0 Revisions

0.1 Record of revisions

Any revision of the present manual, except actual weighing data, must be recorded in the following table and in case of approved sections endorsed by the responsible airworthiness authority.

The new or amended text in the revised page will be indicated by a black vertical line in the right hand margin, and the Revision No. and the date will be shown on the bottom left hand of the page.

Rev. No.	Affected Pages/ section	Description	Issue Date	LBA Approval Date	Inserted Date Signature
1	0.3-0.5, 2.1, 2.9, 2.11, 4.5, 5.4, 6.3, 6.5, 6.10, 7.10	Manual revision TN 413/2	September 2003	Sept.25.03	

0.2 List of effective pages

Section		page	issued	replaced/	replaced/
0		0.0	March 2002		
		0.1	see manual amendments		
		0.2	"		
		0.3	"		
		0.4	"		
		0.5	"		
		0.6	March 2002		
1		1.1	"		
		1.2	"		
		1.3	"		
		1.4	"		
		1.5	"		
		1.6	"		
2	App.	2.1	March 2002	Sept. 2003	
	"	2.2	"		
	"	2.3	"		
	"	2.4	"		
	"	2.5	"		
	"	2.6	"		
	"	2.7	"		
	"	2.8	"		
	"	2.9	"	Sept. 2003	
	"	2.10	"		
	"	2.11	"	Sept. 2003	
	"	2.12	"		
3	"	3.1	March 2002		
	"	3.2	"		
	"	3.3	"		
	"	3.4	"		
	"	3.5	"		
4	"	4.1	March 2002		
	"	4.2	"		
	"	4.3	"		
	"	4.4	"		
	"	4.5	"	Sept. 2003	

0.2 List of effective pages (cont.)

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4	App.	4.6	March 2002		
		4.7			
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5	"	5.1	March 2002		
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	"	5.4	"	Sept. 2003	
	App.	5.5	"		
		5.6	"		
		5.7	"		
6		6.1	March 2002		
		6.2	"		
		6.3	"	Sept. 2003	
		6.4	"		
		6.5	"	Sept. 2003	
		6.6	"		
		6.7	"		
		6.8	"		
		6.9	"		
		6.10	"	Sept. 2003	
		6.11	"		

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	7.6	"		
	7.7	"		
	7.8	"		
	7.9	"		
	7.10	"	Sept. 2003	
	7.11	"		
	7.12	"		
	7.13	"		
8	8.1	March 2002		
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2 Limitations

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2.10 Minimum equipment

As minimum equipment only the instruments and equipment specified in the equipment list (see maintenance manual) are admissible.

Note: The actual equipment list is filed in the enclosures of the maintenance manual.

a) **Normal operation**
Airspeed indicator Range: 0-300 km/h (0-165kts.);
Speed range markings see sect. 2.3
Altimeter Range: 0 – min. 10.000 m,
Altimeter with fine range pointer, 1 turn max. 1000 m (3000 ft.)
Four piece symmetrical safety harness
VHF - transceiver (ready for operation)
Outside air temperature gauge with probe in the fuselage nose.
Marking blue for temperatures below 2°C, (36°F).
Battery Z110 or a ballast weight of 5.75kg (12.7 lbs.) installed in the battery box in the fin
Parachute automatic or manual type or a suitable firm back cushion approximately 8 cm (3 in.) thick for the front seat and 3 – 8 cm (1 – 3 in.) thick for the rear seat
Required placards, check lists
Flight and maintenance manual.

b) **In addition for cloud flying**
(Not permitted in the USA, Canada and Australia)
Variometer
Turn and bank indicator

c) **In addition for aerobatics** (Category Aerobatic)
Accelerometer capable of retaining max. and min. g-values with markings red radial lines at +7 g and -5 g.
Safety bows at the rudder pedals (standard equipment)

Remark:
Experience has shown that the installed airspeed indicator system may be used for cloud flying.

2.13 Tyre Pressure

Main wheel	2,5 bar	(36 psi)
Nose wheel (if installed)	2,5 bar	(36 psi)
Tail wheel	4,0 bar	(58 psi)

2.14 Waterballast (Option)

Max. capacity 80 l (21.1 U.S. gal) per wing.
Filling the water ballast is only allowed with a filling system which enables determination of the exact amount of ballast filled, e.g. water gauge or calibrated canisters. Only symmetrical loading is allowed.
After filling, balance the wings by dumping enough water from the heavy wing, see 4.2.2.
Flight with leaking watertanks is prohibited, as this may result in asymmetrical loading condition.

Warning: Follow the loading chart, see section 6.8.
The max. take off weight must not be exceeded.

2.15 Fin tank (Option)

Warning: As it is dangerous to fly with empty wing tanks while ballast is resting in the fin, **it is prohibited to fill water into the fin tank if there is any risk of icing**. The flight conditions must comply with the following table:

min. ground temperature	°C	13,5	17	24	31	38
	°F	56	63	75	88	100
max. flight altitude	m	1500	2000	3000	4000	5000
	ft	5000	6500	10000	13000	16500

In addition the outside air temperature OAT gauge is to be watched.
The OAT should not be lower than 2°C (36°F)!

2.16 Trim ballast box in the fin

A box for ballast (trim-weights) is installed in the fin. It can be used to compensate the mass of the rear pilot and as a trim-possibility for heavy pilots.
Warning: Follow the loading chart see 6.8.7.
Tape the cover of the fin ballast box with tape min. 19mm (3/4 in.) wide prior to each flight.

4.2.3 Filling the fin ballast tank

This tank must be filled after filling the wingtanks. Determine the amount see section 6.8.6. Connect the transparent funnel equipped filling hose (supplied with the aircraft) via the hose connector GRS 10-12 to the hose which comes out of the left rear end of the fuselage.
The funnel can be suspended at the top of the rudder.
Fill with clean water using a graduated measuring vessel.
In addition you may check the content level by holding the filling hose against the scale on the fin.
After filling, push the fin tank dump lever in forward direction (the dump valve will be closed by a spring).
Then remove the filling hose with the hose connector.

4.2.4 Ballast box in the fin

To fill the ballast box remove the Plexiglas cover plate by inserting a 6mm pin into the hole of the upper locking device and move the locking pin downwards. Determine the amount of trim-weights according to section 6.8.7. Slide the weights into the rails of the box. The heavy weights with 2,4 kg (5.3 lbs.) each must be installed in the lower 4 sections and the lighter weights with 1,2 kg (2.65 lbs.) each in the upper 2 sections. It doesn't matter in which sections the weights are installed (in case that not all sections will be filled up), but it is not allowed to insert the light weights into the sections for the heavy weights. Close the compartment.

Warning: Check that the locking device has engaged completely.
Tape the cover of the fin ballast box with tape min. 19mm (3/4 in.) wide prior to each flight.

A control light in the front instrument panel starts blinking after each transaction with the weights. By counting the amount of blinks, the amount of ballast can be determined. For a heavy weight 2 blinks appear and 1 blink for a light weight, this means 10 blinks if the box is filled up completely. After a pause of 2-3 seconds the blinking will be repeated etc. The blinking can be stopped by pressing on the control light. Pressing again on the control light reactivates the blinking feature.

After filling the ballast box you should check the correct indication of the control light.

5.2.2 Stall speeds

The given speeds are the minimum achievable speeds during level flight in km/h and (kts.).

Airbrakes retracted 20m span							
mass kg	470	500	550	600	650	700	750
mass lbs.	1036	1102	1213	1323	1433	1543	1653
W/S kg/m²	26,8	28,5	31,4	34,2	37,1	39,9	42,8
W/S lbs./ft.²	5.5	5.84	6.43	7.01	7.59	8.18	8.76
V km/h	62,9	64,9	68,0	71,1	74,0	76,8	79,5
V kts.	34	35	36.7	38.4	40	41.5	42.9
Airbrakes retracted 18m span							
W/S kg/m²	28,1	29,9	32,9	35,9	38,9	41,9	44,9
W/S lbs./ft.²	5.76	6.12	6.43	7.35	7.96	8.57	9.18
V km/h	64,4	66,4	69,7	72,8	75,8	78,6	81,4
V kts.	34.8	35.9	37.6	39.3	40.9	42.4	44
Airbrakes extended 20m span							
mass kg	470	500	550	600	650	700	750
V km/h	67,4	69,5	72,9	76,2	79,3	82,3	85,1
V kts.	36,4	37,5	39,4	41,1	42,8	44,4	46,0
Airbrakes extended 18m span							
V km/h	69,0	71,2	74,7	78,0	81,2	84,2	87,2
V kts.	37,3	38,4	40,3	42,1	43,8	45,5	47,1

The loss of height for stall recovery is approximately 30 m (100 ft) if recovered immediately.

6.5 Mass of all non-lifting parts (WNLP)

The max. mass of all non-lifting parts is 469 kg (1034 lbs.).

WNLP is to be determined as follows:
WNLP = WNLP empty + cockpit load (pilots, parachute, baggage, trim ballast, waterballast in the fin, removable items of equipment etc.).
WNLP empty = Total empty weight incl. permanently installed equipment minus weight of the wings.

6.6 Max. mass (weight)

Category A „Aerobatic“

Maximum take off weight:	630 kg	1389 lbs.
Maximum landing weight:	630 kg	1389 lbs.

Category „Utility“, retractable main wheel:
with waterballast:

Maximum take off weight:	750 kg	1653 lbs.
Maximum landing weight:	750 kg	1653 lbs.

without waterballast: Maximum take-off and landing mass = $W_{NLP} + W_{wings}$

W_{NLP} = Maximum mass of all non lifting parts (see above)
W_{wings} = actual mass of the wings

Category „Utility“, fixed main wheel:

Maximum take off weight:	630 kg	1389 lbs.
Maximum landing weight:	630 kg	1389 lbs.

6.7 Useful loads

Max. load **without** waterballast
= max. weight without waterballast - empty weight

Max. load **with** waterballast
= max. weight with waterballast - empty weight

The data is recorded on page 6.7.

6.8.4 Battery in the fin

Only the use of the factory supplied battery Z110 (mass 5.75 kg, 12.7 lbs.) is permitted.
Warning: Flying is only allowed with the battery in the fin as otherwise the forward C.G. limit may be exceeded.
Instead of the battery a suitable weight of 5,5 kg may be used.

6.8.5 Waterballast in the wing tanks (Option)

The tanks have a capacity of 80 l (21,2 US gallons) per wing
The permitted amount of waterballast is dependent on the empty weight and of the load in the fuselage and can be determined from the diagram "**Ballast chart"** section 6.8.10.
It is only allowed to fly with symmetric wing ballast!

6.8.6 Fin ballast tank (Option)

Water ballast in the fin tank should be used to compensate the forward move of C.G. due to the water ballast in the wings.
The amount of ballast in the fin is dependent on the amount of water in the wing tanks and to be determined from the following table.

waterballast in the	
wings	fin
kg	kg
20	0,6
40	1,3
60	2,1
80	2,9
100	3,8
120	4,6
140	5,4
160	6,2
/	/

waterballast in the	
wings	fin
lbs.	lbs.
40	1,2
80	2,7
120	4,2
160	5,9
200	7,5
240	9,2
280	10,8
320	12,4
350	13,5

6.9 C.G. calculation

The actual C.G. can be determined as follows:

For each item, the moment mass x C.G. has to be determined and to be added up and divided by the total mass. See the following example:

1 kg = 2.2046 lbs. = .264 US gal. water 0.305 m = 1 ft

Item	mass [kg]	C.G. behind Datum [m]	Moment [m×kg]
Aircraft empty (with Battery in the fin)	430	0,740	318,20
Pilot front	75	- 1,350	- 101,25
Rear	85	- 0,280	- 23,80
Waterballast in the wings	140	0,206	28,84
Water in the fin tank	5,4	5,260	28,40
Ballast in box in the fin	9,6	5,400	51,84
Total:	**745**	X_S= **0,406**	**302,2**
		(X_S = Moment/Mass)	

The limits of the in-flight C.G 0,190m - 0,440m should not be exceeded!

The most important C.G. positions (behind datum):
Pilot: The C.G. position is dependent on the pilots shape, mass and thickness of the parachute. The pilot C.G. position can be determined by executing a weight and balance measurement with glider empty and equipped with the pilot etc. see maintenance manual. Please note, that the distance a has to be measured with both configurations, as it may change due to deflection of the landing gear.
The pilot C.G. can be determined by the following equation:

$$X_P = (X_{SF} * M_F - X_{SE} * M_E)/M_P$$

M_F = flight mass X_{SF} = flight C.G M_P = pilot mass
M_E = empty mass X_{SE} = empty C.G.

7.11 Ballast box in the fin

A box for ballast (trim-weights) is installed in the fin. It can be used to compensate the mass of the rear pilot and as a trim-possibility for heavy pilots. Max. ballast capacity: 12 kg.

Filling see section 4.2.4, determination of the permissible amount of ballast see section 6.8.7.

Indication of the amount of ballast inserted is via a control light in the front instrument panel see section 4.2.4 and section 7.3 item 23).

7.12 Electrical system

Battery in the fin.
For C.G. reasons the battery is installed in the fin. Only the use of the factory supplied battery Z110 (12 V, min. 12 Ah, mass 5.75 kg, 12.7 lbs.) is permitted. The battery fuse is installed at the battery, type: G fuse 250 V with indicator 5 x 25 medium slow / 4 A.
After inserting the connector plug in the fin the battery is connected to the electrical system of the glider. If you want to charge the battery inside the glider this can be done via the socket see section 7.3 item 20).
Warning: Use only automatic chargers designed to charge sealed lead acid batteries. To charge the battery to its full capacity a charger with 14.4 V max. charging voltage is necessary (normal automatic chargers charge only up to 13.8V). Such a charger is available from DG Flugzeugbau code no. Z 08.
For periodical recharging the “power independent “ unit is suitable. This unit is also available from DG Flugzeugbau.

All current - carrying wiring confirms to aeronautical specifications.