundout to avoid heavy landings. Don't use the airbrakes to full extension during touch-down due to strong effect of the wheel-brake.

If the nosewheel touches the ground the direction can be controlled by rudder until 40 km/h (22 kts, 25 mph).

The side-slip is quite controllable and, if needed, this manoeuvre can be used for steeper approaches. It is effective by using a 15 degrees angle of side-slip and should be finished of a safe hight (98 km/h; 54 kts; 61 mph). Rudder effect reversal have not been observed.

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The temporary control force to overcome the force reversal or rudder lock is calculated approximately 5 to 6 daN (rudder pressure). The aileron does not change its force direction, rather it returns independently from the full deflected position.

Rudder lock can be relieved without pilot input on the rudder. After moving the aileron into neutral position, the Sailplane rolls out of the Slip into wing level position. Thereafter the rudder frees itself from the full deflected position and the force reversal is relieved. Using this method to end the Slip the Sailplane does not adopt unusual flight attitudes and deviates only slightly from its original flight course.

IV. 10 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.

17 th march 1982

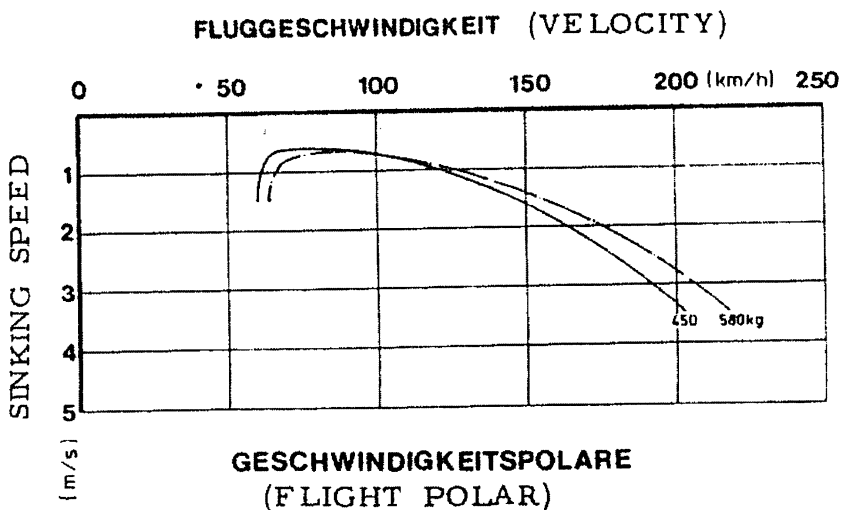


Peri
17. März 1982

V. Appendices

V. 1 Flight Performance

Flying weight	450(992)	580(1279)	kg (lbs)
Wing loading	25,3(5,2)	32,6(6,7)	kg/m ² (lbs/ft ²)
Best glide Angle	36,5	37,0	
at a speed of	95 (51)	105 (57)	km/h (kts)
Minimum sink	0,64(126)	0,70(138)	m/sec(ft/min)
at a speed of	80 (43)	85 (46)	km/h (kts)



17 th march 1982



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V.2 Determination of the Center of Gravity

The determination of the center of gravity is made with 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. (Position on the fuselage see sketch at page 23). 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 .

The Center of Gravity of the pilots is located:

1150 mm (45,3 inch) in front of the Datum Line (1. Seat)

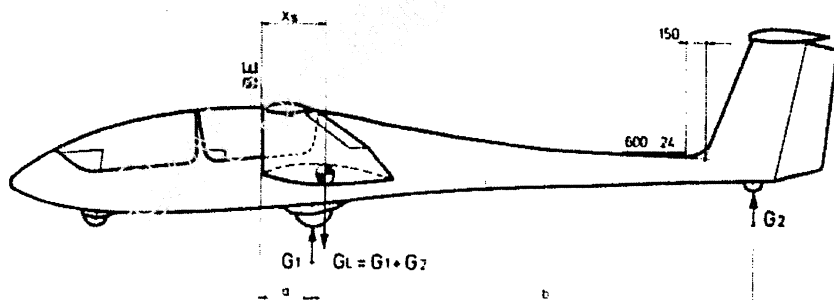
40 mm (1,6 inch) behind the Datum Line (2. Seat)

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17. März 1982

Procedure for determining C. of G. empty



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

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.

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

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.

Conversion	from	to	multiply with
	kg	lbs	
	mm	inches	

2,2
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 glider will be within the permitted range.

Empty Weight		Range of C. of G. behind Datum			
kg	lbs	Forward		Aft	
		mm	inches	mm	inches
360	794	758	29.84	773	30.43
365	805	748	29.45	769	30.28
370	816	739	29.09	765	30.12
375	827	729	28.70	761	29.96
380	838	720	28.35	757	29.80
385	849	711	27.99	753	29.65
390	860	703	27.68	749	29.49
395	871	694	27.32	745	29.33
400	882	686	27.01	742	29.21

It should be noted that to make use of the maximum load the maximum admissible 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 400 kgs (882 lbs). Otherwise 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.

17 th march 1982



17. März 1982



GROB WERKE GMBH & CO. KG
Unternehmensbereich
Burkhardt Grob Flugzeugbau
Am Flugplatz
8939 Maffsies
Telefon 08268/411
Telex 599 623

FLIGHT MANUAL FOR AEROBATICS

GROB G 103 A

„TWIN II ACRO“

This manual must be carried on board at all times and is for U.S.
registered sailplanes (Type Certificate Data Sheet No. G 39 EU)

Registration: N786 Factory Serial Number:
Owner: CYPRESS SOARING 33986-K-219
.....
.....

German edition of operating instructions are approved under §
12 (f) 2 of LuftGerFG.

Published June 1983. LBA approved on July 12, 1983
(valid from serial no. 3730)

Approval of translation has been done by best knowledge and judgment.
In any case the original text in German language ist authoritative.

J. GeneralJ.1. Log of revisions

Revisions No.	Pages affected	Description	LBA approval signature	Date
1	1, 4a, 6, 8, 10, 16a	Automatic connection of elevator and spring trimm system of serial no. 33879 and subsequent		Sept. 26 1984

All manuals for GROB G 103 A can be ordered at:

- Burkhardt Grob of America, Inc.
1070 Navajo Drive, Bluffton Airport Complex, Bluffton, OH 45817
(419)358-9015 or 9025
- Grob Werke GmbH & Co. KG
Unternehmensbereich Burkhardt Grob Flugzeugbau
Flugplatz Mindelheim-Mattsies
8939 Mattsies, West Germany
(08268)411

Sept. 26, 1984 (AM 315-14/2)

Approved by LBA



24. OKT. 1984

I.2. Pages included

Cover page

1	Sept. 26, 1984
1a	Sept. 26, 1984
2	June 1, 1983
3	June 1, 1983
4	June 1, 1983
5	June 1, 1983
6	Sept. 26, 1984
7	June 1, 1983
8	Sept. 26, 1984
9	June 1, 1983
10	Sept. 26, 1984
11	June 1, 1983
12	June 1, 1983
13	June 1, 1983
14	June 1, 1983
15	June 1, 1983
16	June 1, 1983
16a	Sept. 26, 1984
17	June 1, 1983
18	June 1, 1983
19	June 1, 1983
20	June 1, 1983

Sept. 26, 1984 (AM 315-14/2)



Approved by LBA

24. OKT. 1984

<u>I.3.</u>	<u>Table of contents</u>	page
<u>I.</u>	<u>General</u>	
I. 1.	Log of revisions	1
I. 2.	Pages included	1a
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I. 5.	Technical datas	4
<u>II.</u>	<u>Operating limitations</u>	
II. 1.	Operating instructions	4
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II. 8.	Centre-of-gravity	7
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II.10.	Placards	8/9
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<u>III.</u>	<u>Normal and emergency procedures</u>	11
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IV. 1.	Maneuvers	11-16a
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I.4. Description

a) GROB G 103 A "TWIN II ACRO"

Series airplanes GROB G 103 A "TWIN II ACRO" are approved for aerobatic flights.

Structural reinforcements were added to the basic GROB G 103 "TWIN II". Especially the wings are modified by a stronger spar. The airplanes approved for aerobatic flight are identified by "ACRO"-labels on either side of the cockpit.

b) Restrictions to aerobatic certification

Airplanes of the above mentioned series are certified for aerobatics if the operation complies with para II.3 (permitted maneuvers) and these maneuvers or any combination of them are executed in accordance with para IV.1. All other not mentioned especially accelerated maneuvers are prohibited, such as snap rolls, maneuvers with excessive negative g-loads (outside loop) and backwardflying maneuvers (hammerhead stall).

I. 5. Technical datas for normal and aerobatics

Wingspan	17,5 m	57,4 ft
Length	8,18 m	26,8 ft
Height	1,55 m	5,1 ft
Wing ratio	17,1	17,1
Wing area	17,8 m ²	191,6 ft ²
Gross weight	580 kg	1279 lbs
Wing loading	32,6 kg/m ²	6,68 lbs/ft ²

II. Operating limitationsII. 1. Operating instructions

During aerobatic flights the airplane must be operated in compliance with this flight manual and the appropriate valid Flight and Maintenance Manual of the "utility"-category airplane.

II. 2. Airworthiness Group

(A, Aerobatic)

Certification Basis: 14 CFR Sections 21.23 and 21.29 effective 1 February 1965 and Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes (JAR-22), dated 1 April 1980.

June 1, 1983

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II.3. Permitted operating conditions

This sailplane is certified for:

1. VFR Day
2. Simple aerobatics (loop, stall turn, lazy eight, chandelle, spin)
3. Aerobatics (Aileron roll, Half-roll, Immelmann, Split-S, inverted flight)

II.4. Minimum equipment for aerobatics

1. Two airspeed indicators reading to 300 km/h (162 KIAS, 187 mph)
2. Two altimeters
3. One accelerometer with two recording pointers (front cockpit)
4. Safety bows at the pedals in front and back cockpit
5. 5-piece seat harnesses in front and back cockpit
6. Parachute for each crewmember
7. Loading limit plaque in front and back cockpit
8. Flight limits plaque
9. Flight manuals for category "U" and "A".

Note: Accelerometer for rear cockpit is recommended.

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II. 5. Maximum Speeds for aerobatics

Max. airspeed (never exceed)	V_{NE}	=	250 km/h (135 KTAS)
Max. airspeed (rough air)	V_B	=	180 km/h (98 KTAS)
Maneuvering speed	V_M	=	180 km/h (98 KTAS)
Max. tow speed (winch)	V_W	=	120 km/h (65 KTAS)
Max. tow speed (acrotow)	V_T	=	170 km/h (92 KTAS)

ASI Markings of TWIN II ACRO

mph	Speed knots	km/h	Mark	Significance
48-112	42-98	77-180	Green Arc	Normal range of flying speed
112-155	89-135	180-250	Yellow Arc	Range of Flying speeds to be used with care
at 155	135	250	Radial Red Line	Maximum speed
at 59	51	95	Yellow Triangle	Minimum recommended landing speed at full load

Sept. 26, 1984 (AM 315-14/2)

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Note: Explanation of terms, i.e. rough air and control stick movements at maneuvering speed, and airspeed indicator markings correspond to "U"-category manual.

II.6. Acceleration limits

The following load factors may never be exceeded:

Positive loads:

+ 6,5 g up to $V_M = 180$ km/h (98 KTAS)

+ 5,3 g up to $V_{NE} = 250$ km/h (135 KTAS)

Negative loads:

- 4 g up to $V_M = 180$ km/h (98 KTAS)

- 3 g up to $V_{NE} = 250$ km/h (135 KTAS)

Note: Symmetrical maneuvers and airbrakes retracted

II.7. Weights during normal and aerobatics

Empty weight appr.	380 kg (838 lbs.)
Max. weight	580 kg (1279 lbs.)
Max. weight of non lifting parts	400 kg (882 lbs.)

II.8. Centre-of-gravity position

The permissible range for centre-of-gravity corresponds to the figures given in the "U"-category manual.

260 mm to 460 mm
10,24 in. to 18,11 in.

behind datum line (DL), equivalent to 24,7% to 43,6% of mean aerodynamic chord (MAC) of the wing.

II. 9. Load scheme for acrobatics

Minimum load in the front seat under all conditions	70 kg (154 lbs.)
Maximum load in the front seat	110 kg (242 lbs.)
Maximum load in the back seat	110 kg (242 lbs.)

Note: Any load in the baggage compartment prohibited.
Maximum flying weight of 580 kg (1279 lbs.) may never be exceeded.

Caution: Missing weight in the front cockpit must be compensated by firmly connected ballast on the seat or, if installed, at the trimbox.

II. 10. Placards (additional for acrobatic)

Maximum flying weight	580 kg (1279 lbs.)
Maximum airspeeds:	
in calm air:	V _{NE} 250 km/h (135 KTAS)
in rough air:	V _a 180 km/h (98 KTAS)
Aerotow:	V _r 170 km/h (92 KTAS)
Winch/Automobile tow:	V _w 120 km/h (65 KTAS)
Airbrakes extended:	V _{FE} 250 km/h (135 KTAS)
Maneuvering speed:	V _A 180 km/h (98 KTAS)

Front cockpit
Rear cockpit

(See also Maintenance Handbook at page 41)

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21. 7. 84. DKT 1004



Wing root L/H

Wing root R/H

Baggage max. 10 kg
22 lbs

No baggage during
aerobatics

Baggage compartment

Limitmarkings (accelerometer)

Red marks at + 6,5 g and - 4,0 g.

The accelerometers have to be locked during road haulage. The back of the instrument is accessible by removing the instrument panel cover.

June 1, 1983

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II. 11. Weights and residual momentums of control surfaces

1. For the „TWIN II“ (from serial no. 33879) the following values are valid as derived from page 21 of the Maintenance Handbook GROB G 103.

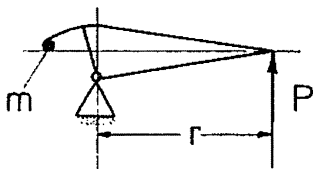
Elevator:	26.0 kg cm $\begin{matrix} + 12 \% \\ - 20 \% \end{matrix}$	4.2 kg $\pm 15 \%$
Rudder:	20.0 kg cm $\pm 10 \%$	5.0 kg $\pm 10 \%$
Aileron:	12.0 kg cm $\pm 12 \%$	6.0 kg $\pm 10 \%$

2. At „TWIN II ACRO“ (from serial no. 33879-K) the residual momentum of the aileron has been reduced over the „normal“ sailplane.

The following figures are valid:

Elevator:	26.0 kg cm $\begin{matrix} + 12 \% \\ - 20 \% \end{matrix}$	4.2 kg $\pm 15 \%$
Rudder:	20.0 kg cm $\pm 10 \%$	5.0 kg $\pm 10 \%$
Aileron:	10.0 kg cm $\pm 12 \%$	6.5 kg $\pm 10 \%$

The moments must be measured with the control surfaces removed. To determine the moment $M = P \cdot r$ 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 changing the mass balance on a surface the manufacturer or his repair agent should be consulted.



See also Maintenance *Manual* at page 21 for a table of weights and moments of control surfaces of serial numbers before.

Sept. 26, 1984 (ÄM 315-14/2)

III. Normal and emergency procedures

Normal operating procedures and handling of emergencies are identical to those described in the Flight Manuals of "TWIN II".

IV. Aerobatics

Acrobatics may only be conducted by rated pilots. Students may conduct solo training flight under the instructor's supervision. Acrobatics during passenger flights only with their approval.

IV.1. Maneuvers

In the following paragraphs permitted maneuvers are described indicating recommended entry airspeeds (V_E) and execution.

1. Loop

Entry airspeed:	190 km/h (105 KIAS)
G-load:	3 g
Exit airspeed:	180 km/h (97 KIAS)

For the benefit of spectators the loop should be performed so as to be a circular flight path. Always start the maneuver against the wind. It is very difficult to achieve a constant radius while conducting the maneuver. Never try to maintain constant back pressure. Neither stick pressure nor stick travel are reliable references for a circular loop. But in general, with decreasing speed back pressure must be released. A constant loop radius can only be checked by observing the radial speed which also must be reduced with decreasing speed. Check your bank during pull-up and inverted flight (wing tips equidistant from the horizon). Disregarding bank control will result in a "spiral loop".

2. Stall turn

Entry airspeed: 190 km/h (105 KIAS)

Constantly rotate to the vertical and reduce aft stick back to neutral (check vertical climb across wing tips perpendicular to horizon). When reaching 140 km/h (approx. 75 KIAS) slowly (not abruptly) apply full rudder into desired turn direction so that the glider performs a 50° turn in the vertical. Assist correct execution of maneuver in this phase by applying slight opposite aileron to avoid ending up inverted.

If rudder was applied too prematurely or too abruptly this will cause only a skidding flight path without further rotation around the vertical axis of the airplane.

Also delayed or partially applied rudder will cause the same flight condition with insufficient rotation. In both cases the glider will slide backwards and either recover abruptly forward or over the back.

Note: In this case maintain full rudder and solidly hold the stick in the neutral position to avoid vehemental motions of the control surfaces while unintentionally sliding backwards.

Exactly performed stall turns require high proficiency.

3. Slow roll

(from normal flight to normal flight)

Entry airspeed 190 km/h (105 KIAS)

From horizontal flight pull up the nose to about 20° - 25° above horizon, neutralize elevator (momentarily straight flight) then apply full aileron into the direction of desired roll (heavy stick forces may require both hands). Initially do not use rudder until approaching 90° of bank. Then shortly apply rudder opposite to roll direction to keep the nose from dropping. While maintaining the roll reduce rudder to neutral and smoothly apply forward stick pressure when approaching inverted flight. Continue the maneuver, reduce forward pressure, apply rudder in the direction of roll when coming to 90° bank and do not pull at the stick until wings level or at a maximum of 20° of bank.

Note: Avoid to apply rudder in the direction of roll during the first half of the maneuver resulting in a high-speed spiral.

Do not pull prematurely while rolling out from the maneuver resulting in a heading change opposite to roll direction.

Deviations from the reference line are usually caused by uncoordinated elevator inputs.

With sufficient proficiency aileron rolls may be started at lower speeds than recommended.

June 1, 1983

4. Half roll

(from normal to inverted flight)

Entry airspeed 170 km/h (92 KIAS)

This roll should be executed like the full roll described above. Proper execution is not easier to manage than a complete roll but this maneuver should be practised during the initial training phase to slowly getting the student used to a controlled combination of all three controls while rolling.

5. Half roll

(from inverted to normal flight)

Entry airspeed 150 km/h (83 KIAS)

From inverted flight slightly lower the nose to below the horizon to gain airspeed. Then push stick forward to about 10 - 15° above the horizon. Maintain flight path for an instant by reducing forward stick pressure and then apply full aileron in the direction of desired roll until wings level normal flight is attained.

6. Immelmann

(1/2 loop followed by 1/2 roll)

Entry airspeed 210 km/h (118 KIAS)

During the pull-up to almost inverted flight (10-15° above horizon) a quick rotation of the "TWIN" is required to have 120-130 km/h (65-70 KIAS) remaining before starting the roll. The roll starts with the same references as for stabilized inverted flight (10-15° above horizon, wings level). An instant of inverted flying is necessary to insure that the roll is commenced without backstick pressure. After this, full aileron deflection in the direction of desired roll is required to complete the Immelmann. For references to problems encountered during the roll and after completion see para. 3.

Caution: At high entry airspeeds (above maneuvering speed) full elevator deflection may not be applied. Observe the maximum allowable load

7. Split S

(1/2 roll followed by 1/2 loop)

Entry airspeed 170 km/h (92 KIAS)

Before starting the roll the glider is pulled up to 20-25° nose high. The half roll is performed as described in para. 3 until reaching inverted flight at airspeeds slightly above 110 km/h (62 KIAS) which is close to stall speed in inverted flight. Momentarily continue inverted and, if necessary, push away excess airspeed while controlling wings level.

Then release forward pressure and start the half loop. To gain a constant radius during this phase of the maneuver initially use only a small amount of back pressure. With increasing airspeed backstick pressure must be increased while observing airspeed limits and load factors. The exit airspeed should not exceed 180 km/h (98 KIAS).

Note: This maneuver does not correspond to the official 45° upwards "Arresti" maneuver. This would require higher entry airspeeds resulting in higher aileron forces. With sufficient proficiency this maneuver can be completed with a 45° climb when the entry airspeed is above 210 km/h (118 KIAS).

Caution: Do not use full controls at airspeeds above maneuvering speed.

8. Inverted flight

Inverted flight can be entered from normal flight by a half roll which provides the best airspeed to control this flight and is preferred rather than entering from a half loop.

The optimum airspeed range is between 125-145 km/h (70-80 KIAS) with a minimum loss of altitude. Minimum control airspeed is appr. 110 km/h (60 KIAS) depending on gross weight.

Exit from inverted flight with a half roll (see para.5) or Split S (para.7)

9. Spin

Entry airspeed 80 km/h (45 KIAS)

From straight and level flight gradually reduce airspeed to 80 km/h (45 KIAS). Then pull the stick full aft and hold. Apply rudder full in the direction of desired rotation and hold. Rotation speed is slow with a rate of 1 rotation per 3 sec. Altitude loss is appr. 80 m (250 ft.) per rotation not including recovery altitude.

Recovery: Rudder-full opposite to direction of spin
 Stick-forward to neutral
 Ailerons-neutral
 Smoothly recover from dive (appr. 3,5 g's)

Caution: Do not exceed the permitted range of centre of gravity. Centre of gravity must be determined prior to flight and must correspond to flight manual.

Note: At forward centre of gravity entering the spin is not very likely and premature recovery from spin has to be expected. After initiating the recovery expect not more than one rotation until it completely stops. Entering the maneuver with full nose-down trim facilitates spinning with the "TWIN II ACRO".

10. Trim control of „TWIN II ACRO“

The „TWIN II ACRO“ is equipped with a spring trim system:
For inverted flights forward trim is used to reduce stick forces.

11. Permitted aerobatics

Note that only the above mentioned and described maneuvers or combinations of those maneuvers are permitted. All other accelerated maneuvers, such as snap-rolls as well as maneuvers performed at high negative g-loads are prohibited.

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IV.2. Preparations and post-flight procedures1. Prior to take-off:

Before executing any acrobatic flights observe maximum weight and centre of gravity. Remove all loose parts and items from cockpit and its map cases. Remove oxygen cylinder.

2. Prior to the maneuvers:

Altitude: sufficient for safe execution? Do not start any maneuver below 400 m (1200 ft.) AGL.

Airspace: Execute clearing turns to observe airspace below. Receive clearance from tower when flying in control zones.

Harness: Check tight

Canopy: Locked

Airbrakes: Locked

Parachutes: Harnesses tight and secure. Ripcord connected for automatic release.

No loose objects in the cockpit, baggage compartment or in map cases.

The maximum permitted airspeed $V_{NE} = 250 \text{ km/h}$ (135 KTAS) may never be exceeded.

If the pilot loses control over the airplane or the airplane accelerates to more than 250 km/h (135 KTAS) extend airbrakes prior to V_{NE} . Airbrakes may be extended up to 250 km/h (135 KTAS).

Note: No acrobatics allowed with airbrakes extended. Max. load factor with airbrakes extended + 3,5 g. If airspeed and/or load factor limitations have been exceeded during any maneuver abort the flight and land.

2. Prior to landing:

Note maximum load factors. If airspeed and/or load factor limits have been exceeded the airplane must be inspected by authorized personal.

During the inspection look for white patches at the wing roots, wing-, fuselage- and elevator connections.

Note bends, cracks and other deformation of the surface. Unusual difficulties during rigging and abnormal wing oscillation frequency.

June 1, 1983

Approved by LBA

IV.3. General remarks to acrobatic training

Acrobatic and flight instructor courses in recent years have shown that "dual stick" flight training for acrobatic flights cannot be waived.

Solo flight training could be accepted for simple acrobatic maneuvers but whenever rolling is necessary for a maneuver, dual controls are mandatory to prevent the student from entering critical and dangerous conditions and at the same time gaining the optimum training effect. For instance during slow rolls airspeeds and g-loads have been exceeded several times before the maneuver finally was performed within the flight envelope. With the increased performance and excellent quality of today's fibre-glass-gliders airspeed and/or load factor limitations are exceeded instantaneously. Instructions over the radio are usually neglected by the student in critical situations due to a mental block. Flight training is best commenced by a solid introduction into inverted flight in steps:

- Constant heading (aimpoint)
- Constant airspeed (horizon)
- Variations in airspeed
- Heading changes
- Inverted turns

This can be very well demonstrated with the TWIN. Other maneuvers are more difficult to perform due to higher masses that must be rolled. It is not very useful to continue acrobatic training in two-seaters after the student has reached a certain level of proficiency to fly solo on easier to handle single-seaters.

V. Remarks

All other informations about rigging/derigging, service and maintenance, performance and empty weight C.G. can be obtained from the regular flight manual.

Maintenance Manual inclusive Airworthiness Limitation Section and Repair Instructions are valid with the exception of weights and moments of control surfaces (see II.11).

June 1, 1983