Waikerie Gliding Club

DUO-DISCUS
Handling Notes

These Handling Notes have been prepared to assist in the safe and efficient operation of the Duo-Discus sailplane, Ser. No 186, VH-DDH.

Details

Wing Span	20.0 metres	Wing Area	16.4 m2
Aspect Ratio	24.4	MAC	0.875m
Fuselage Length	8.62 metres	Width	0.71 m
Height	1.00 m		
Weight – Empty	420 Kg	Max AUW	700 Kg
Wing Loading	29.9 – 42.7 Kg/m2		

Limitations

VNe	135 Kts	Rough Airspeed	97 Kts
Maneuvering Speeed	97 Kts	Max, Aerotow	81 Kts
Max, Winch Launch	81 Kts	Max, Gear Op.	97 Kts
Weak Link	700 – 900 Kg		

ASI Markings – Green 49 – 97 Kts
- Yellow 97 – 135 Kts
- Red Line 135 Kts
Yellow Triangle 54 Kts – Approach speed at max Wt, W/O Water Ballast

Stall Speeds

	499 Kg	**700 Kg**
Aft CofG, Airbrakes closed,	19 – 24 Kts	31 – 32 Kts
Airbrakes Extended	22 – 24 Kts	33 – 36 Kts

Demonstrated Crosswind Component: 11 Kts

Best L/D 45:1 at 55 Kts at 609 Kg

Description

The Schempp-Hirth "Duo-Discus" sailplane is a tandem two-seat sailplane of glass and carbon fibre construction, with a fixed horizontal stabilizer and elevator in a "T" tail configuration. The elevator Trim control consists of adjustable springs within the elevator control circuit.

The wing is a four stage trapezoid in plan view, with double-panel airbrakes on the upper surface and internal pushrod driven ailerons. The wings contain integral water ballast tanks with a total capacity of 198 litres.

The fuselage supports the large, single piece canopy which is hinged sideways.

The main wheel, which is equipped with a hydraulic disc brake, is retractable, while the nose and tail wheels are fixed. The main wheel is retracted and extended from the front seat. It is not possible to lock the undercarriage from the rear seat. The main wheel brake is operated by a lever on each Control Column or at the full extension of the airbrakes.

All of the control circuits are automatically hooked up when the sailplane is rigged.

Emergency Procedures

Spin Recovery
a) Ailerons neutral.
b) Rudder opposite direction of rotation.
c) Nose down elevator until rotation ceases.
d) Centralise Ruder, ease out of dive.

Water Ballast
Wings, Total capacity 198 litres.
Tail Fin Tank, 11 litres
- At temperatures below 2° C, dump all water ballast.

High Altitude Flight

Alt.(Ft)	IAS (Kts)	Alt (Ft)	IAS (Kts)
0 Ft	135	13100	124
3300	135	16400	117
6500	135	19700	111
9800	130	23000	105

Aerobatics

Aerobatics are not permitted.

Care of the Duo-Discus

- Never leave the glider with the canopy open.
- Clean the Canopy with a damp Chamois or recognized plexiglass cleaner.
- Use canopy cover when it is necessary to park the glider outside.
- Clean wings and fuselage with a damp Chamois before and after flying.
- Do not subject the glider to exposure to intense heat or sunlight unnecessarily – if its not to be flown return it to the hangar.
- Dump all water ballast before landing.
- Ensure the cockpits remain clean and tidy.

Rigging & De-Rigging

Rigging

Ensure all pins, connections etc are cleaned and greased.

a) Unlock Airbrake lever.
b) Set Water Ballast Dump to **"Closed"**.
c) Insert **Port** wing panel first.
   Check that the spar stub tip is correctly located.
d) Check that control levers are correctly located.
e) Push the main Wing Pin in approx 30mm.
f) Insert the **Starboard** wing panel (as for Port Panel).
   When fully home, push the main wing pin fully in.
   (Any difficulty, use Rigging Bar).
g) Fit wing-tip extensions,
   - locking pin pushed down.
   - ailerons deflected UP.
   Ensure aileron coupling lap on lower side of inner aileron has slid under adjacent outer aileron.
   Locking pin must be flush with the upper surface.
h) Install Rigging Tool into front tailplane locating pin.
i) Slide tailplane onto two elevator actuating pins, pull locating pin out, align tailplane with locating pin and allow it home (flush with Fin LE).
   Remove and store rigging tool.
   Check elevator function.
j) Check all controls for correct function.
k) Seal all joints with tape.

De-Rigging

a) Remove all sealing tapes.
b) Using Rigging Tool, remove tailplane.
   Store Rigging Tool.
c) Remove wingtip extensions.
d) Unlock the airbrakes.
e) Set Water Dump valve to the closed position.
f) Lift tips, remove main wing pin, except for last 30mm.
   Place wing panel in trailer etc.
g) Remove and store main wing pin.

Duo-Discus

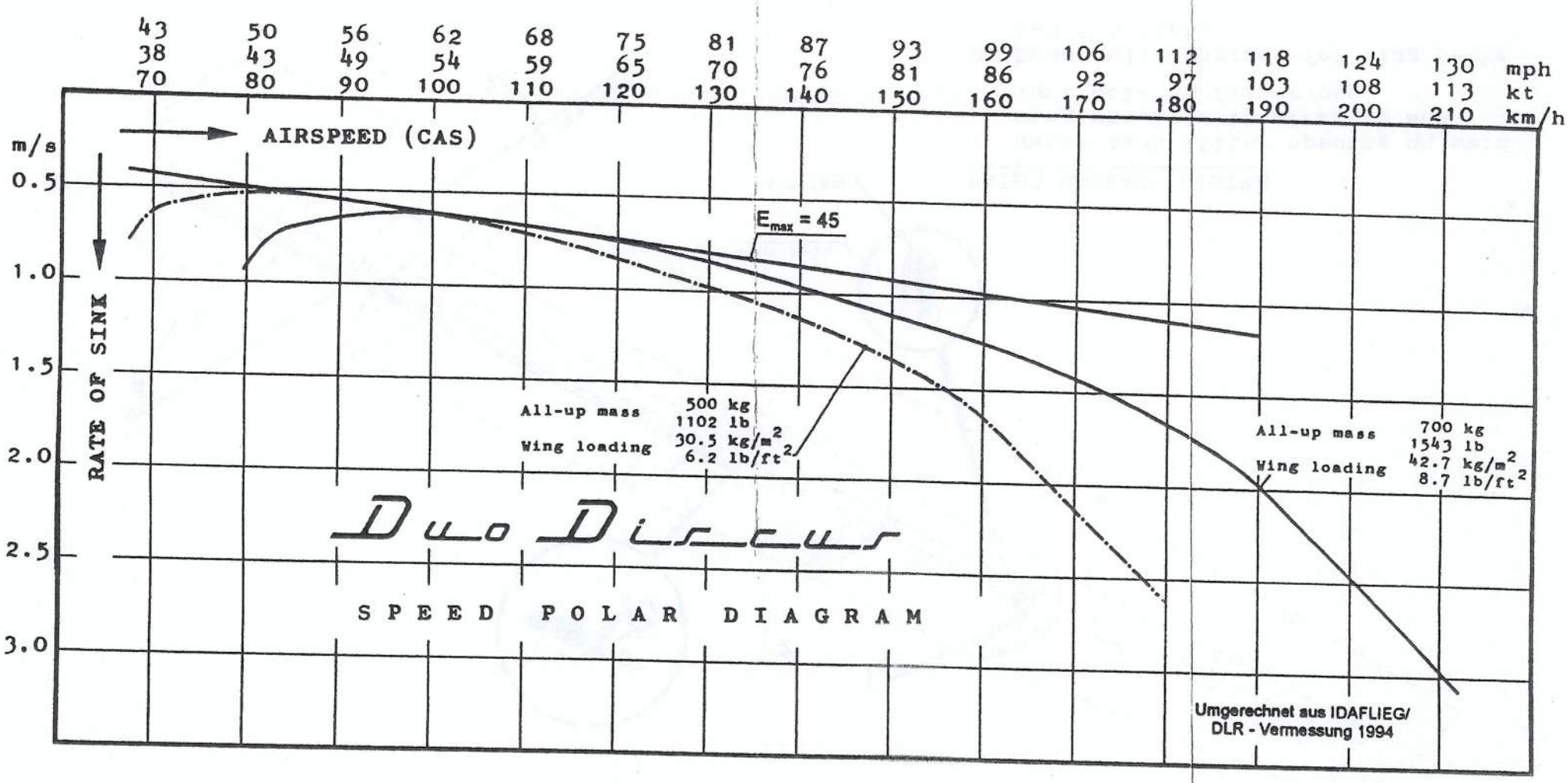
DAILY INSPECTION

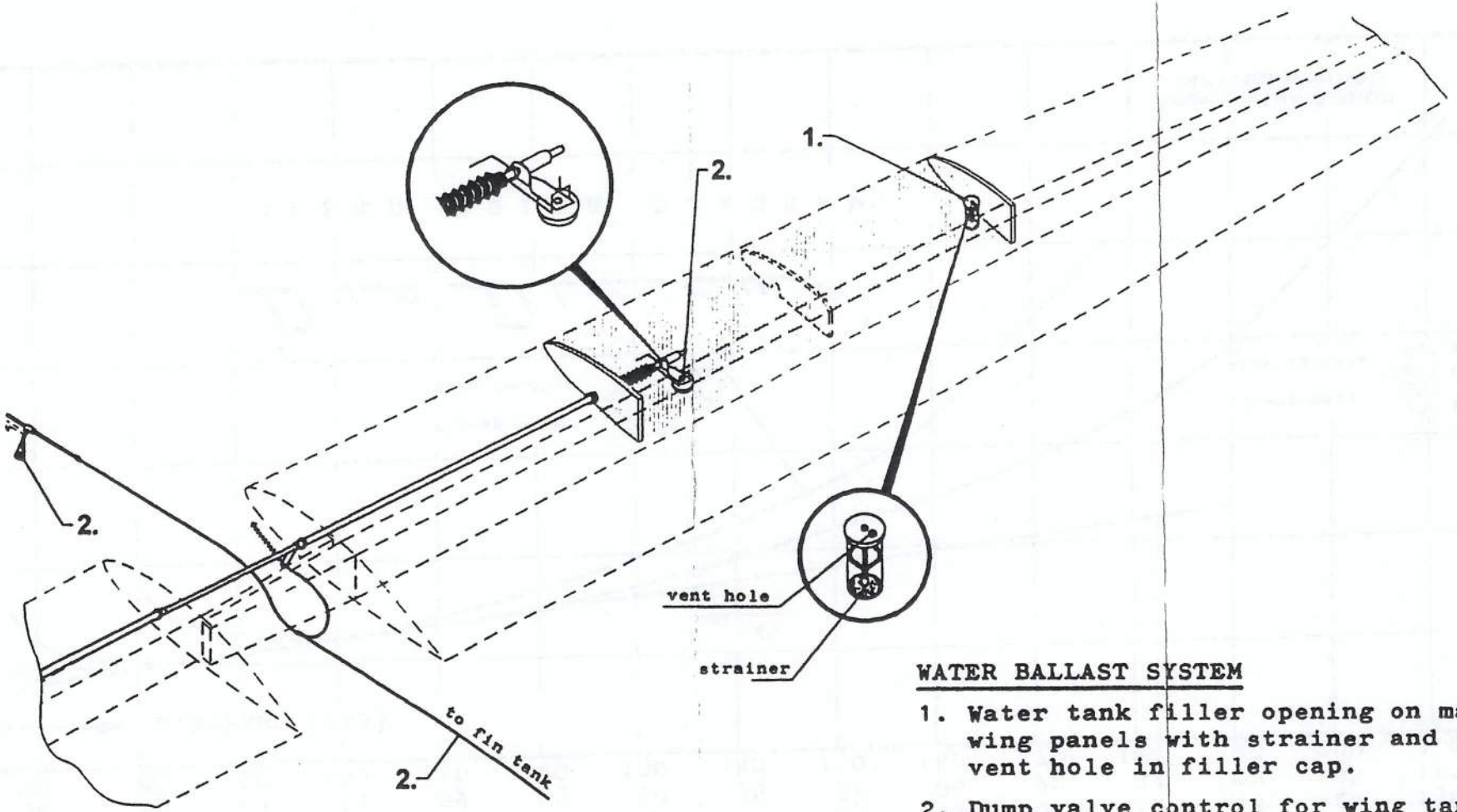
1. Cockpit Check main wing pin fully home and locked.
   Check all visible control circuitry.
   Check full and free movement of all controls.
   Check for foreign / loose objects, Cockpit cleanliness.
2. Undercarriage, Check tyre pressures. Nose wheel 300 kPa (43 psi)
   Main wheel 400 kPa (57 psi)
   Tailwheel 300 kPa (43 psi)
3. Check tow release condition and correct function.
4. Check upper and lower wing surfaces (cracks, dents etc)
   Clean and grease water ballast dump valves.
   Check water ballast dump holes are clear.
   Check airbrake boxes/airbrakes/ailerons.
   Check tip extension security (pin flush with wing top surface).
5. Check fuselage for damage.
6. Check ASI STATIC PORTS (1 m forward of Fin and below Fuselage/wing fillet.
7. Check TE Probe, security, operation.
   Check Pitot head clear, ASI operation.
8. Check tailfin spill holes are clear (if fitted).
   Check level of water in Fin tank.
   Check that the tail fin dump hole is clear.
9. Check horizontal stabilizer attachment and locking.
10. Check elevator and rudder for correct movement.
    Check trailing edge of rudder & elevator for damage.
11. Complete Glider paperwork.

- Avoid flying in lightning conditions.
- With wet wings, increase all speed by 3 – 5 Kts.

Attachments:

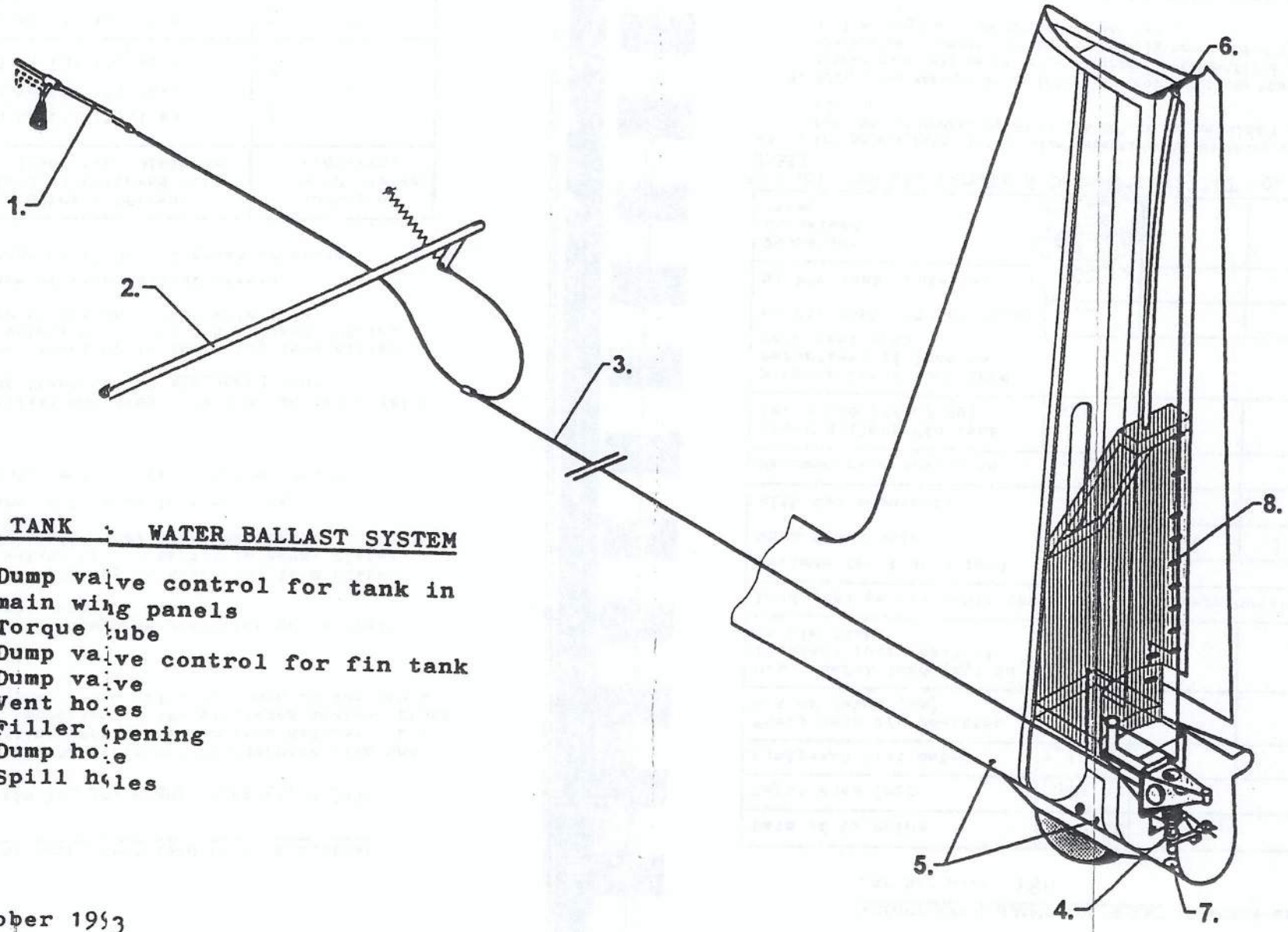
a) Duo-Discus Polar
b) Duo-Discus Wing Water Ballast System
c) Duo-Discus Fin Water Ballast System
d) Duo-Discus Weight and Balance Log.
e) Duo-Discus Water Ballast Loading Chart.


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
AIRSPEED (CAS)
m/s
0.5
1.0
1.5
2.0
2.5
3.0
RATE OF SINK
E_{max} = 45
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
SPEED POLAR DIAGRAM
Umgerechnet aus IDAFLIEG/
DLR - Vermessung 1994



WATER 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

Altering the front seat load by trim ballast

Optional trim ballast mounting provision(s)

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 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:

2055 mm (6.74 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:

1855 mm (6.09 ft) ahead of datum

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

WEIGHT AND BALANCE LOG SHEET (loading chart)

for Ser.No.: 186

Date of weighing	2.10.98			
Empty mass (kg)	** 416.5			
Equipment list dated	2.10.98			
Empty mass c/g position aft of datum (mm)	528.9			
Max. useful load (kg) in fuselage incl. ballast in fin tank	228.4			
Load (kg) on the seats (crew including parachutes):				
Maximum front seat load when flown solo	110	110	110	110
with two occupants	110			
Maximum rear seat load	110			
Water ballast fin tank installed (YES / NO)	YES			
Minimum front seat load regardless of load on rear seat with				
a) Fin tank NOT installed	-.-			
b) Fin tank installed *)	103			
Inspector Signature Stamp				

** incl. manuf. panels & batteries (11.2 kg)

Note:

*) 1. For safety reasons the value determined by weighing with an empty fin tan has been increased by 30 kg (66 lb) so as to allow for an unnoticed fille fin tank.

2. Adding the mass of 30 kg (66 lb) is not required, however, if the pilot either dumps all water ballast (prior to take-off) or does ensure that the ballast quantity in the fin tank is compensated by an appropriate loa in the wing tanks and/or on the aft seat.

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.

Maximum water ballast load

Maximum all-up mass including water ballast : 700 kg (1543 lb)

C/G position of water ballast in wing tanks : 65 mm (2.56 in.) aft of datum plane

Note: When determining the maximum 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), i.e. this load must be added to the empty mass shown in the table below (if tank is used).

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

Tank capacity of both wing tanks : 198 kg/liter (52.31 US Gal., 43.56 IMP Gal.)

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

Empty mass *		Total load on the seats (kg / lb)																											
		kg		lb		kg		lb		kg		lb		kg		lb		kg		lb		kg		lb		kg		lb	
kg	lb	70		154		80		176		100		220		120		265		140		309		160		353		180		397		200		441		220		485	
		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	Liter	US Gal	IMP Gal	Liter	US Gal	IMP Gal
		Water ballast in wing tanks																											
410	904	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						
420	926	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						
430	948	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						
440	970	190	50.2	41.8	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	40	10.6	8.8						
450	992	180	47.6	39.6	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	30	7.9	6.6						

Duo-Discus Weight & Balance Supplement. VH-DDH

This supplement has been developed to assist Pilots in ensuring the Duo-Discus is correctly loaded for flight, in all configurations.

The Duo-Discus VH-DDH is fitted with a Fin Water Ballast Tank having a capacity of 11 litres of water (11 Kg). It is vital that pilot's ensure that any ballast in this tank is appropriate for the weight/s carried in the glider to avoid the development of a serious aft CofG condition.

As it is possible to significantly overload the glider (with water ballast), it must be noted that the **Maximum All Up Weight** of the glider is 700 Kg.
The **Maximum Fuselage Load** (c + f) must be < 228.4 Kg

To determine the correct loading,

a) Determine Total Empty Mass, **417 Kg**
Empty Weight + any Fin Water Ballast, Kg
b) Determine Front Seat load (Pilot, Parachute, Water Bottle etc), Kg
c) Determine Rear Seat load (Pilot, Parachute, Water Bottle etc), Kg
d) Determine **Total** Seat Loading (b + c), Kg.
e) Determine Total **Allowable Wing Water Ballast**, Kg
f) Determine Total **Allowable Fin Ballast** for Wing Ballast, Kg
g) Determine Total **Allowable Fin Ballast** for Rear seat load, Kg
h) Determine **Maximum Fuselage Load**, Kg **< 228.4 Kg**
i) Determine **Maximum AUW of loaded sailplane**, **< 700 Kg.**

John Hudson
Feb 2008.

WEIGHT AND BALANCE LOG SHEET (loading chart)

for Ser.No.: 186

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Empty mass (kg)	** 416.5			
Equipment list dated	2.10.98			
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Max. useful load (kg) in fuselage incl. ballast in fin tank	228.4			
Load (kg) on the seats (crew including parachutes):				
Maximum front seat load when flown solo	110	110	110	110
with two occupants	110			
Maximum rear seat load	110			
Water ballast fin tank installed (YES / NO)	YES			
Minimum front seat load regardless of load on rear seat with				
a) Fin tank NOT installed	-.-			
b) Fin tank installed *)	103			
Inspector Signature Stamp				

** incl. manuf. panels & batteries (11.2 kg)

Note:

*) 1. For safety reasons the value determined by weighing with an empty fin tank has been increased by 30 kg (66 lb) so as to allow for an unnoticed 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 to 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.

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.

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 liter (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 is not allowed!

When determining the water ballast quantity for the fin tank, bear in mind that the maximum permitted useful load in the fuselage (see page 6.2.3 "Weight and balance log sheet") must not be exceeded - check as follows:

m_{P1} = load on front seat

m_{P2} = load on aft seat

m_{FT} = ballast in fin tank (to compensate for ballast in wing tanks)

m_{FT*} = ballast in fin tank (to compensate for loads on the aft seat)

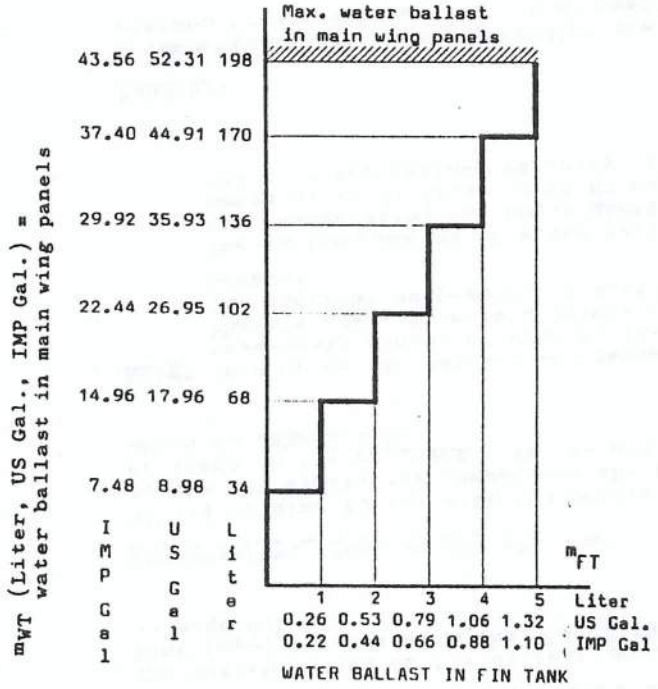
$m_{P1} + m_{P2} + m_{FT} + m_{FT*}$ = less or equal to maximum useful load in fuselage (see also page 6.2.3)

In order to avoid that the maximum permitted all-up 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.

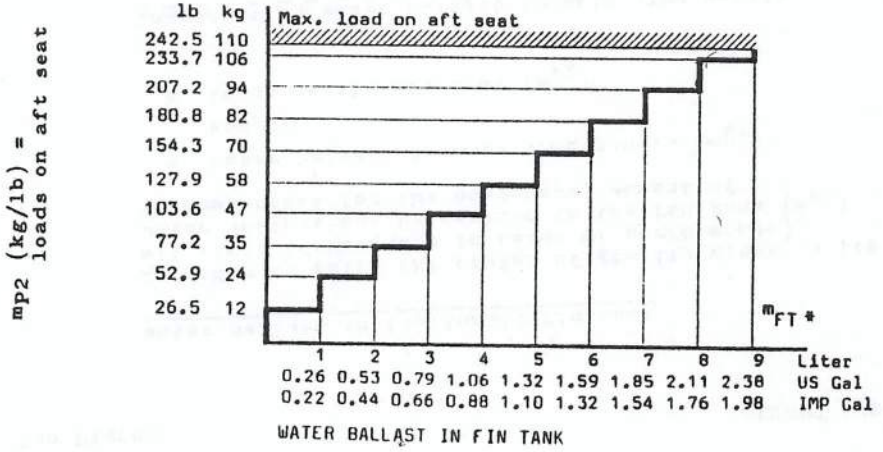
Lever arm of water ballast in fin tank (m_{FT}):

5320 mm (17.45 ft) aft of datum plane

Fin tank capacity: 11 kg/liter (2.91 US Gal., 2.42 IMP Gal.)



WATER BALLAST IN FIN TANK



WATER BALLAST IN FIN TANK

Maximum water ballast load

Maximum all-up mass including water ballast : 700 kg (1543 lb)

C/G position of water ballast in wing tanks : 65 mm (2.56 in.) aft of datum plane

Note: When determining the maximum 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), i.e. this load must be added to the empty mass shown in the table below (if tank is used).

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

Tank capacity of both wing tanks : 198 kg/liter (52.31 US Gal., 43.56 IMP Gal.)

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

Empty mass *		Total load on the seats (kg / lb)																											
		kg	lb		kg	lb		kg	lb		kg	lb		kg	lb		kg	lb		kg	lb		kg	lb		kg	lb	
kg	lb	70	154		80	176		100	220		120	265		140	309		160	353		180	397		200	441		220	485	
		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																											
410	904	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
420	926	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
430	948	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
440	970	190	50.2	41.8	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	40	10.6	8.8
450	992	180	47.6	39.6	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	30	7.9	6.6

Waikerie Gliding Club

DUO-DISCUS VH-DDH WATER BALLAST LOADING CHART

NOTES: **DDH Empty Mass** 416.5 Kg

Empty Mass* = Empty Mass + Ballast in Fin Tank (Kg)

Max All Up Mass, including Water Ballast = 700 Kg.

Wing Ballast Tank Capacity = 99 Litre, Total Capacity 198 Litre.

Max Load in Fuselage, inc Fin Tank Water Ballast = 228.4 Kg

mP1	Front Seat Kg
mP2	Rear Seat Kg
mFT	Fin Tank ballast (litre) for **Front** Seat
mFT*	Fin Tank ballast (litre) for **Rear** Seat

mP1 + mP2 + mFT + mFT* = < 228.4 Kg

	TOTAL LOAD ON SEATS, Kg								
Empty Mass*	**70**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**
Kg	**Allowable Litres / Kg Water Ballast in Wing Tanks**								
410	198	198	190	170	150	130	110	90	70
420	198	198	180	160	140	120	100	80	60
430	198	190	170	150	130	110	90	70	50
440	190	180	160	140	120	100	80	60	40
450	180	170	150	130	110	90	70	50	30

Chart 1

Wing Ballast Ltr / Kg	**Fin Ltr**
34	1
68	2
102	3
136	4
170	5
198	6

Chart 2

Rear Seat Kg	**Fin Tank Litres**
12	1
24	2
35	3
47	4
58	5
70	6
82	7
94	8
106	9
110	9

Chart 3

A/C Empty Mass*, Kg				**AUW Kg**
a as weighed		**417 Kg**		
b mFT - Fin Tank Water, Kg	+			
c **Total Empty Mass, Kg**	=		→	
d mP1 - Front Seat, Kg				
e mP2 - Rear Seat, Kg	+			
f **Total Seat Loading, Kg**	=		→	
g Allowable WB, Wing Tanks, Kg			Chart 1	
h Allowable Fin Ballast re g, Kg			Chart 2	
i Allowable Fin Ballast re e, Kg			Chart 3	
j Fuselage Load (b + f)			**AUW**	
		< 228.4 Kg		**= < 700 Kg**