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| Korff+Co.KG Dieselstrasse 5 D-63128 Dietzenbach | Flight Manual G109B Engine Limbach L2400DT1 Propeller MTV-1-A/L 170-05 | |
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I. General

I.1 Log of Revisions

| Rev.No. | Pages affected | Description | Datum | LBA approval signature |
|---------|--|---|---------------|------------------------|
| 1 | 1, 1a, 7, 9, 18e, 25, 26, 63 | Supplement for engine with double ignition (ÄM 817-7) | Oct. 1, 1984 | |
| 2 | 1, a, 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 | Modification of S/N 6340 and subsequent (ÄM 817-8) | Jan. 15, 1985 | |
| 4 | 1, 1a, 10, 18e, 19, 20a, 20b, 30, 30a, 33, 37, 39b, 39c, 40, 45, 48, 53, 63, 64 | Corrections ÄM 817-11 TM 817-26 | Jan. 15, 1990 | |
| 5 | 0, 1, 1a, 2, 3, 4, 5, 7, 7a, 7b, 7c, 7d, 8, 9, 10, 11, 11a, 12 deleted, 13, 18b, 18c, 18d, 18e, 19, 20, 24, 25, 26 deleted, 27, 28, 29, 30, 31, 32, 32a, 33b, 33c, 33d, 33e, 34, 35, 36, 37, 39, 39a, 62, 63, 64, 65, 66 | Conversion to engine Limbach L2400DT1 with propeller MTV-1-A/L170-05 TM 817-43 | Mar. 1, 2002 | |
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For the Flight Manual G109B Engine Limbach L2400DT1 Propeller MTV-1-A/L 170-05 when using for towing (Option)

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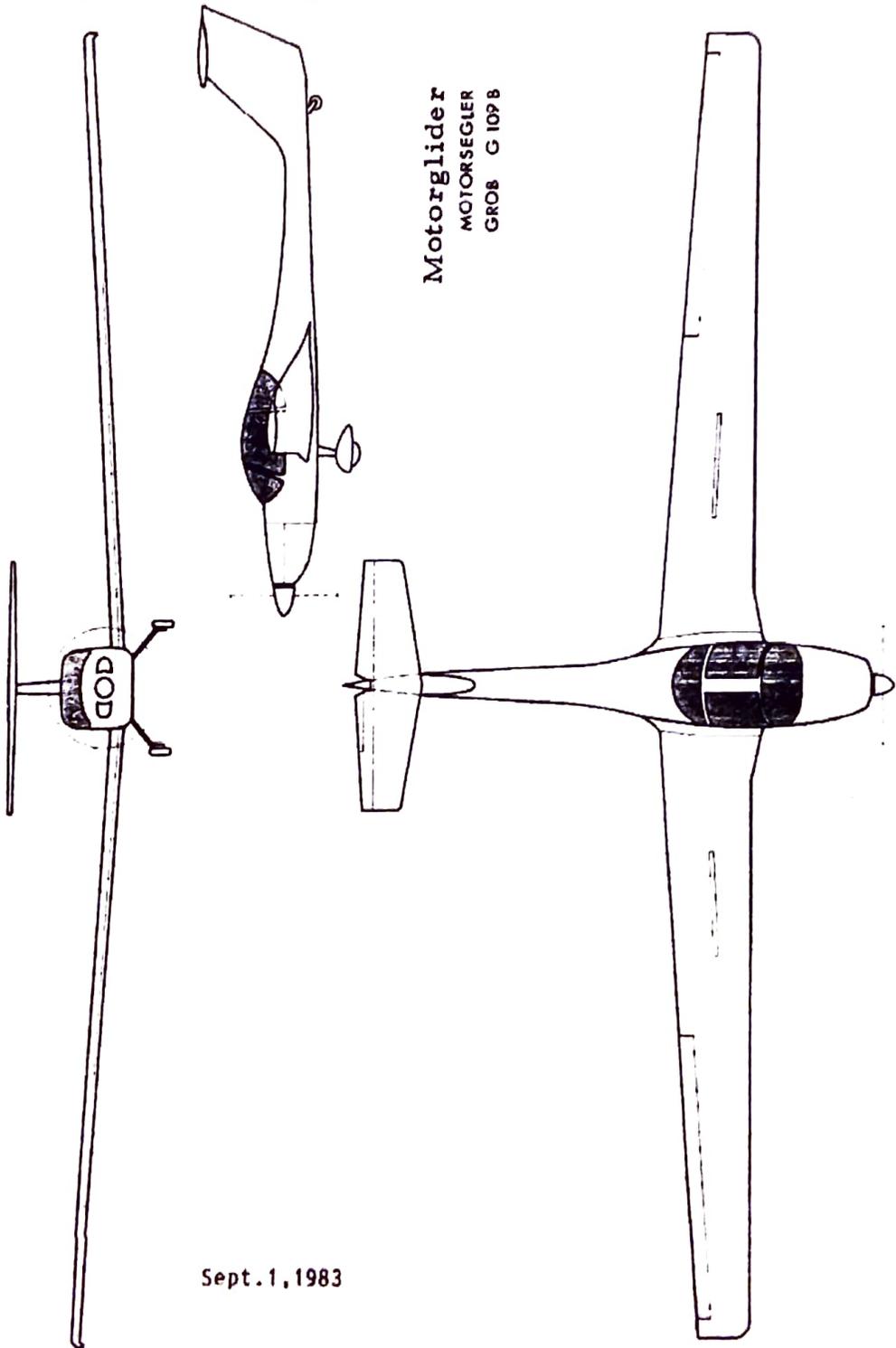
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I.4 Total view (photo)



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I. 5. Three plane view



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1.6 Description

The G 109B is two-seat motorglider with T-type stabilizer, fixed gear with fairings and airbrakes 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 fibre and carbon fibre design. The G 109B is the further development of the G109. It is designed for instruction, training, competition and cross-country flights.

Technical data:

| | |
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| Span: | 17.4m (57.09 ft) |
| Length: | 8.1m (26.57 ft) |
| Height: | 1.7m (5.58 ft) |
| Aspect Ratio: | 16:1 |
| Wing Area: | 19 m ² (204.5 ft ²) |
| Max. Flying Weight: | 850 kg (1874 lbs) |
| Max. Wing Loading: | 44.7 kg/m ² (9.16 lbs/ft ²) |
| Airfoil: | E 580 |
| Engine: | Limbach L2400DT1 |
| Propeller: | MTV-1-A/L 170-05 |

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1.6.1 Engine

The motor glider has retrofitted with an aero engine Type LIMBACH L2400 DT1 certified according JAR-22 H, with electronic fuel injection, dual electronic ignition, turbo charged and liquid cooled cylinder heads. For technical data refer to the appropriate engine operation manual. Engine control and observation instruments are mounted in the instrument panel.

The main switch is a key operated turning switch. When turning clockwise there are two equal ON positions, turning further clockwise there is a spring-loaded STARTER position. The key can withdrawn in the OFF position only, the STARTER position is secured against inadvertent operation, STARTER position operates the engine starter when coming from the OFF position only.(car like) Before a second engine start attempt the key switch must pass the OFF position. Dual ignition is switched on by two tumbler switches and they are secured against inadvertent operation by a U-type metal sheet.

Engine power is controlled by a thrust lever on the pedestal.

Trust lever fully forward = Full power
Trust lever fully aft = idle RPM

1.6.2 Propeller

The propeller is an electric operated two blades constant speed propeller with feathering position type MUEHLBAUER MTV-1 A/L 170-05. The variable pitch propeller is controlled by a simple und comfortable to operate constant speed system. Pitch can be adjusted in any position between low pitch for take off and feather position.

The pitch actuator controls the pitch according RPM-signal and engine power. During malfunction of the pitch actuator, the blades remain in their last position.

1.6.3 Propeller control unit P-120-A

The Propeller control panel has a mode control switch with two locked positions AUTO and MANU. It has a RPM selector button with a range from 2000 to 3000 RPM. The pitch selector switch on the right hand side of the control unit has three locked positions. When in MANU-mode and pitch selector switch is in SEGEL position, propeller pitch increases until feather position. The pitch selector switch in START position decreases the pitch to take off position. The green LED illuminates at take off position. The yellow LED indicates a malfunction of the control unit. When green and yellow LED's illuminate for 1 sec the self test of the control unit is ok. Self test is started every time the main switch is turned from off to on position.

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1.6.3 Propeller control unit P-120-A (continued)



Front view of control unit P-120-A

During cruise flight both switches are in AUTO position, the preselected RPM will be maintained. For take off the preselector knob is set to 3000 rpm.

-To change position of both switches one has to pull out them slightly-

Warning: Avoid engine/propeller RPMs over 3000!

Overrevving may happen when power is applied abruptly, during go around, windmilling engine start and when the propeller is operated in manual-mode.

1.6.4 Operating instructions for constant speed propeller

Propeller type: MTV-1-A/L 170-05 (incl. Spinner)
 Propeller diameter: 170cm
 Number of blades: 2

The pitch of the propeller is electronically controlled by the propeller control unit P-120-A.

1. Auto-mode: The propeller control unit maintains the engine/propeller RPMs which are preselected on the preselector knob. (with a scale from 2000 to 3000 RPM and increments of 100 RPM. If engine power and speed is low, the propellers pitch decrease to minimum or take off pitch which is indicated by the green LED.

2. Manual-mode: Manual-mode is selected when the mode selector switch is in MANU (down) position. Moving the pitch selector switch to SEGELN position will increase the pitch or lower engine/propeller RPMs up to feather position. Moving the pitch selector switch to START position will decrease the pitch or increase engine/propeller RPMs up to minimum or take off pitch which is indicated by the green LED. From feather position to take off pitch the pitch actuator needs 60 sec.

For procedures of propeller control unit malfunctions refer to chapter IV.4

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1.6.5 Fuel System and Fuel Injection

Fuel supply for the injection nozzles is done by a ring-type-tube. The ring-type-tube prevents gas bubbles in the fuel. The fuel tank works like a fuel cooler. Fuel flows from fuel tank through a coarse fuel screen to the fuel shut off valve, through coarse fuel filter, to the active fuel pump to a fine fuel filter and further to fuel injection solenoids and further to the fuel pressure sensor, the fuel pressure regulator. Fuel not used flows back to the fuel tank via a fuel return line.

1.6.6 Electrical System

The task of the relais-box is to provide electrical power for the engine from main battery and or the generator or the emergency battery. 12 volts is the normal voltage.

Engine operation (ignition and fuel injection) is possible with electrical available only, therefore the emergency battery has to be controlled by the relais-box. The emergency battery cannot supply the common (household) bus, but will be charged all times during normal operation –this is indicated by a yellow LED "Charge" on the combined instrument emergency battery charge state/fuel pressure warning light, ("status indication").

Switching logic of the emergency battery cannot be affected by the pilot; switching is done by the relais-box automatically when voltage of common bus drops under a certain fixed value. By pressing the switch near the voltmeter one can check the emergency battery voltage.

Following abnormalities can happen in the electrical System:

1. In case the main battery is defect or cannot be charged anymore, the electrical power from engine driven generator is sufficient for normal operation. **Starting the engine can be done by windmilling only, provided the propeller is not in feathered position.**

2. In case of a malfunction of the engine driven generator, indicated by the red generator warning light, engine operation stops after the main and the emergency batteries are depleted. The main battery will be depleted first, during that period the normal electrical power consumers like radios work normally. If voltage of the main battery drops further, the emergency battery becomes active, by the switching logic of the relais-box, indicated by the red flashing discharge light on the ("status indication"). The emergency battery is capable for 20 min electrical power supply for engine operation. All other electrical consumers like radios are not operable, propeller pitch adjustments inactive also. By pressing the switch near the voltmeter one can check the emergency battery voltage.
Starting the engine can be done by windmilling only, provided the propeller is not in feathered position.
Warning: Remaining flight time is limited to 20 min. Flight planning should be adapted.

3. In case of a malfunction of the common bus, engine driven generator and main battery, the emergency battery will supply the engine with electrical power for 20 min only.
Starting the engine can be done by windmilling only, provided the propeller is not in feathered position.

Warning: Remaining flight time is limited to 20 min. Flight planning should be adapted.

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I.6.6 Electrical System (continued)

red flashing discharge light state

fuel pressure warning light

Emergency
battery charge



Front view of the combined instrument status indication.

I.6.7 Ignition

The dual electronic ignition system has a variable timing and is powered by battery or generator. The timing is controlled by a program from the electronic control unit (ECU).

The ignition system consists of two ignition modules with two dual igniter's coils. This ignition system needs power from the battery, different to the common ignition magneto.

I.6.8 Engine emergency switch

The EMERGENCY position of the engine emergency switch, is necessary if the active fuel pump or a primary Engine sensor does not work properly. During emergency operation the second fuel pump becomes active, the previous active fuel pump will be shutdown, the previous RPM sensor will be replaced by a second RPM sensor, simultaneously are all the other engine sensor replaced by fixed resistances. The engine can be started with the emergency operation switch in EMERGENCY position, provided the main switch is on and the main battery is operable. When turning the emergency operation switch 30° clockwise, from NORMAL position to EMERGENCY position, this may be indicated by the yellow warning light next to the engine emergency switch. The engine emergency switch does not switch the emergency battery!



Front view of the Engine emergency switch

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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 known icing conditions, aerobatics, and cloud flying are prohibited. The motorglider is certified for controlled visual flights (CVFR), VFR flights over cloud layers and VFR flights during nighttimes (restricted to the airport of departure within gliding distance, however no cross-country flights during nighttimes). Provided the ATC equipment according technically notice TM 817-12 is installed and the appendixes for avionic equipment for the flight manual and for the maintenance manual are present for the motorglider GROB G109B.

II.3 Minimum equipment

- 1 Airspeed indicator (300 km/h, 186mph, 162 kts)
- 1 Altimeter
- 1 RPM indicator
- 1 Tachometer hour counter
- 1 Oil pressure indicator
- 1 Oil temperature indicator
- 1 Voltmeter
- 1 Fuel quantity indicator
- 1 Magnetic compass
- 1 Cylinder head temperature gauge (Cooling liquid temperature)
- 1 Manifold pressure gauge
- 1 EGT
- Propeller control unit P-120-A
- 1 Engine Emergency Switch
- 1 Combined Instrument Status Indication
- 2 4-Belt seat harnesses
- Load placard
- Data placard
- Flight manual

When used as a towing motorglider: Observe appendix 1 for the flight manual of the motorglider GROB109B for the operation as a towing motorglider chapter 6.9 "Equipment list".

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Information for the electric system

Voltmeter (up to factory number 6339)
red range 8,0 - 10,7 V
red-green range 10,7 - 12,0 V
green range 12,0 - 15,0 V

red range 15,0 - 16,0 V

Voltmeter (from factory number 6340)
yellow range 6,0 - 10,0 V
green range 10,0 - 15,0 V
yellow range 15,0 - 16,0 V

red limit 16,0 V

optional

Ammeter (up to factory number 6339)
no range indication

Ammeter (from factory number 6340)
green arc - 10 through +10 A
yellow arc - 20 through -10 A
and + 10 through + 20 A
red limit - 20 and + 20 A

If the indication during flight is above 15 respective 16 V and or 20 amps (red range) engine RPMs should be reduced.

If the indication remains in the red range, put main switch off and start troubleshooting after landing to correct the function.

Caution: Main switch in the OFF position shuts down all electrical equipment. The relais box connects the electrical system of the engine to the emergency battery, after 20 minutes the emergency battery is depleted. Flight planning should be adapted. Radio, avionics and other electrical consumers like RPM indicator and propeller control are off. Engine start is only possible by a windmilling, provided the propeller is not in feathered position.

II.4 Engine limitations

II.4.1 Engine Limbach L2400DT1 and Propeller MTV-1-A/L 170-05
Takeoff power 96 KW at 3000 RPM (40 inch Hg)
Max. continuous power 85 KW at 3000 RPM (38 inch Hg)

II.4.2 Engine RPM (RPM markings)
Take off RPM red limit 3000 RPM
Caution: do not operate above red limit!
Operating range (green range) 800 - 2200 RPM
Operating range (green range) 2400 - 2700 RPM
Caution range (yellow range) 2700 - 3000 RPM

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II.4.2 Engine RPM continued

Important: Do not operate between 2200 and 2400 RPM continuously!

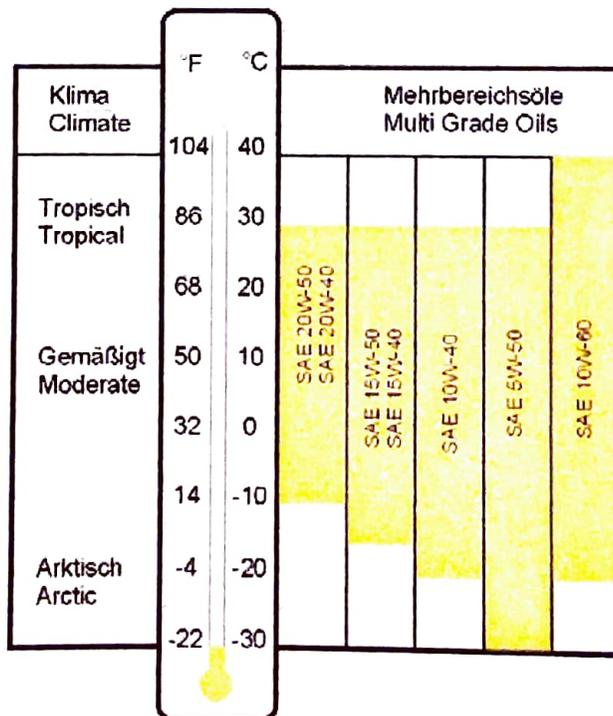
Idle rpm on ground 800 +- 100 RPM
 Run up on ground with propeller in
 take off position, indicated by green LED 2950 +- 50 RPM

II.4.3 Lubrication

Type of oil

Do not use alloyed or unalloyed aviation oils! Use trade mark oils specified with SAE only.

See table



Oil temperature

Maximum temperature (red limit)

120°C

Operating range (green arc)

50-120°C

Minimum temperature (red limit)

50°C

Optimum temperature

80°C

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II.4.3 Lubrication continued

Capacity

Minimum 2.75 ltr (2.85 qts)
Maximum 3.5 ltr 3.7 qts

Note : The oil level indication at the dipstick is almost the same 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 run around the fuselage bottom.

Oil pressure

Minimum oil pressure at 2500 RPM (red line) 1.0 bar
Operating range (green arc) 0.5 – 7,0 bar
Maximum oil pressure (red limit) >7.0 bar

Oil temperature

Maximum temperature (red limit) 120°C
Operating range (green arc) 50-120°C
Minimum temperature (red limit) 50°C
Optimum temperature 80°C

II.4.4 Fuel

Type of fuel

Name brand gasoline should be used only.
Automotive gasoline super plus DIN EN 228 no lead minimum 98 octane (ROZ) or Aviation gasoline AVGAS 100LL.

Fuel tank capacity

Full tank 100 ltr. (22.0 Imp.gal, 26.4 US.gal, 70kg, 154 lbs)
Usable fuel 98 ltr. (21.6 Imp.gal, 25.9 US.gal)

Caution: While refuelling (even from cans) be sure aircraft is connected with a ground wire properly.

Note: Due to the installation position of the quantity transmitter, fuel quantity indication on ground or in flight is almost identical. "Full" is indicated between 95 and 100 ltr. (20.9-22.0 Imp.gal., 25.1 – 26.4 US.gal.) total fuel. So initially the fuel indicator needle will scarcely move at the beginning of a flight when the tank is completely filled.

II.4.5 Cooling liquid

The Radiator system is filled with mixture of water, anti frost and anti corrosion liquid.

Cooling system capacity

Filling capacity 3.3 ltr

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II.4.5 Cooling system continued

Cooling system temperature

Max. Radiator system temperature (red Limit) 110°C

Cooling liquid mixture

The mixture of water and anti frost liquid may vary within certain limits.

| Anti frost down to | Anti frost part | Water part |
|--------------------|-----------------|------------|
| -25 °C | 40% min. | 60% |
| -35 °C | 50% | 50% |
| -45 °C | 60% max. | 40% |

Do not mix nitrate- and silicate free anti frost liquids. Anti frost and anti corrosion liquids should meet VW specification TL VW 774 C or TL VW 744 D. Nitrate free anti frost liquids have certain colours.(red in general) A brownish colour indicates a mixture between nitrate- and silicate free liquid. When changing the anti frost liquid flush the whole system with clean water.

II.4.6 Engine manifold pressure

Caution range (yellow arc) 36-40 inch Hg
Maximum manifold pressure (red limit) 40 inch Hg

Assuming standard atmosphere values following Engine manifold pressures should not be exceeded:

| | | |
|---------------|----------|------------------|
| During climb | 3000 RPM | 40.0 inch Hg MAP |
| During cruise | 2700 RPM | 36.0 inch Hg MAP |

Caution: Exceeding these values can lead to exceeding the maximum flight speed.
Do not operate manifold pressure and RPM in the yellow during cruise flight.

II.4.7 Engine exhaust gas temperature

| | |
|---|------------|
| Maximum exhaust gas temperature (red Limit) | 980 C° |
| Normal operation (green arc) | 400-950 C° |
| Caution range (yellow arc) | 950-980 C° |

| | | | | | |
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|--|---|--|

II.4.7 Engine exhaust gas temperature

| | |
|---|------------|
| Maximum exhaust gas temperature (red Limit) | 960 C° |
| Normal operation (green arc) | 400-950 C° |
| Caution range (yellow arc) | 950-960 C° |

| | | |
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|--|---|--|

II.6 Airspeed limitations and load factors limits

| | | |
|---|---------|---------|
| Maximum allowable airspeed (calm air) $V_{NE} = 240 \text{ km/h}$ | 130 kts | 149 mph |
| Maximum allowable airspeed (rough air) $V_B = 170 \text{ km/h}$ | 92 kts | 106 mph |
| Manoeuvring speed $V_M = 170 \text{ km/h}$ | 92 kts | 106 mph |
| Maximum speed with airbrakes extended $V_{LE} = 240 \text{ km/h}$ | 130 kts | 149 mph |
| Stall speed with airbrakes extended $V_{S1} = 80 \text{ km/h}$ | 43 kts | 50 mph |
| Stall speed with airbrakes retracted $V_{S0} = 73 \text{ km/h}$ | 39 kts | 45 mph |

All speeds are indicated airspeeds (V_{IAS})

Calibrated airspeed is indicated airspeed corrected for position error
($CAS = IAS + V_j$)

On page 15 the calibrated airspeed (V_{CAS}) are determined
(airspeed indicator calibration table)

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

| | | |
|-------------------------------|-------|--------|
| at manoeuvring airspeed | + 5.3 | - 2.65 |
| at maximum allowable airspeed | + 4.0 | - 1.5 |

| | | | | |
|---------------------|---------------|---------------|-----------------------|-------------|
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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.

Jan. 10. 1985 (TM 817-17)

Approved by LBA

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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.

Sept. 1, 1983

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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.)

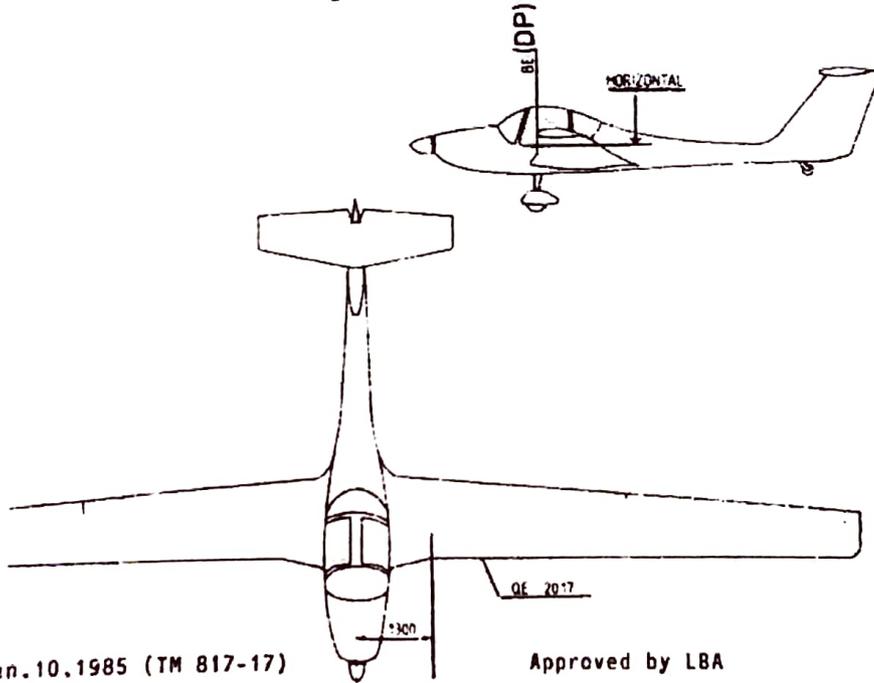
behind the datum line, equivalent to

24% to 38%

of the MAC of 1.1247 m (44.3 inches)

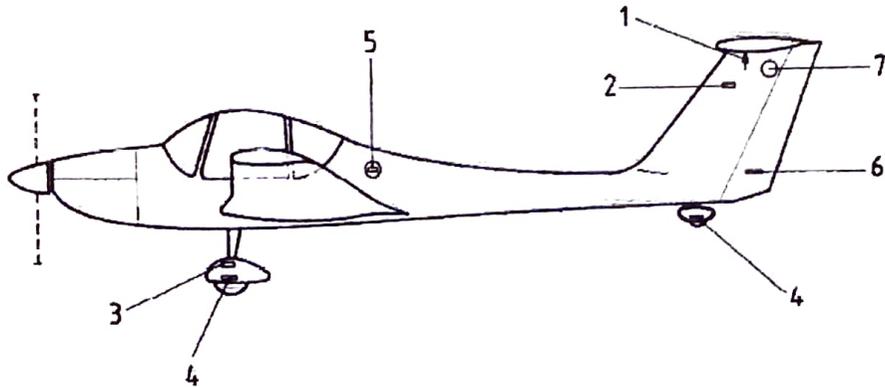
Datum plane (DP): Leading edge at span 1.3 m (4.3 ft.)
(Out of oblique wing-fuselage fairing)

Aircraft attitude: edge of door frame horizontal



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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

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✓ **D-KEYC**

(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 850kg 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

X 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

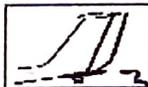
(Less weight must be compensated with ballast in the seat)

Maximum payload right or left: 110 kg, 243 lbs
The maximum gross weight must not be exceeded.

below canopy frame right side

✓ Parking brake

✓ Cabin heat



Towing option only

labels on operating knobs on center console

✓ **Fuel capacity**

100 ltr. 220 imp gal.
26,4 US gal.

Open

closed

fuel shutoff valve (center console)

✓ nose down TRIM nose up

near trim handle on center console

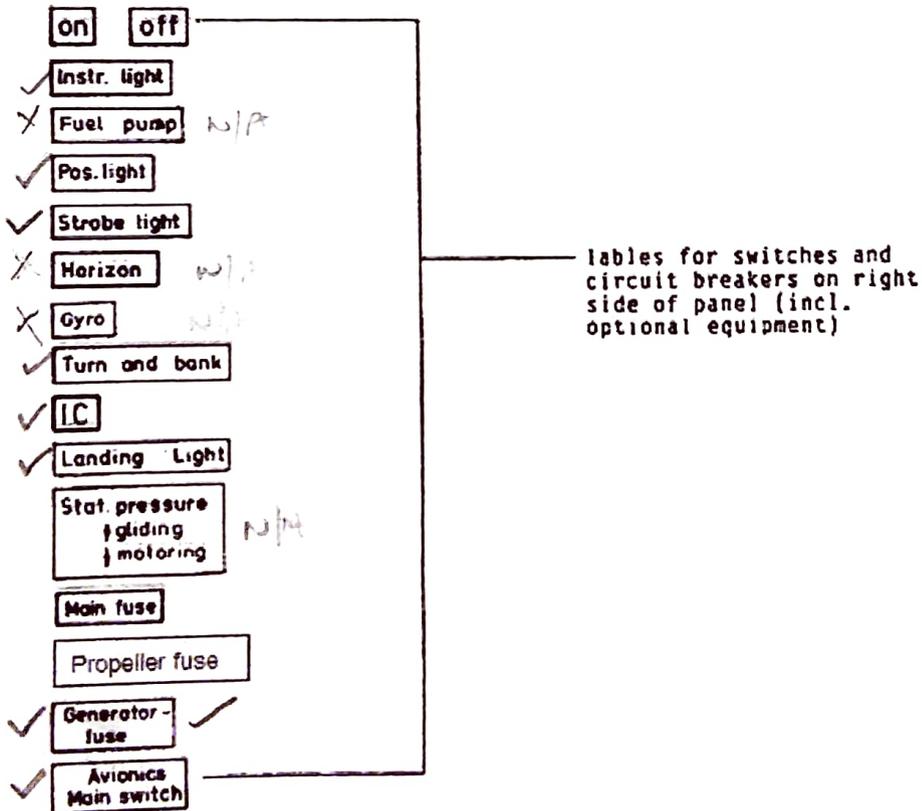
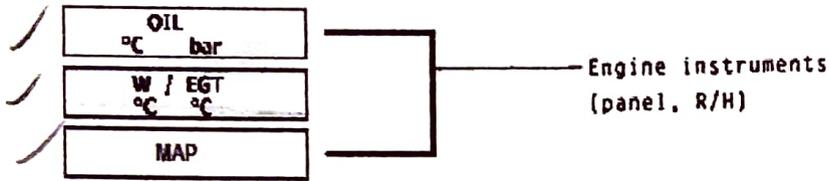
✓ **Baggage**

max 20kg, 44 lbs

baggage compartment

| | | | | |
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✓ **Tire pressure**
2,5 - 2,8 bar
360 - 398 psi

————— all 3 wheel fairings

✗ **Oil according to Flight Manual** ——— **Coolant according to Flight Manual** ——— next to oil dipstick and coolant reservoir

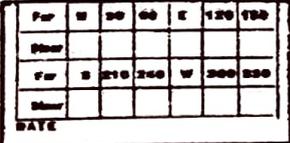
✓ **Fuel**
- Avgas 100LL or
- min. ROZ 98 octane

————— at fuel filler cover L/H fuselage

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

✓ **Dont push or lift here** ——— on both sides at bottom of rudder

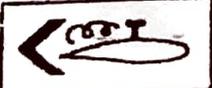
✓ **Elevator quick lock connected**
Markings notice
Rotating knob turned in
Tailplane secured (cover closed) ——— at L/H top of fin

✓  ——— Deviation table (near the magnetic compass)

| | | | | | |
|------|---|----|----|---|---------|
| For | W | SW | SE | E | 120 000 |
| Min | | | | | |
| For | S | SW | SE | W | 300 000 |
| Min | | | | | |
| DATE | | | | | |

✓  ——— 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)

X **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)

Under fuse box



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III. Normal operating procedures

III.1 Cockpit layout and controls



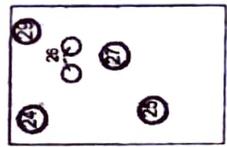
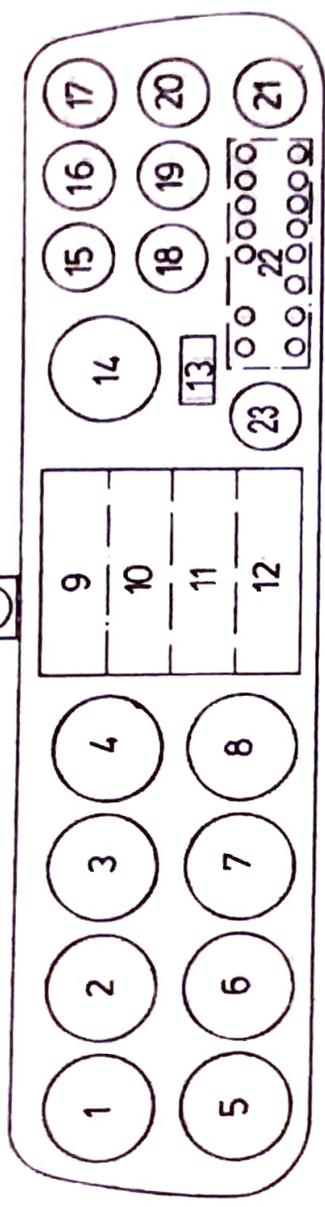
- | | |
|---|-------------------------------------|
| 1 Control stick | 10 Heating *) |
| 2 Rudder pedals (with toe brakes) | 11 Fuel shut off valve |
| 3 Air brakes | 12 Tow cable release (Towoption) |
| 4 Parking brake *) | 13 Propeller control unit |
| 5 Throttle (at S/N 6340 and subsequent there is a second throttle at the left Panel side) | 14 Flight instruments |
| 6 Elevator trim | 15 Radio and avionics |
| 7 Master switch with starter | 16 Engine instruments |
| 8 Ignition switches 1 + 2 | 17 Engine emergency switch |
| 9 Test switch for emergency battery | 18 Compass |
| | 19 Circuit breaker propeller system |
| | 20 Status indication |
| | 21 Towing mirror (Tow option) |

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 are adjustable (right turn to fix and left turn to release).

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Instrument panel left side:
Flight instruments

Instrument panel middle:
Radio and Avionics
Main switch, Starter, Ignition switches
Parking brake and Heater

Instrument panel right side:
Engine instruments and switches

Special instrument panels with different instrument arrangements are possible.

- | | | | |
|----|------------------------------|----|--------------------------------|
| 1 | Airspeed indicator | 17 | Voltmeter |
| 2 | Horizon | 18 | Status indicator with |
| 3 | Altimeter | 19 | Elapsed time indicator |
| 4 | NAV - indicator | 20 | Combi-Instrument |
| 5 | Space for optional equipment | 21 | Oil pressure / Oil temperature |
| 6 | Directional gyro | 22 | Combi-Instrument |
| 7 | Variometer | 23 | Coolanttemp/EGT |
| 8 | ADF - indicator | 24 | Temperature (outside) |
| 9 | COM - control | 25 | Switch board |
| 10 | NAV - control | 26 | Emergency switch |
| 11 | ADF - control | 27 | Parking brake |
| 12 | Transponder | 28 | Heating |
| 13 | Propeller Control Unit | 29 | Ignition switch 1+2 |
| 14 | RPM - indicator | | Main switch |
| 15 | Mainfold pressure gauge | | Towing mirror (Tow option) |
| 16 | Fuel quantity | | Tow cable release (Tow option) |

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

| | | |
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III.2 Daily inspections

Prior to flight operations the following visual exterior checks have to be performed (see page 22 also).

First ensure ignition and main switches are off.

1. Engine and propeller

- Check propeller blades for cracks and dents and proper installation
- Remove engine cowling check oil min. 2.75 ltr ., max. 3.5 ltr. (min. 2.85 qts., max. 3.7 qts.) and cooling fluid quantity between min. and max. (see page 10 also).
- Visually inspect engine
- Install engine cowling properly

Note: For further details refer to propeller and engine manuals.

2. Landing gears

- Check tire pressure (main and tail wheels 2.5 bar, 36.26 psi ea.)
- Check slip marks, tire conditions and fairings

3. Wings

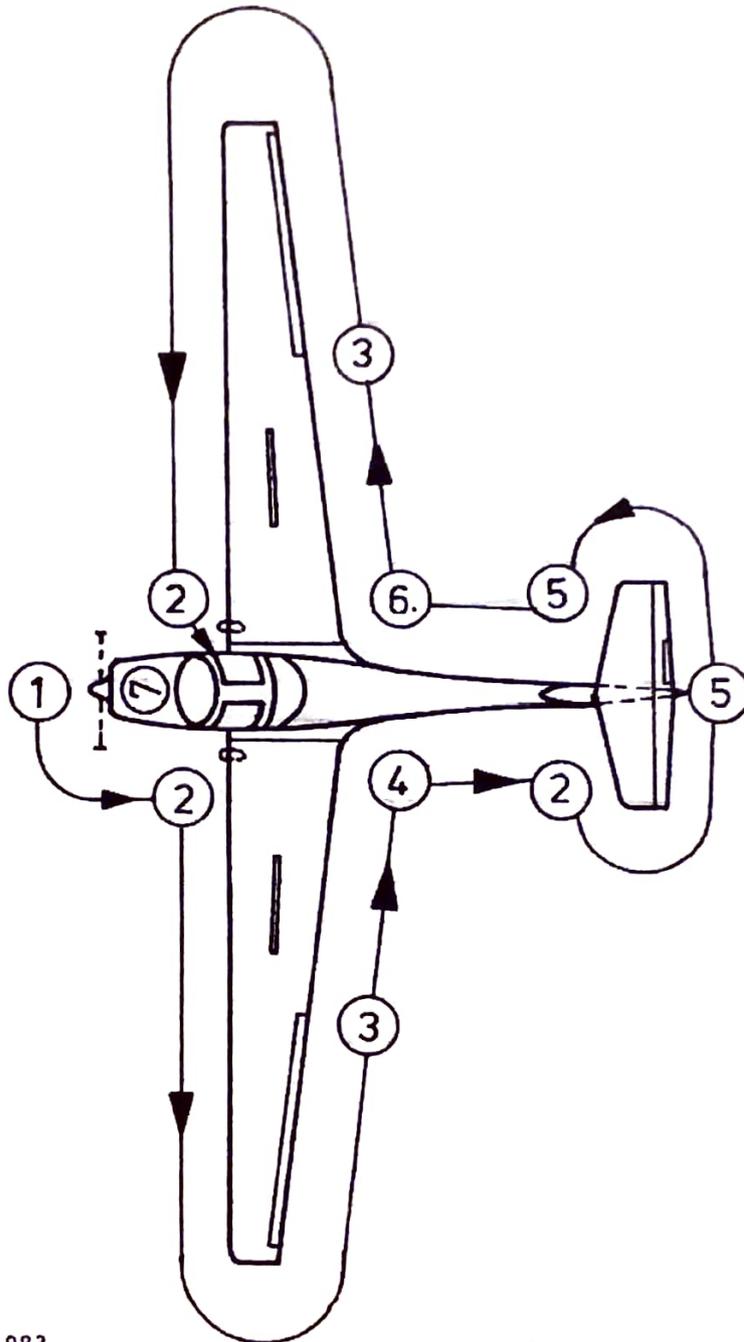
- Condition (surface is clean: remove rain, ice or snow and check for cracks and dents)
- Attachment check
- Airbrakes check
- Aileron play and freedom of movement, slot tape and push rod connection
- Check strobe and position light for function attachment and plexiglass cover.

4. Tank and wing connections

- Drain tank by pressing the drain valve, located at the bottom of the fuselage
- Check fuel quantity through tank filler neck and tank ventilation
- Check main bolt, nose bolt and existing electrical connectors through inspection plate

Caution: Close the inspection plate carefully (see page 42)

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III.2 Daily inspections continued

5. Tail unit

- Check rudder for play, free movement, control connection, damage and slot tape.
- Check position and strobe light for function attachment and cover.
- Check stabilizer for proper installation, installation screw tight, damage and taped flap.
- Check elevator for play, free movement, control connection, damage and slot tape.
- Check trim tab for play, control connection, damage and slot tape.
- Check pitot tube for proper installation, all openings for dirt and cover removed
- Check towing assembly for function and proper installation

6. Fuselage

- Check fuselage for damage

7. Cockpit:

- Check all cockpit and flight controls for proper installation and damage
- Check flight controls for proper function
- Check folding doors for operation check lock
- Clean windows and doors
- Check for loose items in the cockpit

III.3 Preflight inspection

1. Daily inspection completed.
2. Oil, cooling fluid and fuel quantity checked
3. Weight and balance calculation performed (according page 55 and following)

III.4 Before starting the engine

1. Each rudder pedals adjusted correctly side by side in neutral rudder position. Red knobs adjust on each pedal, lock the red knobs positively). From S/N 6340 both rudder pedals are adjusted with one crank simultaneously. Adjust back rest.
2. Seat belt tight, parachute harness tight and ripcord attached (automatic parachutes only).
3. Folding doors locked

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III.4 Before starting the engine continued

- | | |
|----------------------------------|-------------|
| 4. Parking brake | as required |
| 5. Radio and Navigation switch | off |
| 6. Fuel shut off valve | open |
| 7. Flight controls and airbrakes | checked |
| 8. Altimeter | set |
| 9. Flight instruments | set |

III.5 Starting the engine

- | | |
|---|--|
| 1. Master switch | on |
| 2. Propeller system | one cycle to feather and back to take off position, then switch to AUTO 3000 RPM STOP (green LED on propeller control unit illuminated) |
| 3. Electric instruments battery voltage and fuel quantity | check |
| 4. Avionics and navigation instruments | off |
| 5. Anti collision light | on |
| 6. Ignition switches | 1+2 on, fuel pump no. 1 operates audible for 10 sec. |
| 7. Emergency battery voltage | check |
| 8. Ignition switches | 1+2 off |
| 9. Engine emergency switch | Emergency, yellow LED illuminates |
| 10. Ignition switches | 1+2 on, fuel pump no. 2 operates audible for 10 sec. |
| 11. Engine emergency switch | Normal, yellow LED extinguished |
| 12. Throttle | idle |

Caution: Be sure there are no persons in the vicinity of the propeller.

- | | |
|---------------------------------|---|
| 13. Master switch hold to | Start position and release after engine is running. Note: for another attempt, master switch must be Switch to off first. |
| 14. Throttle adjust | to 1300 RPM (at lower RPM the red generator warning light may illuminate, due to insufficient charge) |
| 15. Oil pressure within 10 sec. | green range |

Caution: Shut down engine if oil pressure remains under green range.

- | | |
|--|--|
| 16. Avionic switch after engine is running | on (other electrical device on as required) |
| 17. Battery charge | verify, red generator warning light extinguished |

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III.6 Engine warm up, propeller check and run up

III.6.1 Engine warm up

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Parking brake 2. Engine warm up | as required to 50°C, 2 min 1300 RPM to begin, then 1500RPM, taxi as required. on |
| <ol style="list-style-type: none"> 3. Avionic and other electrical devices | on |

III.6.2 Propeller check

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Propeller mode switch 2. RPM preselector knob 3. Throttle advance to 4. RPM drop to 2000 RPM | Auto 2000 RPM 2200 RPM Check, green LED on propeller control unit will extinguish |
| <ol style="list-style-type: none"> 5. Throttle retard to | idle, green LED on propeller control unit will illuminate |
| <ol style="list-style-type: none"> 6. Engine instrument indications | green range |

III.6.3 Run up

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Parking brake 2. Elevator 3. Propeller control unit 4. Throttle advance to 5. RPM 2950 +/- 50 RPM 6. Throttle retard to 7. Ignition system | set pull Auto/3000 RPM/Stop full throttle slowly check for propeller MTV-1-A/L 170-05 2000 RPM check Ignition switch 2 off Ignition switch 2 on Ignition switch 1 off Ignition switch 1 on Normally there is no noticeable RPM drop. RPM drop should be less than 100 RPM. Emergency, yellow LED illuminates, engine operates normally after a short RPM drop Normal, yellow LED extinguishes, engine operates normally after a short RPM drop |
| <ol style="list-style-type: none"> 8. Engine emergency switch | |
| <ol style="list-style-type: none"> 9. Engine emergency switch | |

| | | | | | |
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III.7 Taxiing

Due to coupling of the rudder and tail wheel, the aircraft handling on the ground is simple. To achieve a very small turning radius, an individual brake application on 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 air brake handle operates both main wheel brakes simultaneously.

Caution: Since S/N 6340 and later, there is no brake application with the airbrake handle.

When manoeuvring the aircraft manually on the ground, the tail wheel disengages automatically and can be rotated 360°

III.8 Before take off

- | | |
|--|---|
| <ol style="list-style-type: none"> 0. Run up 1. Throttle 2. Airbrakes 3. Folding doors 4. Emergency jettisoning 5. Trim 6. Fuel shut off 7. Engine instrument indication 8. Parking brake | performed according III.6 free movement locked locked secured neutral open green range released |
|--|---|

Caution: It is necessary to a check for the fuel shut off valve in. open position The engine will operate for approximately 2.5 minutes with the fuel shut off valve closed. A hurried take off can end tragically without fuel.

III.9 Take off and climb

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Propeller control unit 2. Throttle 3. Engine/Propeller 2950+/-50 RPM 4. Engine manifold pressure in yellow arc 5. Aircraft direction 6. Airspeed 85 km/h and 3 point attitude 7. Initial climb speed 90-110 km/h 8. Engine instrument indications 9. Manifold pressure and engine RPM | Auto/3000RPM/Stop and green LED illuminated forward check adjust observe lift off (46 kts) observe Vx 90 km/h (49 kts), Vy 110 km/h (60kts) green range at safe altitude retard out of yellow range |
|--|---|

Note: If the oil temperature comes close to 120°C, continue flying at higher airspeeds for better cooling effect 130 km/h (70 kts)

Note: Maximum cross wind component for take off and landing on dry and wet surfaces is 20 km/h (11 kts)

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III.10 Cruise flight

- | | | |
|----|---------------------------------------|-----------------|
| 1. | Cruising altitude and cruising speed | obtained |
| 2. | Manifold pressure for cruising flight | throttle adjust |
| 3. | Propeller control unit cruising RPM | select |

Caution: Do not operate engine/propeller RPM continuously above 2700 RPM

Caution: Do not operate engine at low RPM and high manifold pressure simultaneously.
(for example 2000 RPM and 40 inch Hg.)

Economic power combinations are shown on the table below.

| Power (%) | Manifold pressure (in HG) | Engine/propeller (RPM) | Fuel consumption (l/h) | IAS in altitude 6000 (ft) (km/h) | TAS in altitude 6000 (ft) (km/h) |
|-----------|---------------------------|------------------------|------------------------|----------------------------------|----------------------------------|
| 100 | 40,0 | 3000 | 32,3 | Not to for continuous use | Not to for continuous use |
| 75 | 36,0 | 2700 | 23,5 | 207 | 231 |
| 65 | 33,0 | 2600 | 19,8 | 190 | 212 |
| 55 | 30,0 | 2600 | 16,7 | 185 | 206 |
| 50 | 28,5 | 2600 | 15,2 | 175 | 185 |
| 45 | 25,0 | 2600 | 14,2 | 162 | 181 |

Note: Full deflection of flight controls is considered up to manoeuvring speed only (170 km/h, 92 kts).

Note: If the elevator is deflected, the maximum allowable acceleration forces (chapter II.6) must not be exceeded .

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III.10 Engine shutdown and restart during flight

Engine shutdown during flight

- | | |
|---------------------------------|--|
| 1. Airspeed 100 km/h (54 kts) | maintain |
| 2. Avionics | off |
| 3. Throttle | idle |
| 4. Electrical power consumers | off |
| 5. Ignition 1 + 2 | off |
| 6. Propeller control unit | mode switch to MANU , pitch switch to SEGELN |

Important note: Because of windmilling engine/propeller keep turning although the ignition is of, however the engine/propeller RPM indicator is inoperative. While the propeller blades pitch increase to feather position, engine/propeller will stop.

Important note: During gliding all unnecessary electrical consumers should be shutdown, to save electrical energy for engine restart. An automatic shut down of electrical power consumer like position-, landing- and strobe light when the engine stops saves energy for restart. Battery capacity is good for a 5 hours lasting gliding flight operating radios and electrical variometer. Engine can be restarted by windmilling (provided the battery is still able to move the propeller blades in the take off position). Refer to chapter IV.6 engine restart in flight with main battery discharged.

Caution: The propeller blade pitch changes with 1°/sec only, that's why there is a risk of overrevving while restarting the engine during flight. The RPM indicator starts to indicate when engine/propeller RPM are more than 1200 RPM.

Engine restart during flight

- | | |
|------------------------------------|---|
| 1. Airspeed 120 km/h (65 kts) | maintain |
| 2. Master switch | on |
| 3. Avionics and electrical devices | off |
| 4. Propeller control unit | mode switch to MANU, pitch switch to START |
| 5. Throttle | idle |
| 6. Ignition 1 + 2 | on |
| 7. Master switch | hold to start position and release after engine is running. |

Note: for another attempt, master switch must be switched to of first

- | | |
|-------------------------------------|--|
| 8. Oil pressure within 10 sec. | green range |
| 9. Fuel pressure warning light | extinguished |
| 10. Avionics and electrical devices | on |
| 11. Engine instrument indications | green range 1 |
| 12. Propeller control unit | mode switch to AUTO, pitch switch to STOP peselector knob as required 1 |
| 13. Throttle | as required |

Note: Do not apply full power as long as engine is cold. Like on ground, warm up engine first.

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III.12 Descent

Reduce power, and trim, if necessary use air brakes. Check parking brake is released.

III.13 Approach

Maintain approach speed 115 km/h (62 kts, yellow triangle) increase airspeed when turbulence is experienced.

- | | |
|---------------------------|--|
| 1. Throttle | retard |
| 2. Propeller control unit | Auto/3000RPM/Stop and green LED illuminated |
| 3. Airbrakes | as required (effective even for very steep approaches) |

Caution: Keep the airbrake lever firmly in your hand to control the glide path. Fully extended brakes increase the stalling speed. Side slips cannot be maintained continuously to control the glide path. Airbrakes lever shall be returned to the locked position if hand is removed from air brake handle.

Note: At S/N 6340 and subsequent at the left airbrakes lever to stop is installed, which can be thrown in or out by little clutch.

If the stop is thrown in you can lock the air brake lever in the middle position. In this position you can and by using this throttle only. You can go around and climb with a reduced climb rate in this position also. It is recommended to retract the airbrakes before bailed landing to achieve maximum climbing performance.

If necessary you can move the air brake lever in both directions also with the right lever and jump over the stop easily. The side-slip is barely effective by using a 20 degrees angle and an airspeed of 110 km/h (60 kts , 68 mph). You have only a small degradation in the airspeed system during slip-manoevres. The slip should be finished at a safe height. 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 motorglider rolls out of the slip in to wing level position. Using this method to end the slip the motorglider does not adopt unusual flight attitudes and deviates only slightly from its original flight path.

III.13 Landing

Reduce airspeed to a minimum, smoothly pull back control stick and touch down in the 3-point attitude. S/N and earlier not to use airbrakes fully extended during touchdown, since the wheel brakes of the main wheels will brake heavily.

After touchdown keep control stick in the aft position and apply made in the ad breaks with either the air brake handle all the tip toe brakes on the rudder pedals. Keep direction with its rudder and tail wheel.

Caution: Since S/N 6340 main wheel brakes can not activated by the air brake lever but by tip toes only.

Do not retract airbrakes immediately after touchdown, the motorglider can become airborne again.

Maximum crosswind component for landing is 20 km/h.

When using high power for longer time during taxiing for parking, cool down engine for 2 or 3 minutes with 1300RPM.

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III.14 Landing continued: After taxiing to parking position

- | | |
|--------------------------------------|---|
| 1. Propeller control unit | Auto/3000RPM/Stop and green LED illuminated |
| 2. Throttle | idle |
| 3. Electrical consumer all | off |
| 4. Radios and navigation instruments | off |
| 5. Ignition 1 + 2 | off |
| 6. Master switch | off , remove key |
| 7. Parking brake | set |

Caution: Do not turn off master switch while is engine is still running, this could damage the generator.

Parking the motorglider for a longer time unattended it should be either anchored or put into a hangar.

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 circled whiles maintaining 95 km/h (51 kts).

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

If the compensation nozzle and the transfer switch for the static pressure is installed, switch from Motoring to Gliding. If the engine is restarted, switch back to Motoring.

The motorglider 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 airspeed will never be exceeded even at maximum gross weight.

Engine restart is recommended at altitude loss while soaring.
Recommended height under normal conditions:

- 600 m (2000 ft) GND commence engine restart.
- 300 m (1000 ft) GND engine restart completed resume climb.

Note: If engine restart attempt was not successful prepair emergency landing.

Note: Do not thermal below 300 m (1000 ft) GND even with running engine for safety reasons.

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III.16 Landing with dead engine

Start the approach from sufficient height, on final control the glide path with airbrakes if necessary.

III.17 Inspections after hard landings

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

- Check the main wheels,
- Check the main wheel struts and suspension,
- Check rudder control rods,
- Check rudder actuator lever behind the tail wheel,
- Check wing spar at the root for white spots,
- Check main wing fittings (fuselage and root ribs)
- Check spar connection unit

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

Note: A crash switch is installed in the RAF-version of the G 109B which is activated during a hard landing (> 3,6 g) at the lower side of the instrument panel. Resetting the switch is accomplished manually.

III.18. Engine start with external power

The engine is equipped with a battery ignition system and cannot be cranked up manually because the cranking RPM are too low.

Caution: However, be careful when cranking the engine manually.

At the right hand lower fire wall is the external power connector installed. For engine start with external power the cowling can remain closed. As special cable for external power connection with a connector that fits the receptacle on the motorglider should be used. The cable needs a section of 16mm². The male pin is plus, the receptacle is minus.

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III.18. Engine start with external power continued

Insert the connector in to is the receptacle of the motorglider and lock it by turning it 30° clockwise. The plus terminal on the motorglider side has no voltage yet. Put clamps with correct polarity (red plus and black minus) on a car battery or external battery terminals.

Caution: Check external power has 12V

Caution: no persons should be in the vicinity of the propeller. The motorglider must be secured against moving.

The electrical system of the motorglider is protected against wrong polarity and under voltage. Electrical power is direct it to the motorglider when polarity and voltage is correct only.

Start engine according III.4 – III.5.

Caution: Watch for running propeller. Electrical short can happen if ends of cable have contact.

Remove clamps from external battery terminals, when engine is running and red generator warning light extinguished.

After disconnecting the connector, the plus pole on the receptacle on the aircraft has still electrical power, until the main switch has been turned to off position once. If the main switch is in the on position the next time (whether the engine is running on not) the plus pole on the receptacle on the aircraft as no electrical power.

Caution: Switching off the main switch when engine is running can damage the generator, The external power connector can not be used for charging the battery, because connection exists with main switch on only.

For charging the main battery, remove upper cowling and connect battery charger to the main battery.

Caution: observe correct polarity (danger of electrical short) and observe the manual of the battery manufacturer about charging time and current. Charging beyond limits can lead to fire or explosion.

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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 permissible 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.

Jan.15,1990

Approved by LBA

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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:

- | | |
|--------------------------|--|
| 1. Throttle | idle |
| 2. Ignition 1 + 2 | off |
| 3. Red handle first then | Emergency jettison handle |
| 4. Doors | pull to full extension push upwards |
| 5. Seat harness | release |

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

IV.3 Engine failure

Any malfunction on the engine/propeller system has to be detected and corrected before commencing the next flight.

IV.3.1 Engine failure after take off

- | | |
|----------------------------|---------------------------------------|
| 1. Engine emergency switch | emergency |
| 2. Fuel shut off valve | open |
| 3. Propeller control unit | mode switch Manu, pitch switch Start |
| 4. Ignition switches 1 + 2 | on |
| 5. Exhaust gas temperature | keep within 600-750°C by the throttle |

Caution: If the engine emergency switch is in emergency position the second fuel pump starts and some sensors for the engine control are replaced or shutdown. The emergency mode is indicated by a yellow LED. The LED is illuminated during the emergency mode and 10 secs. after engine shutdown.

Caution: If normal engine operation cannot attained, and engine power is not sufficient, commence emergency landing.

Before touch down:

- | | |
|------------------------|--------|
| 1. Fuel shut off valve | closed |
| 2. Ignition 1 + 2 | off |
| 3. Main switch | off |

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IV.3.2 Engine failure during cruise flight

- | | |
|----------------------------|---------------------------------------|
| 1. Engine emergency switch | emergency |
| 2. Fuel shut off valve | open |
| 3. Ignition switches 1 + 2 | on |
| 4. Exhaust gas temperature | keep within 600-750°C by the throttle |

Caution: If the engine emergency switch is in emergency position the second fuel pump starts and some sensors for the engine control are replaced or shutdown. The emergency mode is indicated by a yellow LED. The LED is illuminated during the emergency mode and 10 sec after engine shutdown.

Caution: If normal engine operation cannot be attained, and engine power is not sufficient, start following procedure.

- | | |
|------------------------------------|---------------------------------------|
| 1. Throttle | idle |
| 2. Ignition 1 + 2 | off |
| 3. Propeller control unit | mode switch Manu, pitch switch Segeln |
| 4. Main switch | off |
| 5. Airspeed for best gliding angle | 115 km/h |
| 6. Suitable landing field | select |

IV.3.3 Red LED emergency battery discharge illuminates

The red flashing LED emergency battery discharge on the status indication indicates a malfunction of the electrical power supply for the engine. The engine gets its electrical power from the capacity limited emergency battery only. Press the test switch close to the voltmeter to check the charge status of the emergency battery.

- | | |
|-------------------------|--|
| 1. Electrical consumers | off (radios, nav-instruments, RPM-indicator etc off) |
| 2. Nearest airport | land (for trouble shooting and maintenance) |

Caution: the maximum remaining flight time is 20 minutes. (The capacity of the emergency battery is good for 20 minutes only). Land at nearest suitable airfield. All electrical devices are off, this includes engine instruments and propeller control. And engine restart is possible by windmilling only, provided the propeller is not in feather position.

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IV.3.4 Red LED fuel pressure illuminates

The red flashing LED fuel pressure discharge on the status indication indicates a malfunction of the fuel supply for the engine.

- | | |
|----------------------------|---|
| 1. Engine emergency switch | emergency |
| 2. Fuel shut off valve | open |
| 3. Ignition switches 1 + 2 | on |
| 4. Fuel quantity | check |
| 5. Exhaust gas temperature | keep within 600-750°C by the throttle |
| 6. Nearest airport | land (for trouble shooting and maintenance |

Caution: Engine failure may happen any time.

Caution: If the engine emergency switch is in emergency position the second fuel pump starts and some sensors for the engine control are replaced or shutdown. The emergency mode is indicated by a yellow LED. The LED is illuminated during the emergency mode and 10 sec after engine shutdown.

Caution: If normal engine operation cannot attained, and engine power is not sufficient, start following procedure.

- | | |
|------------------------------------|---------------------------------------|
| 1. Throttle | idle |
| 2. Ignition 1 + 2 | off |
| 3. Propeller control unit | mode switch Manu, pitch switch Segeln |
| 4. Main switch | off |
| 5. Airspeed for best gliding angle | 115 km/h (62 kts 72mph) |
| 6. Suitable landing field | select |

| | | | | | |
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IV.3.5 Red generator warning light illuminates continuously

The engine driven generator supplies the electrical power for all electrical devices. The red generator warning light indicates a malfunction of the generator. The generator delivers no more electrical power to the electrical system.

- | | |
|-----------------------------------|---|
| 1. Unnecessary electrical devices | off |
| 2. Nearest airport | land (for trouble shooting and maintenance) |

Caution: This engine has no mechanical fuel pump. If the generator fails, the electrical fuel pump gets electrical power from the main battery. The fully charged main battery can operate the electrical fuel pump for 60 minutes, provided all of the unnecessary devices are switched off. (The electrical fuel pump draws 6 A. from the main battery)
 At a certain voltage the relays box switches to the emergency battery automatically indicated by the red flashing LED emergency battery discharge.

The engine gets its electrical power from the capacity limited emergency battery only. Press the test switch close to the voltmeter to check the charge status of the emergency battery.

- | | |
|--------------------|--|
| 1. Ships power | off (radios, nav-instruments, RPM-ind. etc off) |
| 2. Nearest airport | land (for trouble shooting and maintenance) |

Caution: the maximum remaining flight time is 20 minutes. (The capacity of the emergency Battery is good for 20 minutes only). Flight planning should be. All electrical devices are off, this includes engine instruments and propeller control.
 And engine restart is possible by windmilling only, provided the propeller is not in feather position.

IV.3.6 Engine oil pressure low

- | | |
|--------------------|---|
| 1. Throttle | to minimum (to sustain flight) |
| 2. Nearest airport | land (for trouble shooting and maintenance) |

Caution: Engine failure may happen any time.

IV.3.7 Oil or cooling fluid temperature high

- | | |
|--------------------------------|---|
| 1. Throttle | to minimum (to sustain flight) |
| 2. Propeller/engine RPM reduce | to minimum (to sustain flight) |
| 3. Nearest airport | land (for trouble shooting and maintenance) |

Caution: Engine failure may happen any time.

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IV.4 Propeller pitch actuation malfunction.

IV.4.1 Malfunction during engine operation.

Malfunction of the propeller control unit P-120 A

A malfunction of the propeller control unit P-120 A is indicated by the difference between actual RPM and preselected RPM. (RPM migration or oscillation) To stop inadvertent rpm changes pull propeller circuit breaker. (close to the propeller control unit)

P-120 A. A manual RPM/pitch change can be achieved by positioning the pitch switch to Start or Segeln and resetting the circuit breaker momentarily. If this procedure is not successful, and the propeller pitch remains in a high position/low RPM engine should be shutdown and an emergency landing shall be prepared.

Malfunction of the propeller control unit P-120 B

A malfunction of the propeller control unit P-120 B is indicated by the difference between actual RPM and preselected RPM. (RPM migration or oscillation) To stop inadvertent RPM changes position mode switch to Manu.

P-120 B A manual RPM/pitch change can be achieved by positioning the pitch switch to Start or Segeln.

IV.4.2 Malfunction during soaring

If propeller pitch actuation remains in feather position, depending on the flight situation a emergency landing should be commenced. (see section IV.7)

Commence engine restart and propeller operation check in 2000 feet height, to have enough time choosing a suitable landing field in case of the propeller that function.

Frozen propeller pitch actuation

In this case the propeller pitch will remain in its last position like a fixed pitch propeller. Depending on the situation the flight should be finished or continued, keep in mind, go around power could not be achieved with propeller blades frozen in high pitch.

IV.5 Fire and smoke

IV.5.1 Fire under engine cowling

- | | |
|----------------------------|---------------|
| 1. Cabin heat | off |
| 2. Fuel shut off valve | closed |
| 3. Throttle | fully forward |
| 4. Ignition switches 1 + 2 | off |
| 5. Emergency landing | commence |

IV.5.2 Fire In the Cockpit

- | | |
|---------------------------------------|------------------------------------|
| 1. Main switch | off |
| 2. Main and generator circuit breaker | pull |
| 3. Cabin heat | off |
| 4. Cabin ventilation | off |
| 5. Fire extinguisher if available | use (open ventilation after use) |

Caution: The preceding procedure shuts down all electrical devices. The relay box switches automatically to the emergency battery. Due to the limited capacity the engine will not more than 20 min. (The capacity of the emergency battery is good for 20 minutes only). Flight planning should be adapted. All electrical devices are off, this includes engine instruments and propeller control. And engine restart is possible by windmilling only, provided the propeller is not in feather position.

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IV.6 Engine restart during flight with main battery depleted.

The engine can be restarted in flight by windmilling as long as the main battery has sufficient capacity to change pitch of the propeller into start position

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Electrical devices 2. Fuel shut off valve 3. Main switch 4. Throttle 5. Ignition switches 1 + 2 6. Propeller control unit 7. Airspeed 140 km/h – 180 km/h | <p>all off open on idle on propeller mode switch Manu, propeller pitch switch Start, green light on , propeller mode switch Auto, propeller pitch switch Stop, preselect knob 3000 RPM. maintain</p> |
|--|--|

Caution: During restart that is a risk of overrevving, because the pitch changes with a maximum 1°/sec. The RPM indicator indicates after engine is running more than 1200 RPM.

- | | |
|--|--|
| <ol style="list-style-type: none"> 8. Oil pressure in green range 9. Throttle and propeller RPM for flight condition 10. Electrical devices 11. Voltage in green range 12. Flight | <p>after 10 sec adjust on as required check continue</p> |
|--|--|

Caution: Engine restart in flight is done by windmilling. This procedure needs high airspeed. A essential altitude loss inevitable. After longer soaring flights a reserve of height for warm up the engine is to be calculated. Engine restart in flight should be commenced in 2000 feet in height. Observe maximum airspeed. Be aware engine is not starting at the first attempt. This procedure should be a training item. Observe minimum safe altitude.

Warning: If main battery is not charged by generator (red generator warning light on) land exit nearest airport for trouble shooting and maintenance.

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IV.7 Other emergencies

IV.7.1 Flights through precipitation

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

IV.7.2 Stalls

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

- Stick - push forward
- Rudder - apply opposite rotation

IV.7.3 Emergency landing

Choose usable field from sufficient height. Watch wind direction. And approach to is the desired landing site must be executed carefully and precisely. Flare and touchdown smoothly at minimum speed. Prior to touchdown pull stick fully aft and brake moderately.

The above mentioned is valid for dead engine and engine failure. Be always prepared for an emergency landing. If an emergency landing is intended with engine power available, the landing site should be circled at low altitude to check for obstacle, ditches, fences etc. after shut down :

- 1. Ignition switches 1 + 2 off
- 2. Main switch off
- 2. Fuel shut off valve closed

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V. Performance data

All airspeeds are indicated airspeed V_{IAS} .

V.1 Take off distance

Sea level, + 15° C temperature:

| | |
|--|-------------------|
| -Ground roll | 110 m |
| -Take off distance 15m/50ft obstacle | 248 m |
| -Lift off speed | 85 km/h (48 kts) |
| -Airspeed when crossing 15 m (50 ft) obstacle | 95 km/h (51 kts) |

| Field elevation above MSL | | Ambient temperature | | | |
|---|------|---------------------|-----|-------|-------|
| (m) | (ft) | - 15°C | 0°C | +15°C | +30°C |
| Ground roll distance (m) | | | | | |
| 0 | 0 | 93 | 101 | 110 | 119 |
| 250 | 750 | 98 | 106 | 115 | 124 |
| 500 | 1500 | 103 | 111 | 121 | 129 |
| 750 | 2250 | 108 | 117 | 126 | 135 |
| 1000 | 3000 | 114 | 123 | 132 | 141 |
| Take off distance over 15m (50 ft) obstacle | | | | | |
| 0 | 0 | 214 | 230 | 248 | 264 |
| 250 | 750 | 225 | 241 | 259 | 275 |
| 500 | 1500 | 233 | 250 | 268 | 285 |
| 750 | 2250 | 242 | 261 | 280 | 296 |
| 1000 | 3000 | 254 | 272 | 293 | 308 |

All figures are based on an maximum weight of 850 kg (1874 lbs) in zero winds and from a dry, level, hard surface.

For other surfaces add additional according AIP 1. For instance.

| | |
|---|-------|
| - Grass (level, dry, hard and short grass) | + 20% |
| - Grass wet | + 10% |
| - Grass wet and soft | + 50% |
| - Grass high (max. 8cm) | + 20% |
| - Slush ,standing water (appr. 1 cm) | + 30% |

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V.2 Landing distance

Sea level, + 15° C temperature:

| | |
|---|-------------------------|
| -Landing roll | 205 m (673 ft) |
| -Landing distance 15m/50ft obstacle | 390 m (1280 ft) |
| -Approach speed | 115 km/h (62 kts) |
| -Touch down speed (depending on weight) | 75-85 km/h (41-46 kts) |

V.3 Climb schedule

Sea level, + 15° C temperature:

| | |
|---|-------------------------|
| -Maximum vertical speed at take off configuration | 5,2 m/s at V_x |
| - V_x (max, vertical speed) | 110 km/h (59 kts 69mph) |
| - V_y (best climbing angle) | 90 km/h (49 kts 56mph) |
| -Service ceiling | 6096 m |

V.4 Go around performance

Sea level, + 15° C temperature:

| | |
|--|-------------------------|
| -Maximum vertical speed (airbrakes retracted) | 5,2 m/s at V_x |
| - V_x (max, vertical speed) | 110 km/h (59 kts 69mph) |

V.5 Cruising speed

Sea level, + 15° C temperature:

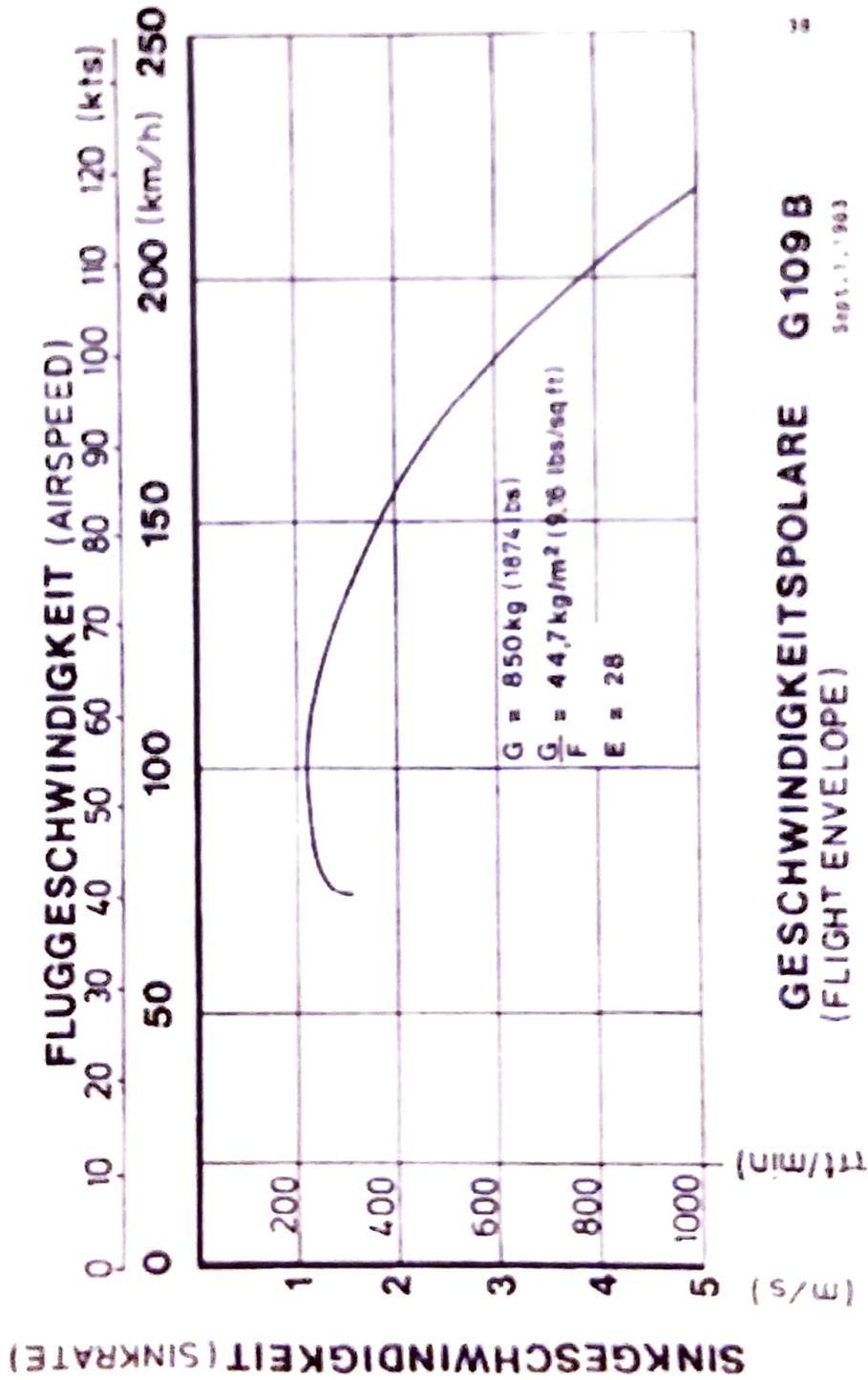
- Maximum continuous power is 36 inch HG MAP and 2700 RPM, the true airspeed is 207 km/h (112 kts)

V.6 Gliding performance

| | |
|----------------------------------|---|
| -Gross weight | 850 kg (1874 lbs) |
| -Wing load | 44,7 kg/m ² (9,16 lbs/in ²) |
| -Gliding ratio at airspeed | 1 : 28 115 km/h (62 kts) |
| Minimum sink rate at airspeed | 1,10 m/s (217 fpm) 108 km/h (58 kts) |

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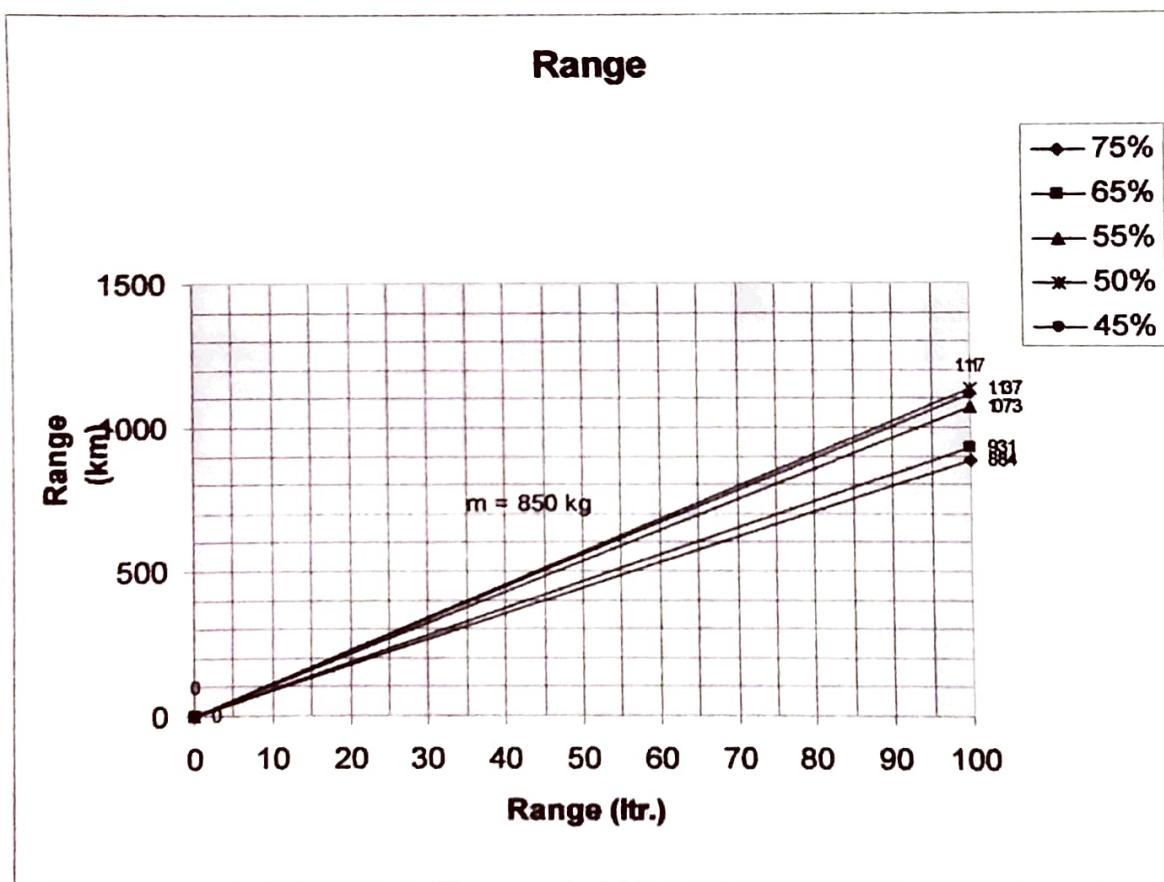
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V.7 Range

The influence of airspeed (TAS) to the range is shown in the diagram. The data for power speed and fuel consumption are shown in sector. V.8.

All data shown are based on zero wind with no fuel reserve in standard ICAO-atmosphere. Fuel for take off and climb is not included. Calculation is base n a gross weight off 850 kg (1784 lbs) and flight altitudes from 0 to 3000 m (0 to 10000 ft) MSL.



Example: With full tank and 50% power the range will be 1137 km (613 nm) under the restriction shown above.

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V.8 Fuel consumption

The fuel tank capacity is 100 ltr (22,0 Imp.gal., 26,4 US.gal.). All data based on ICAO standard atmosphere and the application of Avgas, or trade mark automotive fuel Super-Plus DIN EN 228 no lead minimum 98 octane (ROZ).

| Power (%) | Manifold pressure (in HG) | Engine/ propeller (RPM) | Fuel con- sumption (l/h) | IAS in altitude 6000 (ft) (km/h) | TAS in altitude 6000 (ft) (km/h) |
|--------------|---------------------------------|-------------------------------|--------------------------------|---|---|
| 100 | 40,0 | 3000 | 32,3 | Not to for continuous use | Not to for continuous use |
| 75 | 36,0 | 2700 | 23,5 | 207 | 231 |
| 65 | 33,0 | 2600 | 19,8 | 190 | 212 |
| 55 | 30,0 | 2600 | 16,7 | 185 | 206 |
| 50 | 28,5 | 2600 | 15,2 | 175 | 185 |
| 45 | 25,0 | 2600 | 14,2 | 162 | 181 |

Caution: Do not operate engine/propeller RPM continuously above 2700 RPM

**Caution: Do not operate engine at low RPM and high manifold pressure.
(for example 2000 RPM and 40 inch Hg).**

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

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).

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VI. Rigging and derigging

Due to the fact, that the landing gear is mounted on the fuselage of the motorglider, rigging and derigging can be executed by two persons only, because wings and elevator can be removed with out supporting the fuselage. Hangar space is reduced to a minimum, due the folding mechanism of the wings

VI.1 Rigging

The statement above mentioned the wings of the motorglider G 109 B, are a commit 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 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 the best that the wing tip should be supported on a trestle while the second wing is rigged.

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VI.1. Rigging continued

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 control 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 dismantled condition. The Clamps prevent the face of the 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

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.

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VI.1. Rigging continued

Tail unit:

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

The tail plane can now be positioned by two persons.

It can be rested on the top of the leading edge of the fin with the elevator angled upwards so that the Hotellier-type quick connection of the trim rods 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 the fin and push aft onto this three attachment stubs. It is then necessary to tighten the wing bolt clockwise to secure the tail plane.

The assembly is completed when the bolt is sufficiently tight (hand-tight) to avoid play in any directions 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 to ¼ turn of fit.

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

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VI.1. Rigging continued

Checks after assembly:

1. Wheel brakes and tire pressure check
2. Check the tail plane is mounted correctly and the elevator push rod and trim rod connect.
3. Control divinity checked by two persons (1 moving the control is stick, 1 seizing the appropriate control surfaces 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 tail unit unscrew the wing bolt counter-clockwise and pull it back to its foot extension.

VI.3. Parking

When the motorglider is parked outside, use the parking brake and shocks, due to possible decrease in braking action of the hydraulically activated 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 the engine and cockpit plexiglass. The cover can be ordered by the manufacture of the motorglider. 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 dismantled horizontal tail.

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VI.4. Transport

For the transport of the motorglider on roads with a trailer, we recommend: 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 inch) and should start at the root rip. The support must be covered with foam, rubber or felt.

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

3. Tail plane

Secure the tail plane 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 tail plane mounting blocks.

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VI.5. Simple maintenance

- Humidity-

The entire surface of the motorglider is coated with weather-resistant white polyester gel coat. 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 flight through rain, dry the aircraft with the soft chamois.

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

All in unprotected metal surface should be regularly greased due to condensation.

-Sun light-

To prevent over temperature 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 disk is very a resistant. A mild agent should be used for minor dirt (i.e. dust, grease, insects). More stubborn dirt should be removed by using only special silicone free polishes.

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VI.5. Simple maintenance continued

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 Juli 1989.

Caution: Do not use nitro-thinner on the red lacquer or on markings, they contain at 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 cloths or chamois leather should be taken to wipe the canopy dry and clean. Never use a dry cloth or chamois when wiping plexiglass.

-Miscellaneous-

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

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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. Check all metal parts for no corrosion. if necessary recondition and paint
4. No play in wing and tail plane 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 operational test; measure the control deflections
7. If control with it do not move free throughout their range, search for the cause and corrected
8. Check condition of main and tail wheel, 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 possible make functional test of the instruments, radios, and other electric equipment. (i. e. Transponder, navigation equipment, strobe lights etc.). Compare it with the appropriate equipment list.

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VI.6. Maintenance directions continued

- 12. The engine must be serviced and maintained according to engine operations manual
- 13. The propeller must be service and maintained according to propeller owners manual

For further details of maintenance refer to the instruction for continued airworthiness of GROB 109 B.

VI.7. Repair directions

For the execution of the minor repairs, refer to the attached repair instruction of GROB 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.

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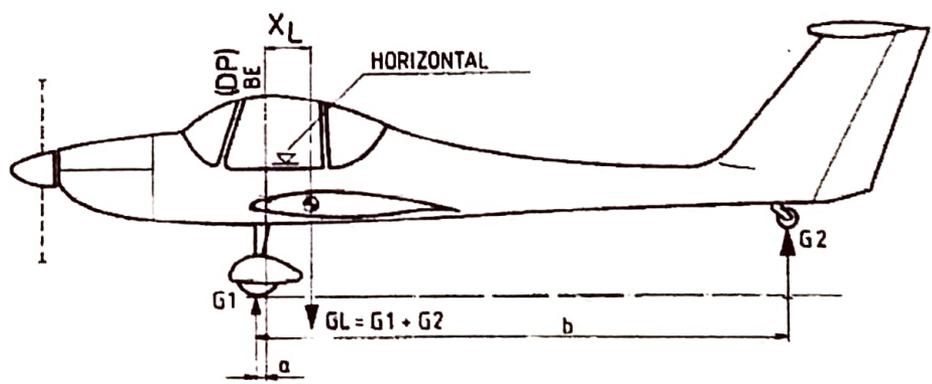
VII. Center of gravity (CG)

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)

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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 installation 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.

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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 kg lbs | | Approved position of CG aft of DL | | | |
|-----------------------------------|------|-----------------------------------|-------|-----|-------|
| | | Forward | | aft | |
| | | 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.

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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. | Signature |
|----------------------------------|---|---------------------|------------------------------------|---------------------------------|------------------------|-----------|
| | | | | | | |

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 weights 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) xm (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) | |

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

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 50).

If this moment exceeds the approved range, the load must be redistributed or limited and weight-and-balance calculations must be repeated.

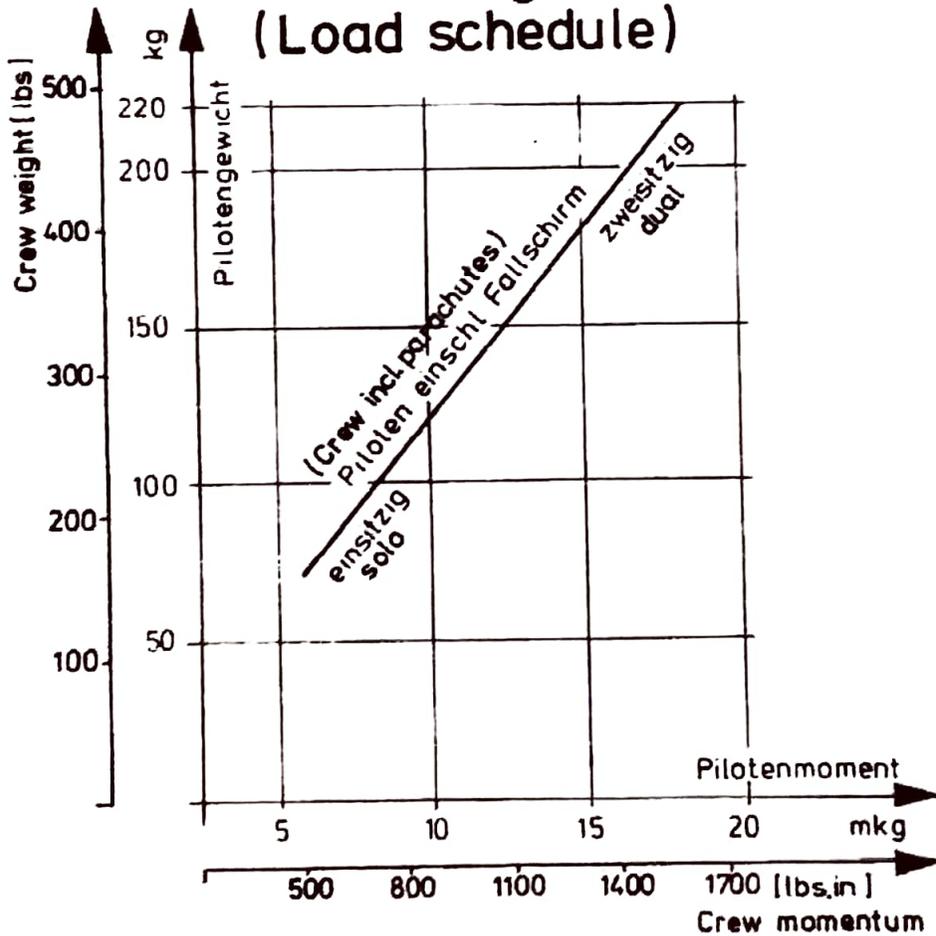
Max. gross weight may never be exceeded.

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

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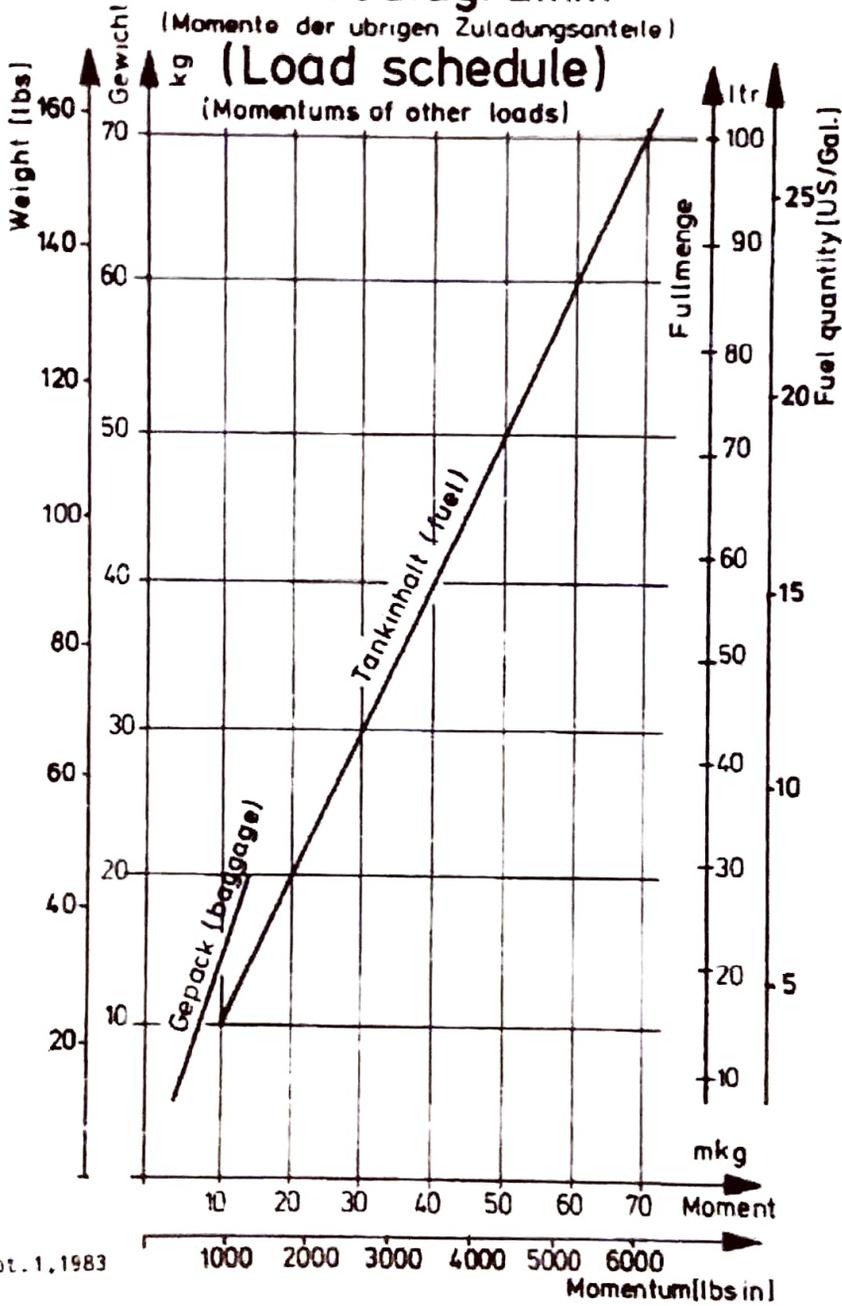
Beladediagramm (Load schedule)



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Beladediagramm



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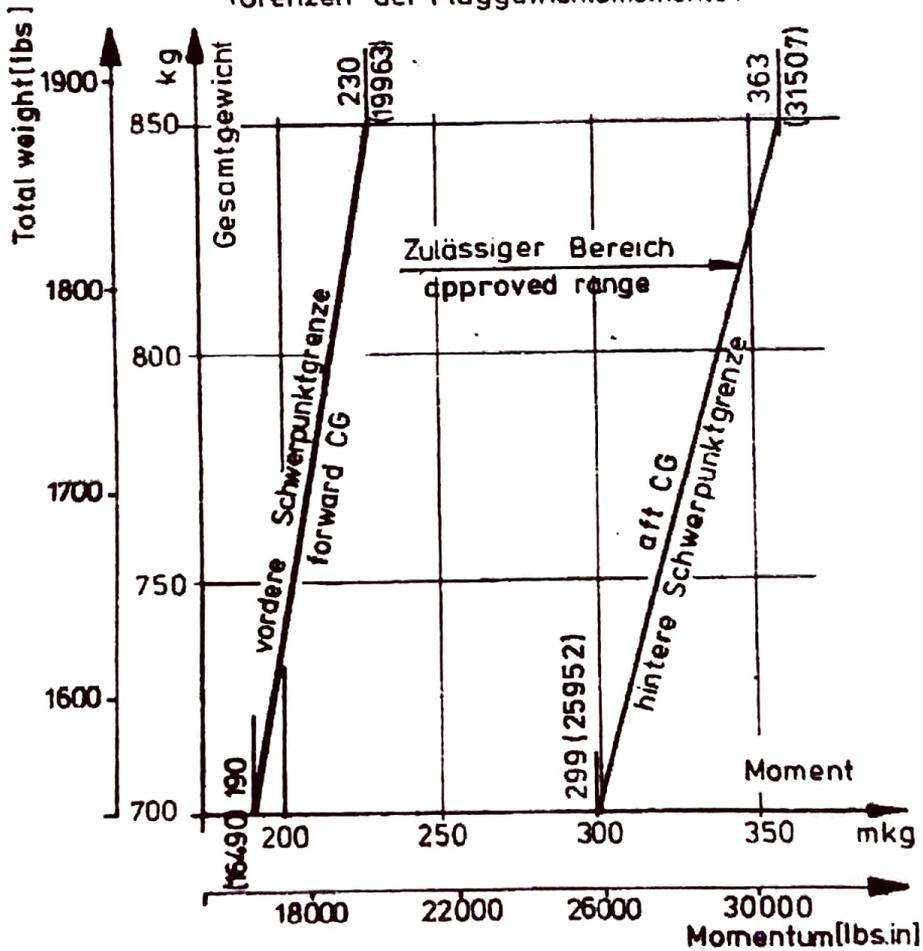
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CG-schedule

(Limits of total momentum)

Schwerpunktdiagramm

(Grenzen der Fluggewichtsmomente)



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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 noticeable differences.

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

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

| | weight | | distance | | momentum | |
|-----------------|-------------------|--------|----------|--------|------------------------|-----------|
| | kg | (lbs) | m | (inch) | 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) |
| | <u>850 (1875)</u> | | | | <u>278.9 (24210.2)</u> | |

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

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.

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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) |
| | <hr/> 800 (1763.7) | | <hr/> 330.2 (28719.4) |

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

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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Checklist GR0B G 109 B

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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.

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Checklist

- I. **Before starting engine**
- 0. Preflight inspection completed (see flight manual page 28)
- 1. Pedals and backrest adjusted
- 2. Seat harness (and parachute) adjust and secure
- 3. Folding doors locked
- 4. Parking brake set
- 5. Radio and avionics switch off
- 6. Fuel shutoff valve open
- 7. Controls and airbrakes free

- II. **Starting the engine**
- 1. Main switch on
- 2. Propeller control unit one cycle to feather and back to take of position, then switch to AUTO 3000 RPM STOP (green LED on propeller control unit illuminated)

- 3. Electric instruments battery voltage and fuel quantity check
- 4. Avionics and navigation instruments off
- 5. Anti collision light on
- 6. Ignition switches 1 + 2 on, fuel pump no. 1 operates audible for 10 sec.
- 7. Emergency battery voltage check
- 8. Ignition switches 1+2 off
- 9. Engine emergency switch Emergency, yellow LED illuminates
- 10. Ignition switches 1+2 on, fuel pump no. 2 operates audible for 10 sec.
- 11. Engine emergency switch Normal, yellow LED extinguished
- 12. Throttle idle

Caution: Be sure no persons are in the vicinity of the propeller

- 13. Master switch hold to Start position and release after engine is running. Note: for another attempt, master switch must be Switch to off first.
- 14. Throttle adjust to 1300 RPM (at lower RPM the red generator warning light may illuminate, due to insufficient charge)
- 15. Oil pressure within 10 sec. green range

Caution: Shut down engine if oil pressure remains under green range.

- 16. Avionic switch after engine is running on (other electrical device on as required)
- 17. Battery charge verify, red generator warning light extinguished

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|--|---|--|

Checklist

III.1 Engine warm up

1. Parking brake as required
2. Engine warm up to 50°C, 2 min 1300 RPM to begin, then
1500 RPM, taxi as required.
3. Avionic and other electrical devices on

III.2 Propeller check

1. Propeller mode switch Auto
2. RPM Preselector knob 2000 RPM
3. Throttle advance to 2200 RPM
4. RPM drop to 2000 RPM Check, green LED on propeller control unit
extinguished
5. Throttle retard to idle , green LED on propeller control unit
illuminate
6. Engine instrument indications green range

III.3 Run up

1. Parking brake set
2. Elevator pull
3. Propeller control unit Auto/3000 RPM/Stop
4. Throttle advance to full throttle slowly
5. RPM 2950 +/- 50 RPM check for propeller MTV-1-A/L 170-05
6. Throttle retard to 2000 RPM
7. Ignition system check
Ignition switch 2 off
Ignition switch 2 on
Ignition switch 1 off
Ignition switch 1 on
Normally there is no noticeable RPM drop.
RPM drop should be less than 100 RPM.
8. Engine emergency switch Emergency, yellow LED illuminates, engine
operates normally after a short RPM drop
9. Engine emergency switch Normal, yellow LED extinguishes, engine
operates normally after a short RPM drop

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Checklist continued

IV. Before taxiing

- 1. Altimeter set
- 2. Instruments set
- 3. Parking brake released

V. Before take off

- 0. Run up performed according III.6
- 1. Flight controls and throttle free movement
- 2. Airbrakes locked
- 3. Folding doors locked
- 4. Emergency jettisoning secured
- 5. Trim neutral
- 6. Fuel shut off open
- 7. Engine instrument indication green range
- 8. Parking brake released

VI. Take off and climb

- 1. Propeller control unit Auto/3000RPM/Stop and green LED illuminated
- 2. Throttle fully forward
- 3. Engine/Propeller 2950+/-50 RPM check
- 4. Engine manifold pressure in yellow arc adjust
- 5. Aircraft direction observe
- 6. Airspeed 85 km/h and tail down attitude lift off
- 7. Initial climb speed 90-110 km/h observe Vx 90 km/h (49 kts), Vy 110 km/h (60kts)
- 8. Engine instrument indications green range
- 9. Manifold pressure and engine RPM at safe altitude retard out of yellow range

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Checklist continued

VII. Cruise flight

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Cruising altitude and cruising speed 2. Manifold pressure for cruising flight 3. Propeller control unit cruising RPM | obtained throttle adjust according table below select according table below |
|---|---|

Economical power settings see table below

| Power (%) | Manifold pressure (in HG) | Engine/ propeller (RPM) | Fuel con- sumption (l/h) | IAS in altitude 6000 (ft) (km/h) | TAS in altitude 6000 (ft) (km/h) |
|------------------|-------------------------------------|-----------------------------------|------------------------------------|---|---|
| 100 | 40,0 | 3000 | 32,3 | Not to for continuous use | Not to for continuous use |
| 75 | 36,0 | 2700 | 23,5 | 207 | 231 |
| 65 | 33,0 | 2600 | 19,8 | 190 | 212 |
| 55 | 30,0 | 2600 | 16,7 | 185 | 206 |
| 50 | 28,5 | 2600 | 15,2 | 175 | 185 |
| 45 | 25,0 | 2600 | 14,2 | 162 | 181 |

Caution: Do not operate engine/propeller RPM continuously above 2700 RPM

**Caution: Do not operate engine at low RPM and high manifold pressure .
(for example 2000 RPM and 40 inchHg.)**

| | | | | |
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1. General

1.1 Introduction

This section is a supplement for the flight manual GROB G109B with the engine L2400DT1 and the propeller MTV-1-A/L 170-05 and is valid for motorglider towing operation only.

1.2 Requirements for certification

The towing operation of this motorglider was certified in accordance to appendix K "additional requirements for towing gliders by motorgliders i.e. JAR 22, Amendment 6..

1.3 Description and technical data

The cable release E 85 resp. G 75 from TOST will be attached to the rudder fin rib and on the fuselage tube by a special mount for the cable release. The cable release is activated via cable by a yellow release knob in the cockpit. For clearance for the towing cable the rudder has been shortened and tapered. For towing operation a mirror as to be installed on the frame of the canopy or on top of the instrument panel.

1.4 Three-sides view



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2. Operation Limitation

2.1 Airspeed

Remarks: Values shown are indicated airspeed (IAS)

While towing the max. speed is 170 km/h (92 kts, 106 mph). The max. speed while towing of the towed glider must be observed. While towing the min. speed is 90 km/h (49 kts, 56 mph), but not less than $1,2 \cdot v_{S1}$ of the glider being towed.

2.2 Mass (Weight)

The maximum mass of the glider being towed is 800kg (1760 lbs). on a hard surface runway.
 The maximum takeoff mass of the motorglider is 820kg (1804 lbs).

2.3 Flight crew

Aero tows with the G109b should be with one pilot only. If a second pilot is necessary that the total mass of the motorglider shall not exceed 850 kg (1870 lbs). and the addition of the mass of the motorglider and the glider being towed does not exceed 1620kg (3564 lbs).

2.4 Other limitations

Aero tow with more than one glider at the same time is not permitted.
 The towing cable should be hooked to the glider in to the certified cable release device.

Remarks: During towing tests all common glider types have been towed without observing any operational limitations. However the pilot should check in any case whether the glider being towed stays within the operational limits.

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3. Emergency procedures

3.1 Engine failures

If an engine failure is experienced during aero tow the pilot of the motorglider should urge the pilot being towed by signs or radio to release the cable or, if not, the pilot of the motorglider shall release the cable. Follow the applicable procedures in the flight manual "GROB G109B with engine L2400DT1 and propeller MTV-1".

3.2 Other emergencies

3.2.1 Unnormal position of the glider being towed.

If the controllability of the motorglider is restricted by an unnormal position of the glider being towed, release the towing cable immediately.

If the glider being towed is definitely out of the 60° cone (i.e. angle between towing cable and the longitudinal axis is more than 30°), release the towing cable immediately.

Towing cable can not be released by the glider.

Landings with the towing cable connected to the motorglider and the glider can be done, when the glider extends the air brakes to control the angle of approach for both aircrafts.

Remark: For this procedure a short briefing via radio is necessary.

WARNING: Do not extend air brakes off the motorglider during aero tow.

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4. Normal procedures

4.1 Daily checks

- Check release device and operating mechanism for contamination and funktion. (Release test).
- Ceck aero tow cable, weak link and connecting ring pair for correct position and damages.
- Rear view mirror installed ?

4.2 Normal procedures recommended airspeeds.

4.2.1 Take off and Climb

- Normally the aero tow cable is connected to the nose release of the glider to be towed. If the glider is not equipped with a nose release, the glider pilot has to meet legal requirements.

IMPORTANT: While towing gliders with high wing loadings, accelerate close to the ground, because the lift off speed of the glider being towed may be higher than the lift of speed off the motorglider. The normal airspeed during aero tow is 110 km/h (59 kts, 69 mph). Max angle of climb will be attained at 60 mph, for max. climb speed maintain 110 km/h (59 kts, 69 mph). While towing gliders with high wing loading 120 km/h (65 kts,75 mph) is recommended.

IMPORTANT: When towing below the recommended airspeed of 110 km/h (59 kts, 69 mph) monitor engine oil temperature closely. In case engine oil temperature, engine coolant temperature or exhaust gas temperature approaching the red line accelerate for cooling purposes to 120 km/h (65 kts,75 mph) but observe max airspeed for aero tow of the glider being towed.

4.2.2 Approach and Landing

Release the towing cable before landing and confirm cable is dropping in rear view mirror.

Landings with cable not released, should be done when approach sector is without obstruction only.

Attention: Landings with towing cable not released on hard surfaces are not recommended, because the towing cable can be damaged.

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5. Performance

5.1 LBA-confirmed data

5.1.1 Take off distances

Values below do not contain any safety margin, evaluation took place under following condition.

- Take off power,
- Take off weight GROB G109B 820 kg (1804lbs),
- Lift off speed appr. 90 km/h (49 kts,56mph),,
- Speed for max. climb rate = 95 km/h (51 kts,59mph)
- Hard surface run way,
- Cross wind component 0,
- Head wind component 0.

IMPORTANT:

All values do not contain any safety margin. For a safety margin the run way available should be at least correspond the take off distance value for a 15m obstacle. All values are based on the following assumption, motorglider and engine are in good condition, and the pilot has adequate experience.

WARNING:

If after lift off, for instance by a request of the glider pilot or due to weather reasons, speed is increased above the value of max. rate of climb of 95 km/h (51 kts,59mph) the take off distance increases considerably.

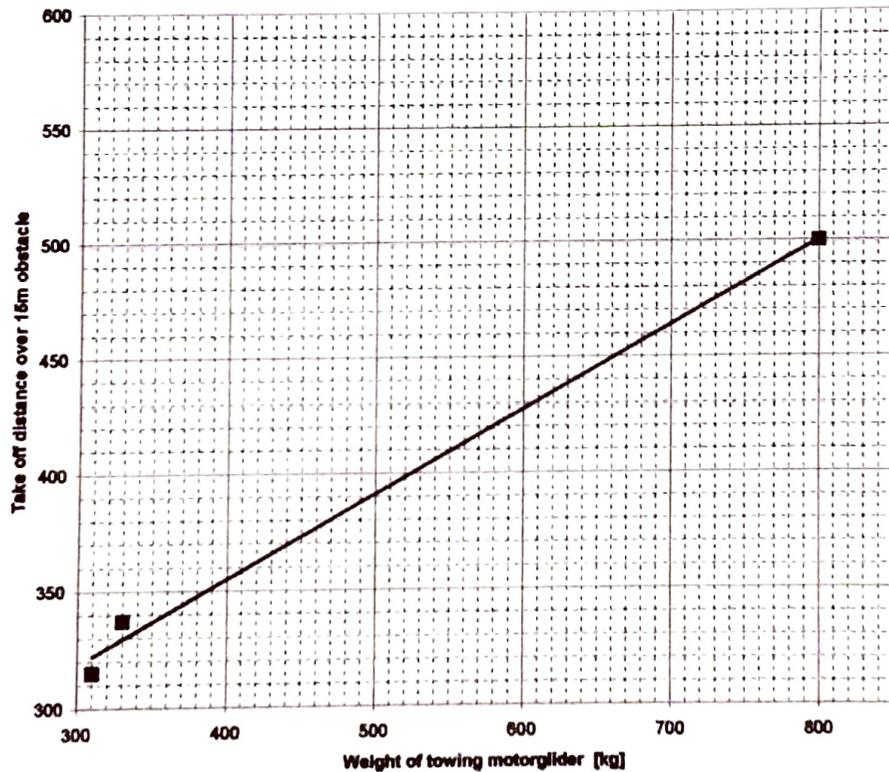
If conditions are unfavourable, for instance: high grass, soft or uneven surface, cross wind or gusty winds, wet or dirty wings on the motorglider or on the glider can increase the take off distance considerably.

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Take off distances for towing motorglider under ISA-conditions.

Take off distance



Picture 1

For different surfaces add factors according AIP I.

| | |
|--|------------|
| add for grass run way (surface dry ,hard and even, grass short) | + 20 % |
| humid grass surface | add + 10 % |
| soft grass surface | add + 50 % |
| grass high (max. 8 cm)(3 inch) | add + 20 % |
| slush, standing water (depth app 1 cm)(1/ inch) | add + 30 % |

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Example for some gliders being towed:

LS4 330 kg(726lbs) Hard Surface:

| Field elevation (m above sea level) | Ambient temperature | | | |
|--|----------------------------|-----|-------|-------|
| | - 5°C | 0°C | +15°C | +30°C |
| | Take off distance (m) | | | |
| 0 | 165 | 174 | 201 | 230 |
| 250 | 179 | 188 | 217 | 249 |
| 500 | 194 | 204 | 235 | 269 |
| 750 | 210 | 221 | 254 | 291 |
| 1000 | 227 | 239 | 275 | 315 |
| | Distance over 15m obstacle | | | |
| 0 | 265 | 279 | 322 | 369 |
| 250 | 287 | 302 | 348 | 399 |
| 500 | 311 | 327 | 377 | 432 |
| 750 | 337 | 354 | 408 | 467 |
| 1000 | 365 | 383 | 442 | 506 |

Values shown are valid for a hard surface runway, no wind and the glider being towed weighs 330kg (726 lbs.)

For different surfaces add factors according AIP I.

For instance:

| | |
|--|------------|
| add for grass run way (surface dry ,hard and even, grass short) | 20 % |
| humid grass surface | add + 10 % |
| soft grass surface | add + 50 % |
| grass high (max. 8 cm)(3 inch) | add + 20 % |
| slush, standing water (depth app 1 cm)(1/ inch) | add + 30 % |

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Example for some gliders being towed:

DG 500 660 kg(1452lbs) Hard Surface:

| Field elevation (m above sea level) | Ambient temperature | | | |
|--|----------------------------|-----|-------|-------|
| | - 5°C | 0°C | +15°C | +30°C |
| | Take off distance (m) | | | |
| 0 | 225 | 237 | 273 | 313 |
| 250 | 244 | 256 | 296 | 339 |
| 500 | 264 | 277 | 320 | 366 |
| 750 | 286 | 300 | 346 | 396 |
| 1000 | 310 | 325 | 375 | 429 |
| | Distance over 15m obstacle | | | |
| 0 | 321 | 338 | 390 | 447 |
| 250 | 348 | 365 | 422 | 483 |
| 500 | 377 | 396 | 456 | 523 |
| 750 | 408 | 428 | 494 | 565 |
| 1000 | 442 | 464 | 535 | 612 |

Values shown are valid for a hard surface runway, no wind and the glider being towed
Weights 660kg (1452 lbs.)

For different surfaces add factors according AIP I.

For instance:

| | |
|--|------------|
| add for grass run way (surface dry ,hard and even, grass short) | + 20 % |
| humid grass surface | |
| soft grass surface | add + 10 % |
| grass high (max. 8 cm)(3 inch) | add + 50 % |
| slush, standing water | add + 20 % |
| (depth app 1 cm)(1/ inch) | add + 30 % |

| | | | | |
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5.2 Further, non certified informations

5.2.1 Climb performance

Under ISA-conditions

| Weight of glider being towed (kg)(lbs) | Rate of climb (m/s) |
|---|------------------------|
| 310(682) | 3,10 |
| 660(1452) | 2,05 |
| 800(1760) | 1,90 |

For remarks refer to section 5.1.1

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6. Weight and balance/list of equipment

6.1 Introduction

When operating the motorglider for towing the weight and center of gravity remain the same as for non-towing operation. Observe limitations outlined in section 2.2 and 2.3 of this appendix.

6.2 List of equipment

Equipment necessary for towing with motorglider

- 1 Release mount with reinforcements
- 1 Release TOST E 85 respective E 75
- 1 Release operating system KOCO-817-44
- 1 Rear view mirror

Remarks: Following equipment is not considered in the weight and balance calculation but is necessary for towing operation.

- 1x Towing cable (40 – 60m)*
- 2x connecting ring pair according LN
- 1x weak link (simple connect), breaking load 300 daN (green)

Important remark: The pilot should close the check that the correct weak link (300 daN green) is installed, because the fuselage of the motorglider can be damaged with an uncorrected weak link.

Extract from the draft for requirements for airworthiness for motorgliders in towing operation:

Towing cable and weak link:

*Use plastic cables (i.e. Polyamid, Polyester, Polypopylen aso.) or such made of other textile material (natural fibers) according AN, DIN or other industrial standards only when standards (specifikation) show sufficient data and charges have equal quality guaranteed. Cable connection should be protected against damages and wear by coatings.

[...] The elasticity should not exceed 30% when max. load is applied.

The operator of the towing aircraft is responsible for the selection, operation and maintenance of the towing cable.

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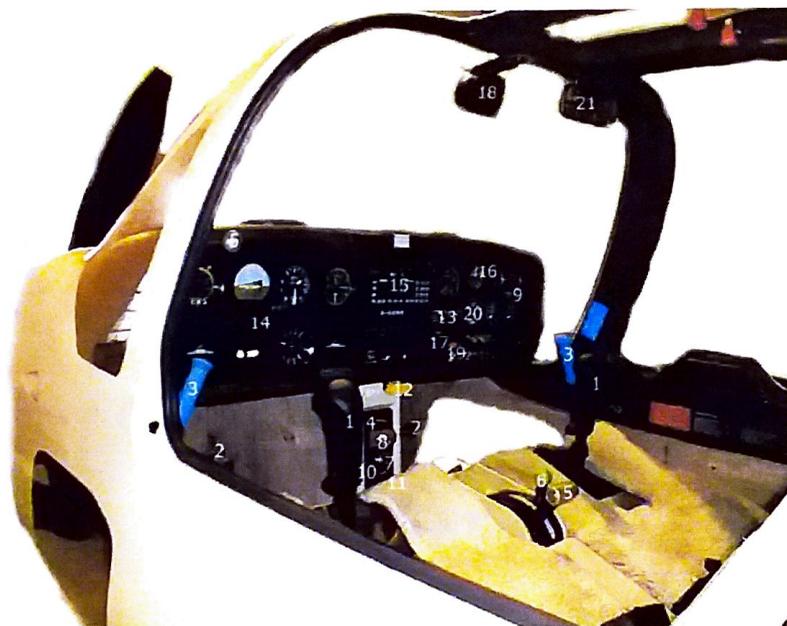
7. Description of the motor glider and its systems.

7.1 Cockpit

The release knob is yellow and is located under the instrument panel on the center pedestal. The knob has appr. 10 mm dead play, to ensure correct closing of the release.

Pull the knob to relase the towing cable.

The rear view mirror is mounted on the canopy frame or on top of the instrument panel.



- | | |
|---|------------------------------------|
| 1 Control stick | 10 Heating *) |
| 2 Rudder pedals (with toe brakes) | 11 Fuel shut off valve |
| 3 Airbrakes | 12 Tow cable release (Towoption) |
| 4 Parking brake *) | 13 Propeller control unit |
| 5 Throttle (at S/N 6340 and subsequent there is a second throttle at the left Panel side) | 14 Flight instuments |
| 6 Elevator trim | 15 Radio and avionics |
| 7 Master switch with starter | 16 Engine intruments |
| 8 Ignition switches 1 + 2 | 17 Engine emergenca switch |
| 9 Test switch for emergency battery | 18 Compass |
| | 19 Circuitbreaker propeller system |
| | 20 Status indication |
| | 21 Towing mirror (Towoption) |

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 are adjustable (right turn to fix and left turn to release).

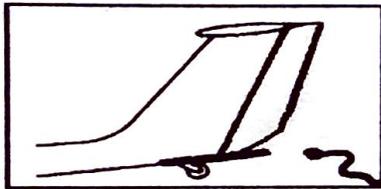
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7.2 Placards and legend

Following placards are installed when motor glider G109B is used for towing.

Next to the release knob:



Weak link max. 300 daN

Next to the warning light for towing cable (if required):

Towing cable

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8. Operation and maintenance

8.1 Maintenance intervals for the motorglider

8.1.1 Maintenance Intervals for the cable release

In the course of the 100h-check of the motorglider, the cable release should be cleaned, greased and a functional check shall be performed.

An overhaul is recommended after 2000 aero tows.

An overhaul is recommended after 4 years or by the judgement of the operator.

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