GROB-WERKE GMBH & Co. KG
Unternehmensbereich
Burkhart Grob Flugzeugbau
8939 Mattsies
Am Flugplatz
Telefon 08268/411
Telex 539 623

FLIGHT MANUAL

GROB G 109 B

This manual must be carried on board of the motorglider at all times.

Registration: SE-UYF Factory Serial Number: 6333

Owner: ALVSBY FLYGKLUBB

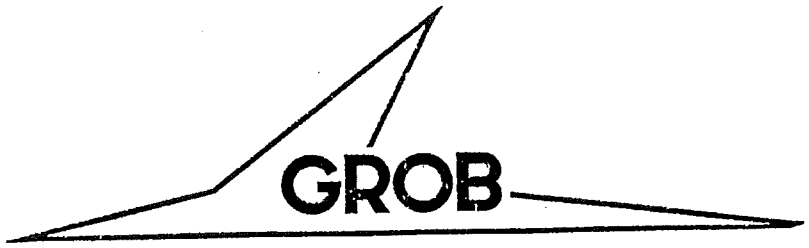
.....

.....

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

Published Sep 1, 1983 LBA approved on Febr. 8,1984

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



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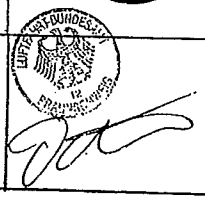
I. General

I.1. Log of revisions

Revisions No.	Pages affected	Description	LBA approval signature	Date
1	1,1a,7,9, 18e,25, 26,63	Supplement for engine with double ignition (ÄM 817-7)		Oct.1, 1984
2	1,1a,14,17, 29,30,35, 40,58	Adjustment of manual (TM 817-17)		Jan.10, 1985
3	1,1a,9,11 18d,19,20a, 24,30a,31	Modifications of S/N 6340 and subsequent (ÄM 817-8)		Jan.15, 1985
4	1,1a,10,18e, 19,20a,20b, 26,28,29,30, 30a,33,37, 39b,39c,40, 45,48,53,63, 64	Corrections ÄM 817-11 TM 817-26		Jan. 15. 1990
5	1, 1a, 11, 18d	TM 817-46		09.03.98

All manuals for GROB G 109B can be ordered from:

GROB-WERKE GMBH & CO. KG
AEROSPACE DIVISION
Lettenbachstr. 9
D-86874 Tussenhausen-Mattsies
Phone: +49-(0)82 68-99 80
Fax: +49-(0)82 68-998-190

GROB Systems, Inc.
1070 Navajo Dr.,
Bluffton, OH 45817
USA
Phone: (419) 3589015
Fax: (419) 3583660

I.2. Pages included:

Cover page	Sept.1,1983	20	Sept.1,1983	40	Jan.15,1990
1	09.03.98	20a	Jan.15,1990	41	Sept.1,1983
1a	09.03.98	20b	Jan.15,1990	42	"
2	Sept.1,1983	21	Sept.1,1983	43	"
3	"	22	"	44	"
4	"	23	"	45	Jan.15,1990
4a	"	24	Jan.15,1985	46	Sept.1,1983
5	"	25	Oct. 1, 1984	47	"
6	"	26	Jan.15,1990	48	Jan.15,1990
7	Oct. 1, 1984	27	Sept. 1, 1983	49	Sept.1,1983
8	Sept. 1, 1983	28	Jan.15,1990	50	"
9	Jan.15,1985	29	Jan.15,1990	51	"
10	Jan.15,1990	30	Jan.15,1990	52	"
11	09.03.98	30a	Jan.15,1990	53	Jan.15,1990
12	Sept.1,1983	31	Jan.15,1985	54	Sept.1,1983
13	"	32	Sept.1,1983	55	"
14	Jan.10,1985	33	Jan.15,1990	56	"
15	Sept.1,1983	34	Sept.1,1983	57	"
16	"	35	Jan.10.1985	58	Jan.10,1985
17	Jan.10,1985	36	Sept.1,1983	59	Sept.1,1983
18	Sept.1,1983	37	Jan.15,1990	60	"
18a	"	38	Sept.1,1983	61	"
18b	"	39	"	62	"
18c	"	39a	"	63	Jan.15,1990
18d	09.03.98	39b	Jan.15,1990	64	Jan.15,1990
18e	Jan.15,1990	39c	Jan.15,1990	65	Sept.1,1983
19	Jan.15,1990				

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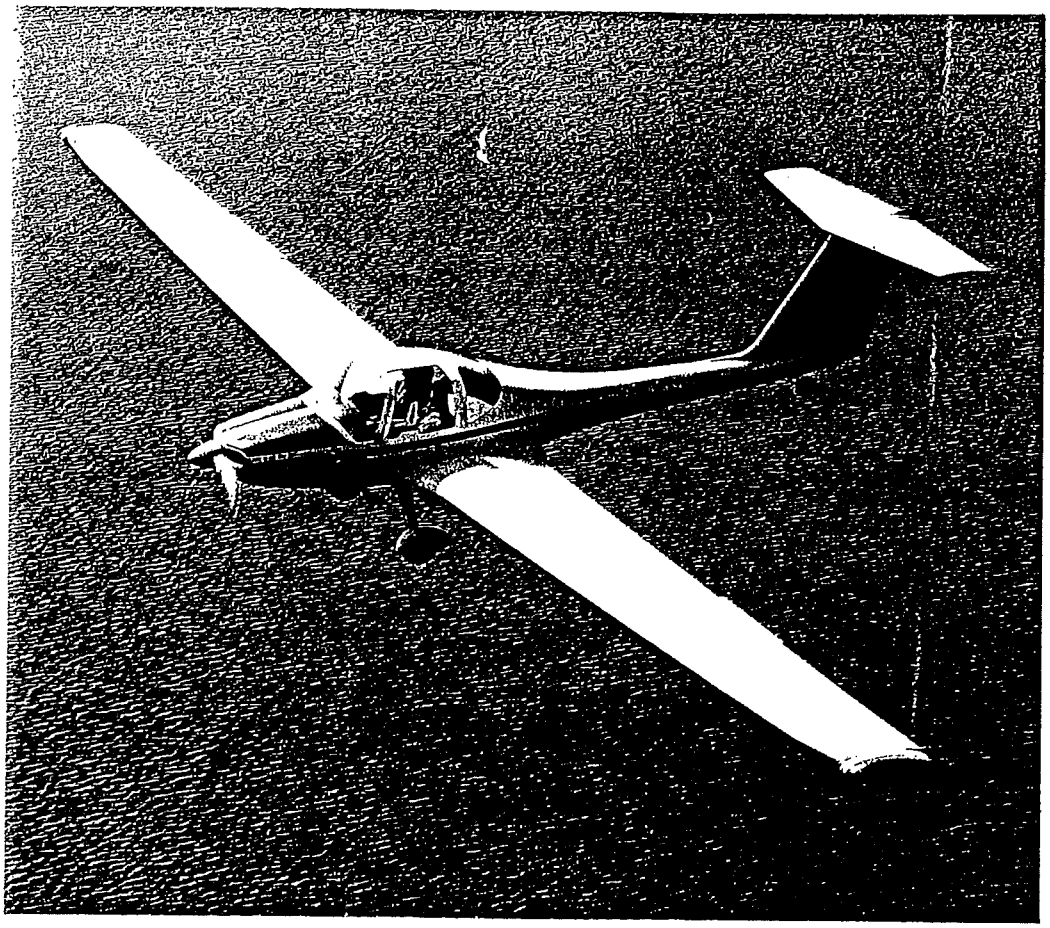
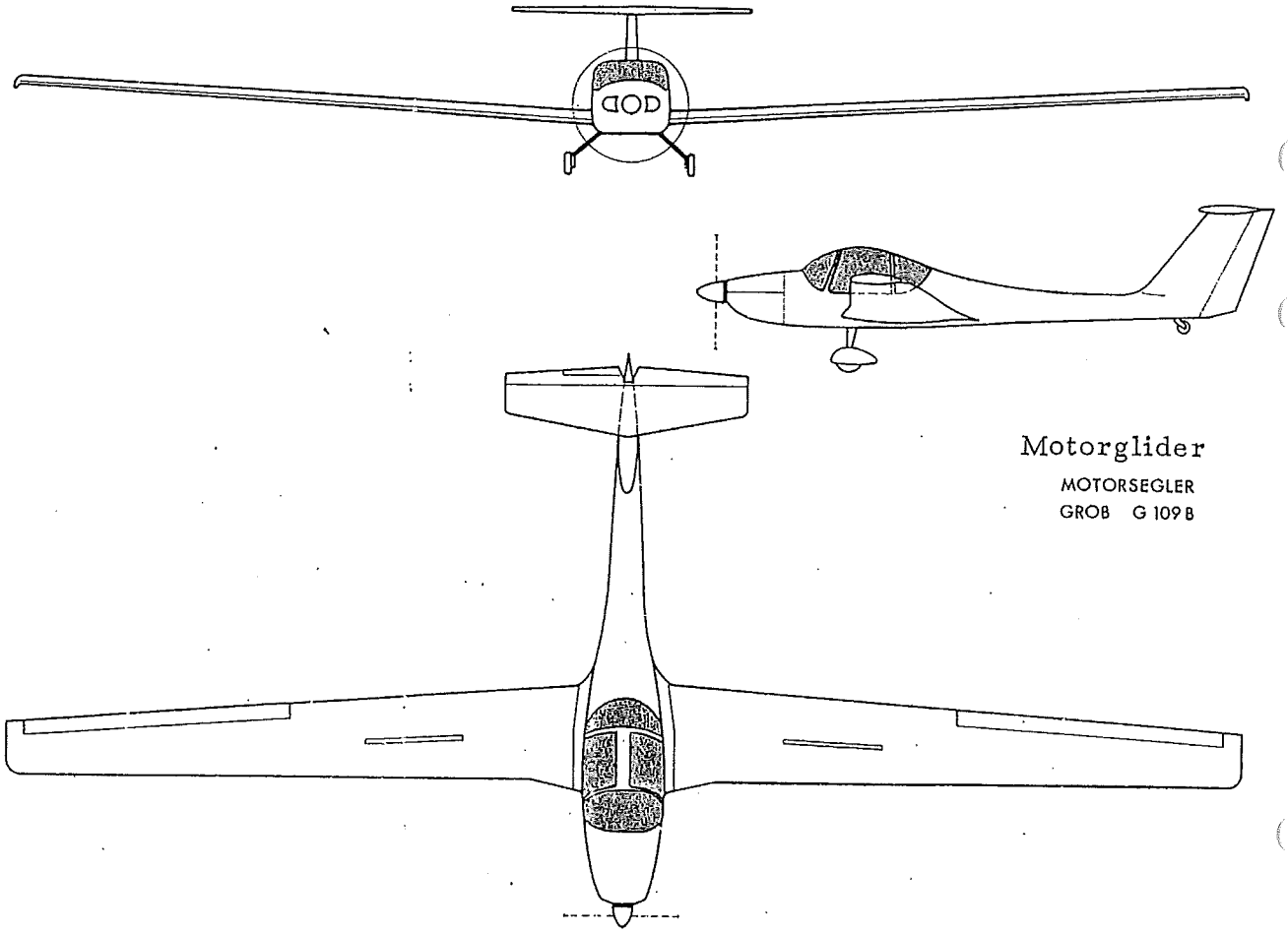
I.4 Total view



I. 5. Three plane view



I.6. Description

The G 109 B is a two-seat motorglider with T-type stabilizer, fixed gear with fairings and air brakes extending out of the upper surface of the wings. The seats are arranged side-by-side.

This motorglider has been produced under the latest technology of industrial glass fiber and carbon fiber design. The G 109 B is a further development of the G 109. It is designed for instruction, training, competition and cross-country flights.

Technical data:

Wing span:	17.4 m (57.09 ft.)
Length:	8.1 m (26.57 ft.)
Height:	1.7 m (5.58 ft.)
Wing ratio:	15.9
Wing area:	19 m² (204.5 sq.ft.)
Max. gross weight:	850 kg (1874 lbs.)
Max. wing load:	44.7 kg/m² (9.16 lbs/sq.ft)
Airfoil:	E 580
Engine:	GROB 2500
	(64 kW/87 PS rated at 3000 RPM)
Propeller:	Hoffmann Ho-V62 R/L 160 BT

Approved by LBA

II. Operating limitations

II.1. Category of airworthiness:

U (Utility) according to JAR 22

Certification Basis: Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes (JAR-22), dated April 2, 1982, with modifications dated Sept.13, 1982

II.2. Permitted Operations:

The motorglider is certified for VFR flights during daytime (VFR day).

IFR-flights and flights in known icing conditions, aerobatics, and cloud flying are prohibited.

II.3. Minimum equipment:

- 1 airspeed indicator (300 km/h, 186 mph, 162 Kts.)
- 1 altimeter
- 1 RPM indicator
- 1 Tachometer hour counter
- 1 Oil pressure indicator
- 1 Oil temperature indicator
- 1 Ammeter
- 1 Fuel quantity indicator
- 1 Magnetic compass
- 1 Cylinder head temperature gauge
- 2 4-belt seat harness
- Load placard
- Data placard
- Flight manual

Note of electrical installation:

Voltmeter (until S/N 6339):

red arc	8,0 - 10,7 V
red/green arc	10,7 - 12,0 V
green arc	12,0 - 15,0 V
red arc	15,0 - 16,0 V

Ammeter (until S/N 6339):

without markings

Voltmeter (beginning at S/N 6340):

yellow arc	6,0 - 10,0 V
green arc	10,0 - 15,0 V
yellow arc	15,0 - 16,0 V
red line	16,0 V

Ammeter (beginning at S/N 6340):

green arc		- 10 to + 10 A
yellow arc		- 20 to - 10 A
	and	+ 10 to + 20 A
red line		- 20 and + 20 A

If during flight the pointer climbs in the red range (15 or 16 V and/or 20A), reduce RPM. If the pointer stays in the red area switch off the master switch and trace the defect after landing.

Warning: All electrical flight control instruments are getting unable to function herewith.

II.4. Engine limitations

II.4.1. Type of engine: GROB 2500 E1 (single ignition) or GROB 2500 D1 (double ignition)

II.4.2. RPM limitations (RPM indicator markings)

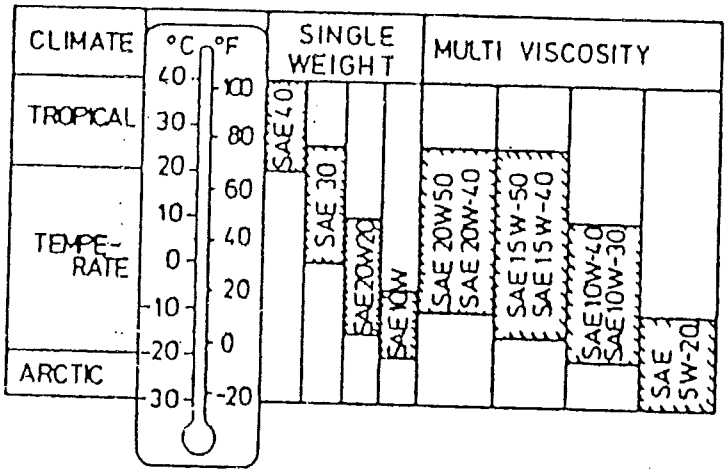
Maximum RPM (red line)	3400 RPM
Caution range (yellow arc)	3000 - 3400 RPM
Operating range (green arc)	700 - 3000 RPM

RPM (aircraft not in motion) with Hoffmann Ho-V62 R/L 160 BT:

Takeoff setting:	2700 $\pm$ 100 RPM
Cruise setting:	2000 $\pm$ 100 RPM

II.4.3 Lubrication

Do not use alloyed or unalloyed aviation oil!
Use only "SAE"-oil for internal combustion engines.



Capacity: min. 1.75 ltr., max. 3.5 ltr.
min. 1.85 qts., max. 3.7 qts.

Note: The oil level indication at the dipstick is almost equal for flight or ground attitude. Filling to just below the upper mark is sufficient. Too much oil will be drained through the vent lines and will run along the fuselage bottom.

Oil pressure:		
	Minimum (red line)	1 bar (14.5 PSI)
	Operating range (green arc)	1 - 5 bar (14.5-72.5 PSI)
	Maximum (red line)	5 bar (72.5 PSI)

Jan.15,1990

Approved by LBA

Oil temperatures:

Max. Oil temperature (red line)	120°C
Cautionary range (yellow arc)	100° - 120°C
Operating range (green arc)	50° - 100°C
Min. temp. (red line) until S/N 6339	50°C
Caut. range (yellow arc) begin. at S/N 6340	40° - 50°C
Optimum operating temperature	80° - 100°C

II.4.4 Fuel:

Gasoline AVGAS 100 LL or Automobile fuel (min. ROZ 96.0 octane) or SUPER unleaded (min. ROZ 96.0 octane) (refer to SB 817-46)

Only name-brand gasoline should be used.
Fuel additives may not be used.

Fuel capacity: 100 ltr. (22.0 Imp.gal., 26.4 U.S. gal.)
70 kg (154 lbs)
useable: 98 ltr. (21.6 Imp.gal., 25.9 U.S. gal.)

Note: Due to the installation position of the quantity meter, fuel quantity indications on the ground or flight are almost identical. At the "empty" indication, 4 ltrs. (0.9 imp.gal., 1.1 U.S.gal.) of fuel are remaining.
"Full" is indicated between 95 and 100 ltrs. (20.9 - 22.0 Imp.gal., 25.1 - 26.4 U.S. gal.) total fuel. So initially the fuel indicator needle will not move after starting when the tank is completely filled.

II.4.5 Cylinder-head temperature:

Max. Cyl.-head temperature (red line)	250°C

Additionally beginning at S/N 6340:

Cautionary range (yellow arc)	0° - 120°C
Operating range (green arc)	120° - 220°C
Cautionary range (yellow arc)	220° - 250°C

Note: engine full power	min.	120°C
engine shutdown	max.	150°C

Approved by LBA

09.03.98

II.5. Operating instructions for the variable pitch prop

Series: Ho-V62-R/L 160 BT with spinner
VP 30 - 82

The prop has three positions:
- climb
- cruise
- feather

Number of blades: two
Diameter: 160 cm ± 0.5 cm (63 inches ± 0.2 in.)

Instructions for the 50 hr-inspections are contained in the operating- and maintenance manual HO-V62.

With running engine the prop can be adjusted from "climb" to "cruise" and vice versa. The prop must be feathered with engine off and prop windmilling.

To change from "climb" to "cruise" the engine RPM must be 2300 RPM, the airplane speed must be about 120 km/h (64.8 kts, 74.6 mph).
The adjustment at higher speeds (dive) is not allowed, because the adjusting forces will become unacceptably high.
To adjust the prop from "cruise" to "climb", RPM and speed must be reduced to 1400 RPM and 110 km/h (59.4 kts, 68.35 mph).

When releasing the prop from "feather" with dead engine it is automatically positioned to "climb".

Adjusting the prop from "climb" to "cruise" and vice versa is accomplished by pulling the prop control knob on the center console. The prop can be feathered by pulling the handle above the prop control knob and rotating it by 90° clockwise to lock the prop in the desired position.

II.6. Airspeed limitations and load factors limits

Maximum allowable airspeed (calm air):

V_{NE} = 240 km/h	130 kts	149 mph

Maximum allowable airspeed (rough air):

V_B = 170 km/h	92 kts	106 mph

Maneuvering speed:

V_M = 170 km/h	92 kts	106 mph

Maximum speed with airbrakes extended:

V_{LE} = 240 km/h	130 kts	149 mph

Stall speed with airbrakes extended:

V_{S1} = 80 km/h	43 kts	50 mph

Stall speed with airbrakes retracted:

V_{S0} = 73 km/h	39 kts	45 mph

All speeds are indicated airspeeds (V_{IAS}).

Calibrated airspeed is indicated airspeed corrected for position error (CAS = IAS + V_i).
On page 15 the calibrated airspeeds (V_{cas}) are determined (airspeed indicator calibration table)

The following acceleration forces may not be exceeded:
(airbrakes retracted, symmetrical maneuvers)

at maneuvering speed	+ 5.3	- 2.65
at maximum allowable speed	+ 4.0	- 1.5

Rough air is defined as turbulence that can be expected in wave rotors, thunderstorms, whirlwinds and when crossing mountain ridges.

Maneuvering speed is the highest speed at which full deflection of controls is considered in calculations. At the maximum allowable airspeed only 1/3 of the full deflection is considered. If the elevator is deflected, the maximum allowable accelerations must not be exceeded. Please note, that with increasing altitude true airspeed increases versus indicated airspeed.
There is no trouble concerning the strength, but the danger of flutter is increased.

Use following table to find V_{NE} at various altitudes:

Altitude:	V_{NE} (IAS)
0-2000 m (0-6500 ft)	240 km/h (130 kts)
3000 m (10 000 ft)	225 km/h (122 kts)
4000 m (13 000 ft)	214 km/h (116 kts)
5000 m (16 500 ft)	203 km/h (110 kts)
6000 m (20 000 ft)	192 km/h (104 kts)

By our present experience the pitot-static-system is insensitive to icing.

Table of indicated airspeeds

(airspeed indicator calibration table)

This table shows airspeed indicator errors due to the position of the pitot pressure port.
Pitot pressure source: Pitot - static tube at the vertical stabilizer.

V_{IAS} - Indicated airspeed

V_{CAS} - Calibrated airspeed

V_{IAS} (kts)	V_{CAS} (kts)	V_{IAS} (kts)	V_{CAS} (kts)
40	39	86	86
43	43	92	92
49	49	97	97
54	54	103	103
59	59	108	108
65	65	113	113.5
70	70	119	119.5
76	76	124	125
81	81	129.5	131

Note the good comparison between indicated and calibrated airspeed throughout the complete speed range. Only near the maximum speed are there any appreciable deviations.

Airspeed indicator markings: (IAS)

Red line (maximum allowable airspeed):

240 km/h	130 kts	149 mph

yellow arc (caution range):

170-240 km/h	92-130 kts	106-149 mph

green arc (normal range):

83-170 km/h	45-92 kts	52-106 mph

yellow triangle (approach speed):

115 km/h	62 kts	71 mph

blue line (best climb; prop in "climb"):

110 km/h	59 kts	68 mph

II.7. Crew : 2 persons
Minimum crew : 1 person

Caution: Solo-flights may only be conducted from the left seat! (Right hand permitted for instructor proficiency only.)

II.8. Weights

Empty weight	620 kg	(1367 lbs.)
Max. gross weight	850 kg	(1874 lbs.)
Max. weight of non-lifting parts	670 kg	(1477 lbs.)
Max. wing load	44.7 kg/m²	(9.16 lbs/sq.ft)

The empty weight doesn't enclose additional equipments.

II.9. Center of gravity at flight weight

The approved range of center of gravity positions during flight is

271 mm (10.7 in.) to 427 mm (16.8 in.)

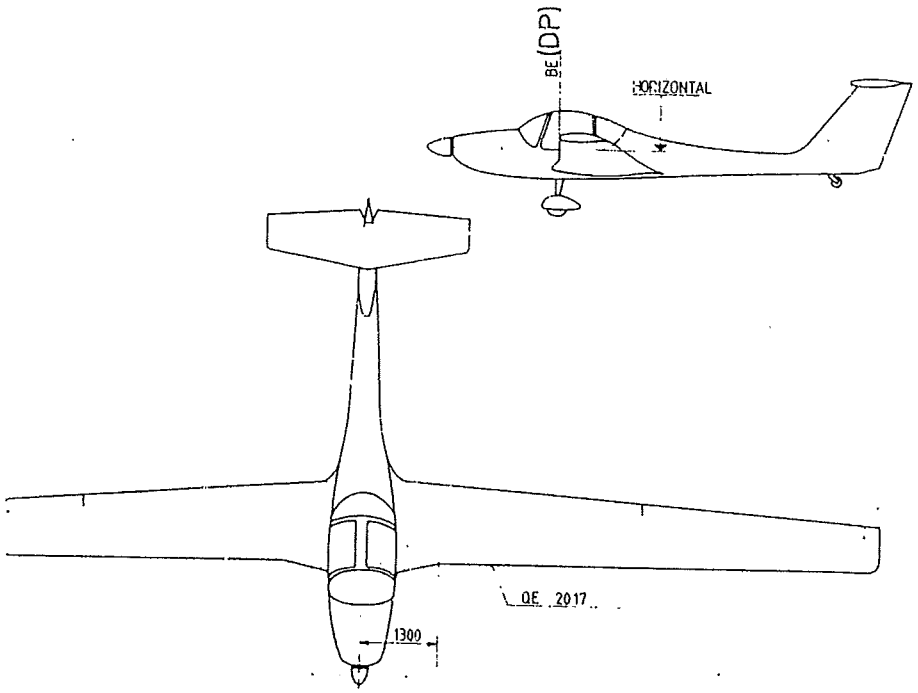
behind the datum line, equivalent to

24% to 38%

of the MAC of 1.1247 m (44.3 inches)

Datum plane (DP): Leading edge at span 1.3 m (4.3 ft.)
(Out of oblique wing-fuselage fairing)

Aircraft attitude: edge of door frame horizontal



II.10. Load table

Load on both seats (Pilot and other occupant including parachutes).

Solo-flights:

min. 70 kg (155 lbs.)
max. 110 kg (242.5 lbs.)

Two-seated:

max. 220 kg (485 lbs), 110 kg (242.5 lbs) on each seat

However the maximum takeoff weight of 850 kg (1874 lbs.) may not be exceeded. Fuel quantity and baggage have to be reduced accordingly (see examples pg. 59 and 60)

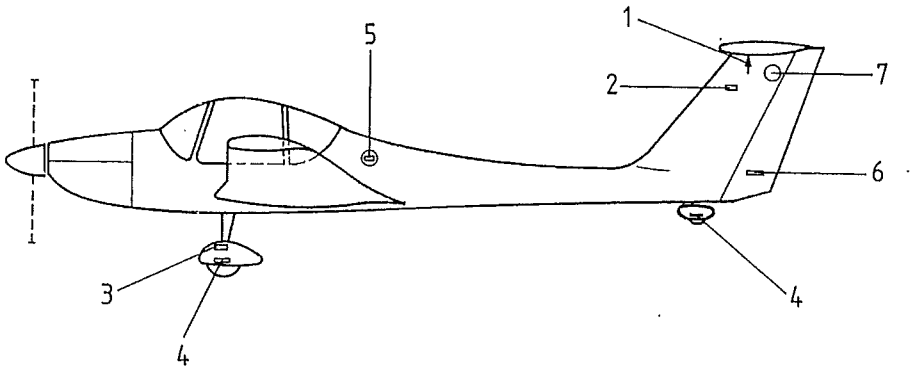
Fuel max. 70 kg (154 lbs.) = 100 ltr. (26.4 US.gal)
Baggage max. 20 kg (44 lbs.) incl. Oxygen-bottle

Caution: Pilot's weight of less than 70 kg (155 lbs.) must be raised by using trim weight secured on the seat. "Trim-weights" which attach to the lapbelt can be ordered from the manufacturer of the aircraft.

If mounting supports are fastened on the floor, trim weights for pilot weight from 55.0 kg (121 lbs.) to 69.9 kg (154 lbs.) can be carried. (Trim weights factor: 0.74 m; 29.1 in. in front of DP)

For calculation of CG at flight weight see page 55.
For positions of CG at empty weight see page 53.

II.11. Placards



1 Arrows for correct mounting of stabilizer
2 Note: Elevator quick-locks connected
3 Note: No step
4 Tire pressure
5 Fuel type
6 Note: Do not lift
7 Inspection window: Elevator connections

D-KECY (Example)

Registration in the center of panel cover

The height of 20 cm (7.9 inch) is LBA approved.

Canopy Jettison and Emergency Exit

- Pull first red handle and than emergency jettison handle fully back
- Push door up and away
- Release safety harness
- Stand up and exit over left or right side
- When using a manual parachute grip release and pull firmly to full extent after 1-3 seconds

below canopy frame right side

Maximum flying weight 850 kg 1874 lbs

Airspeed limits		km/hr	kts	mph
Never exceed	V_{NE}	240	130	149
In rough air	V_B	170	92	106
Manoeuvring		170	92	106

below canopy frame right side

Altitude (ft)	0-6500	10 000	13 000	16 500	20 000
VNE (KIAS)	130	122	116	110	104

below canopy frame right side

Payload (pilots and parachutes)

Minimum payload left: 70 kg, 154 lbs

(Less weight must be compensated with ballast in the seat)

Maximum payload right or left: 110 kg, 243 lbs

The maximum gross weight must not be exceeded.

below canopy frame right side

Parking brake | Carburetor heat

Choke | Cabin heat

lables on operating knobs on center console

Fuel capacity

100 ltr. 22,0 imp gal. 26,4 US gal.

Open | closed

fuel shutoff valve (center console)

nose down TRIM nose up

near trim handle on center console

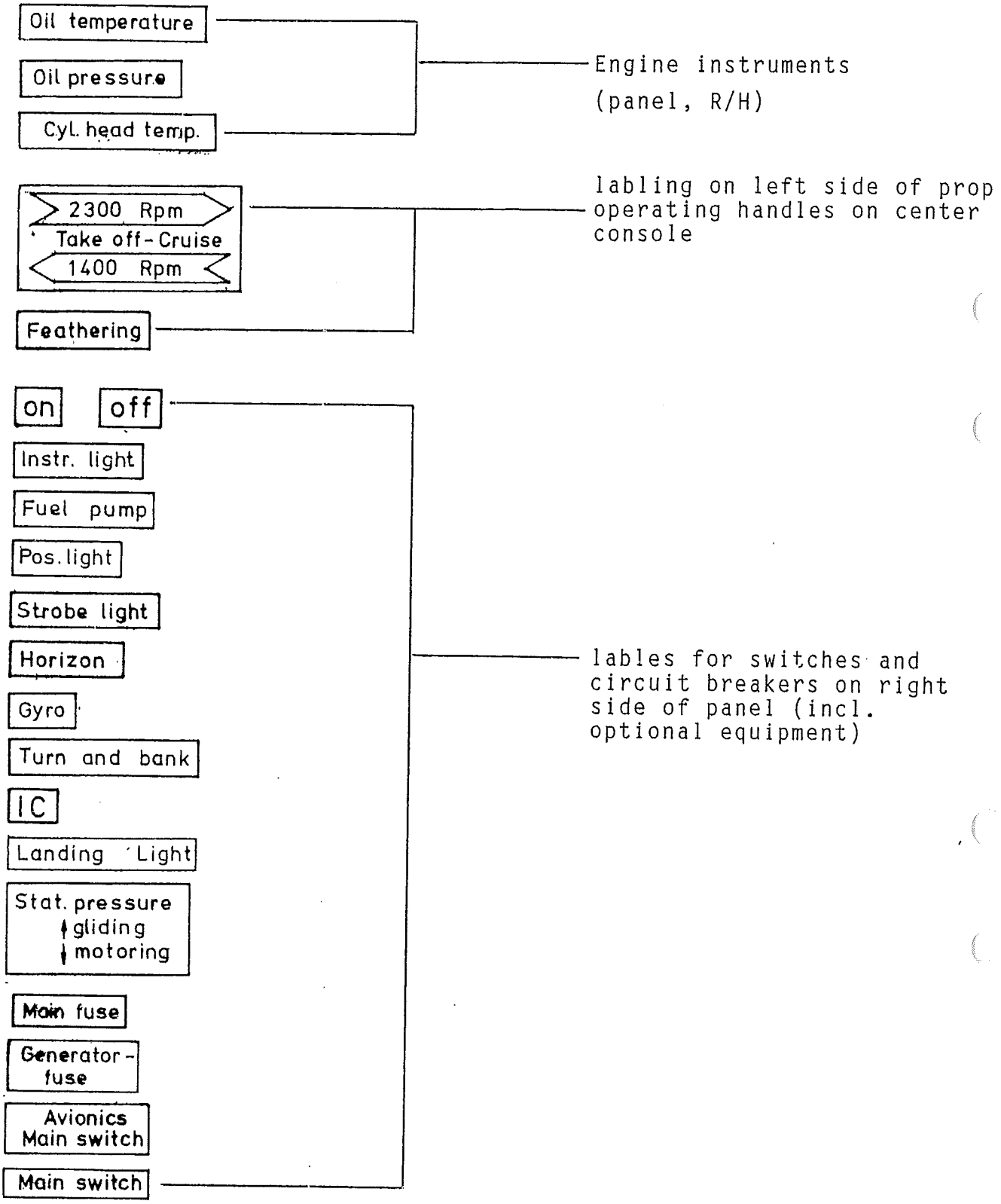
Baggage

max. 20 kg, 44 lbs

baggage compartment

Sept. 1, 1983

Approved by LBA


Oil temperature
Oil pressure
Cyl. head temp.
Engine instruments (panel, R/H)
2300 Rpm
Take off - Cruise
1400 Rpm
Feathering
labling on left side of prop operating handles on center console
on
off
Instr. light
Fuel pump
Pos. light
Strobe light
Horizon
Gyro
Turn and bank
IC
Landing Light
Stat. pressure
gliding
motoring
Main fuse
Generator - fuse
Avionics Main switch
Main switch
lables for switches and circuit breakers on right side of panel (incl. optional equipment)

Tire pressure
2,5 - 2,8 bar
36,0-39,8 psi

all 3 wheel fairings

Oil
SAE 15W-40

next to oil dipstick at L/H air intake

FUEL
100 Ltr.
- AVGAS 100 LL
- min. ROZ 96,0 octane
- SUPER UNLEADED

Fuel capacity
100 ltr. 22,0 imp gal.
26,4 US gal.

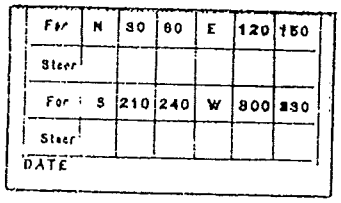
at fuel filler cover L/H fuselage

Dont push or lift here

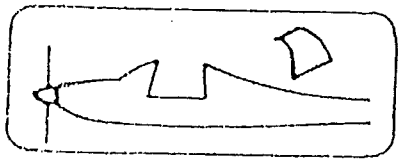
on both sides at bottom of rudder

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

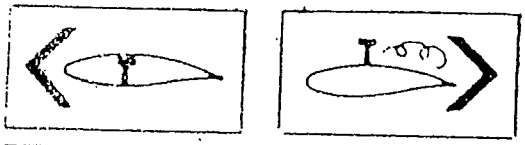
at L/H top of fin



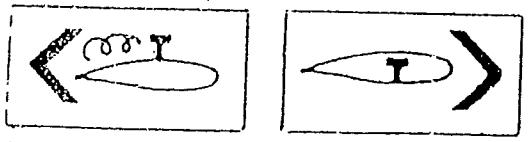
Deviation table (near the magnetic compass)



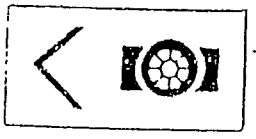
Canopy emergency jettison at cabin roof



Airbrake lever R/H board side



Airbrake lever L/H board side



(only until S/N 6339)

Wheelbrake symbol at the airbrake lever: on R/H and L/H board side

NO STEP — both main wheel facings

Open closed — at handle of folding door

 — 4 arrows at tailunit

Trim weights	
Pilot weight including parachute kg / lbs	Number
55 - 62,4 121,3 - 137,6	2
62,5 - 69,9 137,8 - 154	1
70 - 110 154,3 - 242,5	0
two - seated	0
1 Trim weight yellow 2,3kg, 5lbs	

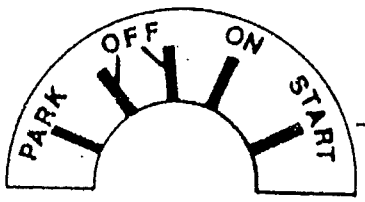
— below canopy frame (only if mounting supports are installed)

WARNING
This entire structure supports the spar connection. Do not drill. Before installing additional equipment refer to maint. manual.

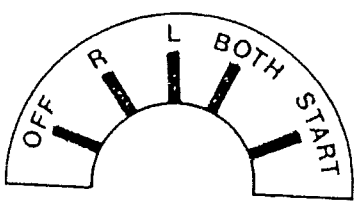
— front of spar connection unit

No smoking — on left side of panel

External supply 12V ⎓ DC — external plug (dependant on equipment)



Single ignition



Double ignition

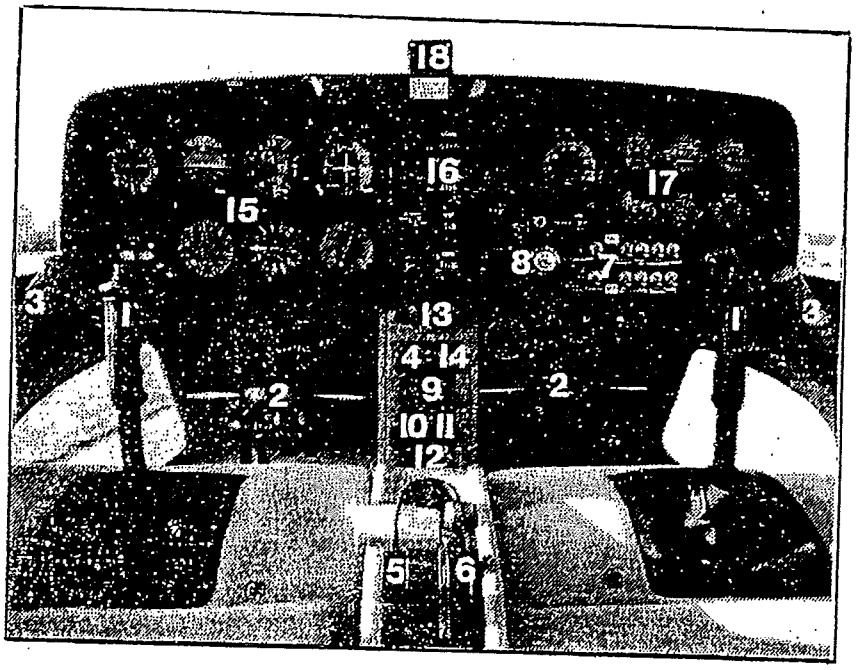
ignition lock

Jan.15,1990

Approved by LBA

III. Normal operating procedures

III.1. Cockpit layout and controls



1 Control stick
2 Rudder pedals (with toe brakes)
3 Airbrakes
4 Parking brake (*)
5 Throttle (at S/N 6340 and subsequent there is a second throttle at the left panel side)
6 Elevator trim
7 Master switch
8 Ignition and starter
9 Choke (*)
10 Heating (*)
11 Carburetor heat (*)
12 Fuel shutoff valve
13 Prop feather handle
14 Prop control knob
15 Flight instruments
16 Radio and Avionics
17 Engine instruments
18 Compass

There is a new design of the right panel side at S/N 6340 and subsequent (see also FM page 20 and 20a). These S/N' s have also an elapsed time indicator with a dynamic pressure switch which counts the engine time only during flight.
As of S/N 6500, the main switch and ignition key were positioned new on the right side of the instrument panel.
The RAF-model comprises the following modifications:
- main switch and toggle switch line in center of panel
- control lights, main and avionic fuses are new located within the right side of the instrument panel

Ripcord attachment-points (red marked) are located behind back-rest on the left and right side close to the fuselage skin.

(*) At S/N 6340 controls adjustable (right turn to stop, left turn to release)

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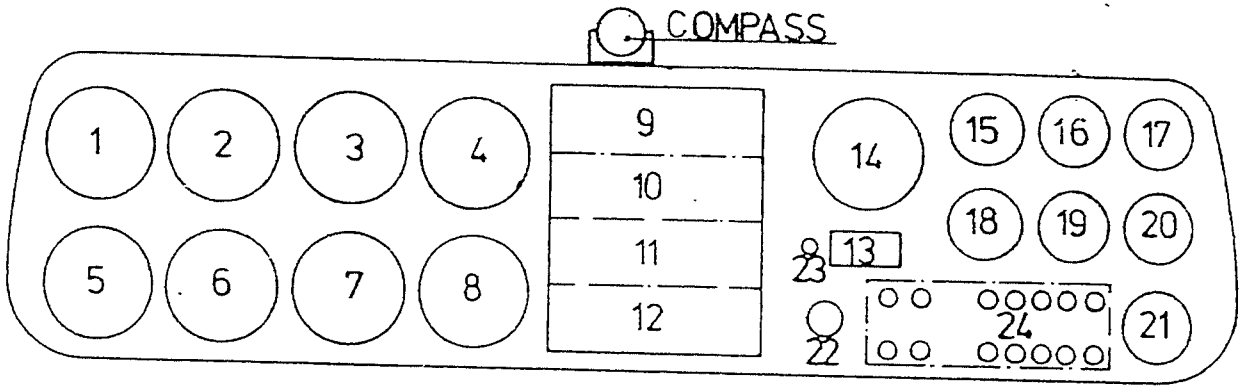
INSTRUMENT PANEL MOTORSEGLER G 109 B



Instrument panel left side:
flight instruments

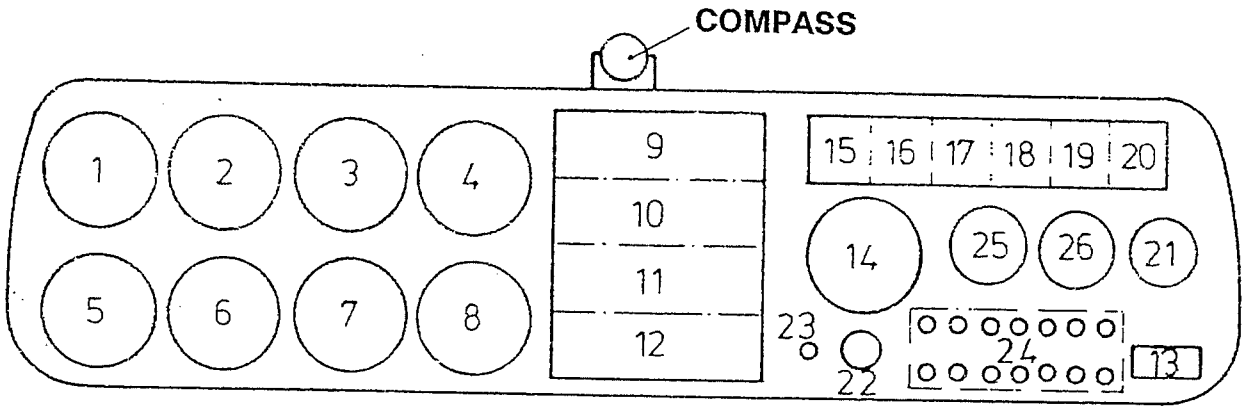
Instrument panel middle:
Radio and Avionics

Instrument panel right side:
Engine instruments and switches

1 Airspeed indicator
2 Horizon
3 Altimeter
4 NAV-indicator
5 Space for optional equipment
6 Directional gyro
7 Variometer
8 ADF indicator
9 COM control
10 NAV control
11 ADF control
12 Transponder
13 Elapsed time indicator
14 RPM indicator
15 Fuel quantity
16 Oil temperature
17 Voltmeter
18 Cyl. head temperature
19 Oil pressure
20 Ammeter
21 Temperature (outside)
22 Ignition lock
23 Charge control lamp
24 Switch board

The circuit breakers are located below the left panel side. (List of circuit breakers see Instructions for continued airworthiness).

INSTRUMENT PANEL MOTORGLIDER G 109 B



Instrument panel left side:
flight instruments

Instrument panel middle:
Radio and Avionics

Instrument panel right side:
Engine instruments and switches

This instrument panel is installed in S/N 6340 and subsequent.

Special instrument panels with different instrument arrangements are possible.

1 Airspeed indicator
2 Horizon
3 Altimeter
4 NAV-indicator
5 Space for optional equipment
6 Directional gyro
7 Variometer
8 ADF indicator
9 COM control
10 NAV control
11 ADF control
12 Transponder
13 Elapsed time indicator
14 RPM indicator
15 Fuel quantity
16 Cyl. head temperature
17 Oil pressure
18 Oil temperature
19 Voltmeter
20 Ammeter
21 Temperature(outside)
22 Ignition lock
23 Charge control lamp
24 Switch board
25 Optional equipment
26 Optional equipment

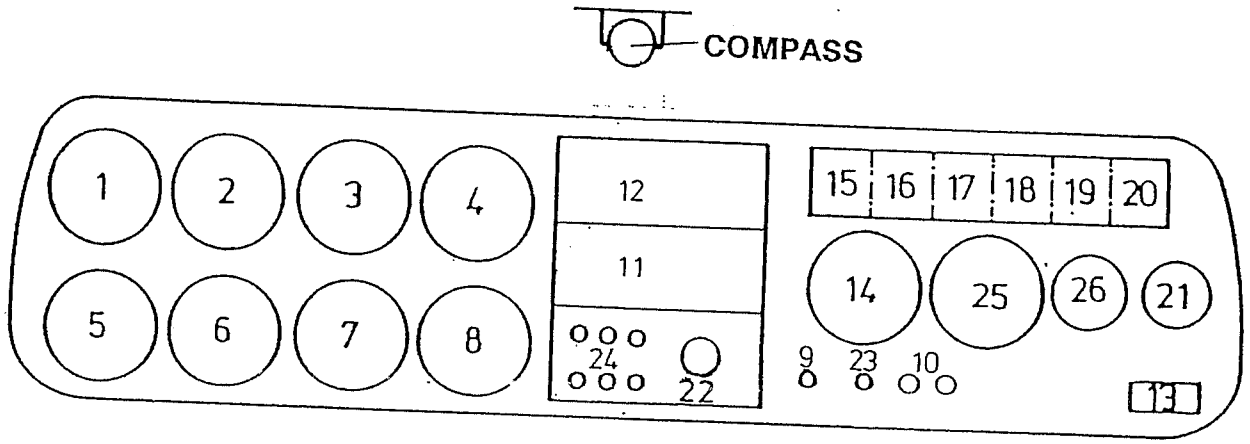
Up to s/n 6500 in the RH-side of the panel are new installed the Master switch and the ignition switch.

The circuit breakers are located below the right panel side. (List of circuit breakers see Instructions for

continued

INSTRUMENT PANEL MOTORGLIDER G 109 B

RAF-Ausführung



Instrument panel left side: flight instruments

Instrument panel middle: Radio and Avionics

Instrument panel right side: Engine instruments and switches

1 Airspeed indicator
2 Horizon
3 Altimeter
4 G-meter
5 Turn and Bank
6 E-Vario
7 Vario
8 Dash board clock
9 Starter warning light
10 Mainfuse, Generator fuse
11 VHF
12 Transponder
13 Elapsed time indicator
14 RPM indicator
15 Fuel quantity
16 Cyl. head temperature
17 Oil pressure
18 Oil temperature
19 Voltmeter
20 Ammeter
21
22 Ignition lock
23 Charge control lamp
24 Switch board
25
26

The circuit breakers are located below the right panel side. (List of circuit breakers see Instructions for

III.2. Daily inspections

Prior to flight operations the following visual exterior checks have to be performed (see also pg. 22):
First ensure ignition and main switch are off.

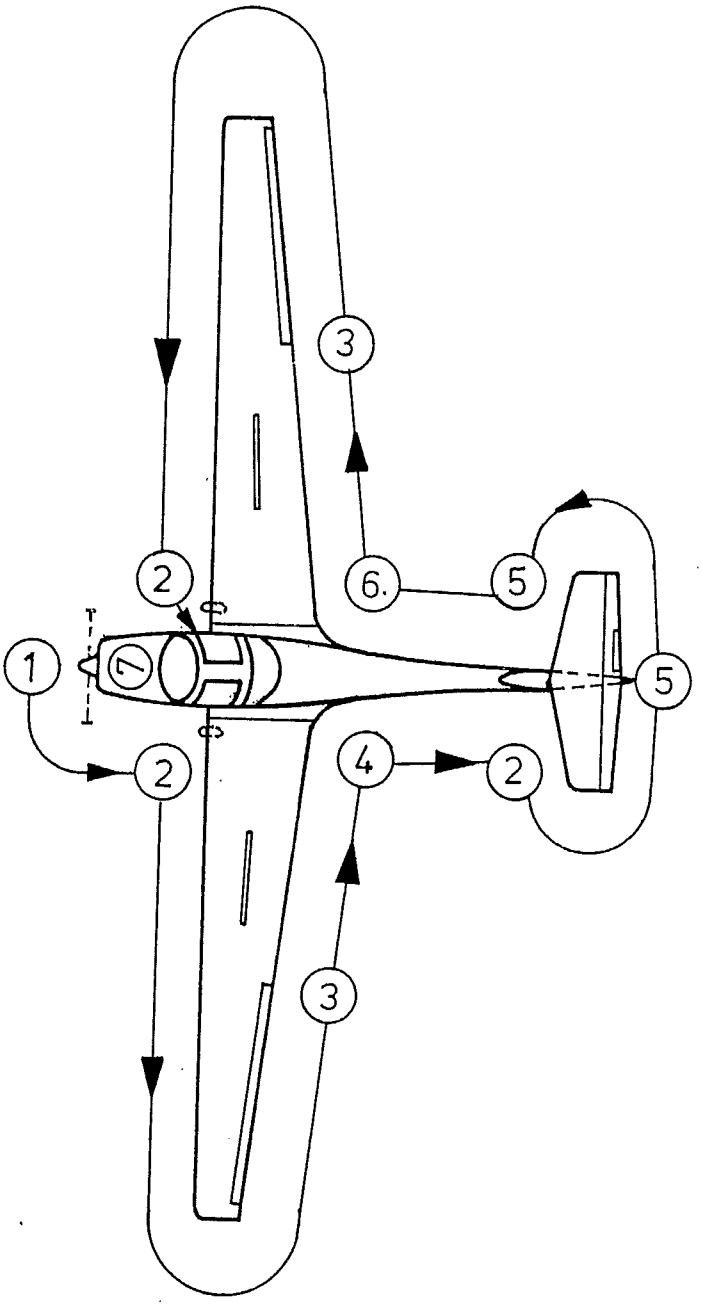
1. Engine
   - Check the prop blades for cracks and dents and proper installation (radial play up to 1.5° permitted)
   - Remove cowling
   - Check oil quantity min. 1.75 ltr, max. 3.5 ltr. (min. 1.85 qts., max. 3.7 qts.) view page 10
   - Visually inspect the engine
   - Install cowling

   Note: For further details refer to Prop and Engine manuals.

2. Gear
   - Tire pressure (main and tailwheel 2.5 bar; 36.26 psi ea.)
   - Check slip marks, tire condition and fairings
3. Wings
   - Condition
   - Attachment
   - Airbrakes
   - Aileron play and freedom of movement
4. Tank and wing connections
   - Drain by pressing the drain valve located at the bottom of the fuselage
   - Check fuel quantity through tank filler neck
   - Mainbolt, nosebolt and existing electrical connections-check

The last step is performed through the inspection plate in the fuselage-wing-fairing.

Warning: Close the inspection plate carefully! (s.p. 42)


3
2
6
5
1
5
2
4
2
3

5. Tail unit
   - Proper installation
   - Securely locked
   - Control connections locked
   - Freedom of movement
   - Damage
   - Pitot pressure tube (vertical fin) checked, cover remove

6. Fuselage
   - Damage

7. Cockpit
   - Folding doors and locking mechanism checked and, if necessary, cleaned
   - Check for loose items in the cockpit.

III.3. Preflight inspection

1. Daily inspection completed?
2. Oil and fuel quantity
   Oil level stick can be reached through maintenance cover in the engine cowling.
   To refill oil the upper cowling has to be removed.
3. Weight and balance calculation (See load table at page 18)

III.4. Before starting engine

1. Each rudder pedal adjusted correctly side by side in neutral rudder position (red knobs to adjust on each pedal, lock the red knobs positively). At S/N 6340 a handwheel is installed in the floor for the simultaneous adjustment of both pedals. Adjust the back rest.	
2. Seat harness tight and ripcord attached (automatic parachutes only).	
3. Folding doors	- locked
4. Parking brake	- set
5. Radio and Nav.-equipment	- off
6. Fuel shutoff valve	- open
7. Controls	- free movement
8. Airbrakes	- extend; then retract and lock
9. Altimeter	- set
10. Instruments	- set

III.5. Starting the engine

1. Prop. position	- "climb" (pull the below prop control knob back by 10 cm; 4 in.
2. Choke	- pull with cold engine
3. Throttle	- advance 2 cm (1 in.) out of idle or shut when using choke
4. Propeller	- clear of persons and objects
5. Master switch	- on
6. Auxiliary fuel pump	- on
7. Electrical instruments	- check (12 V Battery voltage, fuel supply)

8. Anti-collision lights - on
9. Start the engine starter with ignition key (release immediately if the engine picks up). With the single ignition engine the key goes back to position ON. You have two positions OFF. The key can only be removed in position PARK. With the double ignition engine the key goes back to position BOTH. You have the positions R and L. The key can be removed in position OFF.
10. Adjust throttle and choke (as needed) so that the engine is running smoothly between 1000 - 1200 RPM.
11. Check the oil pressure; if no indication after 10 sec. shut off the engine.
12. Avionic main switch - on after the engine is running
13. Radio and Nav. equipment - on when required
14. Charging current - check

Note: The auxiliary fuel pump must be switched on during take off, climb, and landing.
During normal cruising the aux. fuel pump should be switched off. If the engine does not fire after five starting procedures propably too much fuel was ingested and the spark plugs are wet.

Then: 1. Ignition - off
2. Choke - off
3. Throttle - full power
4. Rotate the prop about 10 times backwards manually

New starting procedure:

5. Choke - off
6. Throttle - full power
7. Ignition - on
8. Starter - engage

After the engine is running reduce throttle to between 1000 and 1200 RPM.

When the engine is already warm prior to starting, do not use choke and only a small amount of power.

If the battery is low after the starting procedure with external power supply with 12 V DC (i.e. with external power receptacle), the motor should not exceed 1700 RPM, as long as the ammeter indicates less than 10 ampere.

III.6. Warm-up and run-up

The engine should be running at 1000 to 1200 RPM for about 2 min. before accelerating to 1500 RPM for 5 to 10 min. depending on outside air temperature to get an oil temperature of 50° C and a cyl. head temperature of 130° C. The indicati is relatively slow so that at the indicated temperature of 50°C sufficient operating temperature exists.

With cold engine the oil pressure can climb temporarily above 5 bar.

Run-up the engine in prop position "climb":

Parking brake	- set
Elevator	- pull back and hold
Throttle	- slowly advance to full power
RPM	- 2700 ± 100
Oil pressure and air temperature	- observe
Throttle	- idle (after apprx. 25 sec.)

Note: (Provided the engine is in good shape)
If only 2000 ± 100 RPM are reached with full power the prop is at "cruise" position and must be set to "climb" using the standard procedures

With engine hot, test function of carburetor pre-heating; push throttle fully, pull careburetor pre-heating. A distinct decrease in rotation (≥ 50 RPM) has to be recognized.

Magneto test (only for engine with double ignition)	- at 2400 RPM - check R (no RPM drop) - switch to BOTH - check L (no RPM drop) - switch to BOTH

(III.5. and III.6 also refer to Engine Manual)

III.7. Taxiing

Due to coupling of the rudder and tailwheel, the aircraft handling on the ground is simple.
To achieve a very small turn radius, an individual brake application of each wheel of the landing gear is possible with toe brakes fixed on the rudder pedals.
To decelerate the aircraft, either toe brakes (apply toe brakes simultaneously with the same strength) or airbrakes can be used.
In the full aft range, the airbrake handle operates both mainwheel brakes simultaneously.
When maneuvering the aircraft manually on the ground, the tailwheel disengages automatically and can be rotated 360°.

III.8. Before takeoff

0	Engine	- run-up (see III.6.)
1	Throttle	- unobstructed
2	Airbrakes	- locked
3	Folding doors	- locked
4	Emergency jettisoning	- secured
5	Trim	- neutral
6	Fuel shutoff valve	- open
7	Carburetor heat	- off
8	Auxiliary fuel pump	- on
9	Engine instruments	- checked
10	Parking brake	- released

Caution: It is always necessary to check for the open fuel shutoff valve. The engine will operate for appr. 2.5 min. with a closed valve.
A hurried takeoff can end tragically without fuel.

III.9. Takeoff and climb

Throttle	- advance smoothly
Directional control	- maintain
Lift tailwheel	- at 40 km/h (21.6 Kts.)
Lift-off	- at 85 km/h (46 Kts.)
Climb speed	- 90 - 110 km/h (49-60 Kts.)
Oil temperature	- monitor (max. 120° C)

Note: If the oil temperature exceeds 120° C, continue flying at higher speeds for better cooling effect (130 km/h; 70 kts.).
Maximum effective cross wind for takeoff and landing on wet and dry surfaces is 20 km/h (11 kts.).

After initial climb (altitude ~100 m, 330 ft.):

Auxiliary fuel pump	- off
Best angle of climb	- at 90 km/h (49 Kts.)
Best rate of climb speed	- at 110 km/h (60 Kts.)

III.10. Horizontal flight and cruise

To change the prop position from "climb" to "cruise", RPM must be adjusted to 2300 RPM (airplane speed about 120 km/h; 64.8 Kts.). Then pull back the prop control knob momentarily about 7 cm (3 in.). Afterwards a RPM-drop of appr. 500 RPM occurs without changing the throttle.

Note: When advancing the throttle to full power, the RPM exceeding its initial value indicates that the propeller is still in "climb" setting and the procedure must be repeated.

After adjustment of propeller configuration, the motor-glider gathers speed slowly. Therefore it is recommended to climb over cruising altitude, in order to reach, in a dive, the cruising speed.
Recommended "cruise" : 2000 - 2800 RPM

Under high relative humidity and outside air temperatures of up to 25° C, carburetor icing can occur indicated by rough-running engine or even engine failure. Whenever carburetor icing is suspected, immediately pull the carburetor heat full. (It is not recommended to use intermediat positions) While flying under weather conditions prone to carburetor icing, pull the carburetor heat at frequent intervals. If a small RPM-drop of 100 or 200 RPM occurs and stays, this is a safe indication that no icing exists in the carburetor. If a RPM-drop of 50-200 RPM occurs and stays, this is safe be a sign for the existence of a slight carburetor icing which is melted off. In this case the carburetor heat is to stay pulled until the icing conditions have stopped. The effect of the carburetor heat is intensified by shutting the cabine heat.

Note: Full deflection of controls is considered only up to 170 km/h (92 Kts.) (maneuvering speed). Accordingly, at higher speeds, control movement should be limited carefully by the pilot. If the elevator is deflected, the maximum allowable acceleration forces (II.6) must not be exceeded.

III.11. Engine shutdown and restart in flight

The engine should be idling until the cylinder head temperature is 150°C. Reduce airspeed to 100 km/h (54 Kts.).
Before the engine-shutoff turn off certain electrical equipment (i.e. radios, electric varios, etc.) with help of the avionic main switch to avoid damage caused by excessive voltage peaks.
Turn off the ignition and then feather the wind-milling prop by pulling the feather handle bach about 17 cm (7 in.) and rotate it 90° clockwise. Now avionic main switch can be switched on again.

Caution: The prop may only be feathered with engine off and prop windmilling. (Soaring see also III.15)

Note: During unpowered flight, all unnecessary electrical equipment must be switched off to assure sufficient electrical power to restart the engine. This happens if the engine is stopped. All the large electrical current consumers (i.e. position and strobe lights, landing light) are switched off by an automatic relay. Battery capacity has been designed for a 5-hour unpowered flight with operating radio and electic varios.

After a 10-hours unpowered flight the wind milling RPM at speeds between 140 km/h (80 kts) and 180 km/h (105 kts) is sufficient to airstart the engine without starter. First turn on ignition, then unlock the prop feather handle and push in slowly. Increase the airspeed until the engine starts. Normally the propeller starts turning before the handle is completely pushed in.

About 350 feet will be lost in a normal windmill air start, so an air start should not be attempted below 1300 feet above ground. We recommend to exercise the air start before.

To achieve the above altitude loss, the stick must be pushed immediately forward. Having reached an airspeed of approximately 150 km/h (84 kts) (IAS) the propeller feathering lever must be eased gradually into the take-off position. If the engine does not fire, repeat the procedure (propeller feathered -->take-off position).

To airstart the engine normally the prop feather handle is unlocked, rotated 90° counter-clockwise, and pushed forward. The propeller is now adjusted to the starting position.

- Turn off the avionic main switch
- Maintain airspeed 120 km/h (65 Kts.)
- Choke and throttle according to engine temperature
- Ignition on
- Engage starter
- Turn on the avionic main switch

All electrical current consumers are switched on again by the automatic relay.

Use Caution not to apply high power settings at low engine temperatures to avoid unnecessary damage. Use the same technique to warm-up as described in para. III.6.

III.12. Descent

Reduce power, pull carburetor heat and trim for 115 km/h (62 kts), if necessary, use airbrakes. During longer descents under certain weather conditions, carburetor icing can occur (see para. III.10.). In this case close additionally the cabin heat control for better effectiveness. Watch out, that the parking brake is released.

III.13. Approach

Before approach put prop in "climb"-position:

Notice:

1. RPM	- 1400 RPM (speed 110 km/h; 59.4 kts.)
2. Prop control knob	- "climb" position prior to final (see para. II.5.)
3. Throttle	- back
4. Approach speed	- maintain 115 km/h (62 kts) yellow triangle on A/S indicator (turbulent air: perhaps higher speeds)
5. Auxiliary fuel pump	- on
6. Airbrakes	- as required (effective even for very steep approaches)

Caution: Keep the airbrake lever firmly in your hand to control the glidepath. Fully extended brakes increase the stalling speed. Side slips cannot be maintained continuously to control the glidepath. Airbrake lever should be returned to the locked position if hand is removed from airbrake handle.

At S/N 6340 and subsequent at the left airbrake lever a stop is installed, which can be thrown in or out by a little clutch.
If the stop is thrown in you can lock the airbrake lever in the middle position. In this position you can land only with handling the throttle. Also you can go around and climb with a little rate in this position. It is recommended to retract the airbrakes before balked landing to achieve maximum climbing performance.

If necessary you can move the airbrake lever in both directions also with the right lever and jump over the stop easy.
The side-slip is barely effective by using a 20 degrees angle and a speed of 110 km/h (60 kts. 68 m ph). You have only a small degradation in the airspeed system during slip maneuvers. The slip should be finished at a safe hight. Rudder effect reversal and control force reversal has not been observed. The aileron returns independently from the full deflected position. After moving the aileron into neutral position, the glider rolls out of the slip into wing level position. Using this method to end the slip the glider does not adopt unusual flight attitudes and deviates only slightly from its original flight course.

III.14. Landing

1. Airspeed	- reduce to minimum
2. Control stick	- pull back smoothly
3. Touchdown	- 3-point attitude
4. Airbrakes	- do not fully extend due to heavy breaking action(only until S/N 6339)

- After touchdown keep the stick fully aft and reduce speed either by operating the airbrakes in their extended position thus actuating the wheel brakes or make use of toe brakes.
- Maintain heading with rudder and the coupled tail-wheel

Caution: At S/N 6340 and subsequent the connection of airbrake and wheelbrake is inapplicable and you can only actuate the toe brakes.

Maximum effective crosswind for takeoff and landing on wet and dry surfaces is 20 km/h (11 kts).

Note: Do not retract the airbrakes immediately after touchdown because unintentional floating may occur.

After taxying to parking location:

1. Avionic main switch	- off
2. Auxiliary fuel pump	- off
3. All electrical current consumers	- off
4. Throttle (for cooling)	- idle
5. Ignition	- off
6. Master switch	- off
7. Parking brake	- set
8. Parking (see para. VI.3.)	

Note: At the end of the flight manual there is a removable checklist, which contains an excerpt of paragraph III.. This excerpt was made for training pilots and allows for easier handling in the cockpit.

III.15. Soaring

When entering updrafts, reduce throttle to idle. Shut off the engine upon reaching sufficient vertical velocity (see para. III.11.) and circle while maintaining 95 km/h (51 Kts).

Best glide-ratio is 1:28 at 115 km/h (62 Kts)

If a compensation nozzle and a transfer switch for static pressure is installed, switch from "motoring" to "gliding". If the engine is restarted, switch back to "motoring".

The aircraft shows no tendency to flutter over the complete range of speed from minimum to red-line speed. At a 30°-dive with fully extended airbrakes, maximum allowable airspeed will never be exceeded even at maximum gross weight.

III.16. Landing with dead engine

Start the approach from sufficient height. On final control the glidepath with airbrakes, if necessary.

III.17. Inspections after hard landings

After hard landings, or other undue stress during flight, the aircraft must be checked very thoroughly with the wings and elevator removed. If any damage is observed, consult authorized personnel or the manufacturer. Under no circumstances may the aircraft be flown until repairs have been completed.

After hard landings or groundloops inspect the following:
- Wheels
- Gear struts and suspension
- Rudder control rods
- Rudder actuator lever behind the tailwheel
- Wing spar at the root for white spots in GRP
- Main wing fittings (fuselage and root ribs)
- Spar connection unit

The spar connection unit is accessible if the baggage hold floor and the covering behind the back rests are removed.

A crash switch is installed in the RAF-version of the G 109B which is activated during a hard landing (> 3.6 g) cutting all power from the battery. This switch is located at the lower side of the instrument panel. Resetting the switch is accomplished manually.

IV. Emergency procedures

IV.1. Spin recovery

Intentional spinning within the frame of simple aerobatics is, according to para. II.2., prohibited.

Recover from unintentional spins with the following control movement.
1. Rudder full against spin direction
2. Stick full forward.
3. Ailerons neutral
4. Throttle idle
5. Hold the controls in position until rotation stops
6. Recover smoothly from dive.

You need for 1 spin turn, between 80 m (260 ft) and 100 m (330 ft), and have a sink rate of 26 m/s (5000 ft/min). To recover from the spin to the normal attitude, a difference in height of 150 m (492 ft) minimum is needed.

Spin entry with prompt recovery is permissable for training purposes only. All such exercises are only feasible if the flight C.G. is checked and if the altitude is sufficient for safety.

IV.2. Canopy jettison and emergency exit

The wide cabin guarantees the unobstructed emergency exit. Adhere to the following procedure:

If the engine is running: Throttle - idle
Ignition - off

If the prop is feathered:
Prop feather handle - released to start
(Otherwise it is sticking about 17 cm (7 in.) out in the cabin and may hinder the exit)

First red door handle,
then emergency jettison handle - pull to full extension

Door - push upwards
Seat harness - release

Stand up and leave airplane on either side. After 2 to 3 secs., grip ripcord handle and pull firmly until fully extended.

IV.3. Engine failure after takeoff

1. Fuel shutoff switch - close
2. Ignition - off
3. Land from glide

IV.4. Other emergencies

a) Engine failure during flight (same as para. IV.3.)

In addition, if applicable, declare emergency on the radio and squawk emergency transponder code.

b1) Engine fire during flight

Cabin heat and fuel shutoff switch	- closed
Throttle	- full power
Ignition	- off when the engine stops

Land from glide

b2) Fire in the cockpit

Master switch	- off
Main and Generator circuit breaker	- off
Cabin heat and cabin ventilation	- off (Avoid any draft)

Use the fire extinguisher if available.

(Open the ventilation after using the fire extinguisher)

b3) Smoke in the cockpit

Master switch	- off
Main and Generator circuit breaker	- off
Cabin heat	- off
Cabin ventilation	- open

Warning to b2 and b3: All electrical flight control instruments are getting unable to function herewith.

c) Flights through precipitation

There is a noticeable deterioration of flying characteristics when water is present on the wings. This raises the stall speed about 10 km/h (6 kts) and increase take off and approach speed also by 10 km/h (6 kts). The same effect exists with insects on leading edge of the wing. Before takeoff clean the wings with a soft chamois.

d) Stalls

When pitching down from straight-and-level or banked flight:

stick	- push forward to neutral
rudder	- apply opposite to rotation

e) Emergency landing

From sufficient height choose useable field. Watch the wind. Approach to the desired landing site must be executed carefully and precisely. Flare and touchdown smoothly at minimum speed. Prior to touchdown pull stick full aft and brake moderately.

The above mentioned is valid for dead engine and engine failure. You have to place all flight to be able to land immediately without propeller working. With sufficient engine power still available, the landing site should be circled at lower altitude to check for obstacles, ditches, fences etc.

After touchdown: Ignition, master switch and fuel - off

V. Performance data

All speeds are indicated airspeeds (V_{IAS})

V.1. Takeoff distance

All figures based on ICAO-standard atmosphere

Ground roll	194 m (636 ft.)
Takeoff distance (15m;50ft. obstacle)	316 m (1037 ft.)
Liftoff speed	85 km/h (46 kts)
Airspeed when crossing 15 m; 50 ft. obstacle	95 km/h (51 kts)

	Field elev. MSL		Outside air temperature ° C / ° F							
	m	ft	-10°C	14°F	0°C	32°F	+15°C	59°F	+30°C	86°F
Ground-roll m/ft	0	0	149	489	166	545	194	636	228	748
	200	660	157	515	175	574	204	669	241	791
	400	1310	165	541	183	600	214	702	254	833
	600	1970	172	564	193	633	225	738	266	873
	800	2620	182	597	203	666	236	774	281	922
Takeoff distance 15m/50ft obstacle m/ft	0	0	243	797	270	886	316	1037	371	1217
	200	660	256	840	285	935	332	1089	392	1286
	400	1310	269	883	298	978	349	1145	414	1358
	600	1970	280	919	313	1027	367	1204	433	1421
	800	2620	296	971	331	1086	384	1260	458	1503

Atmospheric moisture reduces engine power and increases the takeoff distance.

All figures are based on a maximum weight of 850 kg (1874 l in zero wind and from a dry, level, hard surface. For operating on a dry, level, grass surface increase distance by 15% of the "ground roll" figure.

Moist and soft surface can considerably increase the takeof distance.

V.2. Landing distance

All figures are based on ICAO-standard atmosphere

Landing roll	205 m (673 ft.)
Landing distance (50 ft. obstacle)	390 m (1280 ft.)
Approach speed	115 km/h (62 Kts.)
Touchdown speed (depending on gross weight)	75-85 km/h (41-46 Kts)

Sept.1,1983

Approved by LBA

V.3. Climb schedule

All figures based on ICAO-standard atmosphere

Vertical velocity with prop in "climb" at sea level	3.4 m/s (670 fpm)
at optimum airspeed	110 km/h (59 kts)
Max. angle of climb at airspeed	90 km/h (49 kts)
Service ceiling	5400 m (16500 ft)

V.4. Go-around performance

All figures based on ICAO-standard atmosphere

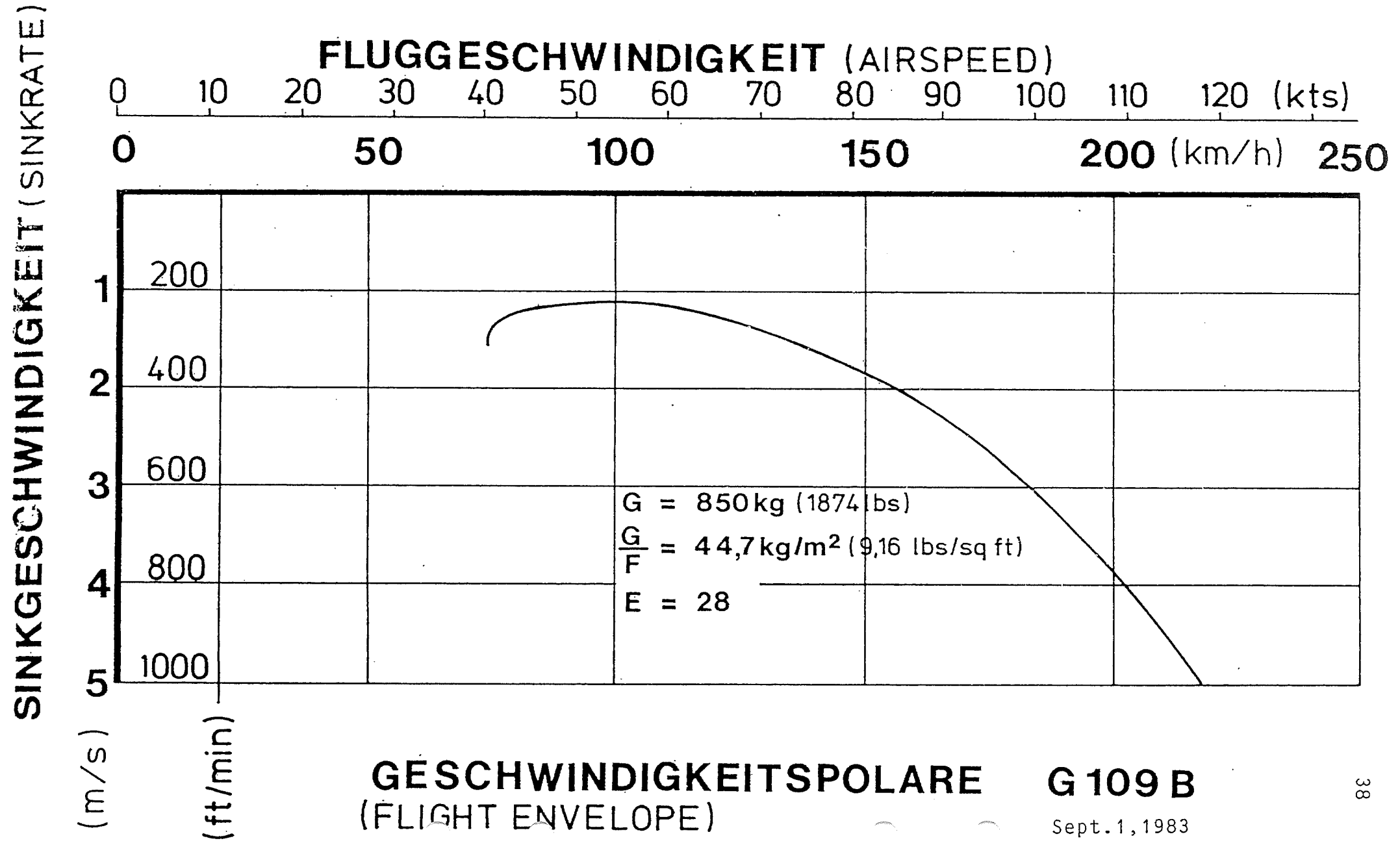
Vertical velocity (Airbrakes retracted)	3.4 m/s (670 fpm)
at approach speed	110 km/h (59 kts)

V.5. Cruise speeds

All figures based on ICAO-standard atmosphere
At maximum continous power setting :
n_{Dmax} = 2800 RPM, horizontal flight TAS: 200 km/h (110 kts)

V.6. Gliding performance

Gross weight	850 kg (1874 lbs.)
Wing load	44.7 kg/m² (9.16 lbs/in²)
Glide ratio	1:28
at airspeed	115 km/h (62 kts)
minimum sink rate	1.10 m/s (217 fpm)
at airspeed	108 km/h (58 kts)



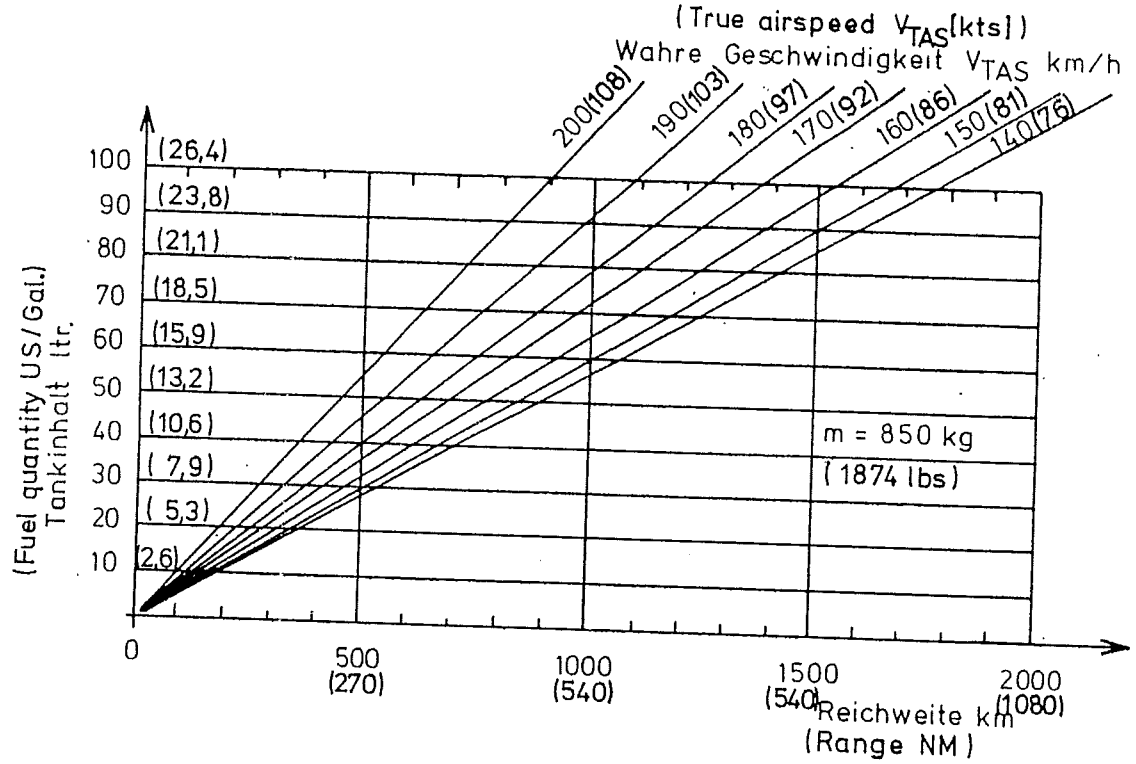
GESCHWINDIGKEITSPOLARE
(FLIGHT ENVELOPE)

G 109 B

Sept. 1, 1983

V.7. Range.

The influence of airspeed (V_{TAS}) to the range is shown in the diagram. All data shown is based on zero wind with no fuel reserve on ICAO-standard atmosphere. Take off and climb are not considered.



Example: At 97 kts and max. fuel the range comes to 675 NM (with the above mentioned restrictions).

The instructions of the diagram are valid for gross-weight (850 kg, 1874 lbs.) and altitudes between 0 and 3000 m (0-10000 ft).

V.8. Fuel consumption

The fuel capacity is 100 ltr. (22.0 Imp.gal., 26.4 U.S.gal.). All data is based on ICAO-standard atmosphere and the application of AVGAS. If automobile fuel (min. ROZ 96.0 octane) is burned the fuel flow increases about 3 per cent.

Note: All figures are based on good maintenance condition of the motorglider and its engine and average flying abilities of the pilot.

Climbing: Full power, prop in "climb"-position
RPM 3000
Speed 111 km/h (60 kts.)
Fuel flow 24 l/h (5.8 Imp.gal, 6.34 U.S.gal.)

Climbing: Full power, prop in "cruise"-position
RPM 2500
Speed 125 km/h (67.5 kts.)
Fuel flow 18 l/h (3.96 Imp.gal., 4.76 U.S.gal.)

Cruise: Up to 3000 m (10000 ft) MSL the fuel flow is independent of altitude. That is, it is only advantageous to fly at higher altitudes, if tail wind can be utilized.
The values in the following tables are valid for gross weight (850 kg, 1874 lbs.) and no side angle.

Altitude 0 m (0 ft) MSL

RPM	Indicated Airspeed V_{IAS}		True Airspeed V_{TAS}		Fuel flow per hour		
	km/h	kts.	km/h	kts.	ltr.	Imp.gal.	U.S
2800	205	111	205	111	24	5.28	6.3
2600	190	103	190	103	17	3.74	4.5
2400	176	95	176	95	13.3	2.93	3.
2200	162	87	162	87	10.4	2.29	2.75
2000	148	80	148	80	8.6	1.89	2.27
1800	133	72	133	72	7.0	1.54	1.85
1650	120	65	120	65	6.8	1.5	1.8

Altitude 1000 m (3300 ft) MSL

RPM	Indicated Airspeed V_{IAS}		True Airspeed V_{TAS}		Fuel flow per hour		
	km/h	kts.	km/h	kts.	ltr.	Imp.gal.	U.S
2800	190	103	202	109	22	4.84	5.8
2600	179	97	190	103	17	3.74	4.5
2400	166	90	176	95	13.5	2.97	3.5
2200	153	83	162	87	10.5	2.31	2.77
2000	139	75	148	80	8.8	1.94	2.33
1800	125	67	133	72	7.2	1.58	1.9
1650	113	61	120	65	7.0	1.54	1.85

Altitude 2000 m (6500 ft) MSL

RPM	Indicated Airspeed V_{IAS}		True Airspeed V_{TAS}		Fuel flow per hour		
	km/h	kts.	km/h	kts.	ltr.	Imp.gal.	U.S
2700	174	94	195	105	20	4.4	5.2
2600	170	92	190	103	18	3.96	4.7
2400	157	85	176	95	13.5	2.97	3.(
2200	145	78	162	87	10.5	2.31	2.7
2000	132	71	148	80	8.8	1.94	2.3
1800	119	64	133	72	7.2	1.58	1.9
1650	107	58	120	65	7.0	1.54	1.8

Altitude 3000 m (10 000 ft) MSL

RPM	Indicated Airspeed V_{IAS}		True Airspeed V_{TAS}		Fuel flow per hour		
	km/h	kts.	km/h	kts.	ltr.	Imp.gal.	U.S
2600	160	86	187	101	17	3.74	4.5
2400	151	82	176	95	13.5	2.97	3.57
2200	139	75	162	87	10.5	2.31	2.77
2000	127	69	148	80	8.8	1.94	2.33
1800	114	62	133	72	7.2	1.58	1.9
1650	103	56	120	65	7.0	1.54	1.85

Jan.15,1990

Approved by LBA

V.9. Stall speeds (IAS)

Stall speeds are dependent on useful load and condition of the aircraft.

All figures are based on max. gross weight 850 kg (1874 lbs

With full power	: unaccelerated level flight	70 km/h	(38 ...
	30° - bank flight	75 km/h	(40 kt
With idle power	: unaccelerated level flight	73 km/h	(39 kt
	30° - bank flight	78 km/h	(42 kt
With power off, prop feathered	: unaccelerated level flight	74 km/h	(40 ...
	30° - bank flight	79 km/h	(43 ...
Airbrakes fully extended		80 km/h	(43 kt

Stall speeds are reduced at lower gross weights.

For a bank angle of more than 30°, the stall speeds increase.

The loss of altitude from beginning of the stall until regaining normal flight may be maximal 80 m (260 ft).

VI. Rigging and derigging

Due to the fact that the landing gear is mounted on the fuselage of the G 109 B, rigging and derigging can be executed by only 2 persons, because wings and elevator can be removed without supporting the fuselage.
Hangar space is reduced to a minimum, due to the folding mechanism of the wings.

VI.1. Rigging:

The statement above mentioned the wings of the motorglider, G 109 B, are equipped with a folding mechanism. This makes rigging and derigging quite easy.

First the inspection panels are opened to expose the two wing bolt mechanisms. Using the enclosed lever extension, the front and main bolts are withdrawn. The first wing should now be lifted from its support on the fin and be drawn out in relation to the fuselage until the tube supporting the wing root is fully extended. The wing can now be rotated forward until it is 90 degrees to the fuselage and then rotated from the vertical to the horizontal plane. The electrical fittings can now be made (second person) and the wing pushed home into the fuselage. The second person can now drive the main bolt and then the nose bolt fully home using the lever mechanism. The first wing is now in place and the wing tip may be released. Although the fuselage will support one wing, it is best that the wing tip should be supported on a trestle while the second wing is rigged.

Repeat the same procedure to rig the second wing. Now the lever extensions can be stowed and the inspection panels closed. The connection of the air brake and aileron controls are fully automatic. The wing root should be sealed with self-adhesive tape. To complete the rigging of the wings, all there is left to do is to remove the slings from the wing, unscrew the supports from the fin and stow them in the bag provided.

In this bag there is also a screwing clamp, it serves for connection between both wing tip skids in the dismounted condition. The clamps prevent the surface of wings striking together and prevents damage. Also, the handling is easier.

Important directions for the use of the lever mechanism:

Mounting the wings with help of the lever mechanism you must note the following:

- pull main bolt lever backward to full extend
- pull nose bolt lever forward to full extend
- do not shut the inspection panel with force
- the quick-release fastener of the inspection plates must be flush with the outline of the wing when closed.

Note:

If the wings are incorrectly mounted, the inspection plates cannot be closed!
The folding mechanism was made in order to simplify storage on the ground.
For the transport of the motorglider on roads, screw off the wings from fuselage (see page 46).
Push the folded motorglider slowly to spare the tailwheel. A great deal of the weight of the wings is on the tailwheel.
Pot-holes, curbs and ditches could damage the tailwheel if crossed roughly.

Tailunit:

Before assembly is commenced, the front cover must be opened and the rotating wing bolt pulled out to full extention.

The tailplane can now be positioned by two persons.

It can be rested on top of the leading edge of the fin with the elevator angled upwards so that the "Hotellier"-type quick connection of the trim rod can be connected to the ball on the elevator tab horn as well as "GROB"-type quick lock fastener of the elevator pushrod to the spherical bearing on the elevator horn.

Afterwards the elevator unit can be rested flat on to the fin and pushed aft onto the three attachment stubs. It is then necessary to tighten the wing bolt clockwise to secure the tailplane.

The assembly is completed when the bolt is sufficiently tight (hand-tight) to avoid play in any direction and the red arrows at the fin and elevator unit coincide.

The cover provides a safety measure to the locking bolt as it can only be closed with the bolt horizontal. If necessary the wing bolt must be turned a 1/4 turn to fit.

Then cover the slots between fin and tailplane and at the front cover with self-adhesive tape.

Checks after assembly:

1. Wheelbrakes and tire pressure checked
2. Check the tailplane is mounted correctly and the elevator push rod and trim rod connected
3. Controlability check by two persons
   (1 moving the control stick, 1 seizing the appropriate control surface simultaneously)
4. Check the correct levers extension in the inspection hole (see page 42)

VI.2. Derigging

Derigging is carried out in the opposite manner and it does not matter which wing is folded first.
Relieve the weight of the respective wing at the tip and support the other wing at tip before the lever in the inspection hole is actuated.
At tailunit unscrew the wing bolt counter-clockwise and pull it back to its full extension.

VI.3. Parking

When the motorglider is parked outside, use the parking brake and chocks, due to possible decrease in braking action of the hydraulically actuated brakes. Close the folding doors. To tie the airplane, pull ropes through the wing tip skids and tie it to the ground.
For longer parking outside use a water-repellent cover over engine and cockpit plexiglass. The cover can be ordered from the manufacturer of the aircraft. Also lock the controls by using the seat harness.

Protect the elevator push-pull rod against damage by moisture by means of a suitable cap, if the motorglider is parked outside with dismounted horizontal tail.

VI.4. Transport

For the transport of the motorglider on roads with a trailer we recommend the following: All parts must be carefully supported and secured so they cannot slide.

1. Fuselage

The fuselage remains on its three wheels. To tie down the forward part, secure the main wheels. To fix the tail use a broad strong band.

2. Wings

The minimum length for the spar support is 100 mm (4 in.) and should start at the root rib. The support must be covered with foam rubber or felt.

The wing support should be below the inboard aileron, should be a shaped mounting block of a minimum length of 300 mm (12 in.) and a height of 400 mm (16 in.) and must be padded by felt.

3. Tailplane

Secure the tailplane on padded supports with its upper surface downwards and tied with bands, or vertically supported on the leading edge downwards in shaped mounting blocks.

Profile drawings are available for the construction of fuselage, wing, and tailplane mounting blocks.

VI.5. Simple maintenance

- Humidity

  The entire surface of the motorglider is coated with weather-resistant white polyester gelcoat. Although it should be protected as much as possible against precipitation. Water that has entered the aircraft should be dried out by storing that part in a dry place and frequently turning it around.

  After flights through rain, dry the aircraft with a soft chamois.

  Although all metal parts of the motorglider, with the exception of wing and elevator mounts, are surface protected, corrosion cannot be prevented under long lasting high humidity conditions.

  All unprotected metal surfaces should be regularly greased due to condensation.

- Sun light

  To prevent overtemperature of the surface that may lead to structural damage, all supporting structural parts must be coated with white paint.

- Maintenance of gelcoat

  The wax coat that was applied with a rotating disc is very resistant. A mild cleaning agent should be used for minor dirt (i.e. dust, grease, insects). More stubborn dirt should be removed using only special silicone-free polishes.

Remove the adhesive residue of tape at wings and fuselage or oil traces etc. carefully with alcohol or benzine. The care of the finish should be carried out according to the instruction "Pflege für UP-Beschichtungen an Segelflugzeugen" GROB-AKZO Ident-Nr.4319 H dated 13 July 1989.

Caution: Do not use nitro-thinner on the red lacquer or on markings, they contain a nitro-polyester lacquer!

- Cleaning of plexiglass doors and cockpit-windows.

  The most effective way to clean the doors and the cockpit windows is to use a special plexiglass cleaner, but usually luke warm water will do.
  A soft, clean cloth or chamois leather should be taken to wipe the canopy dry and clean.
  Never use a dry cloth or chamois when wiping plexiglass.

- Misellaneous

  The safety belts should be regularly inspected for damage and wear. Check the metal parts for corrosion.

VI.6. Maintenance directions

At regular intervals, but not later than the annual inspection, the following service schedule must be completed:

1. The entire aircraft must be checked for cracks, holes, and bumps
2. All fittings in satisfactory condition (no play, scores or corrosion)
3. All metal parts-no corrosion. If necessary re-condition and paint
4. No play in wing and tailplane to fuselage fittings
5. Control linkages (bearings, fittings, stops, hinges and control cable-check for condition)
6. The flight controls including airbrakes must be submitted to an cperational test; measure the control deflections
7. If controls do not move free throughout their range, search for the cause and correct it.
8. Check condition of main and tailwheel, including tires and brakes
9. No obstructions in the pitot-static pressure ports, no leakage in the pitot-static system.
10. Check condition and, if applicable, calibration of all instruments, radios, and other electric equipment. (i.e. transponder, Nav. equipment, strobelights etc.) Compare it with the appropriate equipment list.

11. The engine must be serviced and maintained according to Engine Operations Manual.

12. The propeller must be serviced and maintained according to Propeller Owners Manual.

For further details of maintenance refer to the Instructions for Continued Airworthiness of GROB G 109 B.

VI.7. Repair directions

For the execution of minor repairs, refer to the attached Repair Instructions of GROB G 109 B.

Major repairs may only be handled by the manufacturer or authorized workshops. The GROB company will help in those cases and name an agency with the appropriate license and experience.

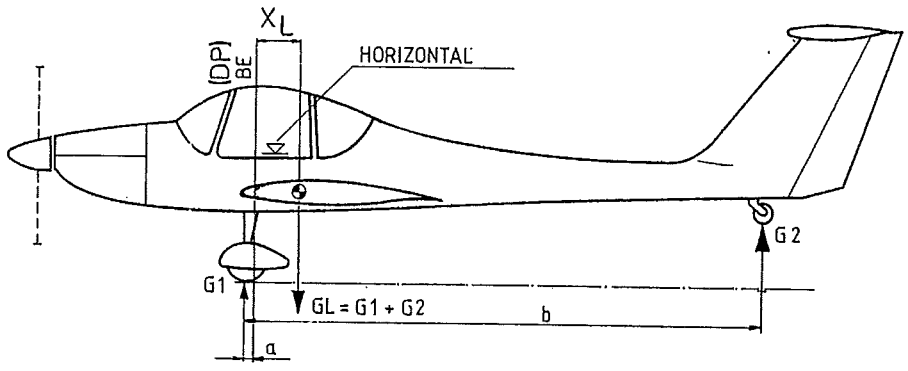
VII. Center of gravity (CG)

VII.1. Weighing procedure for CG at empty weight

Prior to determining the CG for flight, CG at empty weight has to be determined by weighing the aircraft. For this procedure the motorglider is placed on three scales (2 x mainwheel, 1 x tailwheel), so that the edge of door frame is horizontal (see figure).

Note: When rolling on to the scales with the maintires avoid friction in the scales due to the strain of the maingear that can cause erroneous results.

The datum plane (DP) is situated at the wing leading edge at span 1.3 m (4.3 ft) (out of oblique wing-fuselage fairing). The distance a and b are measured by using a plumbline. The empty weight is the sum of $G_{1\ R/H}$, $G_{1\ L/H}$ and G_2.



Datum plane (DP) : Leading edge at span 1.3 m (4.3 ft) (out of oblique wing-fuselage fairing)

Aircraft attitude : edge of doorframe horizontal (see figure)

Sept.1,1983

CG at empty weight:

$$X_L = \frac{G_2 \times b}{G_L} - a$$

Weight on the mainwheel	R/H	$G_{1\ R/H}$	=	kg (lbs.)
Weight on the mainwheel	L/H	$G_{1\ L/H}$	=	kg (lbs.)
Weight on tailwheel		G_2	=	kg (lbs.)
Empty weight $G_L = G_{1R/H} + G_{1L/H} + G_2$		G_L	=	kg (lbs.)
Support point main gear		a	=	mm (in.)
Support point tailwheel		b	=	mm (in.)

Note: Determining empty weight and CG at empty weight must be conducted without additional balance weights (trim cushion) and without fuel or baggage, but with motor oil.

Use caution not to exceed the maximum weight of non-lifting parts when using maximum useful load.
The total weight on non-lifting parts contains the particular weight of fuselage, elevator and maximum useful load and may not exceed 670 kg (1477 lbs.). In other cases the useful load must be reduced correspondingly.

The center of gravity should be recalculated after repair, repainting, or installtion of additional equipment, but not later than 4 years after the last weighing.

The empty weight, empty weight CG-position, and maximum load should be recorded after each weighing on pg. 54 of Flight Manual by an authorized individual.

VII.2. Position of CG at empty weight

The manufacturer adjusts the empty weight CG within the below mentioned limits. You have to recheck these limits also if you change the equipment or during repairs.
See note at page 18.
If necessary, permanent trim ballast can be fixed at the nose or the tail of the airplane. (See Instructions for Continued Airworthiness 3.2.)

Empty weight		Approved position of CG aft of DL			
		Forward		aft	
kg	lbs	mm	in.	mm	in.
600	1323	343	13.5	389	15.32
610	1345	342	13.46	389	15.32
620	1367	341	13.43	390	15.35
630	1389	337	13.27	390	15.35
640	1411	333	13.11	391	15.39
650	1433	329	12.95	392	15.43
660	1455	325	12.8	392	15.43
665	1466	324	12.76	392	15.43
670	1477	322	12.68	393	15.47
675	1488	320	12.60	393	15.47

If the empty weight CG is within the above mentioned ranges and if the pilot weight according to load table is preserved, the CG for flight is in the approved range. This is for maximum and minimum fuel weight.

VII.3. Weighing report

Date of weighing carried out by:	Equipment list used for weighing (date)	Empty weight kg/lbs	Empty C of G (behind datum) mm/in.	Empty weight moment mkg/lbs.in	Max. * Payload kg/lbs.	Signatur

The empty weight moment is necessary to calculate the CG for flight (load table).

* The maximum payload consists of crew, fuel and baggage.

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VII.4. Calculation of CG for flight (x_F)

For determination of the actual CG for flight, the individual weight must be multiplied with their distances to the datum plane (factor), to obtain the moments.
The sum of moments divided by the total weight equals the actual CG for the given load conditions.

Empty weight x CG (empty) (latest figure from table pg. 54)	=	empty weight moment
.....kg (lbs) x .....m (in.)	=	..... mkg (lbs in.)
weight of crew x crew factor	=	crew moment
.....kg (lbs) x 0.083 m (3.3in.)	=	.....mkg (lbs in.)
weight of fuel x fuel factor	=	fuel moment
.....kg (lbs) x 1.0 m (39.4in.)	=	..... mkg (lbs in.)
weight of baggage x baggage factor	=	baggage moment
.....kg (lbs) x 0.72m (28.3in.)	=	..... mkg (lbs in.)

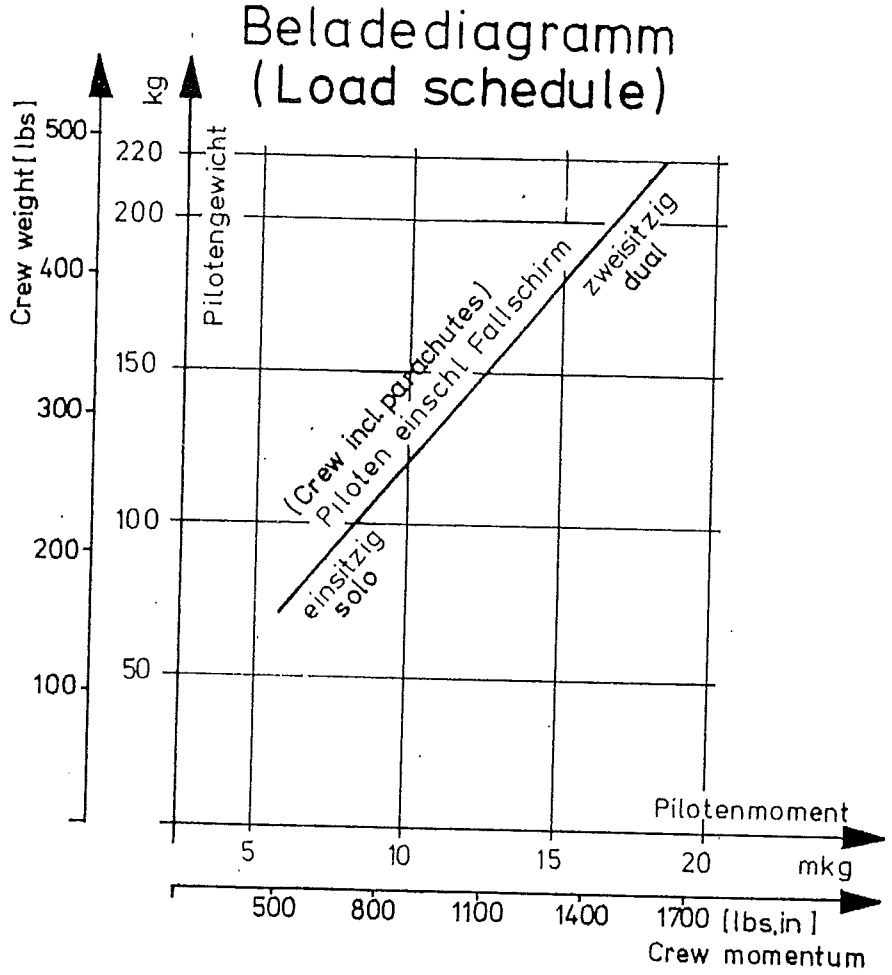
+ ..... kg (lbs)	+ .....mkg (lbs in.)
Total weight (G)	Total moment (M)

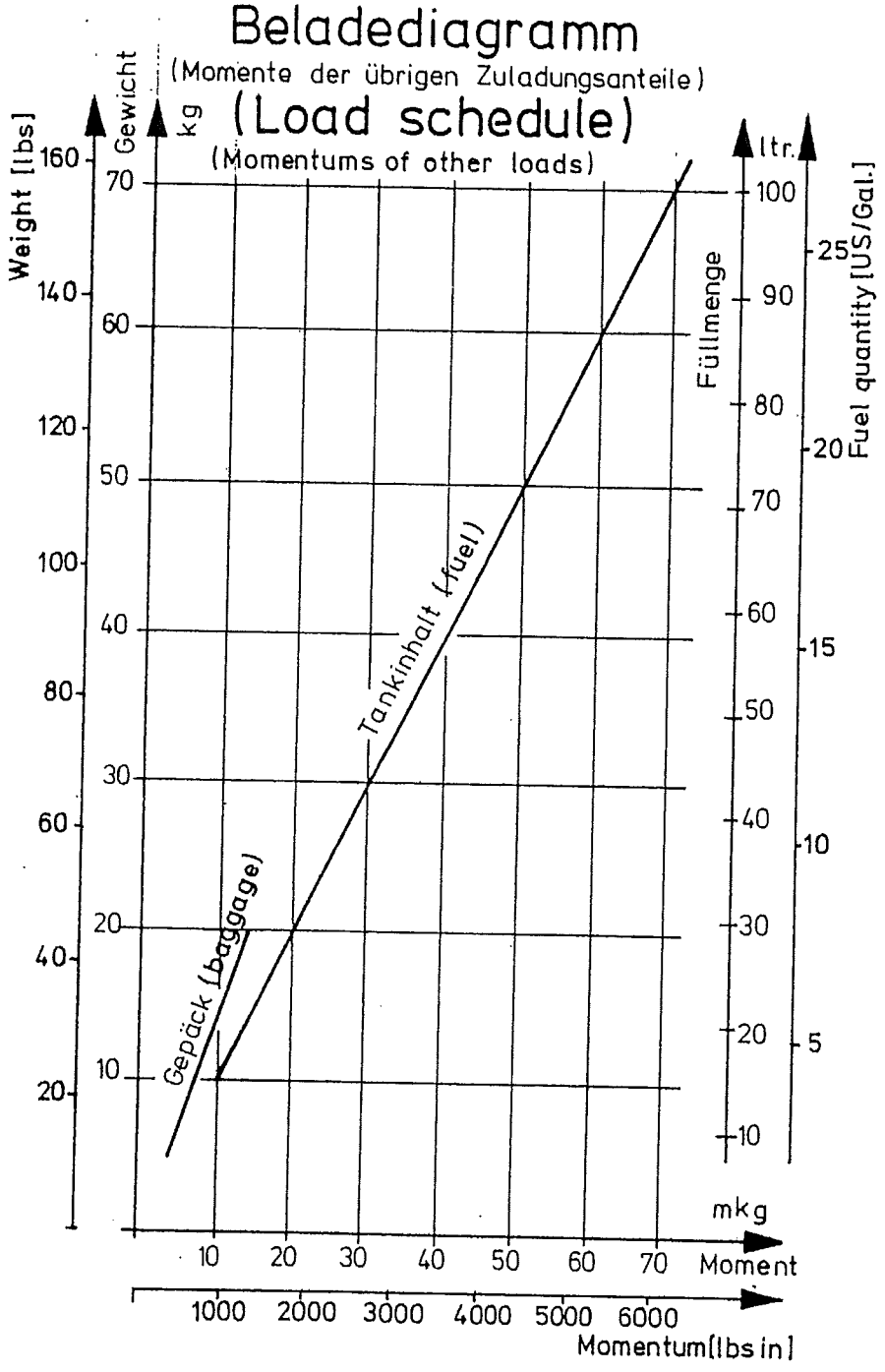
$$\text{CG of flight } (x_F) = \frac{\text{total moment (M)}}{\text{total weight (G)}}$$

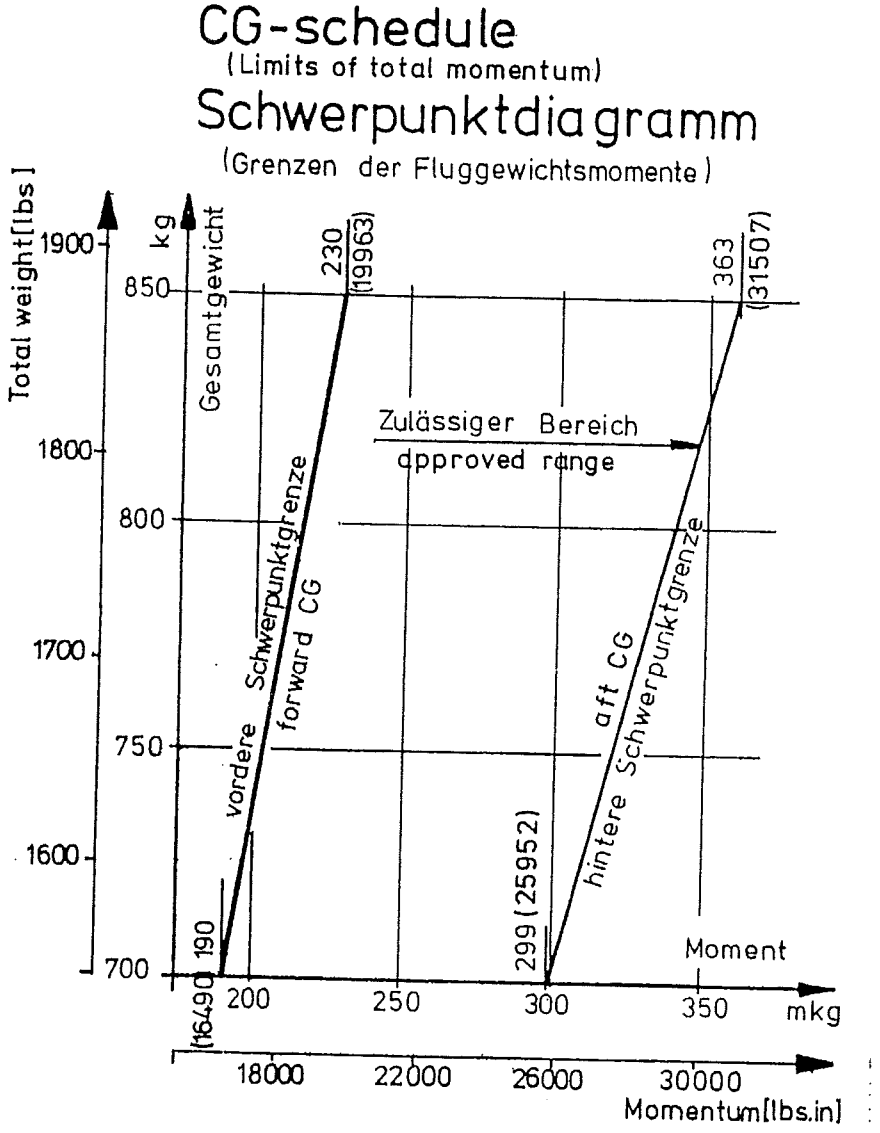
The approved range of center of gravity see page 17.

The individual moments can be figured out from the two load schedules (page 56 and 57). The total moment must not exceed the approved range of the CG schedule (page 58).
If this moment exceeds the approved range, the load must be redistributed or limited and weight-and-balance calculations must be repeated.
Max. gross weight may never be exceeded.

Note: The baggage factor is the distance to the center of the baggage compartment.The baggage should be placed as far forward as possible.


Beladediagramm
(Load schedule)
Crew weight [lbs]
500
400
300
200
100
kg
220
200
150
100
50
Pilotengewicht
(Crew incl. parachutes)
Piloten einschl. Fallschirm
einsitzig
solo
zweisitzig
dual
Pilotenmoment
5
10
15
20
mkg
500
800
1100
1400
1700 [lbs.in]
Crew momentum


Beladediagramm
(Momente der übrigen Zuladungsanteile)
(Load schedule)
(Momentums of other loads)
Weight [lbs]
Gewicht kg
160
140
120
100
80
60
40
20
70
60
50
40
30
20
10
Füllmenge ltr.
100
90
80
70
60
50
40
30
20
10
Fuel quantity [US/Gal.]
25
20
15
10
5
Tankinhalt (fuel)
Gepäck (baggage)
mkg
10 20 30 40 50 60 70 Moment
1000 2000 3000 4000 5000 6000
Momentum [lbs in]


CG-schedule
(Limits of total momentum)
Schwerpunktdiagramm
(Grenzen der Fluggewichtsmomente)
Total weight[lbs]
1900
1800
1700
1600
700
kg
850
800
750
Gesamtgewicht
230
(19963)
363
(31507)
Zulässiger Bereich
dpproved range
vordere Schwerpunktgrenze
forward CG
aft CG
hintere Schwerpunktgrenze
190
(16490)
299 (25952)
Moment
200
250
300
350
mkg
18000
22000
26000
30000
Momentum[lbs.in]

Caution: Incorrect loading can deteriorate aircraft performance and flight characteristics and can cause hazardous flight conditions. The pilot-in-command is responsible for correct location of loads.

Note: The empty weight and the empty weight CG only differ very little on the standard aircraft; additional equipment however can cause noticable differences.

VII.5.1. Example to the load table: given empty weight 630 kg (1389 lbs
given empty weight CG 360 mm(14.2 in. aft of DP.

(Caution: The example does not correspond with your motorglider)

	weight kg	(lbs)	distance m	(inch)	momentum m kg	(lbs.in.)
empty weight	630	(1389)	0.360	(14.2)	226.8	(19723.8)
Crew (2 pilots)	180	(400)	0.083	(3.3)	14.9	(1320)
baggage	10	(20)	0.720	(28.3)	7.2	(566)
fuel	30	(66)	1.0	(39.4)	30.0	(2600.4)
	850	(1875)			278.9	(24210.2)

CG for flight $\frac{278.9}{850}$ = 0.328 m ($\frac{24210.2}{1875}$ = 12.91 in)

CG-position is 328 mm (12.91 in) aft of datum plane within approved range.

Fuel weight had to be reduced to 30 kg (66 lbs) not to exceed the maximum gross weight.

2. Example to the load table: given empty weight 640 kg (1411 lbs)
given empty weight CG 375 mm (14.8 in.) aft of DP

(Caution: The example does not correspond with your motorglider)

	weight kg	(lbs)	distance m	(inch)	moment mkg	(lbs in.)
empty weight	640	(1411)	0.375	(14.8)	240.0	(20882.8)
Crew (1 pilot)	70	(154.3)	0.083	(3.3)	5.8	(509.2)
baggage in the second seat	20	(44.1)	0.72	(28.3)	14.4	(1248.0)
fuel	70	(154.3)	1.0	(39.4)	70.0	(6079.4)
	800	(1763.7)			330.2	(28719.4)

CG for flight $\frac{330.2}{800}$ = 0.413 m ($\frac{28719.4}{1763.7}$ = 16.3 in.)

CG-position is 413 mm (16.3 in.) aft of datum. Plane is within approved range.
This example shows, that the maximum fuel weight and baggage weight is allowed.

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VIII. Removable Checklist

The following pages contain the contents of the removable checklist mentioned earlier in para.II. If the motorglider is delivered, the checklist will be supplied separately.

In event of loss of the checklist copy the pages 62-65 of your flight manual to get a new one.

The main detailed instructions in the flight manual paragraph III remain obligatory.

I. Before starting engine

0	Preflight check completed (Flight Manual page 21)	
1	Adjust pedals and back rests	
2	Adjust and secure seat harness (parachute?)	
3	Folding doors	LOCKED
4	Parking brake	SET
5	Radio and avionics	OFF
6	Fuel shutoff valve	OPEN
7	Controls and airbrakes	FREE

II. Starting the engine

1	Prop "climb" position	PULL
2	Choke	AS NEEDED
3	Throttle 2 cm (0.8 inch)	ADVANCE
4	Propeller area	CLEAR
5	Main switch	ON
6	Auxiliary fuel pump	ON
7	Electrical instruments and fuel supply	
8	Strobe light	CHECK
9	Ignition key	ON
10	RPM 1200	START
11	Oil Pressure	SET
12	Avionic main switch	GREEN
13	Radio- and Nav.-equipment	ON
14	Current and voltage	AS NEEDED
15	Engine run-up Cyl. 130° C	CHECK
	Oil 50° C	GREEN
		GREEN

III. Run-up

First, apply brake and hold stick full back.

1	Altimeter	SET
2	Instruments	SET
3	Full power 2600 - 2800 RPM slow down, pull pre-heating RPM drop ≥ 50 RPM	CHECK
	Magneto at 2400 RPM (only for double ignition), no RPM drop	CHECK

IV. Before takeoff

1	Controls and throttle	FREE
2	Airbrakes	LOCKED
3	Folding doors check	LOCKED
4	Emergency jettisoning	SECURED
5	Trim	NEUTRAL
6	Fuel shutoff valve	OPEN
7	Carburetor heat	OFF
8	Auxiliary fuel pump	ON
9	Engine instruments	CHECK
10	Parking brake	RELEASED

V. Takeoff and Climbing

1	Exact direction	CONTROLL
2	Tailwheel at 40 km/h (21.6 Kts)	LIFT
3	At 85 km/h (46 Kts)	LIFT-OFF
4	Climb (90-110 km/h) (49-60 Kts)	IF NEEDED
5	Auxiliary fuel pump (100 m, 330 ft)	OFF

VI. Cruise

1	Throttle 2300 RPM, 120 km/h (64.8 Kts.)	SET
2	Prop "cruise" position	PULL
3	Prop position	CHECK
4	Gain speed (lower nose)	
5	Cruise RPM (2000 - 2800 RPM)	SET
6	Carburetor heat	IF NEEDED

Engine shutdown, restart in flight, and soaring — SEE FLIGHT MANUAL

Caution: Avionic main switch — OFF

VII. Descent

1	Carburetor heat	ON
2	Throttle	IDLE
3	SPEED 115 km/h (62 Kts.)	SET
4	Prop "climb" position	PULL
5	Parking brake released	CHECK

VIII. Approach and Landing

1	Speed 115 km/h (62 Kts.)	SET
2	Auxiliary fuel pump	ON
3	Airbrakes	IF NEEDED
4	In 3-point altitude	TOUCH DOWN
5	Airbrakes	OUT SMOOTHLY
6	Brake carefully	OUT
	Landing with dead engine	SEE FLIGHT MANUAL

IX. Engine shutdown

1	Avionic main switch	OFF
2	Auxiliary fuel pump	OFF
3	All electricals	OFF
4	Throttle	IDLE
5	Ignition key	OFF
6	Main switch	OFF
7	Ignition key	PULL OUT
8	Brake	FIXED
	Mooring	SEE FLIGHT MANUAL