FLIGHT MANUAL

for Sailplane

Model: **Duo Discus**

Type sales name: Duo Discus (xL) (S/N 534 and S/N 542 and on when in compliance with MB-No. 396-16)

Serial-No.:

Registr.-No.:

Date of issue: **October 2007**

Pages as indicated by „LBA-app." are approved by

(Signature)

Luftfahrt-Bundesamt (Authority)

(Stamp)

(Original date of approval)

This sailplane is to be operated in compliance with information and limitations contained herein.

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

0.1 Record of revisions

Any revisions of the present manual. except actual weighing data, must be recorded in the following table and in the case of approved sections be 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 left hand margin, and revision number and the date will be shown on the bottom left hand side of the page.

0.1 Erfassung der Berichtigungen / Records of revisions

Lfd. Nr. der Berichtigung	Abschnitt	Seiten	Datum der Be-richtigung	Bezug	Datum der Anerkennung durch das LBA	Datum der Ein-arbeitung	Zeichen /Unter-schrift
Revision No.	Affected section	Affected page	Date of issue	Reference	Date of Approval by LBA	Date of Insertion	Signature

MB: Modification Bulletin – Änderungsblatt
TN : Technical Note – Technische Mitteilung

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
0	0.1.1 0.1.2		
	0.2.1 0.2.2 0.2.3 0.2.4 0.2.5 0.2.6		
	0.3.1		

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
1	1.1.1	Oktober 2007	
	1.1.2	Oktober 2007	
	1.2	Oktober 2007	
	1.3	Oktober 2007	
	1.4.1	Oktober 2007	
	1.4.2	Oktober 2007	
	1.4.3	Oktober 2007	
	1.5	Oktober 2007	
2	2.1.1	Oktober 2007	
	2.1.2	Oktober 2007	
	LBA-anerk. 2.2	Oktober 2007	
	LBA-anerk. 2.3	Oktober 2007	
	LBA-anerk. 2.4	Oktober 2007	
	LBA-anerk. 2.5	Oktober 2007	
	LBA-anerk. 2.6	Oktober 2007	
	LBA-anerk. 2.7	Oktober 2007	
	LBA-anerk. 2.8	Oktober 2007	
	LBA-anerk. 2.9	Oktober 2007	
	LBA-anerk. 2.10	Oktober 2007	
	LBA-anerk. 2.11	Oktober 2007	
	LBA-anerk. 2.12.1	Oktober 2007	
	LBA-anerk. 2.12.2	Oktober 2007	
	LBA-anerk. 2.13	Oktober 2007	
	LBA-anerk. 2.14	Oktober 2007	
	LBA-anerk. 2.15	Oktober 2007	
3	3.1.1	Oktober 2007	
	3.1.2	Oktober 2007	
	LBA-anerk. 3.2	Oktober 2007	
	LBA-anerk. 3.3	Oktober 2007	
	LBA-anerk. 3.4	Oktober 2007	
	LBA-anerk. 3.5	Oktober 2007	
	LBA-anerk. 3.6	Oktober 2007	
	LBA-anerk. 3.7	Oktober 2007	
	LBA-anerk. 3.8	Oktober 2007	
	LBA-anerk. 3.9.1	Oktober 2007	
	LBA-anerk. 3.9.2	Oktober 2007	

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
4	4.1.1	Oktober 2007	
	4.1.2	Oktober 2007	
	LBA-anerk.4.2.1	Oktober 2007	
	LBA-anerk.4.2.2	Oktober 2007	
	LBA-anerk.4.2.3	Oktober 2007	
	LBA-anerk.4.3.1	Oktober 2007	
	LBA-anerk.4.3.2	Oktober 2007	
	LBA-anerk.4.3.3	Oktober 2007	
	LBA-anerk.4.3.4	Oktober 2007	
	LBA-anerk.4.4	Oktober 2007	
	LBA-anerk.4.5.1.1	Oktober 2007	
	LBA-anerk.4.5.1.2	Oktober 2007	
	LBA-anerk.4.5.1.3	Oktober 2007	
	LBA-anerk.4.5.1.4	Oktober 2007	
	LBA-anerk.4.5.2	Oktober 2007	
	LBA-anerk.4.5.3.1	Oktober 2007	
	LBA-anerk.4.5.3.2	Oktober 2007	
	LBA-anerk.4.5.3.3	Oktober 2007	
	LBA-anerk.4.5.3.4	Oktober 2007	
	LBA-anerk.4.5.4	Oktober 2007	
	LBA-anerk.4.5.5	Oktober 2007	
	LBA-anerk.4.5.6.1	Oktober 2007	
	LBA-anerk.4.5.6.2	Oktober 2007	
	LBA-anerk.4.5.6.3	Oktober 2007	
	LBA-anerk.4.5.6.4	Oktober 2007	
	LBA-anerk.4.5.6.5	Oktober 2007	
	LBA-anerk.4.5.7.1	Oktober 2007	
	LBA-anerk.4.5.7.2	Oktober 2007	
	LBA-anerk.4.5.8	Oktober 2007	
	LBA-anerk.4.5.9.1	Oktober 2007	
	LBA-anerk.4.5.9.2	Oktober 2007	

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
5	5.1.1	Oktober 2007	
	5.1.2	Oktober 2007	
	LBA-anerk. 5.2.1	Oktober 2007	
	LBA-anerk. 5.2.2	Oktober 2007	
	LBA-anerk. 5.2.3	Oktober 2007	
	LBA-anerk. 5.2.4	Oktober 2007	
	5.3.1	Oktober 2007	
	5.3.2.1	Oktober 2007	
	5.3.2.2	Oktober 2007	
6	6.1.1	Oktober 2007	
	6.1.2	Oktober 2007	
	6.2.1	Oktober 2007	
	6.2.2	Oktober 2007	
	6.2.3	Oktober 2007	
	6.2.4	Oktober 2007	
	6.2.5	Oktober 2007	
	6.2.6	Oktober 2007	
	6.2.7	Oktober 2007	
	6.2.8	Oktober 2007	

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
	7.1.1	Oktober 2007	
	7.1.2	Oktober 2007	
	7.2.1	Oktober 2007	
	7.2.2	Oktober 2007	
	7.2.3	Oktober 2007	
	7.2.4	Oktober 2007	
	7.2.5	Oktober 2007	
	7.2.6	Oktober 2007	
	7.2.7	Oktober 2007	
	7.3.1	Oktober 2007	
	7.3.2	Oktober 2007	
	7.4	Oktober 2007	
	7.5	Oktober 2007	
	7.6	Oktober 2007	
	7.7	Oktober 2007	
	7.8	Oktober 2007	
	7.9.1	Oktober 2007	
	7.9.2	Oktober 2007	
	7.9.3	Oktober 2007	
	7.10	Oktober 2007	
	7.11	Oktober 2007	
	7.12.1	Oktober 2007	
	7.12.2	Oktober 2007	
	7.12.3	Oktober 2007	
	7.13.1	Oktober 2007	
	7.13.2	Oktober 2007	

0.2 Verzeichnis der Seiten / List of effective pages

Abschnitt Affected section	Seite Affected pages	Ausgabe-Datum Date of issue	Bezug Reference
8	8.1.1	Oktober 2007	
	8.1.2	Oktober 2007	
	8.2	Oktober 2007	
	8.3	Oktober 2007	
	8.4	Oktober 2007	
	8.5.1	Oktober 2007	
	8.5.2	Oktober 2007	
9	9.1.1	Oktober 2007	
	9.1.2	Oktober 2007	
	9.2		

0.3 Table of contents

	Section
General (a non-approved section)	1
Limitations (an approved section)	2
Emergency procedures (an approved section)	3
Normal procedures (an approved section)	4
Performance (a partly approved section)	5
Weight & balance (a non-approved section)	6
Systems description (a non-approved section)	7
Handling, care and maintenance (a non-approved section)	8
Supplements	9

Section 1

1. General

1.1 Introduction

1.2 Certification basis

1.3 Warnings, cautions and notes

1.4 Descriptive data

1.5 Three-side view

1.1 Introduction

The Flight Manual for this sailplane has been prepared to provide pilots and instructors with information for the safe and efficient operation of the „Duo Discus “.

This manual includes the material required to be furnished to the pilot by „JAR“, Part 22.

It also contains supplemental data supplied by the manufacturer of the sailplane.

1.2 Certification basis

This sailplane, model designation

„Duo Discus“

has been approved by the Luftfahrt-Bundesamt (LBA) in compliance with “JAR”, Part 22 effective on October 28, 1995 (Change 5 of the English Original Issue).

The LBA Type Certificate is No. **EASA.A.025** and was issued primarily under Data Sheet No. 396 on

21.03.1994

Category of Airworthiness: UTILITY

1.3 Warnings, cautions and notes

The following definitions apply to warnings, cautions and notes used in this flight manual:

„WARNING“	means that the non-observation of the corresponding procedure leads to an immediate or important degradation of the flight safety
„CAUTION“	means that the non-observation of the corresponding procedures leads to a minor or to a more or less long term degradation of the flight safety
„NOTE“	draws the attention on any special item not directly related to safety, but which is important or unusual

1.4 Descriptive data

The “Duo Discus ” is a two-seat sailplane for advanced training and cross-country flying, constructed from carbon and glass fiber reinforced plastic (CFRP/GFRP), featuring a T-tail (fixed horiz. stabilizer and elevator).

Wing

The wing is four-stage trapezoid in planform, consists of two main panels with tip extension with winglets (having a swept-back leading edge) and features double-panel „Schempp-Hirth“ type airbrakes on the upper surface and connected to a trailing edge flap. Ailerons are internally driven.
The integral water ballast tanks haven a total capacity of approx. 198 Liters (52.3 US Gal., 43.5 IMP Gal.).

The wing shells are a glass and carbon fiber/foam-sandwich construction with spar flanges of carbon fiber rovings and shear webs made as a GFRP/foam-sandwich.

Fuselage

The cockpit is comfortable and features two seats in tandem. The one-piece canopy hinges sideways and opens to the right. For high energy absorption the cockpit region is constructed as an aramid/carbon fiber laminate, which is reinforced by steel tube transverse frame and a double skin on the sides with integrated canopy coaming frame and seat pan mounting flanges. The aft fuselage section is a pure carbon fiber (non-sandwich-) shell of high strength, stiffened by CFRP-sandwich bulkheads and webs. The main wheel is retractable with shock absorber struts and features a hydraulic disc brake; nose wheel and tail wheel (or skid) are fixed.

Horizontal tailplane

The horiz. tailplane consists of a fixed stabilizer with elevator.
The stabilizer is a GFRP/foam-sandwich construction with CFRP-reinforcements, the elevator halves are a pure CFRP/GFRP shell.
The spring trim is gradually adjustable by a lever resting against a threaded rod.

Vertical tail

Fin and rudder are constructed as a GFRP/foam-sandwich.
On request a water ballast trim tank with a capacity of 11 Liter (2.9 US Gal., 2.4 IMP Gal.) is provided in the fin.

Controls

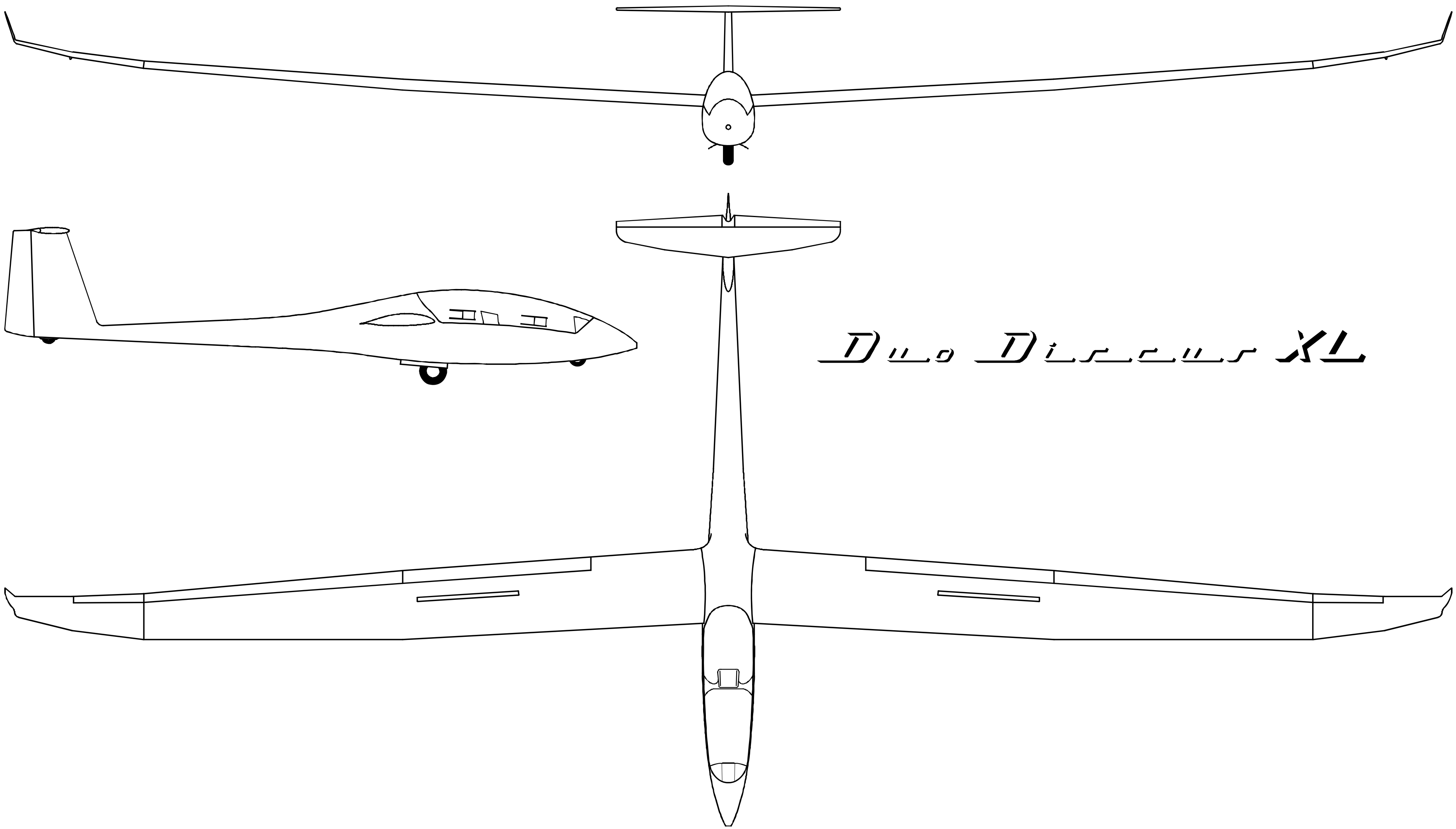
All controls are automatically hooked up when the sailplane is rigged.

R E S E R V E D

TECHNICAL DATA

Wing	Span	20.00 m	65.62 ft
	Area	16.40 m²	176.53 ft²
	Aspect ratio	24.4	
	MAC	0.875 m	2.87 ft
Fuselage	Length	8.73 m	28.64 ft
	Width	0.71 m	2.33 ft
	Height	1.00 m	3.28 ft
Weight (mass)	Empty mass approx.	420 kg	926 lb
	Maximum all-up mass	750 kg	1654 lb
	Wing loading	29.9 - 45.7 kg/m²	6.1 - 9.3 lb/ft²

1.5 Three-side view



Section 2

2. Limitations

2.1 Introduction

2.2 Airspeed

2.3 Airspeed indicator markings

2.4 (reserved)

2.5 (reserved)

2.6 Weights (masses)

2.7 Center of gravity

2.8 Approved maneuvers

2.9 Maneuvering load factors

2.10 Flight crew

2.11 Kinds of operation

2.12 Minimum equipment

2.13 Aerotow and winch launch

2.14 Other limitations

2.15 Limitation placards

2.1 Introduction

Section 2 includes operating limitations, instrument markings and basic placards necessary for safely operating the sailplane, its standard systems and standard equipment.

The limitations included in this section and in section 9 have been approved by the Luftfahrt-Bundesamt (LBA), Braunschweig (Germany).

2.2 Airspeed

Airspeed limitations and their operational significance are shown below:

SPEED		(IAS)	REMARKS
V_{NE}	Never exceed speed in calm air	262,8 km/h 142 kt 163 mph	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection
V_{RA}	Rough air speed	180 km/h 97 kt 112 mph	Do not exceed this speed except in smooth air, and then only with caution. Rough air is met in lee-wave rotors, thunderclouds etc.
V_A	Maneuvering speed	180 km/h 97 kt 112 mph	Do not make full or abrupt control movements above this speed as the aircraft structure might get overstressed.
V_T	Maximum speed on aerotow	180 km/h 97 kt 112 mph	Do not exceed this speed during an aerotow.
V_W	Maximum winch launch speed	150 km/h 81 kt 93 mph	Do not exceed this speed during a winch launch.
V_{LO}	Maximum landing gear operating speed	180 km/h 97 kt 112 mph	Do not extend or retract landing gear above this speed.

2.3 Airspeed indicator markings

Airspeed indicator markings and their colour code significance are shown below:

MARKING	VALUE OR RANGE (IAS)	SIGNIFICANCE
Green arc	90 - 180 km/h 49 - 97 kt 56 - 112 mph	Normal operating range (lower limit is the speed $1.1V_{S1}$ at maximum mass and c/g in most forward position; upper limit is the max. permissible speed in rough air).
Yellow arc	180 - 262,8 km/h 97 - 142 kt 112 - 163 mph	Maneuvers must be conducted with caution and operating in rough air is not permitted.
Red line at	262,8 km/h 142 kt 163 mph	Maximum speed for all operations.
Yellow triangle at	95 km/h 51 kt 59 mph	Approach speed at maximum mass without water ballast

R E S E R V E D

R E S E R V E D

2.6 Weights (masses)

Maximum permitted take-off weight (mass):	750 kg	(1654 lb)
Maximum permitted landing weight (mass):	750 kg	(1654 lb)
Maximum permitted take-off and landing weight (mass) w i t h o u t water ballast:	660 kg	(1455 lb)
Maximum permitted weight (mass) of all non-lifting parts:	440 kg	(970 lb)
Maximum permitted weight (mass) in baggage compartment:	---	---

2.7 Center of gravity

Center of gravity in flight

Aircraft attitude:	Tail jacked up such that a wedge-shaped block, 100 : 4.5, placed on the rear top fuselage, is horizontal along its upper edge
Datum:	Wing leading edge at root rib
Maximum forward c/g position:	45 mm (1.77 in.) aft of datum plane
Maximum rearward c/g position	250 mm (9.84 in.) aft of datum plane

It is extremely important that the maximum rearward c/g position is not exceeded.

This requirement is met when the minimum front seat load is observed.

The minimum front seat load is given in the loading table and is shown by a placard in the cockpit.

A lower front seat load must be compensated by ballast – see section 6.2 „Weight and Balance Record / Permitted Payload Range".

2.8 Approved maneuvres

The sailplane model „Duo Discus“ is certified in category

U T I L I T Y

The following aerobatic manoeuvres are only permitted

- without wing water ballast,
- up to a maximum all-up mass of 630 kg

a) inside loops
b) stalled turns
c) lazy eight
d) spinning

It is recommended that in addition to the instrumentation recommended in section 2.12 an accelerometer (3 hands, resettable) is installed.

2.9 Maneuvering load factors

The following maneuvering load factors must not be exceeded:

a) With airbrakes locked and at V_A = 180 km/h, 97 kt, 112 mph

$n = +5.3$

$n = -2.65$

With airbrakes locked and at V_{NE} = 262,8 km/h, 142 kt, 163 mph

$n = +4.0$

$n = -1.5$

b) With airbrakes extended, the maximum maneuvering load factor is

$n = +3.5$
$n = 0$

2.10 Flight crew

When flown solo, the “Duo Discus” is controlled from the front seat.

Observe the minimum load on the front seat – if necessary, ballast must be installed to bring the load up to a permissible figure. See also section 6.2:

“Weight and Balance Record / Permitted Payload Range”.

When flown with two pilots, the “Duo Discus” can be operated from the rear seat as Pilot in command in compliance with the following requirements:

- All necessary control elements and instruments must be installed for the rear seat
- The responsible pilot needs sufficient experience and practice in flying from the rear seat
- No water ballast in the wings

2.11 Kinds of operation

With the prescribed minimum equipment installed (see page 2.12), the "Duo Discus" is approved for

VFR-flying in daytime

Cloud flying

Restricted aerobatics

2.12 Minimum equipment

Instruments and other basic equipment must be of an approved type and should be selected from the list in the Maintenance Manual.

a) Normal operations

2 Airspeed indicator
(range up to 300 km/h, 162 kt, 186 mph)
with colour markings according page 2.3

2 Altimeter

1 Outside air temperature indicator (OAT) with sensor
(when flying with water ballast – red line at + 2° C [35,6° F])

1 Magnetic compass

2 Four-piece safety harnesses (symmetrical)

2 Automatic or manual parachutes

or

2 Back cushions (thickness approx. 8 cm / 3.15 in when compressed)

CAUTION:

The sensor for the OAT must be installed in the ventilation air intake.

For structural reasons the mass of each instrument panel with instruments in place must not exceed 10 kg (22 lb).

b) Cloud flying only permissible

- without wing water ballast,
- up to a maximum all-up mass of 630 kg (1389 lb)

In addition to the minimum equipment listed under a)
the following is required:

1 Turn & bank indicator with slip ball
1 Variometer
1 VHF-Transceiver

NOTE: From experience gained to date it appears that the airspeed indicator system installed remains fully operational when flying in clouds.

Recommended additional equipment for cloud flying:

1 Artificial horizon
1 Clock

Recommended additional equipment for restricted aerobatics only permissible

- without wing water ballast,
- up to a maximum all-up mass of 630 kg (1389 lb)

1 Accelerometer (3 hands, resettable)

2.13 Aerotow and winch launch

Aerotow

Only permissible at the nose tow release !

Maximum towing speed:	180 km/h	(97 kt, 112 mph)
Weak link in tow rope:	max. 850 daN	(1910 lb)
Minimum lenght of tow rope:	30 m	(98 ft)
Tow rope material	Hemp or Nylon	

Winch launch

Only permissible at the c/g tow release !

Maximum launching speed:	150 km/h	(81 kt, 93 mph)
Weak link in winch cable	max. 950 daN	(2135 lb)

2.14 Other limitations

N o n e

2.15 Limitations placards

MAX. PERMITTED A.U. WEIGHT (MASS): 1654 lb / 750 kg			
MAXIMUM PERMITTED SPEEDS (IAS) :	**km/h**	**kt**	**mph**
Never exceed speed	**262.8**	**142**	**163**
Rough air speed	**180**	**97**	**112**
Maneuvering speed	**180**	**97**	**112**
Aerotowing speed	**180**	**97**	**112**
Winch launching speed	**150**	**81**	**93**
Landing gear operating speed	**180**	**97**	**112**

Max. permitted speed				
Altitude		**V_{NE}(IAS)**		
[m]	**[ft]**	**km/h**	**kt**	**mph**
0-2000	0-2000	**262.8**	**142**	**163**
3000	9843	**253**	**137**	**157**
4000	13123	**241**	**130**	**150**
5000	16404	**228**	**123**	**142**
6000	19685	**215**	**116**	**134**
7000	22966	**204**	**110**	**127**
8000	26247	**192**	**104**	**119**
9000	29528	**180**	**97**	**112**
10000	32808	**170**	**92**	**106**

A E R O B A T I C S

WITH MAX. PERMITTED A.U. WEIGHT OF 660 kg / 1455 lb AND WITHOUT WATER BALLAST THE FOLLOWING MANEUVERS ARE PERMITTED:

(A) Inside loops **(C)** Lazy eight
(B) Stalled turns **(D)** Spinning

Operating Conditions: See Flight Manual

fin tank **not** installed

LOAD ON THE SEATS (crew incl. parachutes)				
SEAT LOAD	TWO PERSONS min.	TWO PERSONS max.	ONE PERSON min.	ONE PERSON max.
front seat load	**70*** kg **154*** lb	**110*** kg **243*** lb	**70*** kg **154*** lb	**110*** kg **243*** lb
rear seat load	at choice	**110*** kg **243*** lb	———	———
valid for the following battery location(s):				
1 battery	engine battery (E)			
2 batteries	in front of rear stick mounting frame (C1, C2)			
1 battery	beside U/C (C3)			
2 batteries	in fin (F1, F2)			
Maximum cockpit seat load			**220*** kg / **485*** lb	

Maximum cockpit load (load on both seats) may not be exceeded. For seat loads below the placarded minimum refer to Flight manual - section 6.2.

fin tank installed

LOAD ON THE SEATS (crew incl. parachutes)				
SEAT LOAD	TWO PERSONS min.	TWO PERSONS max.	ONE PERSON min.	ONE PERSON max.
front seat load	**100*** kg **220*** lb **(70*** kg**)** **(154*** lb**)**	**110*** kg **243*** lb	**100*** kg **220*** lb **(70*** kg**)** **(154*** lb**)**	**110*** kg **243*** lb
rear seat load	at choice	**110*** kg **243*** lb	———	———
valid for the following battery location(s):				
1 battery	engine battery (E)			
2 batteries	in front of rear stick mounting frame (C1, C2)			
1 battery	beside U/C (C3)			
2 batteries	in fin (F1, F2)			
Maximum cockpit seat load			**220*** kg / **485*** lb	

Maximum cockpit load (load on both seats) may not be exceeded. For seat loads below the placarded minimum refer to Flight manual - section 6.2.
The value shown in parenthesis may be used after having thoroughly checked the ballast quantity in the fin tank and the appropriate loading chart.

WEAK LINK FOR TOWING	
for Aerotow:	**max. 850 daN (1910 lb)**
for Winch launch:	**max. 950 daN (2135 lb)**
TIRE PRESSURE	
Nose wheel :	**3.0 bar (43 psi)**
Main wheel :	**4.0 bar (57 psi)**
Tail wheel : (if installed)	**3.0 bar (43 psi)**

***)** As the actual minimum or maximum seat load of this aircraft (to which this manual refers) may differ from these typical weights, the placard in the cockpit must always show the actual values, which are also to be entered in the log chart - see section 6.2.

Note: Further placards are shown in the Maintenance Manual.

Section 3

3 Emergency procedures

3.1 Introduction

3.2 Canopy jettisoning

3.3 Bailing out

3.4 Stall recovery

3.5 Spin recovery

3.6 Spiral dive recovery

3.7 (reserved)

3.8 (reserved)

3.9 Other emergencies

3. Emergency procedures

3.1 Introduction

Section 3 provides check lists and amplifies procedures for coping with emergencies that may occur.

Emergency situations can be minimized by proper pre-flight inspections and maintenance.

3.2 Jettisoning the canopy

The canopy is to be jettisoned as follows:

Swing **b a c k** one of the red locking levers –
provided on the port side of the canopy frame –
up to the stop (approx. 90°) and swing canopy sideways fully open.

The canopy will then be torn out from its hinges by the airstream and gets carried away.

3.3 Bailing out

If possible, first stop and retract engine, than jettison canopy (see section 3) and release harness.

For leaving the cockpit, the person on the front seat should bend upper part of the body slightly forward, grap the canopy coaming frame of the fuselage with both hands and lift the body.

The person on the rear seat should grap the cut-out on either side of the instrument panel and use the canopy coaming frame or the arm rest of the seat pan for support.

Leave the cockpit to the left.

The rip cord of a manual parachute should be pulled at a safe distance and height.

3.4 Stall recovery

On stalling whilst flying straight ahead or in a banked turn, normal flying attitude is regained by firmly easing the control stick forward and, if necessary, applying opposite rudder and aileron.

3.5 Spin recovery

A safe recovery from a spin is effected by the following method:

a) Hold aileron neutral

b) Apply opposite rudder
(i.e. against the direction of rotation of the spin).

c) Ease control stick forward until rotation ceases and the airflow is restored.

d) Centralize rudder and pull gently out of dive.

With the center of gravity in middle through rearward positions, a steady spinning motion is possible.

After having applied the standard recovery method, the “Duo Discus” will stop rotating after about ¼ to ½ turn.

The loss of height - from the point at which recovery is initiated to the point at which horizontal flight is first regained - can be up to 180 m (590 ft), and the recovery speeds are between 130 and 170 km/h (70 – 92 kt, 81 – 106 mph).

With the center of gravity in the foremost position, a steady spinning motion is not possible. The “Duo Discus” stops rotating after a half or a full turn and usually enters a spiral dive.

Recovery is by normal use of opposite controls.

Note: Spinning may be safely avoided by following the actions given in section 3.4 “Stall recovery”.

3.6 Spiral dive recovery

Depending on the use of the controls, a spin may turn into a spiral dive, if the center of gravity is in a forward position. This is indicated by a rapid increase in speed and acceleration.

Recovery form a spiral dive is achieved by easing the control stick forward and applying opposite rudder and aileron.

> WARNING:
>
> When pulling out of the dive, the permissible control surface deflections at V_A / V_{NE} are to be observed!
>
> See also page 2.2.

R E S E R V E D

R E S E R V E D

3.9 Other emergencies

Flying with uneven water ballast

If, on dumping water ballast, the wing tanks are emptying unevenly or only one side – which is recognized at lower speeds by having to apply opposite aileron for normal flying attitude – entering a stall must be avoided.

When landing in this condition, the touch down speed must be increased by about 10 km/h (5 kt, 6 mph) and the pilot must be prepared for the "Duo Discus" to veer off course as the heavier wing tends to drop somewhat sooner than normal (apply opposite aileron).

Emergency landing with retracted undercarriage

An emergency landing with the main wheel retracted is on principle not recommended, because the potential energy absorption of the landing gear is many times higher as compared to the fuselage shell.

Should the wheel fail to extend, the sailplane should be landed at a flat angle and without pancaking.

Ground loop

If there is the danger of the sailplane overshooting the boundary of the landing field in mind, a decision whether or not to initiate a controlled ground loop should be made at least about 40 m (131 ft) away from the boundary:

- If possible, always turn into the wind

and

- as the wing tip is forced down, push the control stick forward simultaneously.

Emergency water landing

From experience gained on the occasion of a composite sailplane landing on water with its undercarriage retracted, the crew must take into consideration that, in the case of the "Duo Discus", the entire cockpit might get forced under water.

Therefore an emergency landing on water should only be chosen as a last resort and the main wheel should always be extended.

Section 4

4. Normal operating procedures

4.1 Introduction

4.2 Rigging and de-rigging

4.3 Daily inspection

4.4 Pre-flight inspection

4.5 Normal procedures and recommended speed

4.5.1 Methods of launching

4.5.2 (reserved)

4.5.3 Flight

4.5.4 Approach

4.5.5 Landing

4.5.6 Flight with water ballast

4.5.7 High altitude flight

4.5.8 Flight in rain

4.5.9 Aerobatics

4. Normal operating procedures

4.1 Introduction

Normal procedures associated with optional equipment are found in section 9.

This section provides check lists and amplifies procedures for conducting the daily and pre-flight inspection.

Furthermore this section includes normal operating procedures and recommended speeds.

4.2.1 Rigging and de-rigging

Rigging

The “Duo Discus” can be rigged by two people if a wing stand or trestle is used under one wing tip.

Prior to rigging, all pins and their corresponding bearings on fuselage, wing panels and tailplane should be cleaned and greased.

Inboard wing panels

Unlock airbrake lever and set water ballast control lever at “CLOSED”.

Insert the port wing panel first. It is important that the helper on the wing tip should concentrate on lifting the trailing edge of the wing panel more than the leading edge, so that the rear wing attachment pin does not force the inner race of the swivel bearing on the fuselage down and out of alignment.

Check that the spar stub tip is located correctly in the cut-out on the far side of the fuselage (if necessary, tilt the fuselage or move the wing gently up and down to help it home).

Check that the angular levers on the wing root rib are properly inserted into their corresponding funnels on the fuselage.

Push in the main wing pin for approx. 3 cm (1.2 in.) so that the wing panel is prevented from sliding out by the cut-out in the vertical rim of the GFRP-panel covering the front wing locating tube.
The wing tip can now be placed on a wing stand.

Next insert the starboard panel – the procedure is the same as for the port wing. As soon as the pin on the starboard spar stub has engaged in its corresponding bearing on the opposing wing panel (recognized by a sudden extension of the unlocked airbrakes), the starboard panel can be pushed fully home under some pressure.

If it is difficult / impossible to push fully home, remove main wing pin and draw the panels together with the aid of the rigging lever (use flat side only).

Finally push main wing pin fully home and secure its handle (depress locking pin and let it engage in the metal fitting on the fuselage inner skin).

Wing tip extensions (outbd. panels)

Insert spar of wing tip extension – with locking pin pushed down and aileron deflected upwards – into the spar tunnel of the inboard wing panel(s).
When fully home, the spring-loaded pin must have engaged (snapped up) in the corresponding opening on the inboard wing panel(s). Make sure that the coupling lap on the lower side of the inner aileron has correctly slid under the adjacent outer aileron.

If the locking pin has not snapped up, it has to be pushed up from the lower side with the aid of the tailplane rigging pin.

Horizontal tailplane

Take the round-headed rigging tool (to be stored in the side-pocket) and screw into the front tailplane locating pin on the leading edge of the fin. Thereafter slide the tailplane aft onto the two elevator actuating pins, pull rigging tool and its pin forward, seat stabilizer nose and push locating pin home into the front tailplane attachment fitting.

Remove rigging tool – locating pin must not protrude in front of the leading edge of the fin.

Check whether the elevator actuating pins are really located (by moving the elevator) and check that the nose of the stabilizer is properly mated with the top of the fin.

After rigging

Check – with the aid of a helper – the controls for full and free movement in the correct sense.

Use tape to seal off the wing / fuselage joint and the joint between main wing panels and their tip extension.

CAUTION: Do not seal off the gap between the aileron on the tip extension and the aileron on the main wing panel.

Seal off the opening for the front tailplane attachment pin and also the joint between fin and horizontal stabilizer (only necessary if there is no rubber sealing on the upper end of the fin).

Sealing with tape is beneficial in terms of performance and it also serves to reduce the noise level.

De-rigging

Remove sealing tape from wing/fuselage joint, the joint between main wing panels and their tip extension and from the fin/ stabilizer joint.

Wing tip extensions (outbd. panels)

Push locking pin down (using the tailplane rigging tool) and carefully pull out tip extension(s).

Horizontal tailplane

Using the threaded rigging tool, pull out front tailplane attachment pin, lift stabilizer leading edge slightly and pull tailplane forward and off.

Main wing panels

Unlock airbrakes, set water dump valve control lever to the "CLOSED" position and unlock handle of main wing pin.

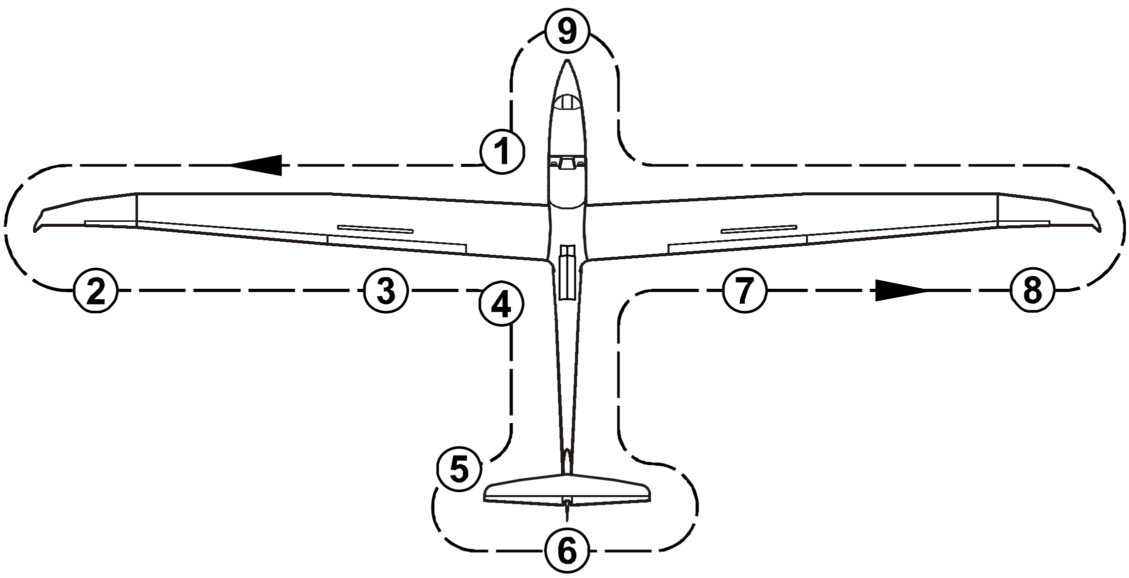
With a helper on the tip of each wing panel, pull out main wing pin up to the last 20 to 30 mm (0.8 -1.2 in.) and withdraw the starboard panel by gently rocking it backwards and forwards if necessary.

Thereafter remove main wing pin and withdraw the port wing panel.

4.3 INSPECTION

a) Daily inspection

The importance of inspecting the sailplane after rigging and before the day’s flying cannot be over-emphasized, as accidents often occur when these daily inspections are neglected or carried out carelessly.



When walking around the “Duo Discus", check all surfaces for paint cracks, dents and unevenness.

In case of doubt, ask an expert for his advice.

a) Open canopy

b) Check that the main wing pin is properly secured

c) Make a visual Check of all accessible control circuits in the cockpit

d) Check for full and free movements of the control elements

e) Check batteries for firm attachment

f) Check for the presence of foreign objects

g) Check fuel quantity

h) (reserved)

i) Check tire pressure:

Nose wheel:	3.0	bar	(43 psi)
Main wheel:	4.0	bar	(57 psi)

j) Check tow release mechanism(s) for proper condition and function

(2) a) Check upper and lower wing surface for damage

b) Clean and grease water ballast dump valves (if necessary)

c) Check wing tip extensions for proper connection (locking pin must be flush with upper wing surface)

d) Check that the ailerons are in good condition and operate freely. Check for any unusual play by gently shaking the trailing edge.

Check hinges for damage

(3) a) Check airbrakes for proper condition, fit and locking

b) Check the trailing edge flap for any unusual play by gently shaking the trailing edge.

c) With airbrakes locked the trailing edge flap must rest against the stop at the inner end of the trailing edge flap.

d) Extending the airbrakes must result in a simultaneous down deflection of the trailing edge flap.

(4) a) Check fuselage for damage, especially on its lower side

b) Check that the STATIC pressure ports for the ASI on the tail boom (1.02 m / 3.35 ft forward of the base of the fin) and below the spar stub cut-out are clear

(5) a) Check condition of tail skid or wheel.
If the latter is installed, check tire pressure:

3.0 bar (44 psi)

b) Should a total energy compensation probe be used, mount it and check the line (when blowing gently from the front to the probe, the variometer(s) connected should read "climb")

c) (reserved)

d) Check that the fin-mounted PITOT tube is clear.
When blowing gently into this probe, the ASI must register.

Should a water ballast fin tank be installed (option):

e) Check that the fin tank spill holes are clear

f) Check water ballast level in fin tank (in case of doubt, discharge ballast)

g) Check that the dump hole for the fin tank in the tail wheel fairing (if installed) is clear

(6) a) Check correct battery installation in vertical tail according to loading chart

b) Check horizontal tailplane for proper attachment and locking

c) Check elevator and rudder for free movement

d) Check trailing edge of elevator and rudder for damage

e) Check elevator and rudder for any unusual play by gently shaking the trailing edge

(7) See (3)

(8) See (2)

(9) (reserved)

After heavy landings or after the “Duo Discus" has been subjected to excessive loads, the resonant wing vibration frequency should be checked (its value to be extracted from the last inspection report for this serial number).

Check the entire powered sailplane thoroughly for surface cracks and other damage. For this purpose it should be de-rigged.

If damage is discovered (e.g. surface cracks in the fuselage tail boom or tailplane, or if delamination is found at the wing roots or at the bearings in the root ribs), then the powered sailplane must be grounded until the damage has been repaired by a qualified person.

4.4 Pre-flight inspection

CHECK LIST BEFORE TAKE-OFF

O Water ballast in fin tank ? (if installed)
O Loading charts checked ?
O Parachute securely fastened ?
O Safety harness secured and tight ?
O Seat back, head rest and pedals in comfortable position ?
O All controls and instruments easily accessible ?
O Airbrakes checked and locked ?
O All control surfaces checked with assistant for full and free movement in correct sense ?
O Elevator trim correctly set ?
O Canopy closed and locked ?

4.5 Normal operating procedures and recommended speeds

4.5.1 Methods of launching

Aerotow

ONLY PERMISSIBLE WITH NOSE TOW RELEASE IN PLACE

Maximum permitted towing speed:

V_T = 180 km/h (97 kt, 112 mph)

For aerotow only the nose tow release must be used - hemp and nylon ropes of between 30 and 40 m length (98-131 ft) were tested.

Prior to take-off set elevator trim as follows:

- Rearward c/g positions: Lever forward to first third of its travel
- Other c/g positions: Lever to the middle of its travel

As the tow rope tightens, apply the wheel brake gently (by actuating the stick-mounted lever) to prevent the “Duo Discus" from overrunning the rope.

In crosswind conditions the aileron control should be held towards the downwind wing, i.e. in winds from the left the stick should be displaced to the right. This is to counteract the lift increase on the right wing generated by the tug's prop wake, which the crosswind forces to drift to the right.

For intermediate to forward c/g positions the elevator should be neutral for the ground run; in the case of rearward c/g positions it is recommended that down elevator is applied until the tail lifts.

After lift-off the elevator trim can be set for a minimum in control stick loads.

When flown solo, the normal towing speed is in the region of 100 to 120 km/h (54-65 kt, 62-75 mph) and 130 to 140 km/h (70-76 kt, 81-87 mph) for two occupants flying with water ballast.

Only small control surface deflections are necessary to keep station behind the tug.

In gusty conditions or when flying into the propeller slip stream of a powerful tug correspondingly greater control stick movements are required.

NOTE:
The minimum towing speeds are lower for aero tow with a powered sailplane:

- 95 km/h (51 kt, 59 mph) (when flown solo)
- 110 km/h (59 kt, 68 mph) (for two occupants with water ballast)

The undercarriage may be retracted during the tow; this is not, however, recommended at low altitude, as changing hands on the stick could easily cause the “Duo Discus” to lose station behind the tug.

When releasing the tow rope, pull the yellow T-shaped handle fully several times and turn only when definitely clear of the rope.

Winch launch

ONLY PERMISSIBLE WITH C/G TOW RELEASE IN PLACE

Maximum permitted launching speed:

V_T = 150 km/h (81 kt, 93 mph)

For winch launching only the c/g tow release must be used.
Prior to take-off set elevator trim as follows:

• Rearward c/g Positions	Lever forward to first third of its travel
• Intermediate c/g Positions	Lever to the middle of its travel.
• Forward c/g positions	Lever backward to last third of its travel

As the cable tightens, apply the wheel brake gently (by actuating the stick-mounted lever) to prevent the “Duo Discus" from overrunning the winch cable.

Ground run and lift-off are normal - there is no tendency to veer-off or to climb excessively steeply on leaving the ground.

Depending on the load on the seats, the “Duo Discus" is lifted off with the control stick slightly pushed forward in the case of aft c/g positions and slightly pulled back with the c/g in a forward position.

After climbing to a safe height, the transition into a typical steep winch launch attitude is effected by pulling the control stick slightly further back.

At normal all-up masses, i.e. both seats occupied, the launch speed should not be less than 100 km/h (54 kt, 62 mph). Normal launch speed is about 110 to 120 km/h (5965 kt, 68-75 mph) with two occupants.

At the top of the launch the cable will normally backrelease automatically; the cable release handle should, nevertheless, be pulled firmly several times to ensure that the cable has actually gone.

CAUTION:

Winch launching at the maximum permitted all-up mass of should only be done if there is an appropriately powerful winch and a cable in perfect condition available.

Furthermore there is not much point in launching by winch for a soaring flight, if the release height gained is less than 300 m (984 ft).

In case of doubt, reduce all-up mass.

WARNING:	It is explicitly advised against winch launching with a tail wind!

CAUTION:

Prior to launching by winch, it must be ensured that the crew is properly seated and able to reach all control elements.

Particularly when using seat cushions it must be made sure that during the initial acceleration and while in the steep climbing attitude the occupants do not slide backwards and up.

R E S E R V E D

4.5.3 Flight

The "Duo Discus" has pleasant flight characteristics and can be flown effortlessly at all speeds, loading conditions (with or without water ballast), configurations and c/g positions.

With a mid-point c/g position the maximum speed range covered by the elevator trim is from about 70 km/h (38 kt, 43 mph) to about 200 km/h (108 kt, 124 mph).

Flying characteristics are pleasant and the controls are well harmonized. Turn reversal from + 45° to - 45° is effected without any noticeable skidding. Ailerons and rudder may be used to the limits of their travel.

All-up mass	620 kg 1364 lb	700 kg 1543 lb
Speed	97 km/h 52 kt 60 mph	105 km/h 56 kt 65 mph
Reversal time	4.8 sec	4.4 sec

Note:

Flights in conditions conducive to lightning strikes must be avoided.

High speed flying

At high speeds up to V_{NE} = 262,8 km/h (142 kt, 163 mph) the “Duo Discus” is easily controllable.

Full deflections of control surfaces may only be applied up to V_A = 180 km/h (97 kt, 112 mph).

At V_{NE} = 262,8 km/h (142 kt, 163 mph) only one third (1/3) of the full deflection range is permissible. Avoid especially sudden elevator control movements.

It strong turbulence, i.e. in wave rotors, thunderclouds, visible whirlwinds or when crossing mountain ridges, the speed in rough air V_{RA} = 180 km/h (97 kt, 112 mph) must not be exceeded.

With the c/g at an aft position, the control stick movement from the point of stall to maximum permissible speed is relatively small, though the change in speed will be noticed through a perceptible change in control stick loads.

The airbrakes may be extended up to V_{NE} = 262,8 km/h (142 kt, 163 mph). However, they should only be used at such high speeds in emergency or if the maximum permitted speeds are being exceeded inadvertently.

When extending the airbrakes suddenly, the deceleration forces are noticeable.

> WARNING:
>
> Consequently it is wise to check in advance that the harness is tight and that the control stick is not inadvertently thrown forwards when the airbrakes are extended. There should be no loose objects in the cockpit. At speeds above 180 km/h (97 kt, 112 mph) extend the airbrakes only gradually (allow 2 seconds).

> WARNING:
>
> It should strictly be noted that in a dive with the airbrakes extended, the “Duo Discus” should be pulled out less abruptly (maximum 3.5 g) than with retracted brakes (5.3 g), see section 2.9 “Maneuvering Load Factors”. Therefore pay attention when pull out with airbrakes extended at higher speeds!

A dive with the airbrakes fully extended is limited to an angle to the horizon of 34° at maximum permitted all-up mass of 750 kg (1654 lb).
At a maximum permitted all-up mass up to 630 kg an angle to the horizon is more than 45°.

Low speed flying and stall behaviour

In order to become familiar with the “Duo Discus" it is recommended to explore its low speed and stall characteristics at a safe height. This should be done whilst flying straight ahead and also whilst in a 45° banked turn.

Wings level stall

A stall warning usually occurs 5 to 12 km/h (3 - 6 kt, 3 - 7 mph) above stalling speed and begins with vibration in the controls. If the stick is pulled further back, this effect becomes more pronounced, the ailerons get spongy and the sailplane sometimes tends to slight pitching motions
(speed increases again and will then drop to stalling speed).

On reaching a stalled condition - depending on the c/g position - a distinct drop of the ASI reading is observed, which then often oscillates because of turbulent air influencing the fin-mounted Pitot tube. With the c/g in rearward positions, the "Duo Discus" may slowly drop a wing, but usually it can be held level.

A normal flight attitude is regained by easing the control stick firmly forward and - if necessary - applying opposite rudder and aileron.

The loss of height from the beginning of the stall until regaining a normal level flight attitude is up to 40 m (131 ft).

In the case of forward c/g positions and stick fully pulled back, the sailplane just continues to fly in a mushed condition without the nose or a wing dropping.

Normal flying attitude is regained by easing the stick forward.

Turning flight stalls

When stalled during a coordinated 45° banked turn, the "Duo Discus" - with the control stick pulled fully back - just continues to fly in a stalled condition. There is no uncontrollable tendency to enter a spin. The transition into a normal flight attitude is conducted by an appropriate use of the controls.

The loss of height from the beginning of the stall until regaining a normal level flight attitude is approx. 60 m (197 ft).

Influence of water ballast

Apart from higher stall speeds - caused by the higher mass in flight - water ballast in the wing tanks has no aggravating influence on the stall characte-ristics.

With water ballast in the fin tank, stall characteristics are like those found for aft c/g positions.

4.5.4 Approach

Normal approach speed with airbrakes fully extended and wheel down is 90 km/h (49 kt, 56 mph) without water ballast and flown solo, or 105 km/h (57 kt, 65 mph) at maximum permitted all-up mass.

The yellow triangle on the ASI at the 95 km/h mark (51 kt, 59 mph) is the recommended approach speed for the maximum all-up mass without water ballast (660 kg / 1455 lb).

The airbrakes open smoothly.
The approach to the ground can be done slowly with airbrakes fully extended because no pancaking occur when flaring out - also when retracting the air-brakes.

Side slipping is also fine aid for landing. It is possible in a straight line with the rudder deflected up to about 90 % of its travel and results in a yaw angle of about 30° and a bank angle of about 10° to 15°. The control force reversal perceptible is low.
To return to level flight, normal opposite controls are required.

CAUTION:

With rudder fully deflected, side slips in a straight flight path are not possible
- the sailplane will slowly turn in the direction of the displaced rudder.
- Side slipping causes the ASI to read less.
- During side slip with water ballast some water escapes through the vent hole of the water tank filler cap of the lower wing. Prolonged slips with water ballast are therefore not recommended.

WARNING:

Both the performance and the aerodynamic characteristics of the "DUO DISCUS " are affected adversely by rain or ice on the wing.
Be cautious when landing!
Increase the approach speed at least 5 to 10 km/h (3-5 kt, 3-6 mph).

4.5.5 Landing

For off-field landings the undercarriage should always be extended, as the protection of the crew is much better, especially from vertical impacts on landing.

Main wheel and tail wheel should touch down simultaneously.

To avoid a long ground run, make sure that the sailplane touches down at minimum speed.

A touch-down at a speed of 90 km/h (49 kt, 56 mph) instead of 70 km/h (38 kt, 43 mph) means that the kinetic energy to be dissipated by braking is increased by a factor of 1.65 and therefore the ground run is lengthened considerably.

As the effectiveness of the wheel brake is good, the landing run is considerably shortened (the elevator control should be kept fully back).

4.5.6 Flight with water ballast

With low seat loads, water ballast is required for reaching the maximum permitted all-up mass.

Wing ballast tanks

The water tanks are integral compartments in the nose section of the main wing panels.

The tanks are to be filled with clear water only, through round openings in the upper wing surface featuring a strainer.

Tank openings are closed with plugged-in filler caps having a 6 mm (0.24 in.) female thread for lifting and venting. Lifting these caps is done with the aid of the tailplane rigging tool.

WARNING:
As the threaded hole in the filler cap also serves for venting the tank, it must always be kept open!

Each wing tank has a capacity of 99 Liters
(26.15 US Gal., 21.78 IMP Gal.).

Dumping the water from full tanks takes about five (5) minutes.

When filling the tanks it must be ensured that the maximum permitted all-up mass is not exceeded - see page 6.2.5.

The tank on either side must always be filled with the same amount of water to prevent lateral imbalance.

Before taking off with partly full tanks, ensure that the wings are held level to allow the water to be equally distributed so that the wings are balanced.

Because of the additional mass in the wing panels, the wing tip runner should continue running for as long as possible during the launch.

Water ballast is dumped through an opening on the lower side of the main wing panels, 1.93 m (6.33 ft) away from the inbd. root rib.

The dump valves are hooked up automatically on rigging the powered sailplane (with, ballast control knob to be set at "CLOSED).

Thanks to baffles inside the ballast tanks there is no perceptible movement of the water ballast when flying with partly filled tanks.

When flying at maximum permitted all-up mass, the low speed and stall behaviour of the “Duo Discus" is slightly different from its flight characteristics without water ballast:

The stall speeds are higher (see section 5.2.2) and for correcting the flight attitude larger control surface deflections are required. Furthermore more height is lost until a normal flight attitude is regained.

WARNING:

In the unlikely event of the tanks emptying unevenly or only one of them emptying (recognized by having to apply up to 50 % opposite aileron for a normal flight attitude), it is necessary to fly somewhat faster to take into account the higher mass and also to avoid stalling the “Duo Discus".

During the landing run the heavier wing should be kept somewhat higher (if permitted by the terrain) so that it touches down only at the lowest possible speed.
This reduces the danger of the “Duo Discus" to veer off course.

Water ballast fin tank

For optimum performance in circling flight, the forward travel of the center of gravity, caused by water ballast in the wing nose and by the crew member of the aft seat, may be compensated by carrying water ballast in the fin tank.

For details concerning the quantities to be filled refer to page 6.2.8.

The water ballast tank is an integral compartment in the fin with a capacity of 11.0 kg/Liter (2.91 US Gal., 2.42 IMP Gal.). This tank is filled as follows – with the horizontal tailplane in place or removed:

Set elevator trim to the rear.
Insert one end of a flexible plastic hose (outer diameter 8.0 mm/0.31 in.) into the tube (internal diameter 10.0 mm/0.39 in.) protruding from the rudder gap at the top of the fin on the left hand side. The other end of this hose is than connected to a suitable container which is to be filled with the required amount of clear water.

The fin tank has eleven (11) spill holes, all properly marked, on the right hand side of the fin, which indicate the water level – see accompanying sketch.

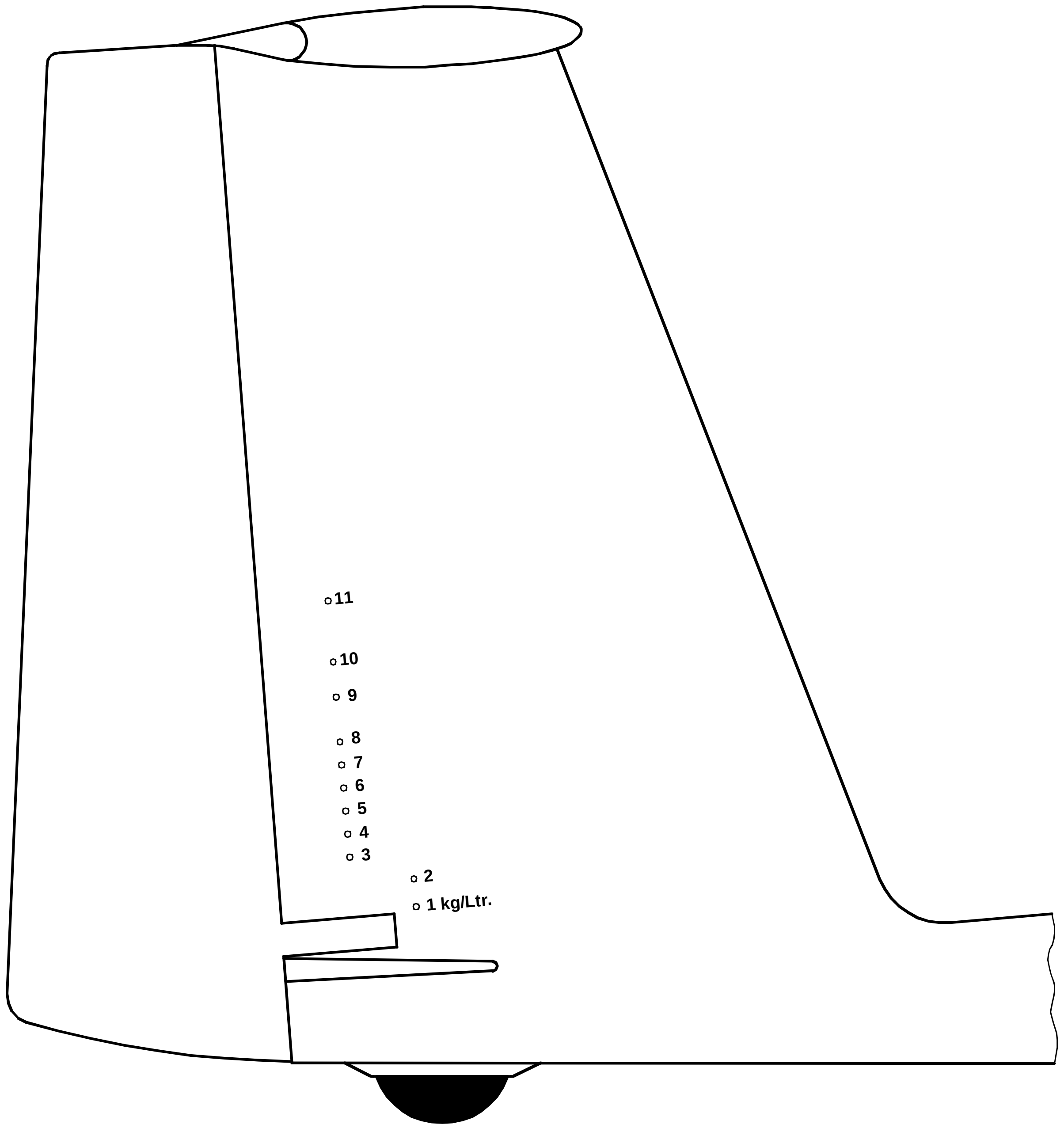
The venting of the tank is through the uppermost 11.0 kg/Liter hole (which always remains open – even with a full tank).

The ballast quantity to be filled depends on the water load in the wing tanks and/or on the load on the aft seat – see loading table on page 6.2.8.

Before filling the tank always tape closed one hole less than the load required, measured in kg/Liter.

If, of instance, a fin ballast load of 3.0 kg /Liter is required, only the lower two holes (1 and 2) are taped closed, any excessive water then escapes through the third spill hole, thus preventing any overloading.

Tank label of the right hand side of the fin



Water is dumped from the fin tank through an opening on the lower side of the fuselage tail boom - adjacent to the rudder.

The fin tank dump valve is linked to the torsional drive for the valves on the main wing panels so that these three tanks are always emptying simultaneously.

The time required to dump the ballast from a fuIl fin tank is about two (2) minutes, i.e. draining the full tanks of the main wing panels always takes longer.

ctd. on page 4.5.6.5

G E N E R A L

WARNING:

1. On longer flights at air temperatures near 0 ° C (32° F), water ballast must be dumped in any case when reaching a temperature of 2° C (36° F).

CAUTION:

2. There is little point in loading much water ballast if the average rate of climb expected does not exceed 1.0 m/s (197 fpm). The same applies to flights in narrow thermals requiring steep angles of bank.

3. If possible, all water ballast should be dumped before conducting an off-field landing.

4. Before the wing water tanks are filled, it should be checked (with dump valves unlocked) that both drain plugs open up equally. Leaking (dripping) valves are avoided by cleaning and greasing the plugs and their seats (with valves opened). Thereafter, with valves closed, the drain plugs are pulled home with the threaded tool used to attach the horizontal tailplane.

WARNING:

5. Never pressurize the tanks - for instance by filling them directly from a water hose – and always pour in clear water only.

6. On no account whatsoever must the “Duo Discus”, ever be parked with full ballast tanks if there is the danger of them freezing up.
Even in normal temperatures the parking period with full tanks should not exceed several days.
For parking all water ballast is to be completely drained off with filler caps removed to allow the tanks to dry out.

7. Before the fin tank is filled, check that those spill holes not being taped closed are clear.

4.5.7 High altitude flight

When flying at high altitude it should be noted that true airspeed (TAS) increases versus indicated airspeed (IAS). This difference does not affect the structural integrity or load factors, but to avoid any risk of flutter, the following indicated values (IAS) must not be exceeded

Altitude		V_{NE} (IAS)			Altitude		V_{NE} (IAS)		
m	ft	km/h	kt	mph	m	ft	km/h	kt	mph
0-2000	0-6562	262,8	142	163					
3000	9843	253	137	157	7000	22966	204	110	127
4000	13123	241	130	150	8000	26247	192	104	119
5000	16404	228	123	142	9000	29528	180	97	112
6000	19685	215	116	134	10000	32808	170	92	106

Flying at temperatures below freezing point

When flying at temperatures below 0° C (32° F), as in wave or during the winter months, it is possible that the usual ease and smoothness of the control circuits is reduced.
It must therefore be ensured that all control elements are free from moisture so that there is no danger of them freezing solid. This applies especially to the airbrakes!

From experience gained to date it has been found beneficial to cover the mating surfaces of the airbrakes with “Vaseline” along their full length so that they cannot freeze solid. Furthermore the control surfaces should be moved frequently.

When flying with water ballast observe the instructions given in section 4.5.6.

Note:

The polyester coating on this aircraft is known from many years experience to become very brittle at low temperature.

Particularly when flying in wave at altitudes in excess of about 6000 m (approx. 20000 ft), where temperatures of below - 30°C (- 22°F) may occur, the gel-coat, depending on its thickness and the stressing of the aircraft's components, is prone to cracking!

Initially, cracks will only appear in the polyester coating, however, with time and changing environment, cracks can reach the Epoxy/glass cloth matrix.

Cracking is obviously enhanced by steep descents from high altitudes at associated very low temperatures.

WARNING:

Therefore, for the preservation of a proper surface finish free from cracking, the manufacturer strongly advises against high altitude flights with associated temperatures of clearly below - 20°C (- 4°F)!

A steep descent with the airbrakes extended should only be conducted in case of emergency (instead of the airbrakes the undercarriage may also be extended to increase the rate of sink).

4.5.8 Flight in rain

When flying the “Duo Discus” with a wet surface or in rain, the size of the water drops adhering to the wing causes a deterioration of its flight performance which cannot be expressed in numerical values due to the difficulties involved with such measurements. Often the air mass containing the moisture is also descending so that - compared with a wet powered sailplane in calm air - the sink rates encountered are higher.

Flight tests in rain, conducted by the manufacturer, did not reveal any significant differences in the stalling behaviour or stalling speeds.

It cannot be excluded, however, that excessive alterations of the airfoil (as caused by snow, ice or heavy rain) result in higher minimum speeds.

Approach in rain: See page 4.5.4

4.5.9 Aerobatics

Only allowed **without** waterballast in the wings and up to an all-up mass of **630 kg**

The following aerobatic maneuvers are allowed:

(a) inside loop
(b) stall turn
(c) lazy eight
(d) spinning

WARNING:

The Duo Discus is a high performance sailplane. Therefore the sailplane will gain speed very rapidly in dive.
Aerobatic manoeuvres with the Duo Discus should only be performed if you can handle these aerobatic manoeuvres safely with similar sailplane types or if you've been briefed in detail by a pilot experienced in aerobatic manoeuvres with the Duo Discus.
The permitted operating limits see section 2, have to be observed.

It is allowed to compensate for the influence of the pilot in the rear seat on the center of gravity of the sailplane for aerobatic maneuvers.

Inside loop

Enter maneuver at a speed between 180 km/h and 200 km/h (recommended).
The speed during the recovery of this maneuver remains in the same speed range.
The load factor during the maneuver depends on the selected entering speed.
The higher the entering speed is, the lower the needed maximum load factors are.

Lazy eight

Enter maneuver at a speed of about 160 km/h. After pulling up in a 45°-climb enter the turn at about 120 km/h. The speed during recovery: about 160 km/h.

Stalled turn

Enter maneuver at a speed between 180 km/h and 200 km/h. Pull up continuously into the vertical climb.

It is recommended to enter the maneuver at a speed of 200 km/h because then you will have more time to establish the vertical climb and you will not have to apply the maximum permitted load factor.

During the vertical climb you can let the wing drag which will be on the outside of the turn. Apply continuous but smooth full rudder deflection in the desired direction, respectively against the dragged wing, at an indicated airspeed of about 140 km/h to 150 km/h. During the turn apply aileron deflection in the opposite direction, if necessary, to turn as clean as possible in one plane.

If you have induced the turn too late or too weakly, it can happen that the turn can no longer be executed as planed and the sailplane will fall backwards or sideward. If this occurs the control surfaces could slam to one side and be damaged as the sailplane accelerates backwards. This must be avoided. You can hold all the control surfaces firmly to their stops to avoid this knock over. Then continuously pull out into normal flight.

Spinning

Stationary spinning is possible with middle to rear center of gravity positions.

Spinning is induced with the standard method:

Stall the sailplane slowly until the first signs of separated airflow can be recognized. Then jerkily pull back the control stick and apply full rudder deflection into the desired direction of the rotation. Depending on the position of the center of gravity the pitch attitude will properly differ widely.

Spinning is terminated with the standard method:

Apply full rudder deflection in the opposite direction of the direction to that of the rotation and decrease elevator deflection. After the rotation has stopped return all control surfaces to neutral and pull out into normal flight.
The loss of height during the recovery to normal flight is about 100 m, the maximum speed is about 180 km/h.

With forward center of gravity positions no stationary spinning is possible. The sailplane will then switch over into a spiral dive very rapidly. This has to be stopped immediately. With middle center of gravity positions stationary spinning is possible if induced with the standard method. But if the spinning is induced with rudder deflection into the direction of rotation and aileron deflection against the direction of rotation, then the sailplane will switch over into the spiral dive after a half to one turn. The spiral dive has to be ended immediately.

You can detect the spiral dive because of the increase of the indicated airspeed and the increasing load factor on the pilots.

Section 5

5. Performance

5.1 Introduction

5.2 LBA-approved data

5.2.1 Airspeed indicator system calibration

5.2.2 Stall speeds

5.2.3 (reserved)

5.2.4 Additional information

5.3 Additional information –
LBA approval not required

5.3.1 Demonstrated crosswind performance

5.3.2 Flight polar / Range

5.1 Introduction

This section provides LBA-approved data for airspeed calibration, stall speeds and non-approved additional information.

The data in the charts has been computed from actual flight tests with a “Duo Discus" in good condition and using average piloting techniques.

5.2 LBA-approved data

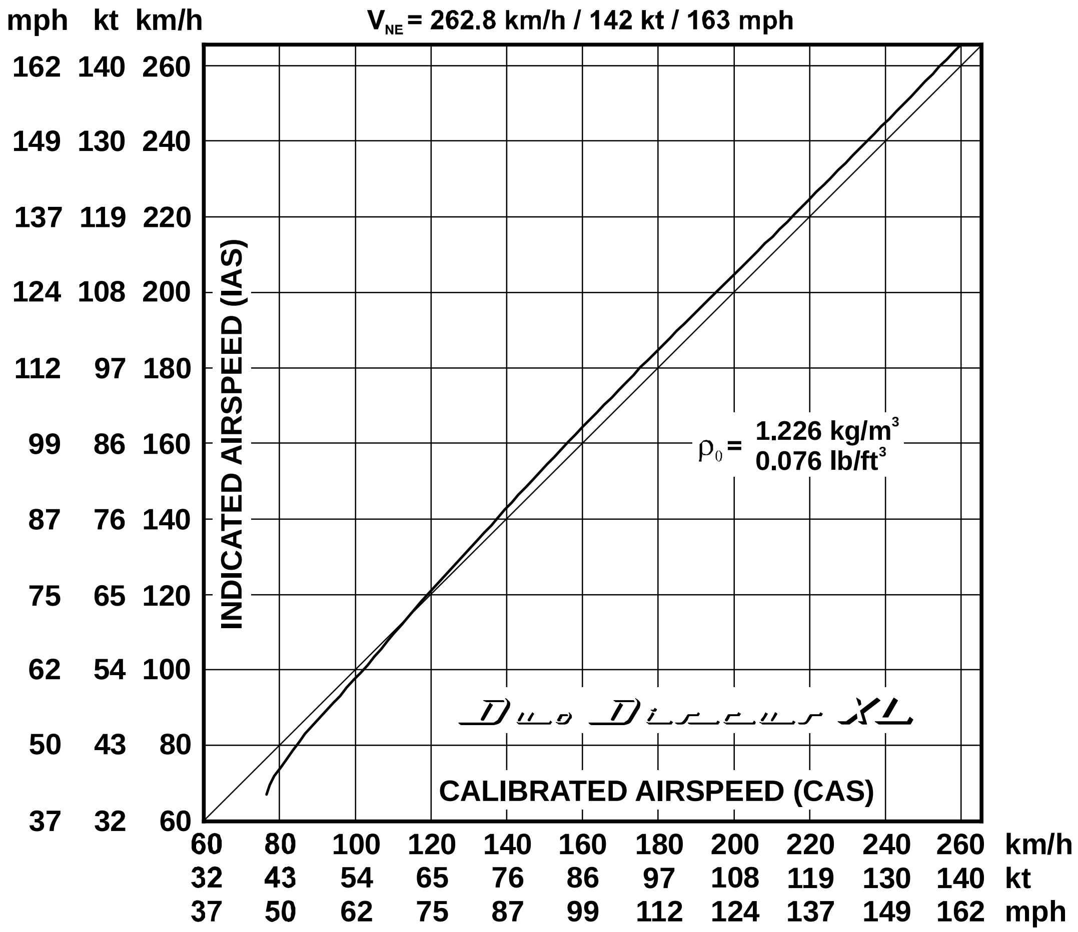
5.2.1 Airspeed inidicator system calibration

Errors in indicated airspeed (IAS) caused by Pitot/Static pressure errors may be read off from the calibration chart below. This chart is applicable to free flight.

PITOT pressure source: Fin

STATIC pressure ports: Fuselage tail boom, approx. 1.02 m (40.16 in.) forward of the base of the fin and 0.18 m (7.09 in.) below main spar cut-out

All airspeeds shown in this manual are indicated airspeeds (IAS) as registered by the airspeed indicator.



5.2.2 Stall speeds

The following stall speeds (IAS) were determined in straight and level flight:

All-up weight (mass) approx.	(kg) (lb)	624 1373	750 1654
C/G position aft of datum	(mm) (in.)	250 9.84	45 1.77
Stall speed, airbrakes closed	(km/h) (kt) (mph)	55* 29* 34*	72* 39* 45*
airbrakes extended	(km/h) (kt) (mph)	55* 29* 34*	72* 39* 45*

* At minimum speed the ASI reading is heavily oscillating because of turbulent air influencing the pitot tube in the fin.

The loss of height from the beginning of the stall until regaining a normal level flight attitude is up to 30 m (98 ft).

R E S E R V E D

5.2.4 Additional information

N o n e

5.3 Non-LBA-approved additional- information

5.3.1 Demonstrated crosswind performance

The maximum crosswind velocity, at which take - offs and landings have been demonstrated, is

20 km/h (11 kt).

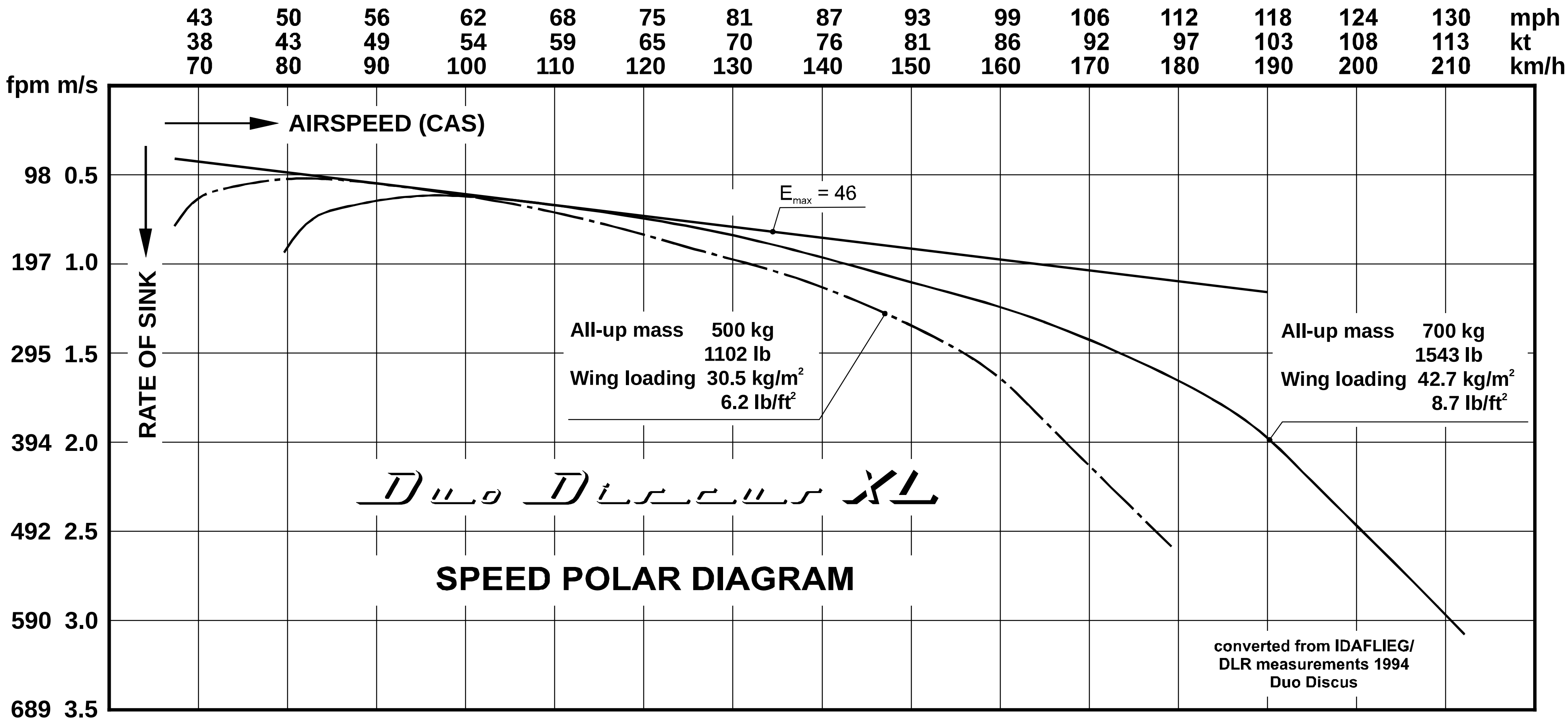
5.3.2 Flight polar

All values shown below refer to MSL (0 m)

Values converted from Idaflieg/DLR measurements 1994.

All-up mass	609 1343	kg lb
Wing loading	37.1 7.6	kg/m² lb/ft²
Minimum rate of sink	0.56 110	m/s fpm
Best L/D	46 - 47	
at a speed of	100 - 103 54 - 56 62 - 54	km/h kt mph

For a speed polar diagram refer to page 5.3.2.2.


43 50 56 62 68 75 81 87 93 99 106 112 118 124 130 mph
38 43 49 54 59 65 70 76 81 86 92 97 103 108 113 kt
70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 km/h
fpm m/s
98 0.5
197 1.0
295 1.5
394 2.0
492 2.5
590 3.0
689 3.5
AIRSPEED (CAS)
RATE OF SINK
E_{max} = 46
All-up mass 500 kg
1102 lb
Wing loading 30.5 kg/m²
6.2 lb/ft²
All-up mass 700 kg
1543 lb
Wing loading 42.7 kg/m²
8.7 lb/ft²
Duo Discus XL
SPEED POLAR DIAGRAM
converted from IDAFLIEG/
DLR measurements 1994
Duo Discus

Section 6

6. Weight (mass) and balance

6.1 Introduction

6.2 Weight (mass) and balance record
and permitted payload range

Determination of:

- Water ballast in wing tanks
- Water ballast in fin tank

6.1 Introduction

This section contains the seat load range within which the “Duo Discus” may be safely operated.

Procedures for weighing the sailplane and the calculation method for establishing the permitted payload range and a comprehensive list of all equipment available are contained in the “Duo Discus” Maintenance Manual.

The equipment actually installed during the last weighing of the sailplane is shown in the “'Equipment List" to which page 6.2.3 refer to.

6.2 Weight and balance record / Permitted seat load range

The following weight and balance log sheet (page 6.2.3) shows the maximum and minimum load on the seats. It is established with the aid of the last valid weighing report - the required data and diagrams are found in the Maintenance Manual.

The weight and balance log sheet is only applicable for this particular sailplane, the serial number of which is shown on the title page.

A front seat load of less than the required minimum
is to be compensated by ballast - there are three (3) methods:

1. By attaching ballast (lead or sand cushion) firmly to the lap belt mounting brackets.

   Optional trim ballast mounting provision(s)

2. a) By installing ballast (by means of lead plates) at the base of the front instrument panel (for further information refer to page 6.2.2)

   b) By attaching, ballast (in addition to method 2 a) by means of lead plates to the front control stick mounting frame on the starboard side near the base of the instrument panel (for further details refer to page 6.2.2).

3. When flown with two occupants, the minimum load on the front seat can be reduced by 25% of the load on the rear seat. This reduction of the minimum load on the front seat is allowed only if the nose heavy moment of the load in the rear seat is not compensated by water ballast in the fin.

Altering the front seat load by using trim ballast

Optional trim ballast mounting provision

On request the "Duo Discus" is equipped with one or two mounting provisions for trim ballast, thus allowing a reduction of the placarded minimum front seat load (when flown solo) as shown in the table below.

a) Trim ballast mounting provision below the front instrument panel:

This tray holds up to three (3) lead plates with a weight of 3.7 kg / 8.2 lb each. Plates are made to fit only into this tray.

Lever arm of trim ballast plates:

2125 mm (6.97 ft) ahead of datum

b) Trim ballast mounting provision on front stick mounting frame on the starboard side:

This tray holds up to three (3) lead plates with a weight of 3.9 kg / 8.6 lb each. Plates are made to fit only into this tray.

Lever arm of trim ballast plates:

1925 mm (6.32 ft) ahead of datum

WHEN FLOWN SOLO: Difference in seat load as compared with placarded front seat minimum		Number of lead plate required:
up to 5,0 kg (11 lb) less	see a)	1
up to 10,0 kg (22 lb) less		2
up to 15,0 kg (33 lb) less		3
up to 20,0 kg (44 lb) less	see b)	4
up to 25,0 kg (55 lb) less		5
up to 30,0 kg (66 lb) less		6

WEIGHT AND BALANCE LOG SHEET (loading chart) FOR S/N ....

Date of weighing:					
Empty mass [kg]					
Equipment list dated					
Installed batteries 3)		piece	piece	piece	piece
		E	E	E	E
		C1/C2	C1/C2	C1/C2	C1/C2
		C3	C3	C3	C3
		F1/F2	F1/F2	F1/F2	F1/F2
Empty mass c/g position aft of datum					
Max. useful load [kg] in fuselage					
Load [kg] on the seats (crew including parachute):					
Front seat load when flown solo:	max.	110	110	110	110
with two occupants:	max.	110	110	110	110
Rear seat load with two occupants:	max.	110	110	110	110
Water ballast fin tank installed (YES / NO)					
Front seat load regard-less of load on rear seat, with a) Fin tank **NOT** installed	min.				
b) Fin tank **installed**	min. 1) 2)				
Inspector Signature / Stamp					

Note:

1. For <u>safety reasons</u> the value determined by weighing with an empty fin tank has been increased by 30 kg (66 lb) so as to allow for an <u>unnoticed</u> filled fin tank.
2. Adding the mass of 30 kg (66 lb) is not required, however, if the pilot either dumps all water ballast (prior of take-off) or does ensure that the ballast quantity in the fin tank is compensated by an appropriate load in the wing tanks and/or on the aft seat.
3. Installed batteries (see page 7.12.2):
   (E) engine battery
   (C1/C2) batteries in front of rear stick mounting frame
   (C3) battery beside undercarriage
   (F1/F2) batteries in fin

For the determination of the water ballast quantity permitted in the wing tanks refer to page 6.2.5.

For the determination of the water ballast quantity permitted in the fin tank refer to page 6.2.6 through 6.2.8.

R E S E R V E D

Maximum water ballast load

Maximum all-up mass including water ballast:	750 1654	kg lb
C/G position of water ballast in wing tanks (aft of datum):	65 2.56	mm in.
Total capacity of wing tanks:	198 52.3 43.6	Liter US Gal. IMP Gal.

Table of water ballast loads at various empty masses and seat loads:

Empty mass *)		LOAD ON THE SEAT (kg/lb)																										
		kg 70		lb 154	kg 80		lb 176	kg 100		lb 220	kg 120		lb 264	kg 140		lb 308	kg 160		lb 180	kg 180		lb 396	kg 200		lb 441	kg 220		lb 485
kg	lb																											
410	903	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	180	47,6	39,6	160	42,3	35,2	140	37,0	30,8	120	31,7	26,4
420	925	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	190	50,2	41,8	170	44,9	37,4	150	39,6	33,0	130	34,3	28,6	110	29,1	24,2
430	947	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	180	47,6	39,6	160	42,3	35,2	140	37,0	30,8	120	31,7	26,4	100	26,4	22,0
440	969	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	190	50,2	41,8	170	44,9	37,4	150	39,6	33,0	130	34,3	28,6	110	29,1	24,2	90	23,8	19,8
450	991	198	52,3	43,6	198	52,3	43,6	198	52,3	43,6	180	47,6	39,6	160	42,3	35,2	140	37,0	30,8	120	31,7	26,4	100	26,4	22,0	80	21,1	17,6
460	1013	198	52,3	43,6	198	52,3	43,6	190	50,2	41,8	170	44,9	37,4	150	39,6	33,0	130	34,3	28,6	110	29,1	24,2	90	23,8	19,8	70	18,5	15,4
470	1035	198	52,3	43,6	198	52,3	43,6	180	47,6	39,6	160	42,3	35,2	140	37,0	30,8	120	31,7	26,4	100	26,4	22,0	80	21,1	17,6	60	15,9	13,2
480	1057	198	52,3	43,6	190	50,2	41,8	170	44,9	37,4	150	39,6	33,0	130	34,3	28,6	110	29,1	24,2	90	23,8	19,8	70	18,5	15,4	50	13,2	11,0
		Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.
		WATER BALLAST IN WING TANKS																										

Note:
When determining the max. permitted wing water ballast load, allowance must be made for water ballast in the fin tank (see page 6.2.7 and 6.2.8) and fuel , i.e. this load must be added to the empty mass shown on the above table.

*) Empty mass as per page 6.2.3 + ballast in fin tank

Water ballast in (optional) fin tank

In order to shift the center of gravity close to its aft limit (favourable in terms of performance), water ballast may be carried in the fin tank (m_{FT}) to compensate for the nose-heavy moment of

- water ballast in main wing panels (m_{WT})
  and/or
- loads on the aft seat (m_{P2})

Compensating water ballast in main wing panels

The determination of the ballast quantity in the fin tank (m_{FT}) is done with the aid of the diagram shown on page 6.2.8.

Compensating loads on the aft seat

Pilots wishing to fly with the center of gravity close to the aft limit may compensate the nose-heavy moment of loads on the aft seat with the aid of the diagram shown on page 6.2.8.

Note: When using fin ballast to compensate for the nose - heavy moment of wing ballast and loads on the aft seat, then both values resulting from the diagrams on page 6.2.8 must be taken into account.

The maximum amount of water ballast, available for compensating the above mentioned nose-heavy moments, is 11 Liters (2.91 US Gal., 2.42 IMP Gal.), which is the maximum capacity of the fin tank.

WARNING:

A compensation of masses exceeding the placarded minimum front seat load with water ballast in fin tank is n o t allowed!

If the influence of the load on the rear seat is taken into account for the minimum load on the front seat, the nose-heavy moment of the load on the rear seat must no be compensated with water ballast in the fin tank.

Waterballast in (optional) fin tank

IMPORTANT NOTE

When determining the useful load in the fuselage the quantity of water-ballast in the fin must **not** be taken in account because of flight mechanic reasons.

In order to avoid that the maximum permitted all-up weight (mass) is exceeded, the ballast in the fin tank must also be taken into account when determining the maximum allowable ballast quantity for the wing tanks.

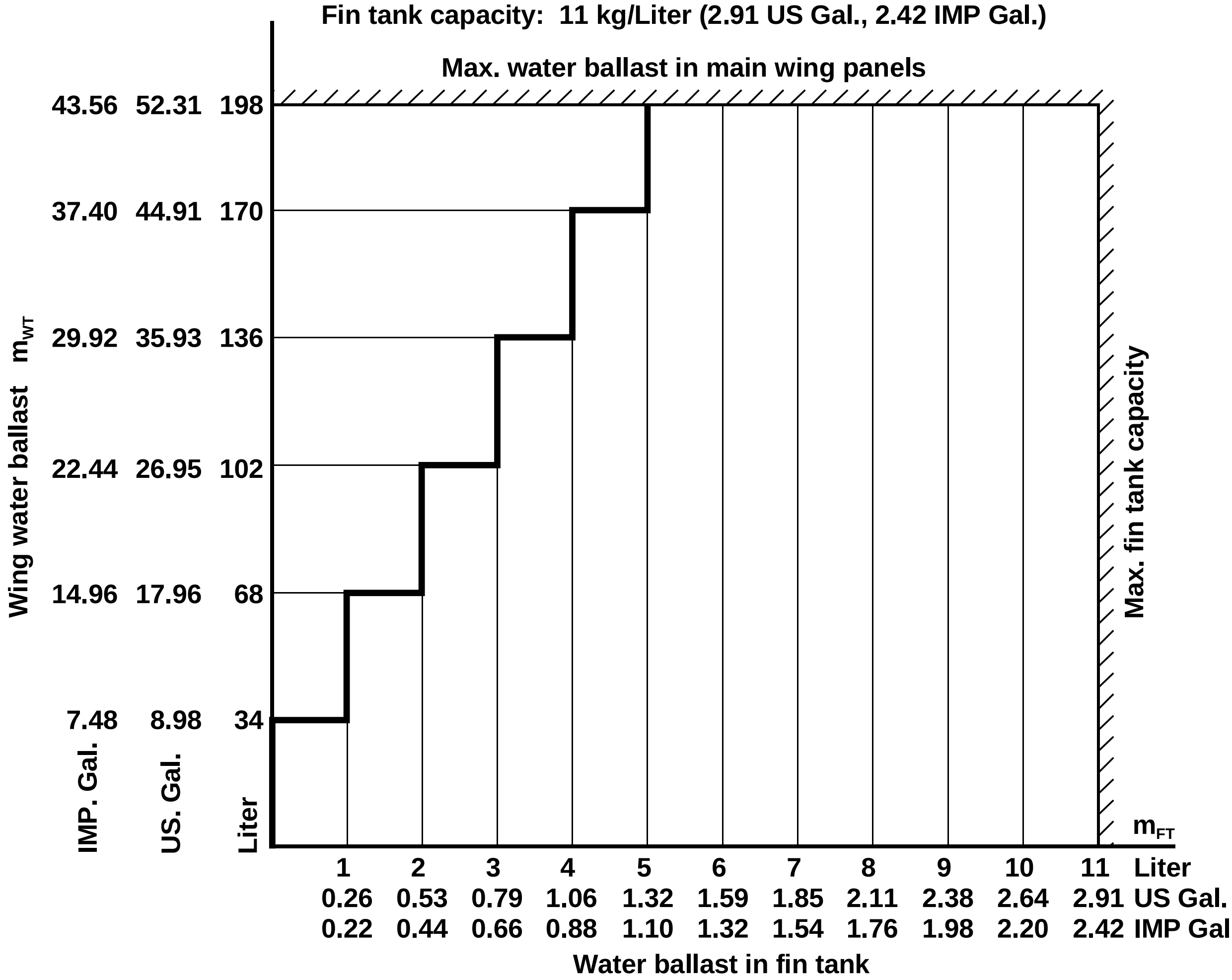
Example:

Assumed ballast load in wing tanks:	40 kg/Liters (88 lb/10.6 US Gal)
Assumed load on aft seat:	75 kg (165 lb)

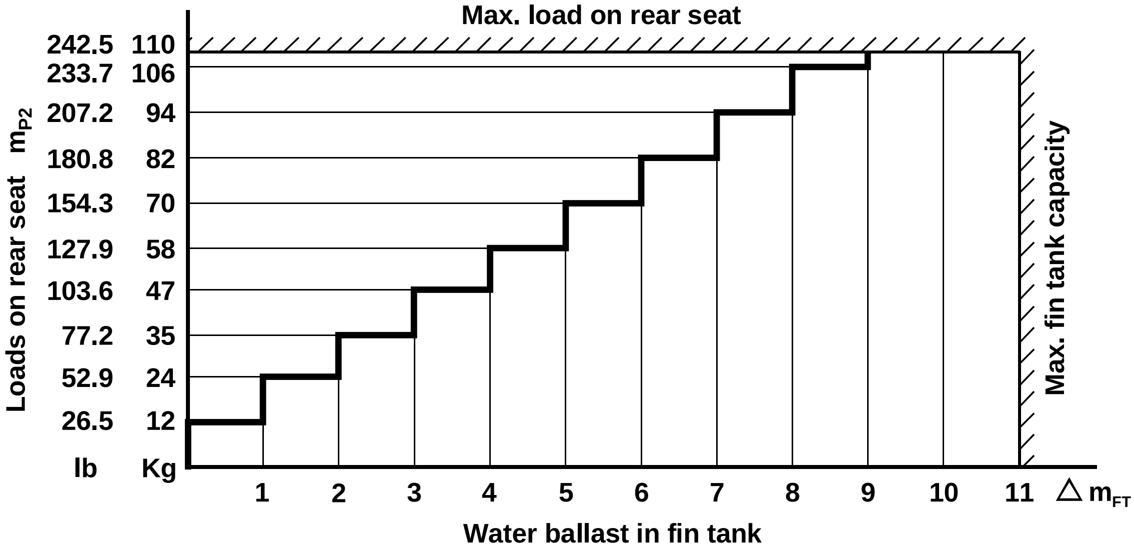
According to the diagrams on page 6.2.8 the following loads in the fin tank are permissible (fill only full Liters):

For ballast in wing tank	:	m_{FT}	=	1 kg/Liter (2.2 lb/0.26 US Gal)
For load on aft seat	:	Δm_{FT}	=	6 kg/Liters (13.2 lb/1.58 US Gal)
Total ballast in fin tank	:	$m_{FT} + \Delta m_{FT}$	=	7 kg/Liters (15.5 lb/1.85 US Gal)

Lever arm of water ballast in fin tank (m_{FT}):
5320 mm (17.45 ft) aft of datum plane
Fin tank capacity: 11 kg/Liter (2.91 US Gal., 2.42 IMP Gal.)



Note: Always full Liters are to be filled. Where value jumps, either the higher or the lower amount of ballast may be used



Section 7

7. Description of the aircraft and its system

7.1 Introduction

7.2 Cockpit-Description

7.3 Instrument panels

7.4 Undercarriage

7.5 Seats and restraint systems

7.6 Static pressure and Pitot pressure system

7.7 Airbrake system

7.8 Baggage compartment

7.9 Water ballast system(s)

7.10 (reserved)

7.11 (reserved)

7.12 Electrical system

7.13 Miscellaneous equipment
(removable ballast, oxygen, ELT etc.)

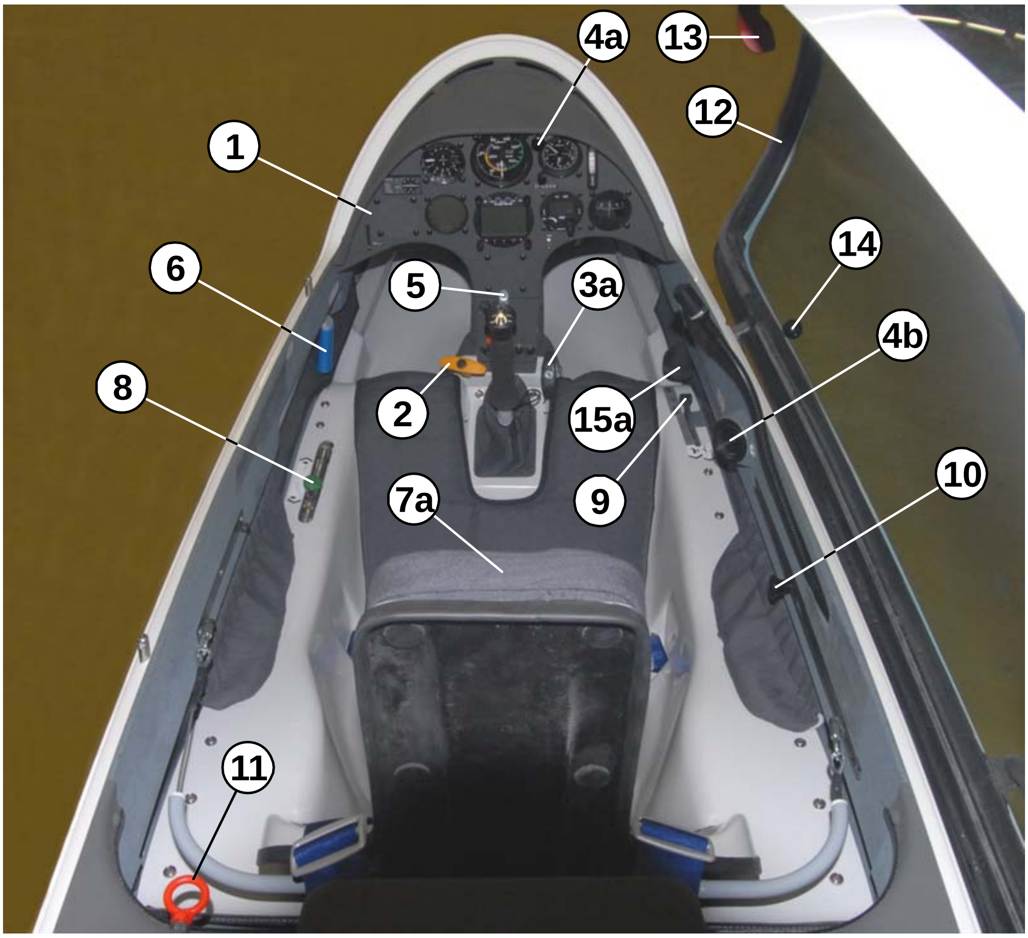
7.1 Introduction

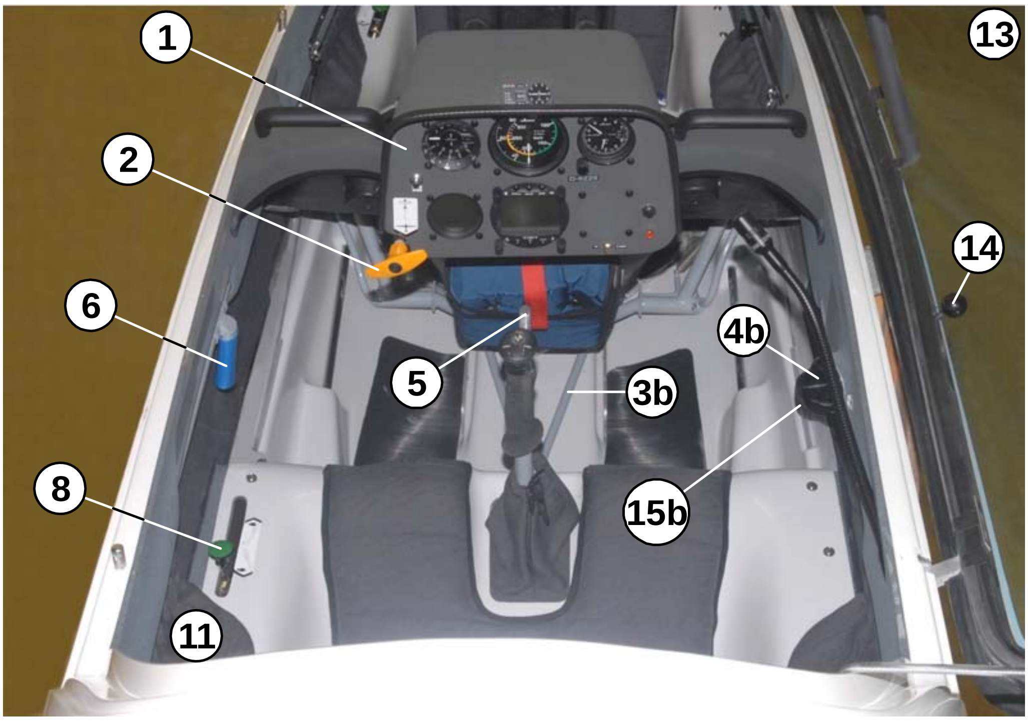
This section provides a description of the sailplane including the operation of its systems.

For details concerning optional- systems and equipment refer to section 9 "Supplements".

For further descriptions of components and systems refer to section 1 of the Maintenance Manual.

7.2 Cockpit description





All instruments and control elements are within easy reach of the crew.

(1) Instrument panels

With canopy opened, the instruments for either seat are easily accessible.

The front instrument panel covering is attached to the front instrument panel with two quick release fasteners. With opened canopy the front instrument panel can be pivoted upwards.

The rear panel is mounted to the steel tube transverse frame between the seats.

Both instrument panels and their glare shields are easily detached after removing the mounting bolts.

(2) Tow release handles

T-shaped handles, actuating the tow release(s) installed
(c/g and/or nose hook)

Front seat: Yellow handle at the base of the control stick on the left

Rear seat: Yellow handle on the lower left hand side of the instrument panel

The winch cable/aerotow rope is released by pulling one of the handles.

(3a) Rudder pedal adjustment (front seat)

Black T-shaped handle on the right hand side near the base of the control stick.

Forward adjustment: Release locking device by pulling the handle, push pedals to desired position with the heels and let them engage.

Backward adjustment: Pull handle back until pedals have reached desired position. Forward pressure with heels (not the toes) engages pedals in nearest notch with an audible click.

An adjustment of the rudder pedals is possible on the ground and in the air.

(3b) Rudder pedal adjustment (rear seat)

Locking device on pedal mounting structure on the cockpit floor.

Forward or backward adjustment:
Pull up locking pin by its ring, slide pedal assemblyto desired forward or backward position and push locking pin down into nearest recess.

An adjustment of the rudder pedals is possible on the ground and in the air.

(4) Ventilation

a) Small black knob on the front instrument panel on the right:
(Ventilation air quantity)

Pull to open ventilator nozzle
Push to close ventilator nozzle

b) Adjustable bull-eye-type ventilator starboard of the front and rear instrument panel

Turned clockwise:	Ventilator open
Turned anti-clockwise:	Ventilator closed

Additionally the clear vision panels or the air scoop in the panels may be opened for ventilation.

(5) Wheel brake

A wheel brake handle is mounted on either control stick.

(6) Airbrake levers

Levers (with blue marking), projecting downwards, below the inner skin on the left.

Forward position: Airbrakes closed and locked

Pulled back about 55 mm (2.2 in.): Airbrakes unlocked

Pulled fully back: Airbrakes fully extended and trailing edge flap deflected

(7) Head rests

a) Front seat: Head rest is an integrated component of the seat back and is adjusted with the seat back.

b) Rear seat (not illustrated):
Mounting rail on upper fuselage skin. Head rest is gradually and horizontally adjustable:
Depress locking tap, slide head rest in desired position and let locking tap engage into nearest recess.

(8) Elevator trim

Green knob (for either seat) at the seat pan mounting flange on the left.

The spring-operated elevator trim is gradually adjustable by swinging the knob slightly inwards, sliding it to the desired position and swinging it outwards to lock.

Forward position	-	nose-heavy
Backward position	-	tail-heavy

(9) Control- lever for dumping water ballast from wing tanks and (optional) fin tank

Black lever on the seat rest on the right.

Forward position	-	dump valves closed
Backward position	-	dump valves opened

The lever is held in the respective final positions

Fin tank (option)

The fin tank dump valve control is connected to the torque tube actuating the valves in the wing so that all three valves open and close simultaneously.

(10) Seat back (front seat)

Sliding black knob on the GFRP inner skin on the right.

Adjustment: Pull knob inwards, slide to desired position and let it engage in nearest notch.

Backward position	-	reclined
Forward position	-	upright

In addition, the attachment position can be varied in the seat rest.

(11) Rip cord anchorage

Front seat: Red steel ring on the aileron of the inter frame.

Rear seat: Red steel ring at the front of the steel tube center frame on the left

(12) Canopy

The one-piece plexiglass canopy hinges sideways on flush fittings.

Take care that the cable restraining the open canopy is properly hooked up.

(13) Canopy locking and jettisoning levers

Lever with red grip for either seat on the canopy frame on the left.

Forward position: canopy locked

To open or jettison the canopy, swing one of the levers back up to the stop (approx. 90°) and raise canopy.

(14) Canopy release

Black lever (for front and rear seat) on the right side of the canopy frame.

To remove the canopy, proceed as follows:

Disconnect restraining.
Afterwards pull back the canopy release handle on the right side of the canopy frame and lift off the canopy.

Undercarriage

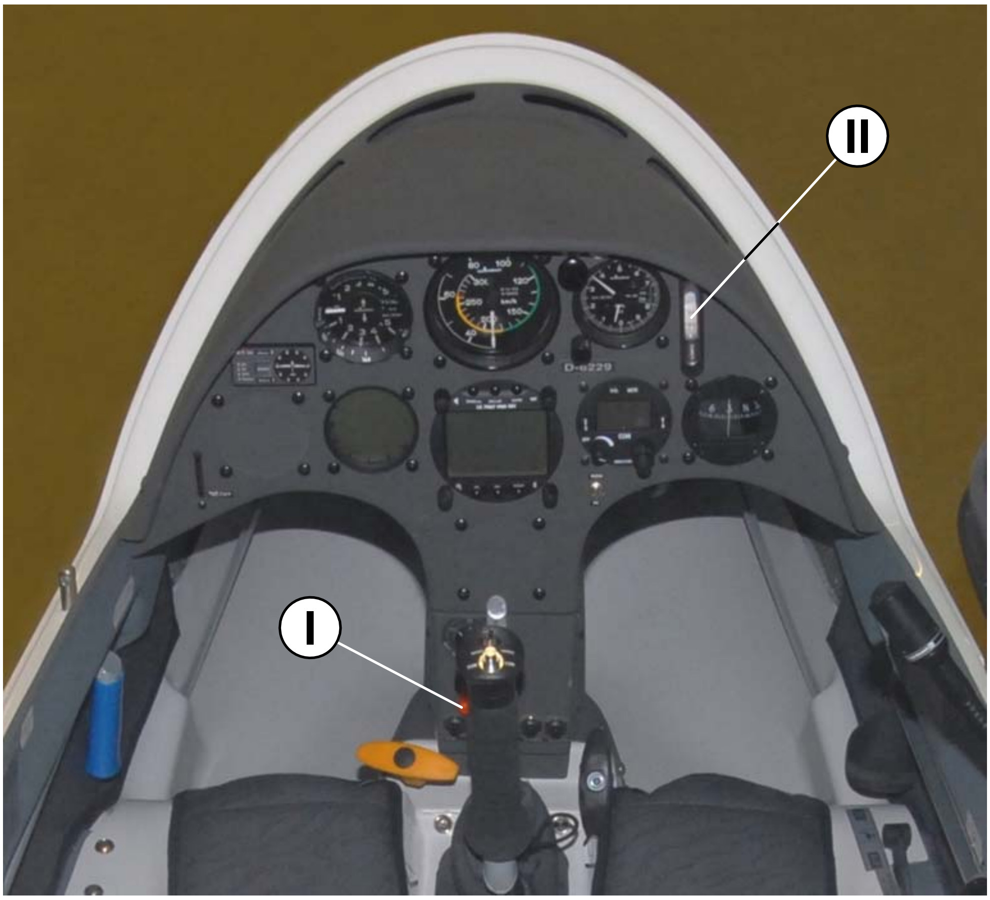
(15a) Front and rear seat
(15b)

Retracting : Disengage black handle below the inner skin on the right, pull it back and lock in rear recess

Extending: Disengage handle, push it forward and lock in front recess

7.3.1 Instrument panels

front panel:



For a description of components No. I and II refer to the following pages.
A description of the instrumentation and an illustration of the rear instrument panel is not deemed necessary.

(I) Master switch

ON/OFF-switch on the instrument panel.

UP	-	ON
DOWN	-	OFF

(II) Outside air temperature indicator

When carrying water ballast, the outside air-temperature (OAT) must not drop below 2° C / 36° F.

7.4 Undercarriage

The main wheel of the “Duo Discus" is retractable and features a hydraulic disc brake.

A small non-steerable wheel is provided on the lower side of the forward fuselage section and protects the latter from damage.

Instead of the standard rubber tail skid a non-steerable pneumatic wheel is available on request.

The extension/retraction process of the main wheel is described on page 7.2.7 (cockpit description), the operation of the main wheel brake is given on page 7.2.4.

For a technical description of the retractable undercarriage including its wheel brake system see also page 1.2.3 of the “Duo Discus" Maintenance Manual.

7.5 Seats and restraint systems

The seat pans are bolted to mounting flanges provided on either side of the cockpit.

The front seat features a back rest, which is adjustable in flight - see also page 7.2.5 concerning the procedure for its adjustment.

For either seat the lap straps are anchored to the seat pan.

While the shoulder straps for the front seat are attached to the steel tube transverse frame, those for the rear seat are anchored to the steel tube center frame.

A list of approved restraint systems is provided in section 7.1 of the “Duo Discus" Maintenance Manual.

7.6 Static pressure and Pitot pressure system

Static pressure sources

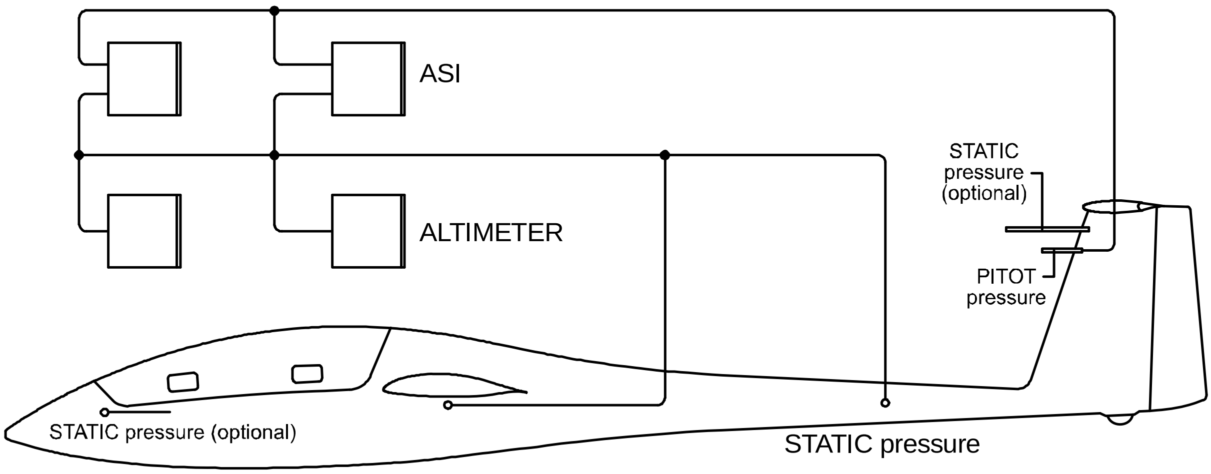
a) Static pressure ports are on either side of the fuselage tail boom, 1.02 m / 40.16 in. forward of the base of the fin (in the horizontal plane) and 0.18 m / 7.09 in. below the main spar cut-out, to be used for ASI etc.

b) On request a special. static pressure probe can be installed near the top of the fin (for further instruments - except ASI).

c) On request additional static pressure ports can be provided on either side of the fuselage skin next to the front instrument panel.

Pitot pressure sources

The Pitot pressure head is situated in the fuselage nose is to be used.



7.7 Airbrake system

Schempp-Hirth type airbrakes are employed on the upper surface of the main wing panels which deflects simultaneously the trailing edge flap.

A schematic view of the airbrake system is given in the Maintenance Manual.

7.8 Baggage compartment

An enclosed baggage compartment is not provided.

For soft objects (like jackets etc.), however, there is space above the spar stubs.

Such items, however, must be taken into account when determining the permissible load on the seats.

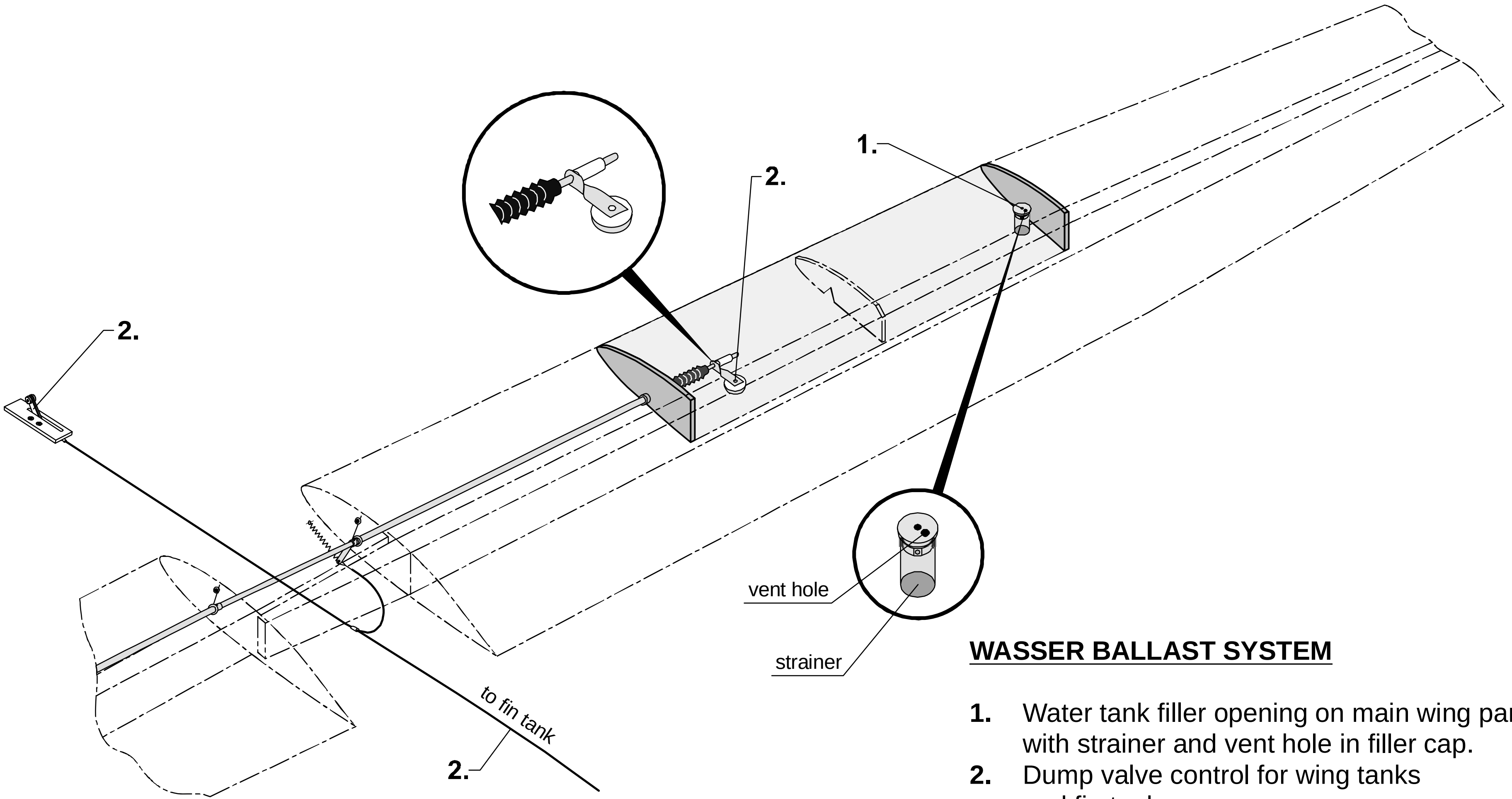
7.9 Water ballast system(s)

A steel cable connects the operating lever in the cockpit to the dump valve of the (optional) fin tank and a further steel cable to the torque tube actuating the wing tanks - see page 7.9.3.

On rigging the main wing panels, the torque tube in the fuselage is automatically hooked up to the torsional drive of the dump valve plugs.

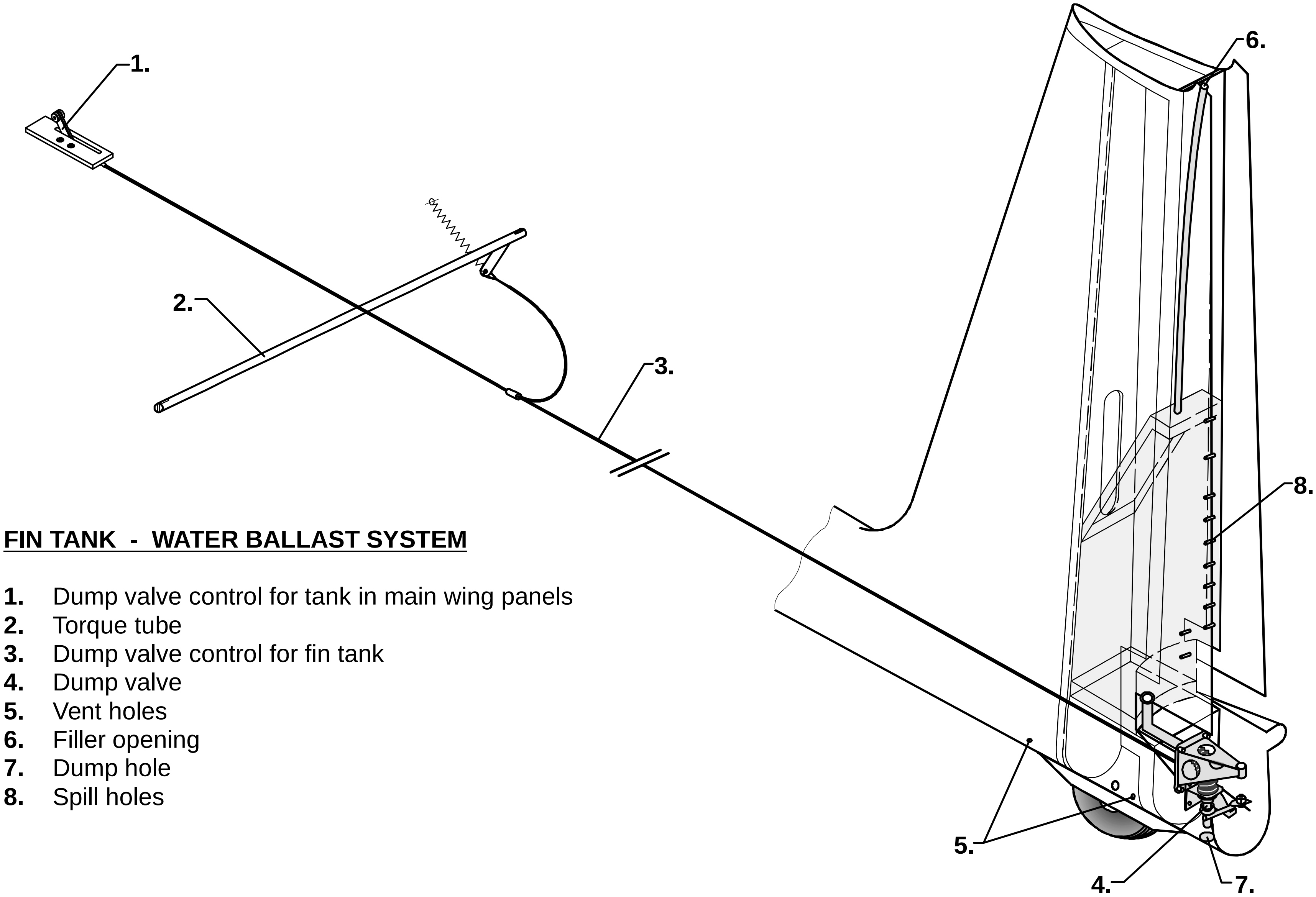
The torque tube is rotated to the "CLOSED" position by spring force - see page 7.9.2.

The operating lever locked in its respective final positions.



WASSER BALLAST SYSTEM

1. Water tank filler opening on main wing panels with strainer and vent hole in filler cap.
2. Dump valve control for wing tanks and fin tank.



FIN TANK - WATER BALLAST SYSTEM

1. Dump valve control for tank in main wing panels
2. Torque tube
3. Dump valve control for fin tank
4. Dump valve
5. Vent holes
6. Filler opening
7. Dump hole
8. Spill holes

R E S E R V E D

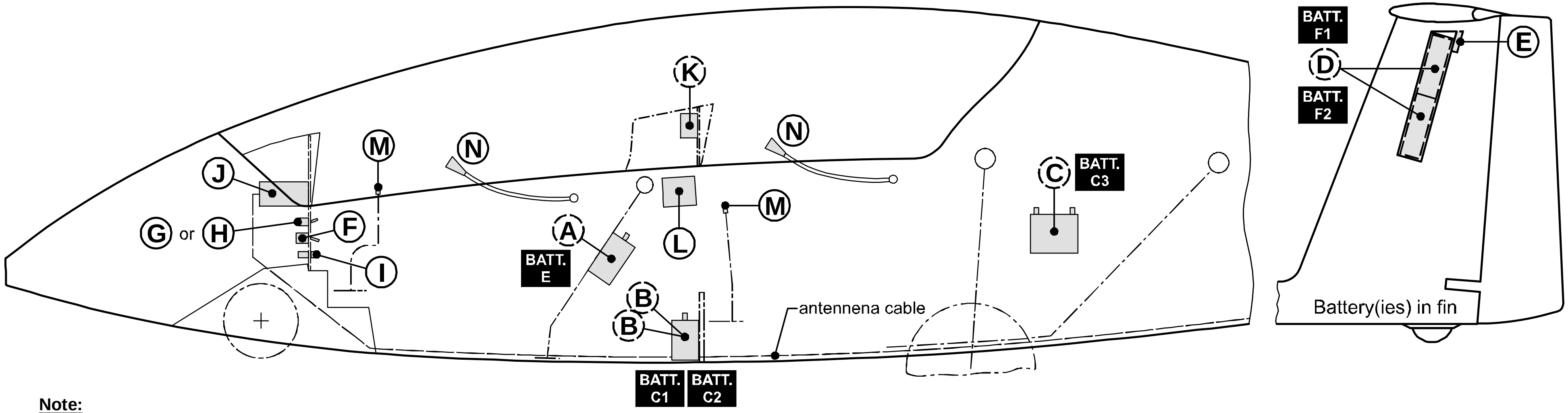
R E S E R V E D

7.12 Electrical system

Gliding avionics

Additional- equipment is to be wired as shown on page 7.12.2 “ELECTRICAL SYSTEM – AVIONICS” and on page 7.12.3 “WIRING DIAGRAM” and must comply with the manufacturer’s instructions for the relevant instrument.

Power for the avionics is supplied by one or more batteries located next to the rear control stick mounting frame.



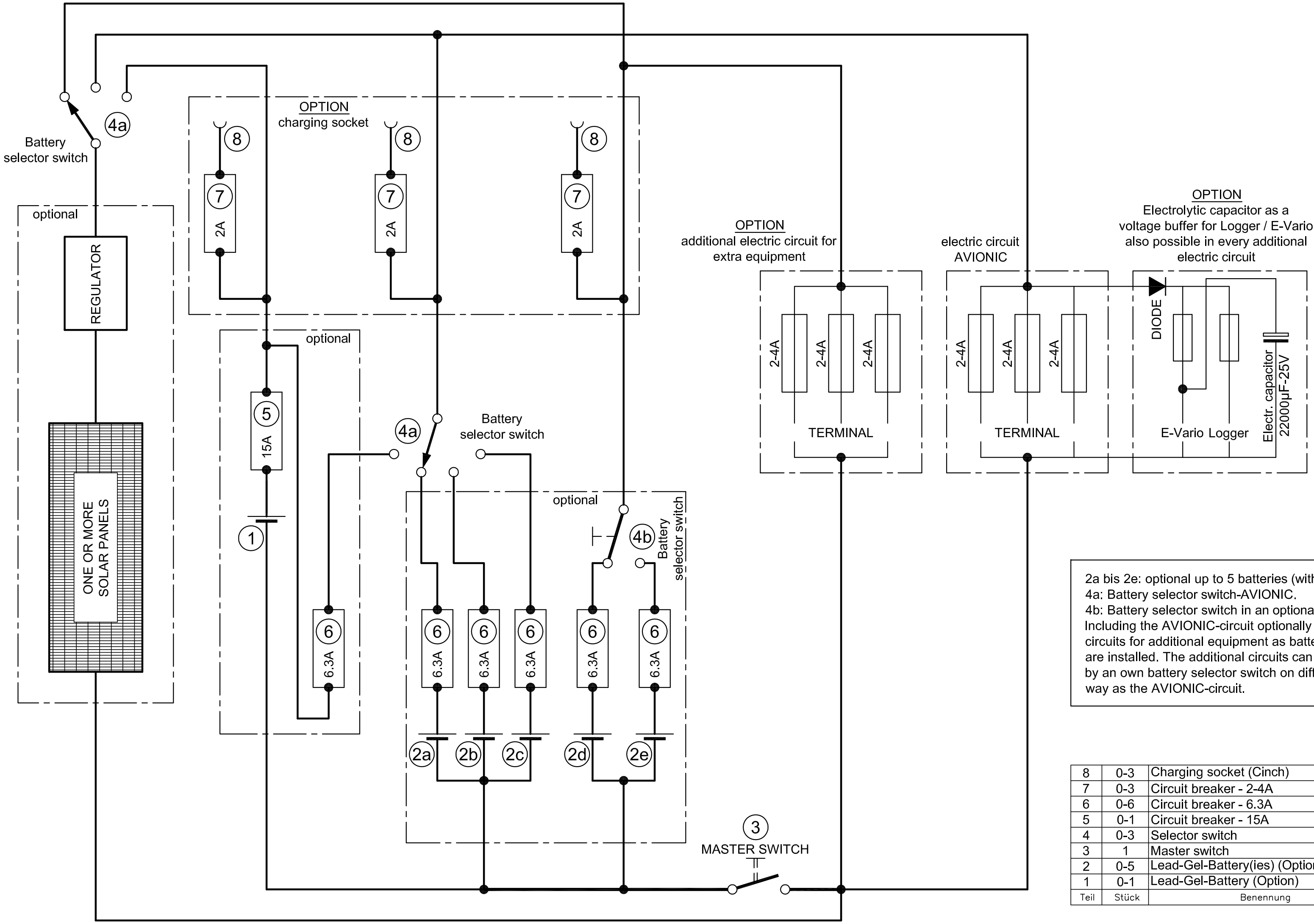
Note:
VHF-Transceiver and other additional equipment to be wired in compliance with the manufacturer's instructions and be fused individually.

Ⓐ	(OPTION) 1 battery 12V / 16 - 18Ah***)** BATT. E
ⒷⒷ	(OPTION) 1 - 2 batteries 12V / 5.7 - 9Ah***)** BATT. C1 BATT. C2
Ⓒ	(OPTION) 1 battery 12V / 5.7 - 9Ah***)** BATT. C3
Ⓓ	(OPTION) 1 - 2 batteries 12V / 5.7 - 9Ah***)** BATT. F1 BATT. F2
Ⓔ	Circuit breaker - 6.3A (mounted on battery)
Ⓕ	Master switch
Ⓖ	Selector switch BATT. E / BATT. Avionic or
Ⓗ	Battery-Rotary multipoint switch-Avionic
Ⓘ	Fuse board
Ⓙ	VHF-Transceiver
Ⓚ	(OPTION) VHF-Transceiver - slave control
Ⓛ	Speaker
Ⓜ	PTT button
Ⓝ	Boom-microphone

***)** Lead-Gel-Batteries with higher capacity and identical dimensions are permitted.

Duo Discus XL

ELECTRICAL SYSTEM - AVIONIC
S14 RE 880



2a bis 2e: optional up to 5 batteries (without battery (1))
4a: Battery selector switch-AVIONIC.
4b: Battery selector switch in an optional electric circuit.
Including the AVIONIC-circuit optionally possible are as much circuits for additional equipment as batteries (without battery (1)) are installed. The additional circuits can be switched optionally by an own battery selector switch on different batteries in the same way as the AVIONIC-circuit.

Teil	Stück	Benennung	Artikel–/Zeichnungs–Nr.	Hersteller/Lieferant
8	0-3	Charging socket (Cinch)	738557-50	CONRAD
7	0-3	Circuit breaker - 2-4A	1410-G111-P2F1	ETA
6	0-6	Circuit breaker - 6.3A	1410-G111-P2F1	ETA
5	0-1	Circuit breaker - 15A	412-K14-LN2	ETA
4	0-3	Selector switch	9030.01 or 9040.0101	MARQUARDT
3	1	Master switch	07.2.1.10 921	KISSLING
2	0-5	Lead-Gel-Battery(ies) (Option)	12V / 5.7 - 9Ah	PANASONIC or sim.
1	0-1	Lead-Gel-Battery (Option)	12V / 16 - 18Ah	HAWKER E. or sim.

Solar panels to be wired at the main power supply only by regulator with V_{max} = 13.8V

WIRING DIAGRAM

7.13 Miscellaneous equipment

Removable ballast (option)

A mounting provision for removable ballast (trim ballast weights) is provided at the base of the front instrument panel.

A second ballast mounting provision is found on the starboard side of the front stick mounting frame.

The trim ballast weights (lead plates) are to be secured in place by bolts.

For information on how to alter the minimum front seat load refer to section 6.2.

Oxygen systems

Attachment points for the mounting brackets for oxygen bottles are provided on the starboard and port fuselage skin above spar joint. To prevent injuries, a hood must be installed covering each valve.

For the installation of oxygen systems, drawings may be obtained from the manufacturer.

Note: After oxygen systems are installed, it is necessary to re-establish the empty mass c/g position of the “Duo Discus" concerned to ensure that the center of gravity is still within the permitted range.

A List of oxygen regulators, currently approved by the Luftfahrt - Bundesamt (LBA), is found in the “Duo Discus” Maintenance Manual.

ELT-installation

The installation of an Emergency Locator Transmitter is possible in the following places and must comply with the instructions provided by Schempp-Hirth:

- In the region of the rear seat
  on either seat pan mounting flange

- beside the top of the main wheel housing

Section 8

8. Handling, care and maintenance

8.1 Introduction

8.2 Inspection periods

8.3 Alterations or repairs

8.4 Ground handling / road transport

8.5 Cleaning and care

8.1 Introduction

This section contains manufacturer’s recommended procedures for proper ground handling and servicing of the sailplane.

It also identifies certain inspection and maintenance requirements which must be followed if the sailplane is to retain that “new plane" performance and dependability.

CAUTION:

It is wise to follow a planned schedule of lubrication and preventative maintenance based on climate and flying conditions encountered -see section 3.2 of the “Duo Discus” Maintenance Manual.

8.2 Sailplane inspection periods

For details concerning the maintenance of this sailplane refer to its Maintenance Manual.

Airframe maintenance

Under normal operating conditions no airframe maintenance work is required between the annual inspection, except for the routine greasing of the spigots and ball bearings of the wing and tailplane attachment fittings.

Should the control system become heavy to operate, lubricate those places in the fuselage and in the wing panels where plain bearings are used (sliding control rods like u/c- and airbrake linkage).

Cleaning and greasing the wheels and the tow release mechanism(s) depends on the accumulation of dirt.

Rudder cables

After every 200 flying hours and at every annual survey, the rudder cables are to be inspected at the point where they feed through the S-shaped guides in the pedals, especially at the point of maximum pedal adjustment.

If the rudder cables are damaged, worn or corroded, they must be replaced.

lt is permissible for individual strands of the cables to be worn up to 25 %.

8.3 Alterations or repairs

Alterations

Alterations on the approved model, which might affect its airworthiness, must be reported to the responsible airworthiness authorities p r i o r to their accomplishment.
The authorities will then determine whether and to what extent a "supplemental type approval" is to be conducted.
In any case, the manufacturer's opinion about the alteration(s) must be obtained.
This ensures that the airworthiness does not become adversely affected and/or enables the aircraft owner/ operator to demonstrate at any time that the sailplane concerned complies with an LBA-approved version.

Amendments of the LBA-approved sections of the Flight- and/or Maintenance Manual must in any case be approved by the Luftfahrt Bundesamt (LBA).

Repairs

Abbreviations:

CFRP: carbon-fibre reinforced plastic
GFRP: glas-fibre reinforced plastic

Before every take-off and especially after the sailplane has not been used for a while, it should be checked on the ground as shown in section 4.3.
Check for any sign of a change in the condition of the aircraft, such as cracks in the surface, holes, delamination in the CFRP/GFRP structure etc.

If there is any uncertainty whatsoever regarding the significance of damage discovered, the "Duo Discus" should always be inspected by a CFRP/GFRP expert.

There is no objection to minor damage - which does not affect the airworthiness in any way - being repaired on site.

A definition of such damage is included in the "REPAIR INSTRUCTIONS" which are found in the appendix to the "Duo Discus" Maintenance Manual.

Major repairs may only be conducted by a certified repair station having an appropriate authorization.

8.4 Ground handling / road transport

a) Towing / pushing

When towing the sailplane behind a car, a tail dolly should always be used to avoid unnecessary tailplane vibration on the fittings - especially in tight turns.
When pushing the aircraft by hand, it should not be pushed at its wing tips, but as near to the fuselage as possible.

b) Hangaring

The sailplane should always be hangared or kept in well ventilated conditions. If it is kept in a closed trailer, there must be adequate ventilation.
The water ballast tanks must always be left completely empty.
The sailplane must never be subjected to loads whilst not in use, especially in the case of high ambient temperatures.

c) Tie-down

In the case of a sailplane remaining rigged permanently, it is important that the maintenance program includes rust prevention for the fittings on fuselage, wing panels and tailplane.
Tie-down kits common in trade may be used to anchor the aircraft.
Dust covers should be regarded as essential for the sailplane.

d) Preparing for road transport

As the wing panels have a thin airfoil section, it is important that they are properly supported, i.e. leading edge down, with support at the spar stubs and at the outer portion in cradles of correct airfoil section.
The fuselage can rest on a broad cradle just forward of the u/c doors and on its tail wheel (or skid).
The horizontal tailplane should be kept leading edge down in two cradles of correct airfoil section or placed horizontally on a padded support.
On no account should the tailplane be supported by its fittings in the trailer.

8.5 Cleaning and care

Although the surface coating of a composite aircraft is robust and resistant, always take care of a perfect surface.

For cleaning and caring the following is recommended:

- Clean the surface (especially the leading edge of wing panels, horizontal stabilizer and fin) with clear water, a sponge and a chamois leather.
- Do not use too often rinsing additives common in trade.
- Polish and polishing materials may be used.
- Petrol and alcohol may be used momentarily only, thinners of all kinds are not recommended.
- Never use chlorine hydrogen (i.e. Tri, Tetra, Per etc.).
- The best polishing method is the buffing of the surface by means of an edge buffing wheel, fitted to a drilling or polishing machine. Thereby hard wax is applied to the rotating disc and distributed crosswise over the surface.

> WARNING:
> To avoid a local overheating, the buffing wheel should be moved constantly!

Note:
Polishs, wax and additives containing silicone should not be used, because this might cause additional effort in the case of repairs of the coating.

- The canopy should be cleaned with a plexiglass cleaner (e.g. "Mirror Glaze", "Plexiklar” or similar) and only if necessary, with warm water. The canopy should be wiped down only with a soft clean chamois leather or a very soft material as used for gloves.
  N e v e r rub the canopy when it is dry!

- The sailplane should always be protected from the wet.

  If water has found a way in, the components should be stored in a dry environment and turned frequently to eliminate the water.

  The sailplane should not be exposed unnecessarily to intense sunlight or heat and should not be subjected to continual loads in a mechanical sense.

WARNING:

All external portions of the sailplane exposed to sunlight must be painted white with the exception of the areas for the registration and anti-collision markings.

Colours other than white can lead to the CFRP/ GFRP overheating in direct sunlight, resulting in an insufficient strength.

Section 9

9. Supplements

9.1 Introduction

9.2 List of inserted supplements

9.1 Introduction

This section contains the appropriate supplements necessary to safely and efficiently operate the “Duo Discus” when equipped with various optional systems and equipment not provided with the standard aircraft.

9.2 List of inserted supplements

Date	Section	Title of inserted supplements
	--	--