FLIGHT MANUAL

for Powered Sailplane

Model: **Duo Discus T**

Serial-No.: ....

Registr.-No.: ....

Date of issue: **May 2000**

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

(Signature)

Luftfahrt-Bundesamt (Authority)

(Stamp)

21. DEZ. 2001

(Original date of approval)

This powered 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 Berichtigung	Bezug	Datum der Anerkennung durch das LBA	Datum der Einarbeitung	Zeichen /Unterschrift
Revision No.	Affected section	Affected page	Date of issue	Reference	Date of Approval by LBA	Date of Insertion	Signature
1	**0** **9**	**0.2.6** **9.1.1** **9.2** **9.3**	**Febr. 2003** **Febr. 2003** **Febr. 2003**	**TM-Nr. 890-2** (Handst. für Seitenr. Werk-Nr. 53, und ab 89 wahlw. bei der Herstlg.) **TN-No. 890-2** (hand operated rudder system, S/N 53, 89 and up optional installation during constr.)			
2	**0** **2** **4** **7**	**0.2.2** **0.2.3** **0.2.5** **2.5** **4.2.2** **7.3.1** **7.3.5**	**Oct. 2003** **Oct. 2003** **Oct. 2003** **Oct. 2003**	**ÄB-Nr. 890-3** LCD-Tankanzeige Werk-Nr. 1 bis 84 wahlweise, Serie ab 85 **MB-No. 890-3** LCD fuel quantity indicator optional S/N 1 – 84, standard S/N 85 and up			
3	**0** **7**	**0.2.5** **7.2.1** **7.2.7** **7.3.1**	**Febr. 2004**	**ÄB-Nr. 890-5** (Haubenscharnier Hebel vorn ab S/N 97 **MB-No. 890-5** (canopy hinge, lever front S/N 97 and up)			
4	**4** **7**	**4.4** **7.2.4**	**August 2004**	**TM-Nr. 890-4** (herausnehmbarer hinterer Steuerknüppel, wahlweise alle Werk-Nr.) **TN-Nr. 890-4** (removable aft stick, optional all S/N)			
5	**0** **1** **2** **3** **4** **5** **8**	**0.2.1** **0.2.2** **0.2.3** **0.2.4** **0.2.6** **1.2** **2.15** **3.8** **4.1.1** **4.2.3.1** **4.3.1** **5.3.2.1** **8.3**	**January 2005**	**General revisions**			

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

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Revision No.	Affected section	Affected page	Date of issue	Reference	Date of Approval by LBA	Date of Insertion	Signature
6	0 4	0.2.1 0.2.3 4.5.1.2	July 2005	**TM 890-6** F-Schlepp mit Motor-segler, wahlweise Werk-Nr. 1 bis 125 **TN 890-6** Aerotow with powered sailplane, optional S/N 1 through 125			
7	 0 1 2 4 5 6 7	Deckblatt cover sheet 0.2.2 0.2.3 0.2.4 0.2.5 1.2 1.4.1 1.4.3 1.5 2.3 4.3.1 4.3.2 4.5.1.2 4.5.3.1 4.5.3.3 4.5.3.4 4.5.4.1 4.5.5 5.2.2 5.3.2.1 5.3.2.2 6.2.3 6.2.4 6.2.7 7.2.4 7.2.7 ***)** 7.7 ***)** entfällt bei Werk-Nr. 126 not applicable for S/N 126	September 2005	**ÄB 890-6** Winglets, Hinterkanten-klappen (Werk-Nr. 126) und gefedertes Fahr-werk ab Werk-Nr. 128 **MB 890-6** Winglets, trailing edge flap (S/N 126) and landing gear with shock absorber struts S/N 128 and on.			

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Revision No.	Affected section	Affected page	Date of issue	Reference	Date of Approval by LBA	Date of Insertion	Signature
8	0 1 4 5	0.2.1 0.2.2 0.2.3 0.2.4 1.4.1 1.5 4.3.1 4.5.3.1 4.5.3.3 4.5.3.4 4.5.4.1 5.3.2.1 5.3.2.2	November 2005	**TM-Nr. 890-7** Winglets wahlweise Werk-Nr. 1 bis 125 **TN-No. 890-7** winglets, optional S/N 1 through 125			
9	0 1	0.2.2 1.4.1	Juli 2006 July 2006	**Ergänzungen zum ÄB-Nr. 890-6** Werk-Nr. 147 und ab Werk-Nr. 151 Flügel in CFK-Bauweise **Supplement to MB-No. 890-6** S/N 147 and 151 and up Wing construction in CFRP shell			
10	0	0.2.2 0.2.3 0.2.4 1.4.3 2.6 2.10 2.13 2.15 3.5 4.5.1.2 4.5.1.4 4.5.3.2 4.5.4.1 5.2.2 5.3.2.1 6.2.1 6.2.5 6.2.6	Juni 2007 June 2007	**Ergänzungen zum ÄB-Nr. 890-6** ab Werk-Nr. 172 **TM-Nr. 890-9** Werk-Nr. 147, 150, 151 bis Werk-Nr. 171 optional Erhöhung der max. Flug-masse auf 750 kg und der nichttragenden Teile auf 500 kg **Supplement to MB-No. 890-6** S/N 172 and up **TN-No. 890-9** SN 147, 150, 151 through 171 optional Increase of the max. take-off mass to 750 kg and the mass of the non-lifting parts to 500 kg			

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Revision No.	Affected section	Affected page	Date of issue	Reference	Date of Approval by LBA	Date of Insertion	Signature
11	0 9	0.2.6 9.2 9.4	Juni 2007 June 2007	**TM 890-11** Nasenschleifsporn wahlweise Alle Werk-Nr. **TN 890-11** Nose skid optional All S/N			

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	0.2.1 0.2.2 0.2.3 0.2.4 0.2.5 0.2.6		
	0.3.1		

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	1.2	January 2005	Rev. 5
	1.3	May 2000	
	1.4.1	May 2000	
	1.4.2	May 2000	
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2	2.1.1	May 2000	
	2.1.2	May 2000	
	LBA-appr. 2.2.1	May 2000	
	LBA-appr. 2.2.2	May 2000	
	LBA-appr. 2.3	May 2000	
	LBA-appr. 2.4	May 2000	
	LBA-appr. 2.5	October 2003	MB 890-3
	LBA-appr. 2.6	May 2000	
	LBA-appr. 2.7	May 2000	
	LBA-appr. 2.8	May 2000	
	LBA-appr. 2.9	May 2000	
	LBA-appr. 2.10	May 2000	
	LBA-appr. 2.11	May 2000	
	LBA-appr. 2.12	May 2000	
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	LBA-appr. 2.15	January 2005	Rev. 5
3	3.1.1	May 2000	
	3.1.2	May 2000	
	LBA-appr. 3.2	May 2000	
	LBA-appr. 3.3	May 2000	
	LBA-appr. 3.4	May 2000	
	LBA-appr. 3.5	May 2000	
	LBA-appr. 3.6	May 2000	
	LBA-appr. 3.7	May 2000	
	LBA-appr. 3.8	January 2005	Rev. 5
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	LBA-appr. 4.2.1.2	May 2000	
	LBA-appr. 4.2.1.3	May 2000	
	LBA-appr. 4.2.2	October 2003	MB 890-3
	LBA-appr. 4.2.3.1	January 2005	Rev. 5
	LBA-appr. 4.2.3.2	May 2000	
	LBA-appr. 4.2.3.3	May 2000	
	LBA-appr. 4.3.1	January 2005	Rev. 5
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	LBA-appr. 4.5.1.3	May 2000	
	LBA-appr. 4.5.1.4	May 2000	
	LBA-appr. 4.5.2	May 2000	
	LBA-appr. 4.5.3.1	May 2000	
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	LBA-appr. 4.5.3.8	May 2000	
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	LBA-appr. 4.5.6.3	May 2000	
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5	5.1.1	May 2000	
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	LBA-appr. 5.2.2	May 2000	
	LBA-appr. 5.2.3	May 2000	
	LBA-appr. 5.2.4	May 2000	
	5.3.1	May 2000	
	5.3.2.1	January 2005	Rev. 5
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	7.1.2	Mai 2000	
	7.2.1	Mai 2000	
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	7.2.4	Mai 2000	
	7.2.5	Mai 2000	
	7.2.6	Mai 2000	
	7.2.7	Mai 2000	
	7.2.8	Mai 2000	
	7.3.1	Oktober 2003	MB 890-3
	7.3.2	Mai 2000	
	7.3.3	Mai 2000	
	7.3.4	Mai 2000	
	7.3.5	Oktober 2003	MB 890-3
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8	8.1.1	May 2000	
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9	9.1.1	May 2000	
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0.3 Table of contents

Section 1

1.1 Introduction

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

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 powered sailplane.

1.2 Certification basis

This non-self-launching powered sailplane, model designation

„Duo Discus T“

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. 890 and was issued on

21.12.2001

Category of Airworthiness: UTILITY

The Noise Certificate is based on the
„Aircraft Noise Protection Requirements „ (LSL), Revision of January 1, 1991 and includes the supplement dated April 6, 2000.

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 T” is a two-seat powered sailplane, not capable of self-launching, 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 (having a swept-back leading edge) and features double-panel „Schempp-Hirth“ type airbrakes on the upper surface. 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 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 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 “Duo Discus” is rigged.

The “Turbo” auxiliary power system

This is a unique concept, which was first developed to avoid tedious retrieves or to overcome zero lift conditions, but it also makes possible the search of thermals, soaring safaris and wave exploratory flights from winch launch or aerotow.

Off-field landings may now be safely avoided and even if the system fails, the sink rate with the power plant extended is only about 276 to 315 fpm (1.4 – 1.6 m/s), so the “Duo Discus T” still has satisfactory performance.

Extending and retracting the power plant is very simple and is done with the aid of an electrical spindle drive (actuator).

The two-stroke SOLO engine type “2350 D” is started by windmilling effect of the multi-blade folding propeller (OEHLER system). Throttle or choke are not required as the engine is preset to operate at max. continuous power.

The engine is stopped by reducing the flying speed, shutting off the fuel valve, switching off the ignition and partly retracting the power plant.
The stopped engine is fully retracted regardless of the position of the propeller blades as they fold up automatically.

Except for the ignition switch, RPM-indicator, fuel pump button, decompression handle and fuel valve, no other engine controls are to be observed. Fuel contents are shown by a panel-mounted gauge.

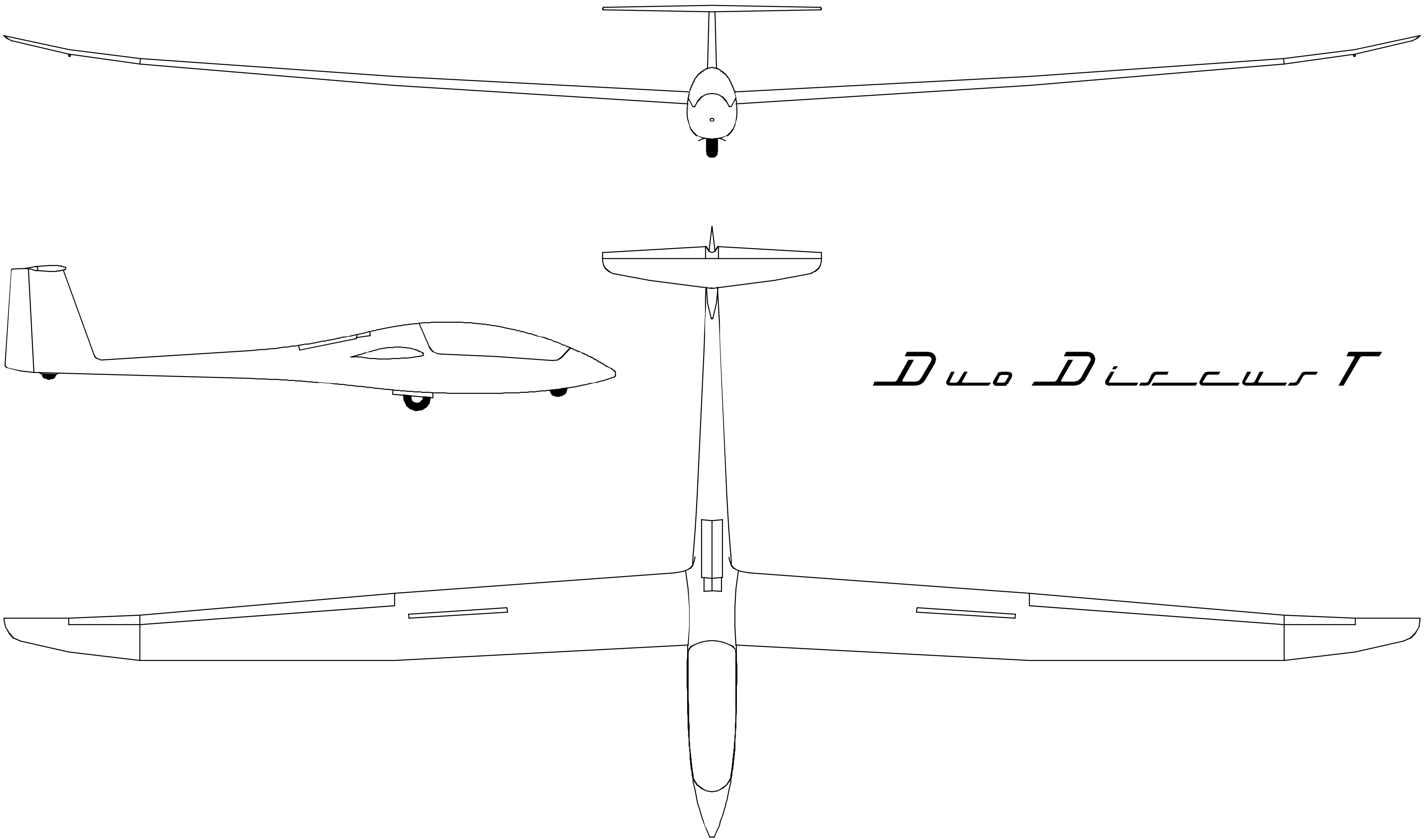
For flights in the plain sailplane configuration the power plant (engine and propeller) may be quickly removed, of course.

The remaining components of the propulsion system (central tank, spindle drive, engine pylon etc.) remain in the aircraft as the saving in weight is not worth the efforts in removing/reinstalling them.

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	8.62 m	28.28 ft
	Width	0.71 m	2.33 ft
	Height	1.00 m	3.28 ft
Weight (mass)	Empty mass approx.	445 kg	981 lb
	Maximum all-up mass	700 kg	1543 lb
	Wing loading	31.7 - 42.7 kg/m²	
		6.5 - 8.7 lb/ft²	

1.5 Three-side view



Section 2

2.1 Introduction

Section 2 includes operating limitations, instrument markings and basic placards necessary for safely operating the powered 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	250 km/h 135 kt 155 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.

Airspeed (ctd.)

	Speed	(IAS)	Remarks
V_{max1}	Maximum speed with power plant extended and ignition „ON“	125 km/h 67 kt 78 mph	Do not exceed this speed with power plant extended and ignition switched ON
V_{max2}	ignition „OFF“	160 km/h 86 kt 99 mph	Do not exceed this speed with power plant extended and ignition switched OFF
V_{POmax}	Maximum speed for extending / retracting power plant	110 km/h 59 kt 68 mph	Do not extend / retract the power plant beyond this speed range
V_{POmin}	Minimum speed for extending / retracting power plant	90 km/h 49 kt 56 mph	

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 - 250 km/h 97 - 135 kt 112 - 155 mph	Maneuvers must be conducted with caution and operating in rough air is not permitted.
Red line at	250 km/h 135 kt 155 mph	Maximum speed for all operations.
Blue line at	95 km/h 51 kt 59 mph	Best rate of climb speed by V_Y.
Yellow triangle at	105 km/h 57 kt 65 mph	Approach speed at maximum mass without water ballast

2.4 Power plant, fuel and oil

Engine manufacturer:	Solo Kleinmotoren GmbH. 71050 Sindelfingen, Germany
Engine model:	SOLO 2350 D
Engine power at MSL (ISA) and 6500 take-off and max. continuous RPM:	22 kW (30 hP)
Maximum cylinder head temperature (CHT):	275° C (527° F)
Fuel:	Two-stroke mixture, unleaded automobile gasoline, not below RON 95 or AVGAS 100 LL
Oil (lubrication):	Fuel / oil mixture, mixing proportion for „CASTROL Super TT" 30 : 1 (3.3 %)
Propeller manufacturer:	Technoflug Leichtflugzeugbau GmbH 78713 Schramberg-Sulgen
Propeller model:	OE-FL 5.110/83 av
Reduction ratio:	1 : 1.56
Fuel capacity:	See table below

	Liter	US Gal.	IMP Gal.
Capacity of central fuselage tank	16.2	4.28	3.56
Usable fuel	16.0	4.23	3.52
Non-usable fuel	0.2	0.05	0.04

2.5 Power plant instrument markings

Power plant instrument markings and their colour code significance are shown below:

Instrument	Red line = Minimum limit	Green = Normal Range	Yellow = Caution Range	Red = Maximum limit
Tachometer (RPM-Indicator)	--	green signal	yellow signal	--

2.6 Weights (masses)

Maximum permitted take-off weight (mass):	700 kg	(1543 lb)
Maximum permitted landing weight (mass):	700 kg	(1543 lb)
Maximum permitted take-off and landing weight (mass) w i t h o u t water ballast:	700 kg	(1543 lb)
Maximum permitted weight (mass) of all non-lifting parts:	490 kg	(1080 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 maneuvers

The powered sailplane model „Duo Discus T“ is certified in category

U T I L I T Y

Not capable of self-launching

WARNING:

Aerobatic maneuvers and cloud flying

n o t a p p r o v e d !

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} = 250 km/h, 135 kt, 155 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 T” 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”.

2.11 Kinds of operation

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

VFR-flying in daytime.

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.

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

1 Engine control unit indicating

- RPMs and
- Engine time

1 Fuel quantity indicator

1 Rear-view mirror

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).

2.13 Aerotow and winch launch

Aerotow (power plant retracted)

Only permissible at the nose tow release !

Maximum towing speed:	180 km/h	(97 kt, 112 mph)
Weak link in tow rope:	700 – 910 daN	(1543 – 2006 lb)
Minimum lenght of tow rope:	30 m	(98 ft)
Tow rope material	Hemp or Nylon	

Winch launch (power plant retracted)

Only permissible at the c/g tow release !

Maximum launching speed:	150 km/h	(81 kt, 93 mph)
Weak link in winch cable	700 – 910 daN	(1543 – 2006 lb)

2.14 Other limitations

N o n e

2.15 Limitations placards

MAX. PERMITTED A.U.WEIGHT (MASS): 1543 lb / 700 kg			
MAXIMUM PERMITTED SPEEDS (IAS) :	**km/h**	**kt**	**mph**
Never exceed speed	**250**	**135**	**155**
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**
For power plant extension/retraction	**110**	**59**	**68**
With ignition **ON**	**125**	**67**	**78**
Power plant extended speed	**160**	**86**	**99**
PERMISSIBLE MINIMUM SPEED (IAS):			
For power plant extension/retraction	**90**	**49**	**56**

Max. permitted speed				
Altitude		V_{NE}(IAS)		
[m]	[ft]	km/h	kt	mph
0	0	**250**	**135**	**155**
1000	3281	**250**	**135**	**155**
2000	6562	**250**	**135**	**155**
3000	9843	**241**	**130**	**150**
4000	13123	**229**	**124**	**142**
5000	16404	**217**	**117**	**135**
6000	19685	**205**	**111**	**127**
7000	22966	**194**	**105**	**121**
8000	26247	**183**	**99**	**114**
9000	29528	**172**	**93**	**107**
10000	32808	**162**	**87**	**101**

fin tank installed

FIN TANK EMPTIED

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	———	———

For front seat loads below placarded minimum refer to Flight Manual, section 6.2

Fuel at maximum seat load	kg	lb	Ltr.	US. Gal.	IMP. Gal.
	12	**26.5**	**16**	**4.23**	**3.52**

Ballast in fin tank is dumpted simultaneously with wing tanks

OPENED  **CLOSED**

FIN TANK FILLED

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	**110***kg **243***lb	**100***kg **220***lb	**110***kg **243***lb
rear seat load	at choice	**110***kg **243***lb	———	———

For front seat loads below placarded minimum refer to Flight Manual, section 6.2

Fuel at maximum seat load	kg	lb	Ltr.	US. Gal.	IMP. Gal.
	12	**26.5**	**16**	**4.23**	**3.52**

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*** kg	**110*** kg **243*** lb	**70*** kg **154*** lb	**110*** kg **243*** lb
rear seat load	at choice	**110*** kg **243*** lb	———	———

Loads of less than the above minimum must be raised by using trim ballast - see instructions given in section 6.2 of the Flight Manual.

Fuel at maximum seat load	kg	lb	Ltr.	US. Gal	IMP. Gal
	12	**26.5**	**16**	**4.23**	**3.52**

***)** As the actual minimum or maximum load on the seats of this "Duo Discus T" (to which this manual refers) may differ from these typical weights, the placards in the cockpit must always show the actual weights, which are also to be entered in the log chart - see section 6.2.

WEAK LINK FOR TOWING

max. 910 daN (2006 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)**

Note: Further placards are shown in the Maintenance Manual.

Section 3

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

a) Power plant retracted

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.

b) Power plant extended

With power plant extended, there are no significant differences in the stall behaviour.

On stalling the turbulent airflow produced by the propeller just superimposes the vibration in the controls.

Important Note:

If, on stalling, the vibration in the controls and in the cockpit becomes more pronounced with controls getting spongy and engine noise increasing, immediately release the back pressure on the stick and, if necessary, apply 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 rearward positions, a steady spinning motion is possible.

After having applied the standard recovery method, the “Duo Discus T” 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 150 m (492 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 T” 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.

3.7 Engine failure (carburetor icing)

From experience gained to date, no carburetor icing has yet occured on the engine installed.

Should the engine fail in flight due to the lack of fuel or a defect, retract it as quickly as possible to avoid any unnecessary deterioration of the flight performance (for more precise data refer to section 5).

3.8 Fire

- CLOSE fuel shut-off valve
- Master switch “OFF”
- Ignition “OFF”

Leave power plant in extended position!

WARNING:

Discontinue flight and land immediately!

Avoid any maneuvers causing a high stressing of the fuselage !

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 T" 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 powered sailplane should be landed at a flat angle and without pancaking.

Ground loop

If there is the danger of the powered 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 T”, the entire cockpit might get forced under water.

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

Section 4

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 T” 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 knob 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 knob 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.

4.2.2 Refueling

Prior to filling the tank, always first actuate the drain valve.

a) Refueling system not installed

The quick-disconnect coupling of the line routed to the central fuel tank is situated on the left hand side next to the front wing locating tube.
Using an electrical. pump, the tank is easily filled from a suitable container by just connecting a hose featuring an appropriate fitting.

b) Refueling system in place (option)

The quick-disconnect coupling of the line routed to the central fuel tank is situated on the left hand side next to the front wing locating tube.
The tank is easily filled from a suitable container by connecting a hose featuring an appropriate fitting and by actuating the switch of the internal electrical fuel pump (installed next to the coupling).
With the fuel tank filled, this pump must be switched off.

In either case there is no danger of spilling fuel as - thanks to the quick-disconnect coupling - the fuel line is closed automatically.

Calibrating the fuel quantity indicator

The number of liters indicated depends on the rating of the fuel used.
After a change the indication must be recalibrate.

- Fill the tank complete.
- With the help of a pin (max. diameter 2.5 mm) the countersunk button on the left side of the display should be pressed for 2 seconds.
- The displayed “CAL” is shown after the successful calibration followed by the LCD-display (LIT) of the filled fuel tank.
- No display “CAL” means again a calibration is necessary.

Important note:

A calibration with partial filled tank or no calibration after a change of the rated fuel leads to wrong indication up to 30%.
The displayed fuel content can be more than the actual fuel content.

4.2.3 Removal and re-installation of the power plant

In order to allow the operation of the “Duo Discus T" in “plain sailplane configuration", its power plant is quickly removable.
The following components may be removed:

- Engine with propeller
- Power plant battery, located at the cockpit transverse steel tube frame (unless needed for the avionics)

The maximum saving in weight is approx. 34 kg (75 lb).
The influence on the c/g position is described in section 6 of the “Duo Discus T” Maintenance Manual.

Whenever the power plant is removed/re-installed, the empty mass c/g position must be re-determined and, together with further data, be entered in the weight & balance log sheet by a licensed inspector.

Removing the power plant

- Remove power plant battery from transverse frame (unless needed for the avionics)
- Pull off fuel line and impulse line from diaphragm pump
- Detach engine wiring by disconnecting 6 wires from the terminal and 3 wires from the ignition control at the front former inside the engine bay – make a note of the correct position of each cable, see also maintenance manual Diagram 9a respectively Diagram 9b.
- Remove screw between lower and right cooling baffle
- Remove decompression valve actuating lever and interconnecting link (see page 4.2.3.3)
- Remove the nuts from the four bolts attaching the engine to the pylon (see page 4.2.3.3)
- Disconnect cooling baffle from port side of front cylinder head
- Disconnect arresting wire from either pylon side
- Lift engine (with prop) free from pylon

Re-installing the power plant

- Seat engine (prop mounted) onto the pylon - together with the rubber shock mounts (vibration isolators, two per each lug).

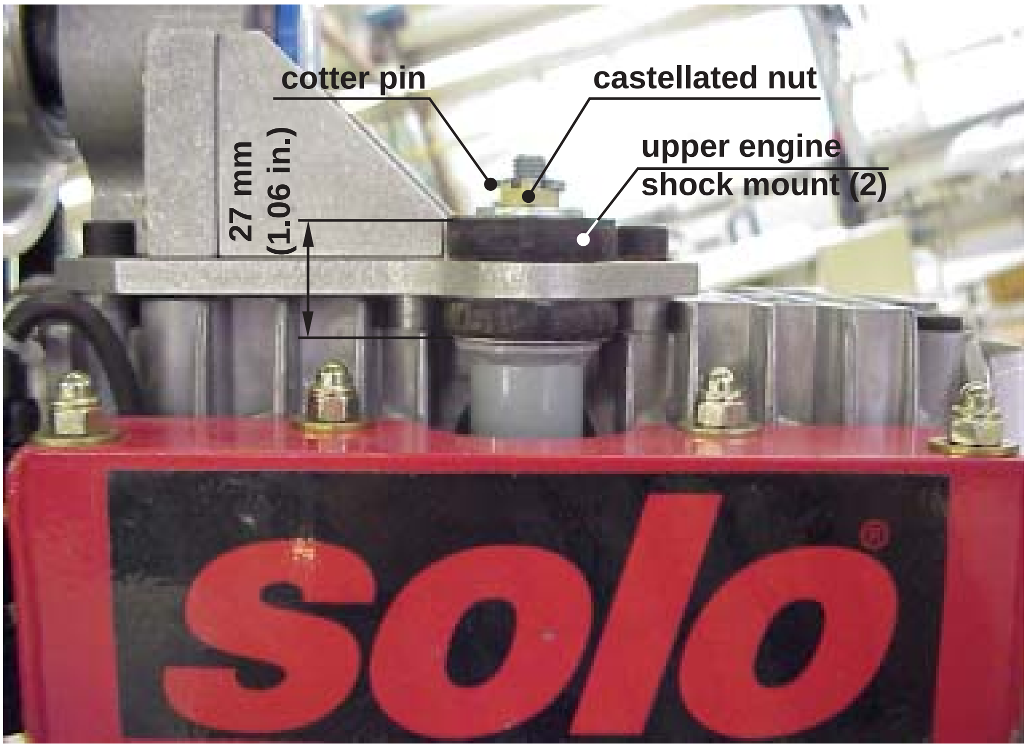
  Tighten the upper castellated nuts such that the spacing between the shock mounts is

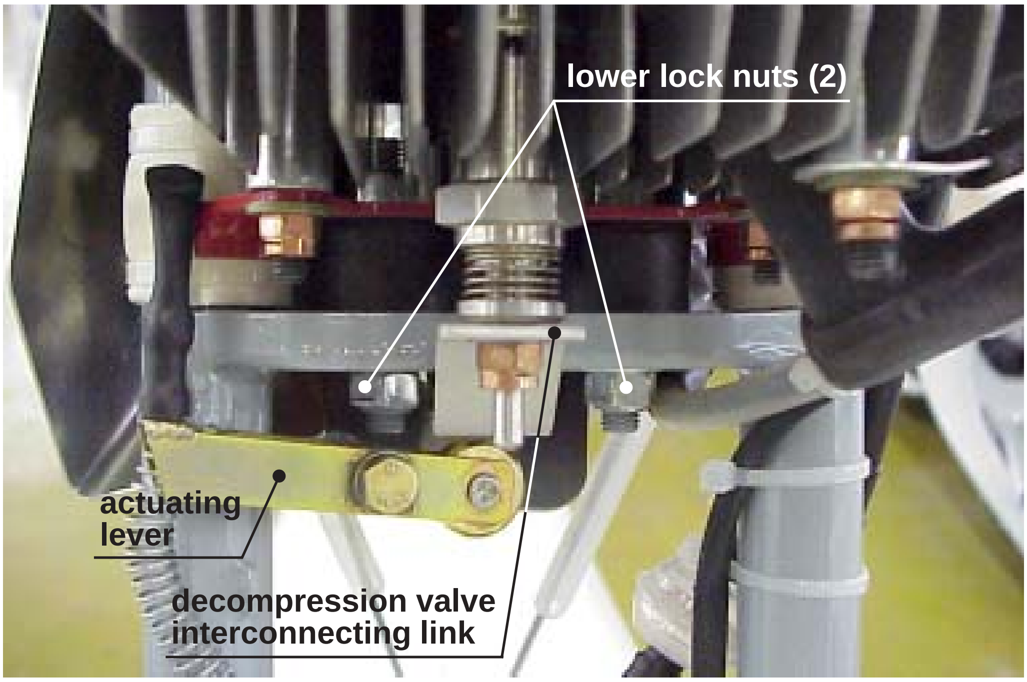
  27 mm (1.06 in.)

  as shown on page 4.2.3.3.

- Secure upper nuts using a cotter pin
- Install and tighten lower stop nuts
- Route arresting wire through guides and reattach on either side of pylon
- Reinstall cooling baffle on the left side to cylinder head and reconnect the lower and the right cooling baffle
- Reinstall decompression valve interconnecting link and actuating lever (see page 4.2.3.3)
- Reconnect engine wiring
- Reconnect fuel line and impulse line to fuel pump
- Reattach wiring and lines to pylon (using cable ties as before)
- Conduct an inspection according to section 4.3 b)
- Reinstall power plant battery (if it was removed from its tray on the cockpit transverse frame)

Power plant attachment

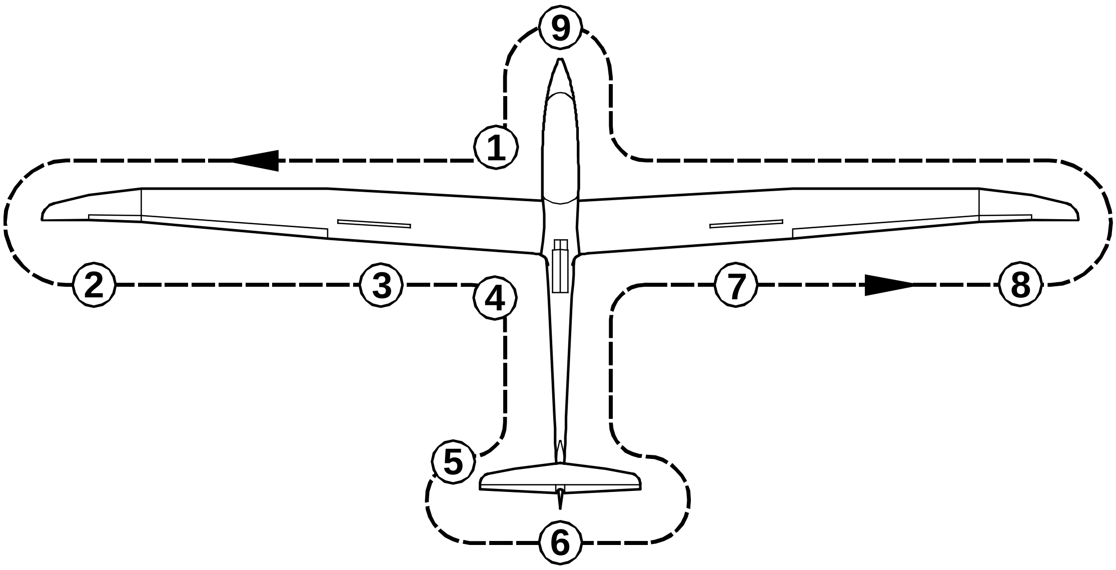




4.3 INSPECTION

a) Daily inspection

The importance of inspecting the powered 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 T", 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) Check airbrakes for proper condition, fit and locking

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

b) Check that the STATIC pressure ports for the AST 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

Visual inspection of the power plant

CAUTION: IGNITION TO BE SWITCHED OFF !

c) Check propeller for damage and ease of movement. Being in the lowermost position, each blade must unfold automatically, otherwise the bearing at the blade root should be lubricated with thin oil.

d) Check power plant for loose bolts and nuts, check all locks and stops

e) Check exhaust system and engine pylon for cracks, especially at the welding joints

f) Check cooling baffles for cracks and correct attachment

g) Check rubber elements of engine mounting and exaust

h) Check components, lines, hoses, pipes and wires etc. for chafing marks

i) Check condition, function and tension of engine arresting wires, engine door operating cables and door actuating mechanism

j) Check condition of retaining rubber and that it is hooked up to the engine arresting wires

k) Pull back decompression handle and hold - prop must rotate freely. Release handle and check that the actuating lever on the pylon returns to its stop.

The gap between the decompression valve interconnecting link and the actuating lever on the pylon must be at least 2.0 mm (0.08 in.)

(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) Check that the fin-mounted PITOT tube is clear.
When blowing gently into this probe, the ASI must register (with pneumatic valve set at "Power off")

d) Check that the opening for the fuel tank vent line (at the upper end of the fin) is clear

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 horizontal tailplane for proper attachment and locking

b) Check elevator and rudder for free movement

c) Check trailing edge of elevator and rudder for damage

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

(7) See (3)

(8) See (2)

(9) Check that the pitot pressure head in the fuselage nose is clear. Gently blowing into the head should produce a reading on the airspeed indicator (with pneumatic valve set at “POWER ON”)

After heavy landings or after the “Duo Discus T" 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.

4.3 b) Inspection after re-installing the power plant

After re-installing the power plant, the following checks are to be carried out:

- Check for correct spacing of the upper rubber engine shock mounts (vibration isolators).
  Check that the engine mounting bolts and nuts are properly secured (see also page 4.2.3.2).
- With completely extended power plant the engine arresting wires must be under about the same tension
- Check function of the stop switch for the extended position (for details see page 5.8.1 and 5.8.2 in the maintenance manual)
- While extending the power plant, check clearance of the tip of the forward directed propeller blade, especially with the longest blades. The blades must not jam with the small engine bay doors.
- Fuel line connected ?
- Impulse line connected to fuel pump ?
- Engine wiring connected correct to terminal inside the engine bay?
- Engine wiring properly secured to pylon?
- Cooling baffles properly fixed, left cooling baffle free from the fixing bolt of the engine arresting wire?
- Engine wiring clear (i.e. no jamming by pylon) and without tension during extension/retraction?
- Decompression valves moving with sufficient ease? (no jamming of the metal link)
- With decompression handle released, a gap of at least 2.0 mm (0.08 in.) must exist between the link and the actuating lever
- Fresh "Weight & Balance Report" established and seat load placard amended to show revised values (see section 6) ?

In addition to the above an inspection of the power plant must be carried out in compliance with section "Daily Inspection".

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** ASI switched to Pitot head in fin ?
- **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 AND POWER PLANT RETRACTED

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 T" 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 120 to 140 km/h (65-76 kt, 75-87 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.

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 T" 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
AND POWER PLANT RETRACTED

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 T" 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 T" 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 700 kg (1543 lb) 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.

4.5.2 Take-off and climb

The “Duo Discus T" is a powered sailplane n o t capable of self-launching, which - like a glider - must either be launched by winch or aerotow (with its power plant retracted - see section 4.5.1).

WARNING: Do not attempt to take-off on own power !

4.5.3 Flight

a) Power plant retracted

The “Duo Discus T” 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 weight (mass)	513 kg 1131 lb	700 kg 1543 lb
Speed	99 km/h 53 kt 62 mph	113 km/h 61 kt 70 mph
Reversal time	4.6 sec	4.6 sec

Note:

Flights in conditions conducive to lightning strikes must be avoided.

High speed flying

At high speeds up to V_{NE} = 250 km/h (135 kt, 155 mph) the “Duo Discus T” 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} = 250 km/h (135 kt, 155 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} = 250 km/h (135 kt, 155 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 T” 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 30° at maximum permitted all-up mass.

Low speed flying and stall behaviour

(Power plant retracted)

In order to become familiar with the “Duo Discus T” it is recommended to explore its low speed and stall characteristics at a safe height. This should be done while flying straight ahead and also whilst in a 30 to 45° banked turn.

Wings level stall

A stall warning usually occurs 5 to 7 km/h (3-4 kt, 3-4 mph) above the actual 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 “Duo Discus T" 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 powered sailplane slowly may 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 “Duo Discus T" 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

(power plant retracted)

When stalled during a coordinated 45° banked turn, the “Duo Discus T” - 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 can be up to about 30 m (98 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 characteristics.

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

4.5.3 Flight (incl. in-flight engine stop/start procedure)

b) Power plant extended (Power plant operation)

The power plant should only be extended and started where there is a suitable landing terrain within gliding range (with power plant extended, L/D is only about 19 : 1).

Below 300 m (984 ft) AGL, starting attempts are to be avoided so as to have a safe height left for planning the approach pattern should the engine fail to run !

For proper starting refer to the accompanying check list.
Proceed as follows:

Open fuel shut-off valve, switch ASI to Pitot pressure head in fuselage nose and extend power plant at a speed of about 90 to 100 km/h (49-54 kt, 56-62 mph) until the green LED signal (EXTENDED) comes on.

Next switch the ignition “ON”, pull back the decompression handle (thus opening the deco-valves) and hold it.
Also depress the fuel pump button and maintain pressure – prop starts spinning.
Should a blade (or more) fail to unfold, wag rudder repeatedly to assist the blade(s) in unfolding.

Once all prop blades are in their proper position, release decompression handle suddenly at a speed of 100 km/h (54 kt, 62 mph) – engine will fire. Let revs build up, release fuel pump button, reduce speed and enter the climb.

The loss of height, from the moment of extending the engine until it runs, is approx. 40 m (131 ft).

Should the prop stop spinning after the decompression handle was released, pull it back again, depress fuel pump button, accelerate to a higher speed (approx. 105 km/h, 57 kt, 65 mph) and repeat starting procedure.

WARNING: OBSERVE THE REQUIRED MINIMUM ALTITUDE !

CHECK LIST
EXTENDING AND STARTING THE POWER PLANT

- O **OPEN** fuel shut-off valve
- O Switch ASI to pitot head in nose cone
- O **EXTEND** power plant at **90-100 km/h (49-54 kt, 56-62 mph)**
- O Ignition **ON**
- O **PULL** decompression handle and **HOLD**
- O **DEPRESS** fuel pump button
- O Accelerate to about **100 km/h (54 kt, 62 mph)**
- O **RELEASE** decompression handle
  WITH ENGINE RUNNING:
- O **RELEASE** fuel pump buttom and
- O Climb at **90 - 95 km/h (49-51 kt, 56-59 mph)**

STOPPING AND RETRACTING THE POWER PLANT

- O Reduce speed to about **90 km/h (49 kt, 56 mph)**
- O Ignition **OFF**
- O **CLOSE** fuel shut-off valve
- O **RETRACT** power plant **for 5 seconds**
- O When prop has stopped, **RETRACT** power plant at **90-100 km/h (49-54 kt, 56-62 mph)** fully
- O Switch ASI to pitot head in fin

Note:

Engine restart was tested up to 3300 m.

Power plant operation (ctd.)

For performance data with power plant extended refer to section 5.3.2.

The best climb rate is achieved at a speed of 90 to 95 km/h (49-51 kt, 56-59 mph).
The higher the flying speed, the lower is the rate of climb - zero climb is attained at V_H = approx. 115 km/h (62 kt, 71 mph), that is in level flight (normal operating range up to V_H).

Between V_H and the maximum permitted speed with ignition switched on = V_{max1}, the "Duo Discus T" is descending. (Caution range: With engine running a constant operation between V_H and V_{max1} = 125 km/h (67 kt, 78 mph) is not permitted). Slow down immediately.

If the maximum permitted speed with ignition switched on V_{max1} is exceeded, either reduce the flying speed or switch off the ignition.

With power plant extended and ignition switched "off", the maximum permitted speed V_{max2} is 160 km/h (86 kt, 99 mph).

Flying the “Duo Discus T" on own power or with its engine retracted ("clean" configuration) there is no difference in its handling qualities.

The stall speeds are shown in section 5.2.2.

Stopping the engine (see check list on page 4.5.3.5)

To stop the engine, reduce speed to about 90 km/h (49 kt, 56 mph) and switch off the ignition. Then close the fuel shut-off valve. To stop the propeller, proceed as follows:

Hold down retraction key, watch rear-view mirror and release key after about 5 seconds just before the prop hub disappears behind the fuselage back (prop blades will still be clear from the engine bay doors) - prop will stop spinning fairly quickly.

Thereafter (with prop stopped) the power plant is fully retracted - regardless of the position of the propeller blades - until the green LED signal (RETRACTED) comes on.

Finally switch back to the Pitot pressure head in the fin.

Automatic control of engine speed (RPM)

In order to reduce the increase of the engine speed as flying speed increases, the number of ignition impulses is electronically lowered on exceeding the speed for best climb V_Y so that the engine is throttled down.

Automatic ignition cutt-off device

As a safety device the ignition of both cylinders is cut off just prior to reaching the maximum permitted propeller speed.

Normally the ignition is cut off after reaching the maximum permitted speed V_{max1} (i.e. at about 125 km/h, 67 kt, 78 mph). The ignition nevertheless may also be cut off at lower speeds due to gusts, causing an increase of the RPM.

Once the ignition has been cut off, reduce the flying speed quickly to 95 km/h (51 kt, 59 mph) through 105 km/h (57 kt, 65 mph) so that the ignition is activated automatically.
Then the engine will run within its normal operating range.
Or switch the ignition off when the engine will not be further used.

WARNING:

The ignition cut-off device is a safety measure.

Operating the “Duo Discus T” with the ignition cut-off device constantly in action is not permitted.

Leave this speed range immediately by reducing the flying speed or switch off the ignition.

Cruising on own power

As clearly shown by the figures of section "Flight Performances", the longest range results from the

"sawtooth" - method,

which consists of the following flight sections being repeated as required:

- a climb at a speed of 90 to 95 km/h (49 - 51 kt, 56 - 59 mph)
- a glide in "clean" sailplane configuration.

Thereby the height to be consumed in glide should not be less than 500 m (1640 ft).

The maximum range in glide is achieved at a speed of about 100 to 110 km/h (54 - 59 kt, 62 - 68 mph), resulting in an average speed of about 100 km/h (54 kt, 62 mph).

Should the "sawtooth" method be impracticable due to low cloud ceiling or because of airspace restrictions, then cruising, in level flight at a speed of about 115 km/h (62 kt, 71 mph) is also possible.

The range, however, is then considerably less - see section 5.3.2.

For cruising flight, the "sawtooth"-method should always be preferred, as besides the longer range the crew is much less exposed to engine noise (RPMs in climb are less than in level flight).

Low speed flight and stall behaviour

(power plant extended)

Compared with the stall behaviour in "clean" configuration (power plant retracted), there are no significant differences when aircraft stalls from straight and level or from turning flight.

On stalling the turbulent airflow produced by the propeller superimposes the vibration in the controls.

Furthermore the noise of the propeller increases considerably.

4.5.4 Approach

a) Power plant retracted

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 105 km/h mark (57 kt, 65 mph) is the recommended approach speed for the maximum all-up mass without water ballast (700 kg / 1543 lb).

In the above configurations the L/D is approximately 1 : 6.7.

The airbrakes open smoothly and are an effective landing aid.

Side slipping is also fine for landing . It is possible in a straight line with the rudder deflected up to about 85 % of its travel and results in a yaw angle of about 40° and a bank angle of about 25 to 30°. The control force reversal is low, so only a gentle amount of opposite pedal pressure is required to keep the rudder displaced.
To return to level flight, normal opposite controls are required.

Side slipping with airbrakes extended was tested from the recommended approach speed up to 160 km/h (86 kt, 99 mph).

CAUTION:

With rudder fully deflected, side slips in a straight flight path are not possible – the “Duo Discus T” will slowly turn in the direction of the displaced rudder.

Side slipping causes the ASI to read less.

Side slipping with water ballast causes water to escape through the vent hole in the filler cap. Therefore continuous slipping with water ballast is not recommended.

WARNING:

Both the performance and the aerodynamic characteristics of the “DUO DISCUS T” 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).

b) Power plant extended

With power plant extended (ignition OFF), the "Duo Discus T" can be landed in the same manner as in "clean" configuration (power plant retracted).
On approach. however, it must be taken into account that the flight performance has deteriorated due to the extended engine and prop:

All-up weight (mass)	536 kg 1182 lb	700 kg 1543 lb
Approach speed	95 km/h 51 kt 59 mph	105 km/h 57 kt 65 mph
Rate of descent Approx.	1.4 m/s 276 fpm	1.6 m/s 315 fpm
L/D approx.	19	18

The reduced performance, however, is sufficient to conduct approaches with the same techniques as in "clean" configuration.

WARNING:

Be cautious when extending the airbrakes!
Due to the additional drag of the extended power plant, more forward stick must be applied for maintaining the above approach speeds.

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 respectively tail skid should touch down simultaneously.

To avoid a long ground run, make sure that the "Duo Discus T" touches down at minimum speed.

A touch-down at a speed of 90 km/h (49 kt, 56 mph) instead of 75 km/h (40 kt, 47 mph) means that the kinetic energy to be dissipated by braking is increased by a factor of 1.44 and therefore the ground run is lengthened considerably.

The hydraulic main wheel disc brake is actuated via the airbrake linkage with airbrakes almost fully extended.

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 T" 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 T".

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 T" to veer off course.

Water ballast fin tank (optional)

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.

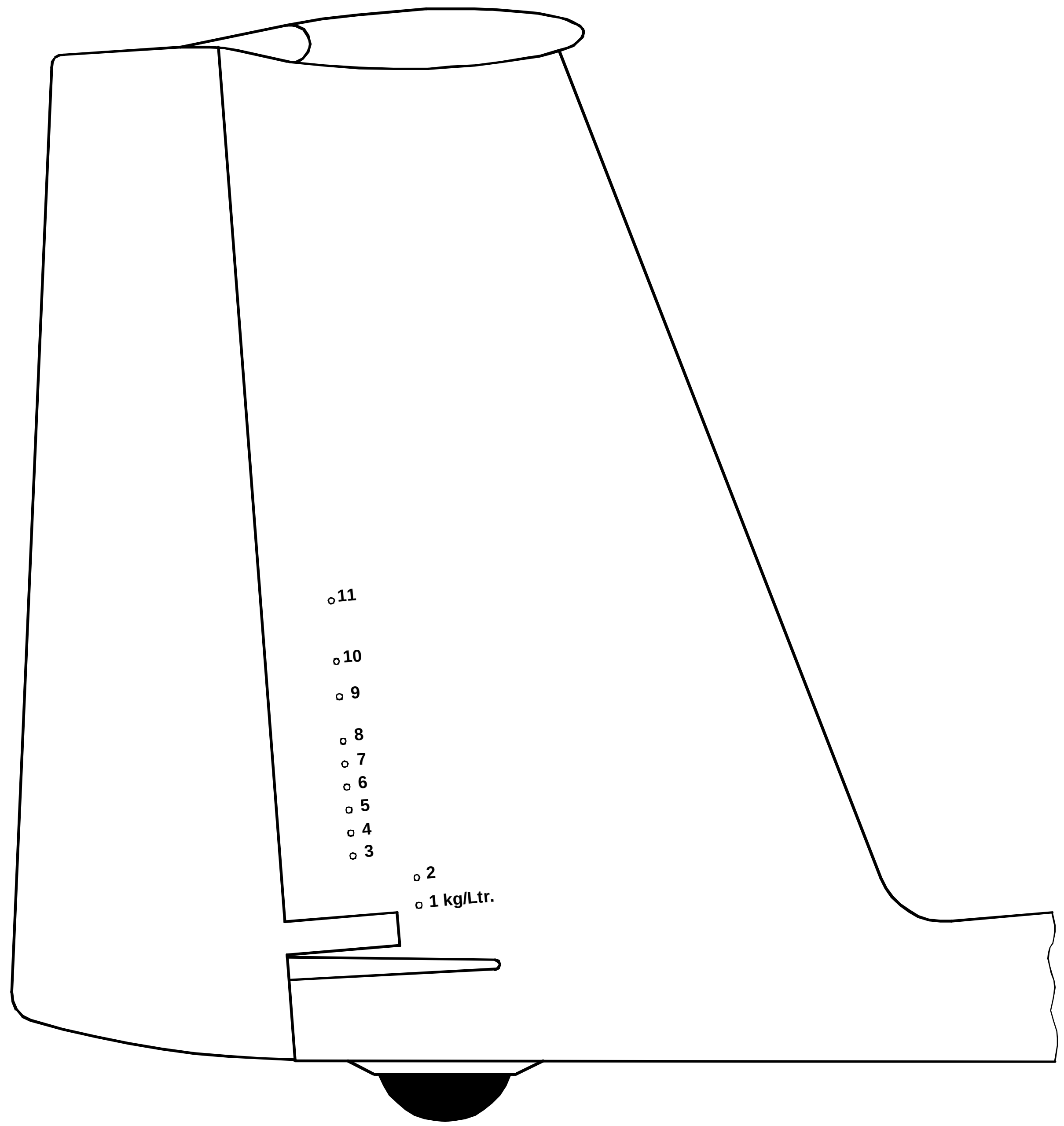
The venting of the tank is through the uppermost 11.0 kg/Liter hole (which always remains open – even with a full tank).

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 T”, 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	250	135	155					
3000	9843	241	130	150	7000	22966	194	105	121
4000	13123	229	124	142	8000	26247	183	99	114
5000	16404	217	117	135	9000	29528	172	93	107
6000	19685	205	111	127	10000	32808	162	87	101

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 T” 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

Aerobatic maneuvers are n o t permitted !

Section 5

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 T" in good condition and using average piloting techniques.

5.2 LBA-approved data

5.2.1 Airspeed inidicator system calibration

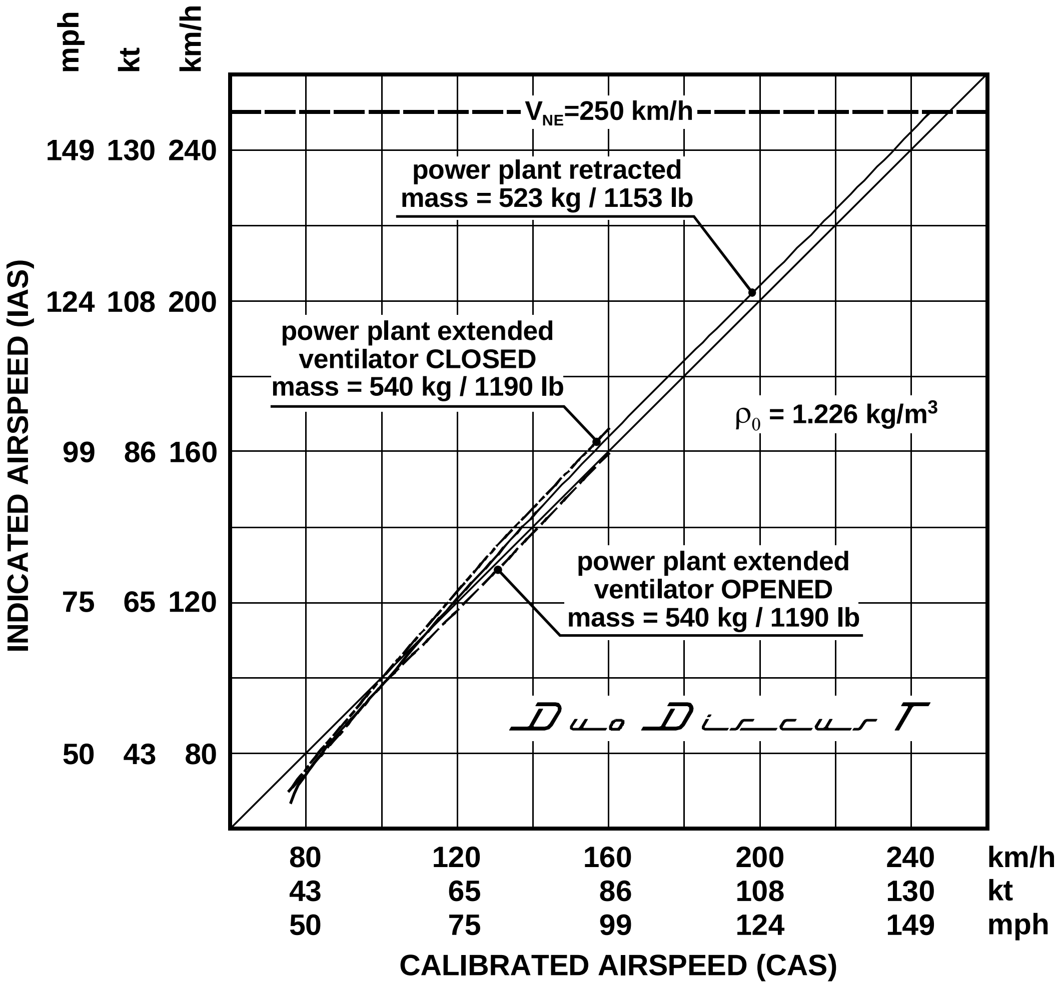
Errors in indicated airspeed (IAS) caused by Pitot/Static pressure errors may be read off from the calibration chart below. This chart is applicable to free flight.

PITOT pressure source:

- power plant retracted: Fin (lower tube)
- power plant extended: Fuselage nose cone

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

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

Configuration		Power plant retracted	
All-up weight (mass) approx.	(kg) (lb)	499 1100	700 1543
C/G position aft of datum	(mm) (in.)	250 9.84	45 1.77
Stall speed, airbrakes closed	(km/h) (kt) (mph)	45 – 35 * 24 – 19 * 28 – 22 *	60 – 58 * 32 – 31 * 37 – 36 *
airbrakes extended	(km/h) (kt) (mph)	45 – 40 * 24 – 22 * 28 – 25 *	66 – 62 * 36 – 33 * 41 – 39 *

* Indication of airspeed heavily oscillating and very unsteady due to turbulence influencing the pitot pressure head.

Configuration		Power plant extended			
IGNITION		OFF	ON	OFF	ON
All-up weight (mass) approx.	(kg) (lb)	536 1182		700 1543	
C/G position aft of datum	(mm) (in.)	250 9.84		45 1.77	
Stall speed, airbrakes closed	(km/h) (kt) (mph)	61 33 38	61 33 38	67 36 42	67 36 42
airbrakes extended	(km/h) (kt) (mph)	63 34 39	63 34 39	80 43 50	78 42 48

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

5.2.3 Take-off distances

Taking-off on own power is n o t permissible -
the “Duo Discus T" is only capable of self - sustaining.

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) and 15° C (59° F).

a) Power plant retracted (or removed)

***)** Values are measured 1994 by Idaflieg/DLR.

All-up weight (mass)	609 1343	kg lb	700 1543	kg lb
Wing loading	37.1 7.6	kg/m² lb/ft²	42.7 8.7	kg/m² lb/ft²
Minimum rate of sink	0.58 114	m/s fpm	0.62 122	m/s fpm
Best L/D	45		45	
at a speed of	100 - 103 54 - 56 62 - 64	km/h kt mph	107 - 110 58 - 60 66 - 69	km/h kt mph
	***)**			

b) Power plant extended – iginition switched OFF

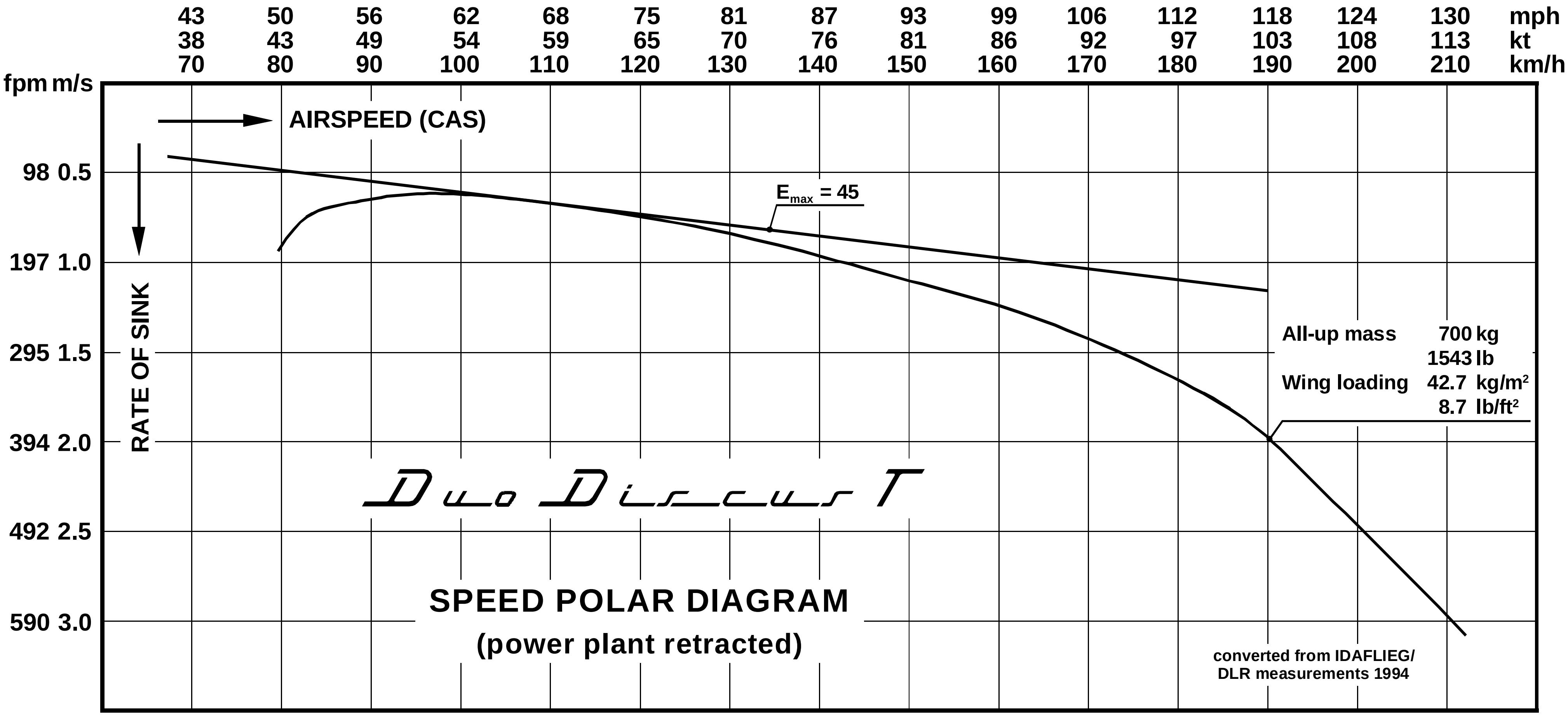
(engine not running)

All-up weight (mass)	536 1182	kg lb	700 1543	kg lb
Rate of sink	1.4 276	m/s fpm	1.6 315	m/s fpm
at a speed of	95 51 59	km/h kt mph	105 57 65	km/h kt mph
Best L/D (-)	19		18	

Power plant extended – maximum power applied

All-up weight (mass)	630 1389	kg lb	700 1543	kg lb
Best rate of climb	0.99 195	m/s fpm	0.80 157	m/s fpm
at a speed of	90 49 56	km/h kt mph	95 51 59	km/h kt mph

A level flight attitude is attained at a speed V_H = 115 km/h (62 kt, 71 mph).


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
AIRSPEED (CAS)
RATE OF SINK
E_{max} = 45
All-up mass 700 kg
1543 lb
Wing loading 42.7 kg/m²
8.7 lb/ft²
Duo Discus T
SPEED POLAR DIAGRAM
(power plant retracted)
converted from IDAFLIEG/
DLR measurements 1994

Range (in calm winds)

a) Values below refer to level, flight at max. continuous power:

Cruising speed approx. : 115 km/h (62 kt, 71 mph)

Fuel consumption approx.: 16.00 Liter/h
4.23 US Gal./h
3.52 IMP Gal./h

Usable fuel: Liter	US Gal.	IMP Gal	Endurance	Range
16.0	4.23	3.52	60 min	115 km (62 nm)

b) The following values are based on the “sawtooth"-method (see page 4.5.3.8) at an all-up mass of 630 kg and 700 kg and the climb effected at max. continuous power:

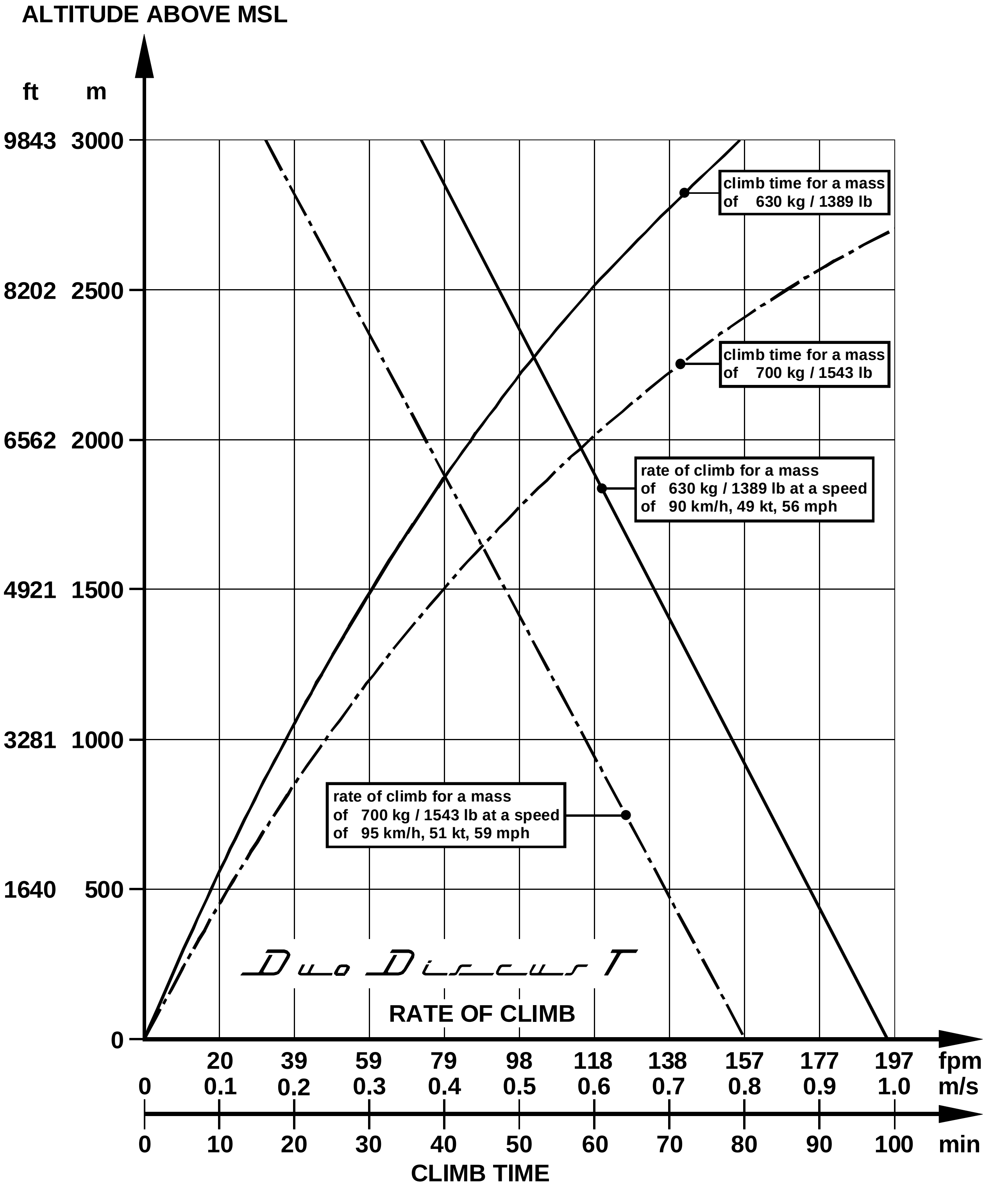
Average cruising speed approx.: 100 km/h (54 kt, 62 mph)

Fuel consumption approx.: 16.00 Liter/h
4.23 US Gal./h
3.52 IMP Gal./h

Usable fuel: Liter	US Gal.	IMP Gal.	All -up mass	Endurance	Range
16.0	4.23	3.52	700 kg 1543 lb	60 min	180 km (97 nm)
			630 kg 1389 lb		207 km (112 nm)

The range determined is based on climbs between 500 m and 1500 m (1640 - 4921 ft) above MSL.

Climb performance: See diagram on page 5.3.2.4 established for a mass of 630 kg and 700 kg (1389 lb and 1543 lb)


ALTITUDE ABOVE MSL
ft m
9843 3000
8202 2500
6562 2000
4921 1500
3281 1000
1640 500
0
climb time for a mass
of 630 kg / 1389 lb
climb time for a mass
of 700 kg / 1543 lb
rate of climb for a mass
of 630 kg / 1389 lb at a speed
of 90 km/h, 49 kt, 56 mph
rate of climb for a mass
of 700 kg / 1543 lb at a speed
of 95 km/h, 51 kt, 59 mph
Duo Discus T
RATE OF CLIMB
20 39 59 79 98 118 138 157 177 197 fpm
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 m/s
0 10 20 30 40 50 60 70 80 90 100 min
CLIMB TIME

5.3.3 Noise data

At 300 m (984 ft) AGL, the measured fly-over noise level of the "Duo Discus T" is

57.3 dB(A)

and is thus far below the noise level limit of 65.3 dB(A).

The "Duo Discus T" therefore complies with the revised Aircraft Noise Protection Requirements: Lärmschutzforderungen für Luftfahrzeuge (LSL),

effective on January 1st, 1991,
with changes, effective on April 6th, 1993.

It is recommended to wear a head set while the engine is running.

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 T” may be safely operated.

Procedures for weighing the powered 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 T” Maintenance Manual.

The equipment actually installed during the last weighing of the powered sailplane is shown in the “'Equipment List" to which page 6.2.3 and 6.2.4 refer to.

6.2 Weight and balance record / Permitted seat load range

The following loading chart (page 6.2.3) shows the maximum and minimum load on the seats - with the fuel load in the fuselage already taken into account.

For configuration ”power plant removed" refer to the loading chart on page 6.2.4.

These charts are established with the aid of the last valid weighing report - the required data and diagrams are found in the Maintenance Manual.

Both loading charts (weight & balance log sheets) are only applicable for this particular “Duo Discus T”, 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 two (2) 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).

Altering the front seat load by using trim ballast

Optional trim ballast mounting provision

On request the "Duo Discus T" 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:

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 plate required:
up to 5,0 kg (11 lb) less up to 10,0 kg (22 lb) less up to 15,0 kg (33 lb) less	see a)	1 2 3
up to 20,0 kg (44 lb) less up to 25,0 kg (55 lb) less up to 30,0 kg (66 lb) less	see b)	4 5 6

WEIGHT AND BALANCE LOG SHEET (loading chart) FOR S/N ....
■ POWER PLANT INSTALLED

Date of weighing:					
Empty mass [kg]					
Equipment list dated					
Empty mass c/g position aft of datum					
Max. useful load [kg] in fuselage incl. ballast in fin tank and f u e l					
Load [kg] on the seats (crew including parachute):					
Front seat load when flown solo:	max.	110	110	110	110
with two occupants:	max.				
Rear seat load with two occupants:	max.				
Water ballast fin tank installed (YES / NO)					
Front seat load regardless of load on rear seat, with a) Fin tank **NOT** installed b) Fin tank **installed**	 min. min.*				
Inspector Signature / Stamp					

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 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.

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.

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

■ POWER PLANT REMOVED:

Date of weighing:					
Empty mass [kg]					
Equipment list dated					
Empty mass c/g position aft of datum					
Max. useful load [kg] in fuselage incl. ballast in fin tank excl. fuel					
Load [kg] on the seats (crew including parachute):					
Front seat load when flown solo:	max.	110	110	110	110
with two occupants:	max.				
Rear seat load with two occupants:	max.				
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.*				
Inspector Signature / Stamp					

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 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.

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 1543	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 + fin ballast + fuel		LOAD ON THE SEAT (kg / lb)																										
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	
410	903	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	925	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	947	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	969	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	991	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
460	1013	170	44,9	37,4	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	20	5,3	4,4
470	1035	160	42,3	35,2	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	10	2,6	2,2
480	1057	150	39,6	33,0	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	20	5,3	4,4	0	0,0	0,0
490	1079	140	37,0	30,8	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	10	2,6	2,2	-	-	-
500	1101	130	34,3	28,6	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	20	5,3	4,4	0	0,0	0,0	-	-	-
		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 resp. 6.2.4, fin ballast as per page 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 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 is n o t allowed!

When determining the water ballast quantity for the fin tank, bear in mind that the maximum permitted load in the fuselage (see "Weight & Balance Log Sheet" on page 6.2.3 and 6.2.4) 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 ballast in wing tanks)
Δm_{FT}	=	ballast	in fin tank	(to compensate load on aft seat)

$m_{P1} + m_{P2} + m_{FT} + \Delta m_{FT}$ less or equal to maximum useful load in fuselage (see also page 6.2.3 and 6.2.4)

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.

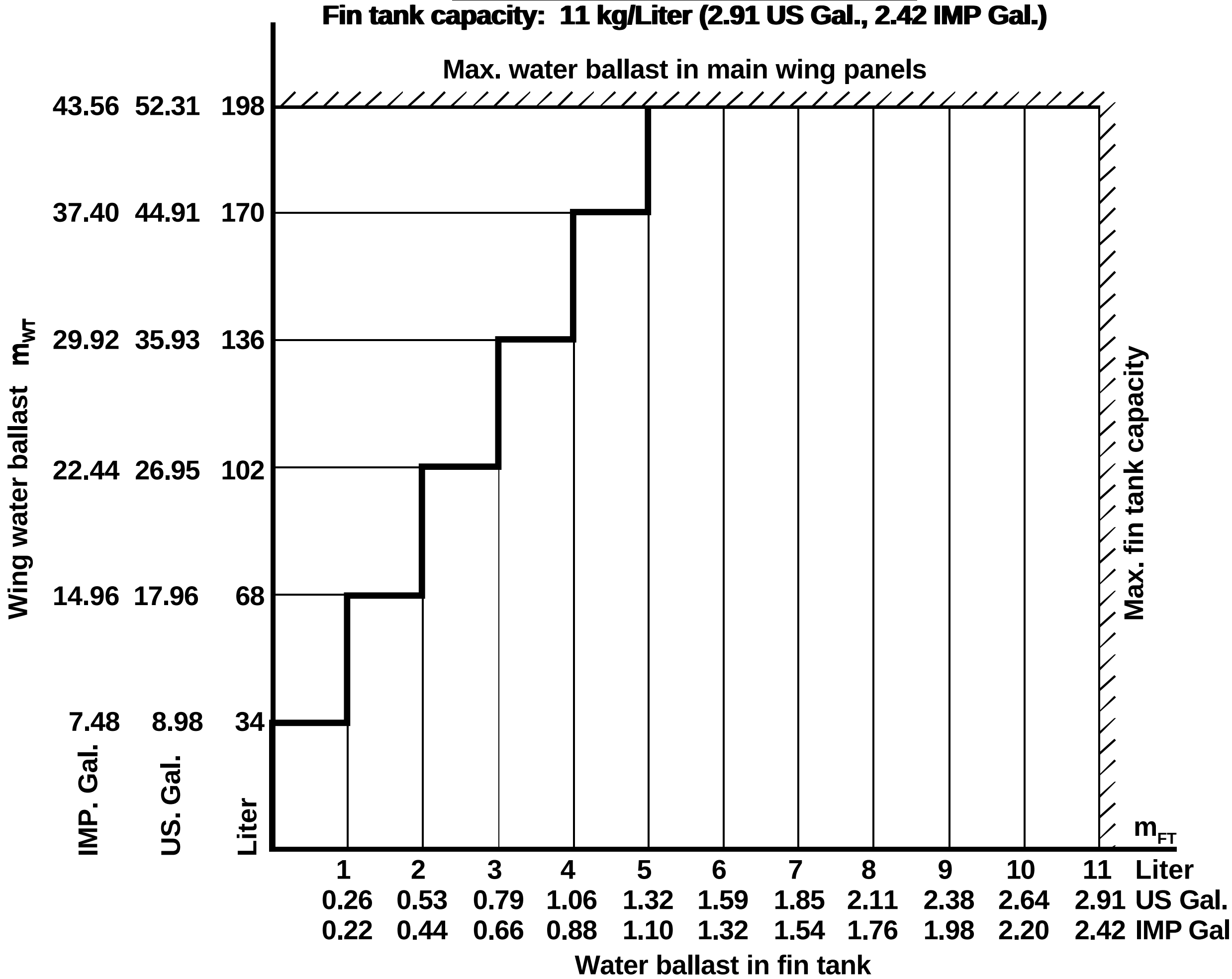
Example:

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

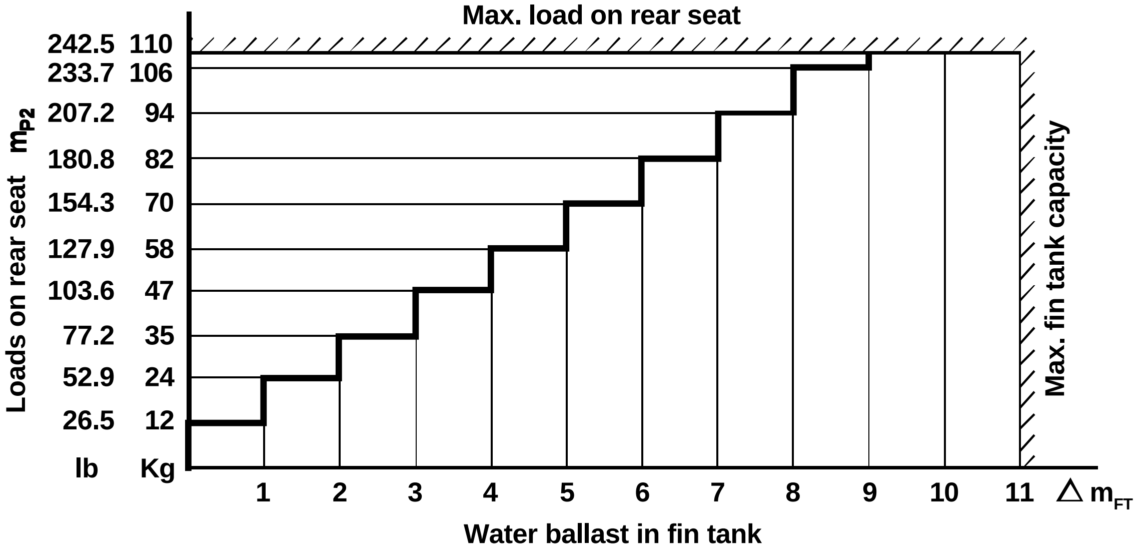
According to the diagrams on page 6.2.8 the following loads in the fin tank are permissible (fill only full Liters):

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

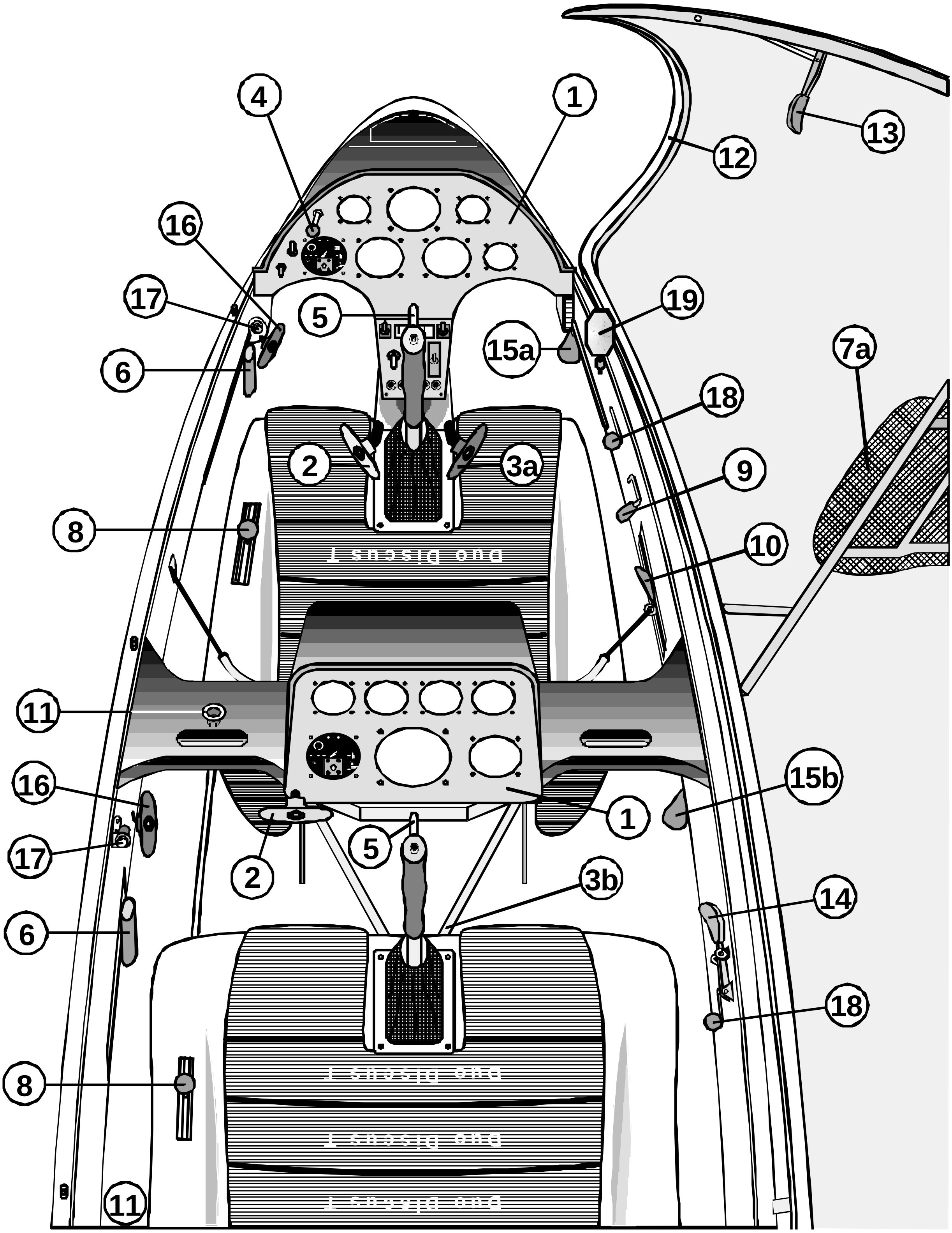
7.1 Introduction

This section provides a description of the powered 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 is attached to the canopy coaming frame on the fuselage and to the control stick mounting frame.

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

Small black knob on the front instrument panel on the left.

Pull to close ventilator
Push to open ventilator

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

(5) Wheel brake

A wheel brake handle is mounted on either control stick. Additionally the wheel brake can be actuated by extending the airbrakes fully.

(6) Airbrake levers

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

Forward position: Airbrakes closed and locked

Pulled back about 40 mm (1.6 in.):
Airbrakes unlocked

Pulled fully back: Airbrakes fully extended and wheel brake actuated

(7) Head rests

a) Front seat: Head rest (vertically adjustable) on canopy transverse frame

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- knob for dumping water ballast from wing tanks and (optional) fin tank

Black knob in the middle of the GFRP inner skin on the right.

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

The operating knob is locked in the extreme positions by swinging it downwards into a recess.

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

(11) Rip cord anchorage

Front seat: Red steel ring on tubular frame between the seats on the left

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 rear seat) on the GFRP inner skin on the right.

To remove the canopy, proceed as follows:

Remove pin securing the canopy release lever, swing back the latter and the canopy locking lever, disconnect restraining cable and lift off the canopy.

Undercarriage

(15a) Front seat

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

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

(15b) Rear seat

Black handle below the GFRP inner skin on the right.

This handle is provided to assist in operating the undercarriage. It also indicates whether the wheel is up or down.

This handle cannot be used, however, to lock the undercarriage.

(16) Decompression handle

Black T-shaped handle on the left hand side on the GFRP inner skin, forward of the airbrake lever, provided for either seat.

With handle pulled back, the decompression valves are opened.

(17) Push-button for electrical fuel pump

Red button on the left hand side on the GFRP inner skin, near the decompression handle, provided for either seat.

Pump is “ON" while button is depressed

Pump is “OFF” with button released

(18) Fuel shut-off valve

Black knob on the right hand side on the GFRP inner skin, provided for either seat.

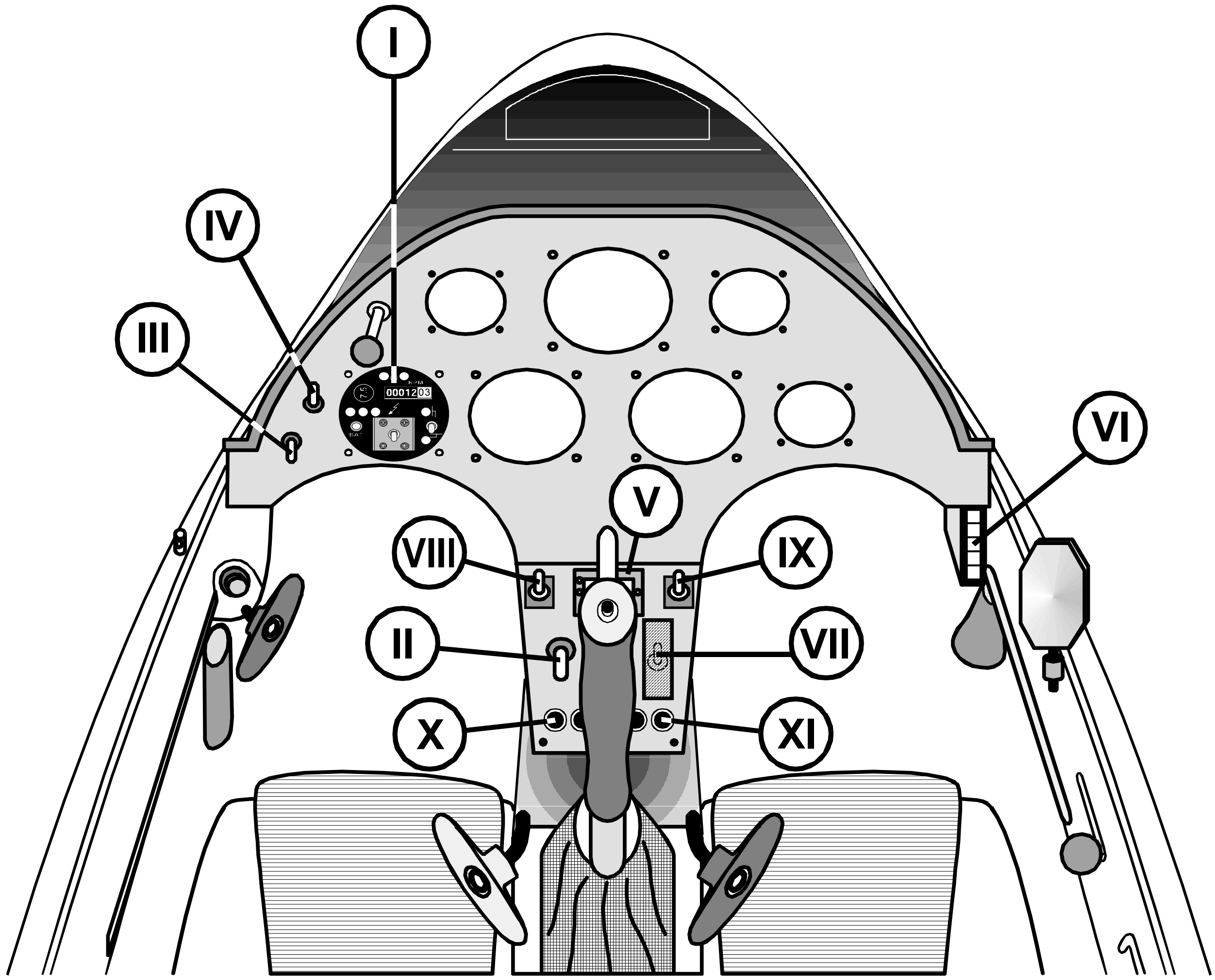
Forward position	-	Valve opened
Backward position	-	Valve closed

(19) Rear-view mirror

Front seat	:	Right hand side of cockpit
Rear seat	:	Upper canopy region

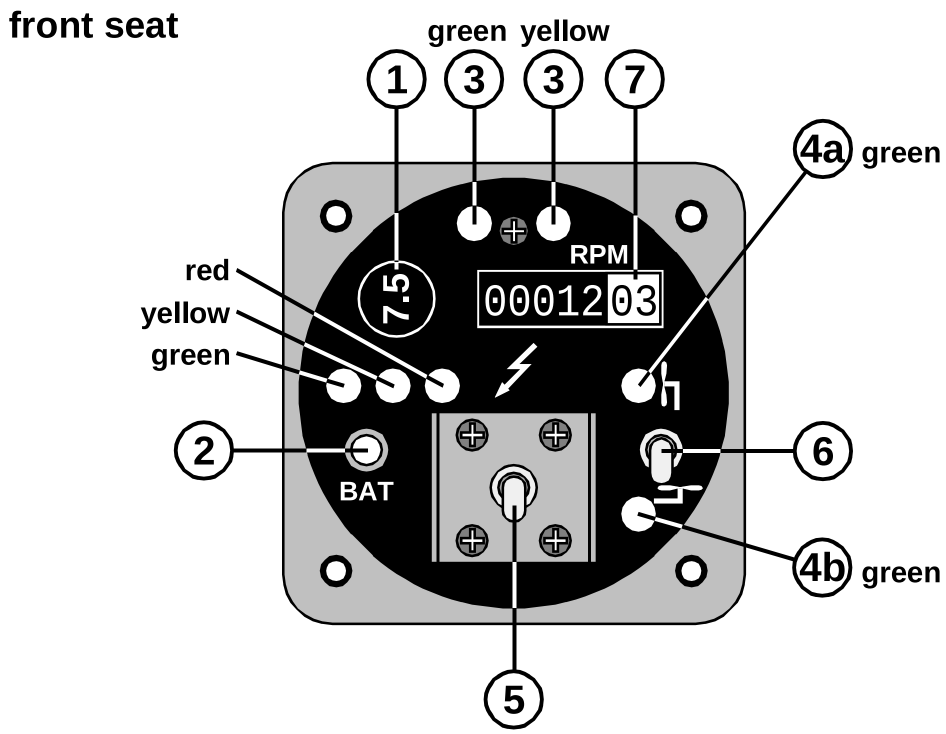
7.3.1 Instrument panels

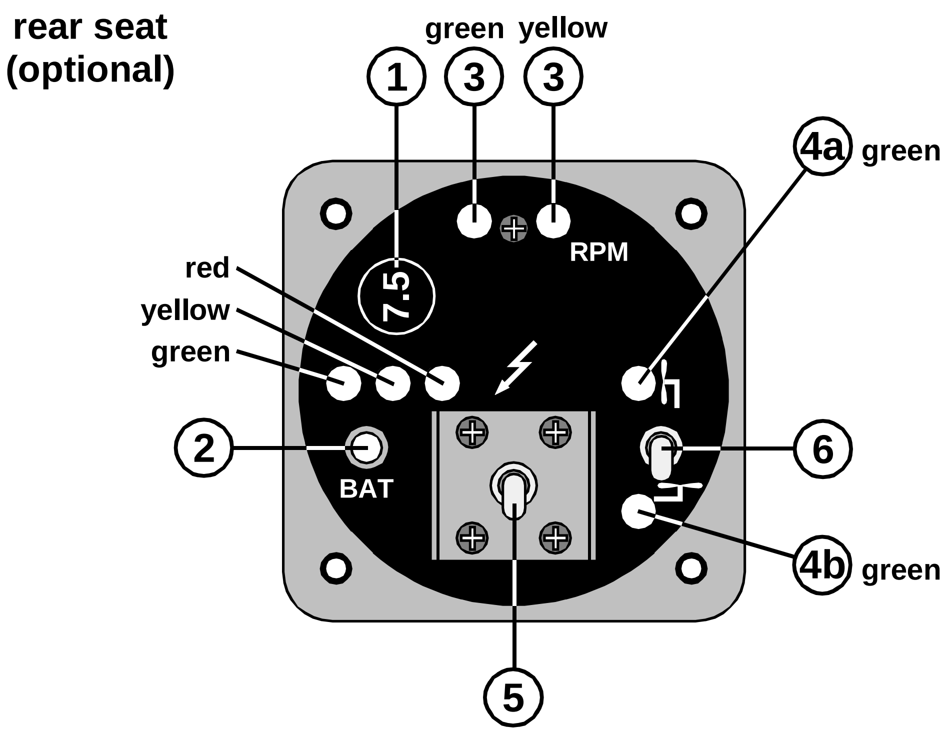
front panel:



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

I Engine control unit





I Engine control unit (ctd.)

(1) Automatic circuit breaker (7,5 A) protecting the pylon's spindle drive (actuatuor).

(2) Battery test button

Green signal	-	voltage is 11.5 V or more (a capacity of approx. 50%)
Yellow signal	-	voltage is between 11.5 V and 10.5 V (a capacity of approx. 25%)
Red signal	-	voltage is below 10.5 V

For safety reasons the (flashing) red signal appears automatically, i.e. independent of the test button, if voltage drops below 10.5 V.

(3) RPM indicator

No signal	-	RPM below 4500 or engine stopped
GREEN signal	-	RPM between 4500 and 6500 (= normal operating range)
YELLOW signal	-	RPM above 6500

(4) Pylon position indicator

a) GREEN signal - Power plant fully extended

b) GREEN signal - Power plant fully retracted

I Engine control unit (ctd.)

(5) Ignition switch

UP	-	ON
DOWN	-	OFF

(6) Pylon drive switch

This switch has three (3) operating positions:

UP	-	Power plant extends fully, pylon spindle drive is cut off by a limit switch
CENTER	-	Pylon spindle drive stops
DOWN	-	Power plant retracts while key is held down. When fully retracted, pylon spindle drive is cut off by a limit switch

Note: With ignition "ON", the power plant may be extended, but it cannot be retracted!

(II) Master switch

“ON/OFF" switch in front instrument panel.

UP	-	ON
DOWN	-	OFF

(III) Pneumatic valve

Panel-mounted two-way cock (should a total energy compensation probe be used).

T.E.	=	Variometer(s) fed from T.E. Compensation probe
STATIC	=	Variometer(s) fed from Static Pressure ports

Power on and valve switched to “STATIC”, the reading of the variometer(s) is steadier.

(IV) Pneumatic valve

Panel-mounted two-way cock for feeding the ASI from either the Pitot pressure head in the fin or in the fuselage nose.

power off	=	Pitot head in fin
power on	=	Pitot head in nose

(V) Fuel quantity indicator

Panel-mounted indicator (labelled “FUEL”), with the following markings:

LCD-display in liter (L)

8 L

(VI) Outside air temperature indicator

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

(VII) Priority selector switch (only with optional second engine control unit)

Key up: engine control unit in front panel active

Key down: engine control unit in rear panel active

Note:
The inactive engine control unit retains all its indicating functions – the commanding functions, however, are cut off.

> Warning:
> With power on, the priority may only be changed if the ignition on both control units is “ON”, otherwise the engine may stop running.
> With power off, the priority may only be changed if the ignition on both control units is “off” to prevent that the ignition is switched on unnoticed.

(VIII) Switch

Panel-mounted switch to select the power for the avionics:

Avionic Bat.: power for the avionics is provided by one of the batteries located in front of the rear seat.

Engine Bat.: power for the avionics is provided by the engine battery located at the steel tube transverse frame

(IX) Switch (only with optional two batteries in front of the rear seat)

Panel-mounted switch to select the power for the avionics either from the one or the other battery in front of the rear seat. That means this switch is only active, if switch VIII is switched to “Avionic Bat.”.

(X) Fuse (6,3 A)

Fuse to protect the complete avionics when fed from the engine battery.

(XI) Fuse (2 A)

Fuse to protect the two electrical fuel pumps (second fuel pump optional).

7.4 Undercarriage

The main wheel of the "Duo Discus T" 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 T" 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 T" 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.

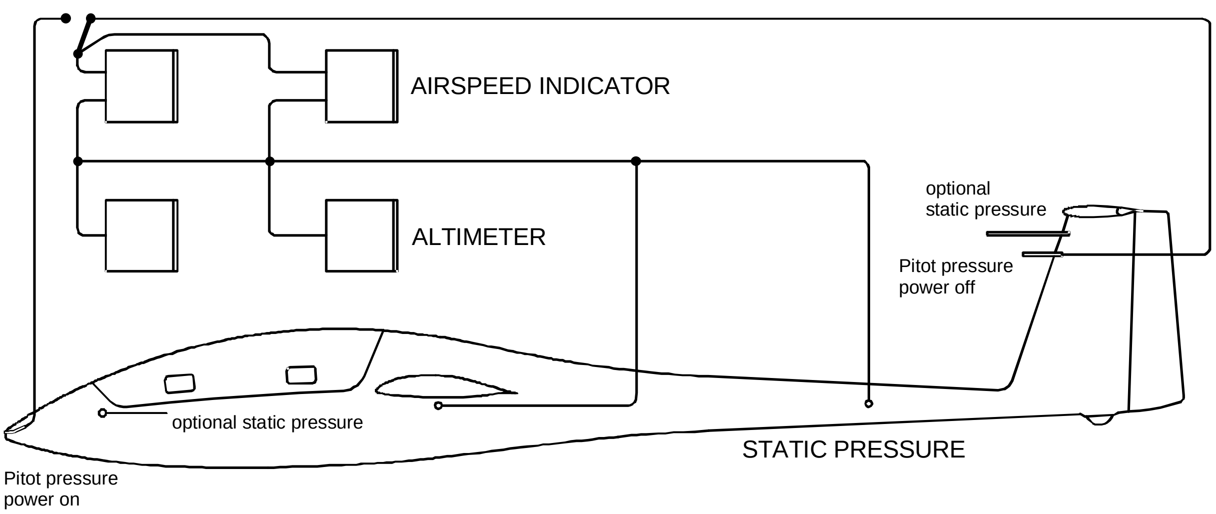
b) On request a special. static pressure probe can be installed near the top of the fin (for further instruments - except ASI).

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

a) For configuration “power plant retracted", the Pitot pressure head installed near the upper end of the fin is to be used.

b) For configuration “power on", the Pitot pressure head 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.

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.

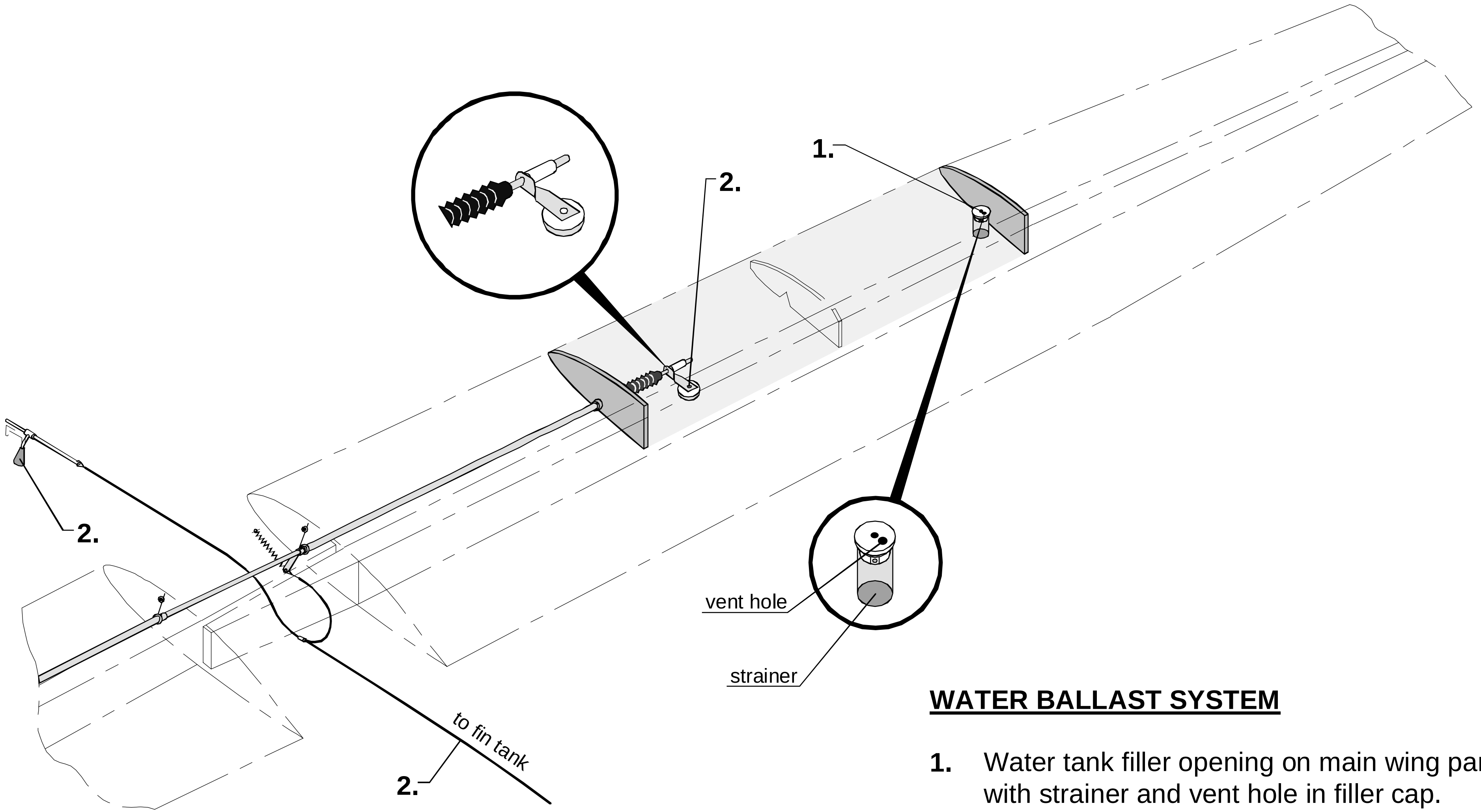
7.9 Water ballast system(s)

A steel cable connects the operating knob in the cockpit to a torque tube actuating the wing tank dump valves and - via a further steel cable - the dump valve of the (optional) fin tank - 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.

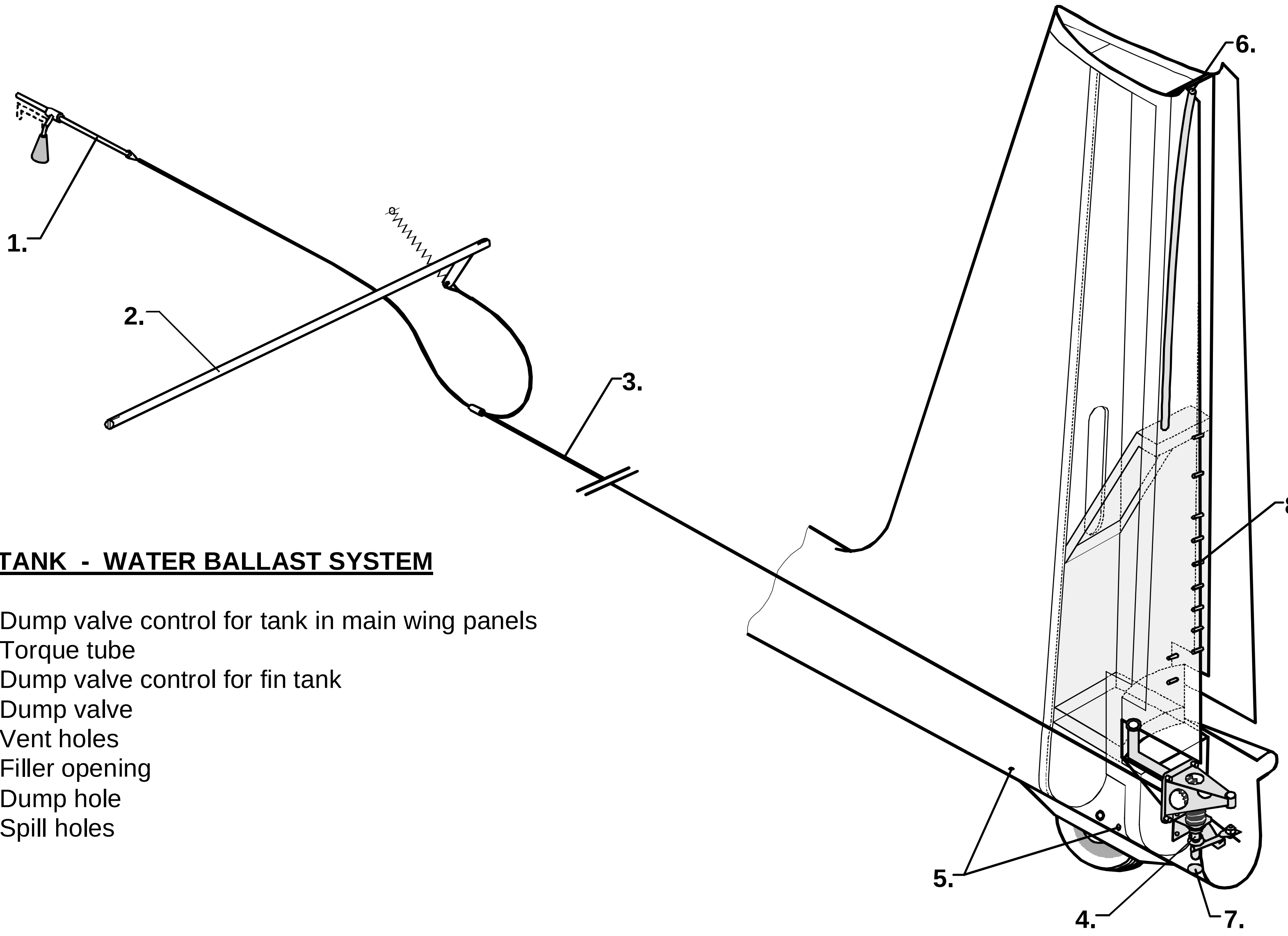
The operating knob in the cockpit is run in a gate and can be locked in its extreme positions.



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

7.10 Power plant system

The engine with its propeller (for a description and technical data refer to the relevant manuals) is suspended in the fork of the steel. tube pylon (by means of four (4) engine shock mounts) - the two engine arresting wires are also attached to the pylon.

An electrical spindle drive (actuator), anchored to the fuselage center frame and assisted by a gas strut, swings the pylon up and down.

A cable-actuated linkage opens and closes the doors of the engine bay automatically while the power plant extends/retracts.

A panel-mounted ILEC engine control unit combines a number of functions necessary to operate the power plant system - a description of this unit is found on page 7.3.2 and the following.

The only other controls required for operating the power plant are the fuel shut-off valve and the decompression handle.

For instructions on how to operate the power plant refer to page 4.5.3.5 and the following.

7.11 Fuel System

The central fuel tank is fitted between the struts of the steel tube center frame and is to be filled as described on Page 4.2.2.1.

The tank vent line extends overboard at the top of the fin (on the right) - its outlet must never be taped closed!

A drain valve for this tank is located at the bottom of the engine bay and is directly accessible.

For a view of the fuel system refer to Page 7.11.2.

Fuel gauge

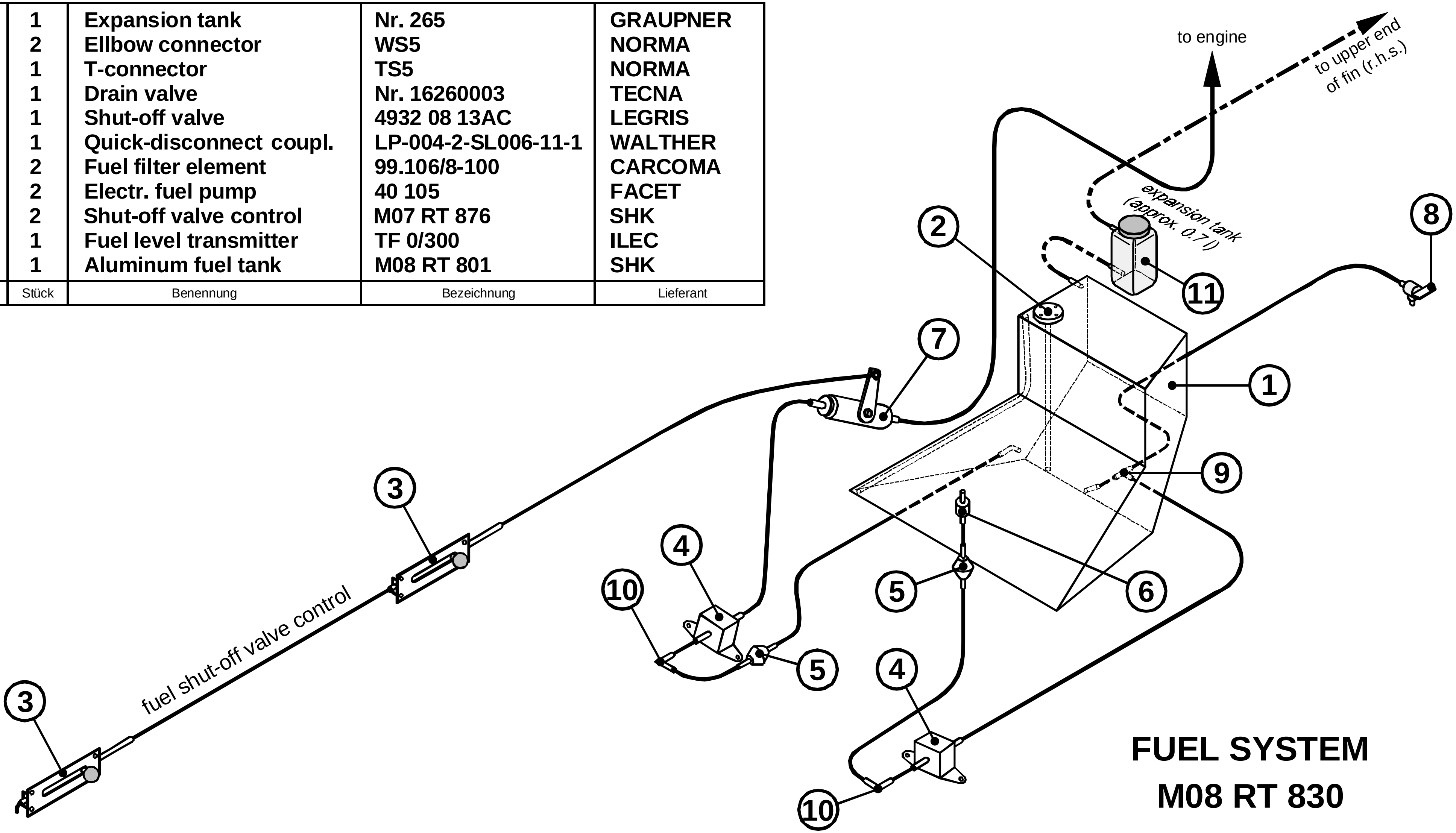
A fuel quantity indicator is provided for the front instrument panel - a description is given on Page 7.3.5.

Cleaning and draining the central tank

The tank may be cleaned and drained through its drain opening.

The fuel system is to be cleaned in compliance with the "Duo Discus T" Maintenance Manual.

Teil	Stück	Benennung	Bezeichnung	Lieferant
11	1	**Expansion tank**	**Nr. 265**	**GRAUPNER**
10	2	**Ellbow connector**	**WS5**	**NORMA**
9	1	**T-connector**	**TS5**	**NORMA**
8	1	**Drain valve**	**Nr. 16260003**	**TECNA**
7	1	**Shut-off valve**	**4932 08 13AC**	**LEGRIS**
6	1	**Quick-disconnect coupl.**	**LP-004-2-SL006-11-1**	**WALTHER**
5	2	**Fuel filter element**	**99.106/8-100**	**CARCOMA**
4	2	**Electr. fuel pump**	**40 105**	**FACET**
3	2	**Shut-off valve control**	**M07 RT 876**	**SHK**
2	1	**Fuel level transmitter**	**TF 0/300**	**ILEC**
1	1	**Aluminum fuel tank**	**M08 RT 801**	**SHK**



FUEL SYSTEM
M08 RT 830

7.12 Electrical system

Gliding avionics

When operated in the plain sailplane configuration, the minimum instrumentation prescribed does not require an electrical power source.

Additional- equipment is to be wired as shown on page 7.12.2 “ELECTRICAL SYSTEM – AVIONICS” 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.

Using a selector switch, power may also be provided by the power plant battery.

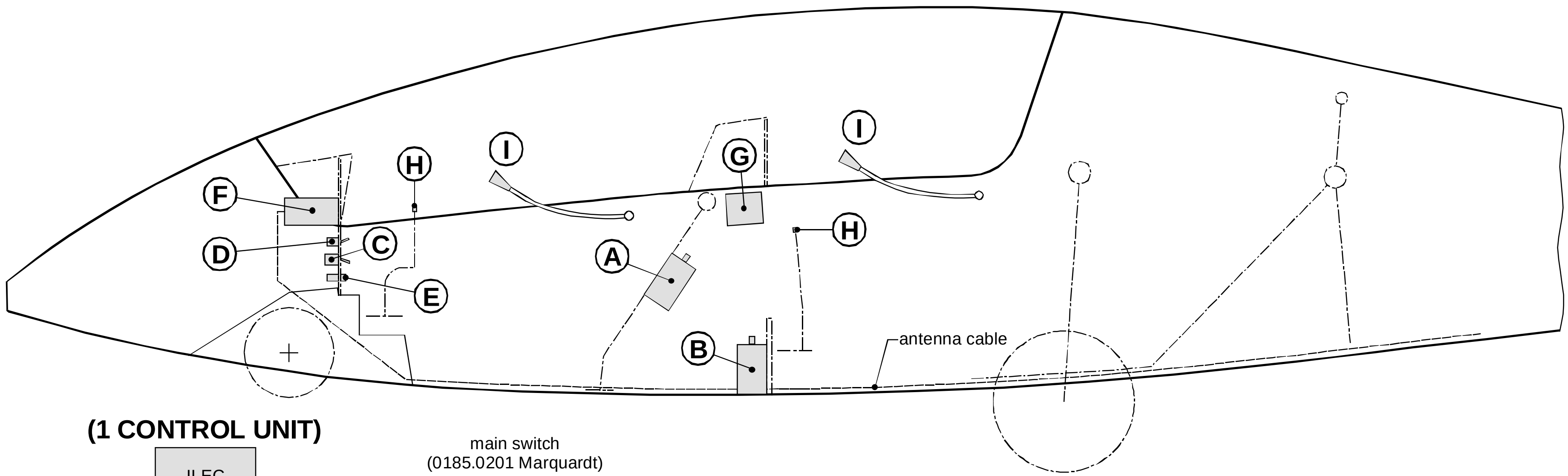
A main switch controls the batteries for the power plant and gliding avionics.

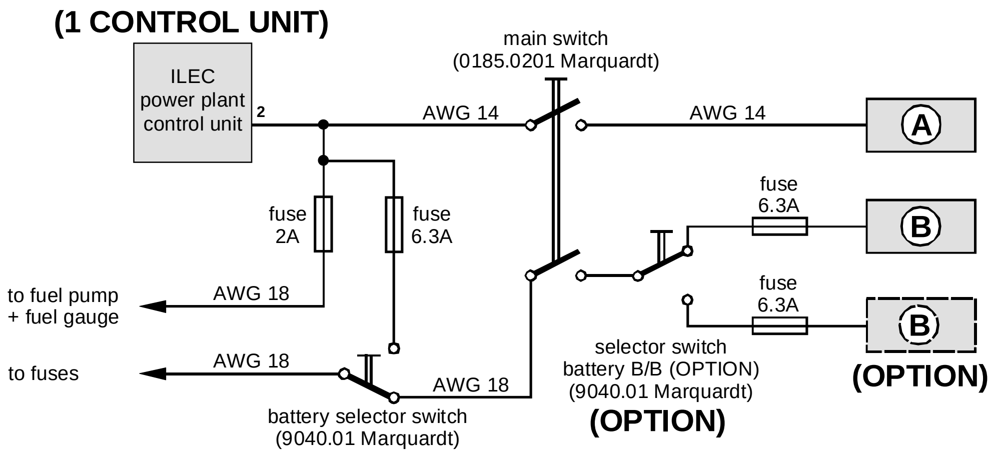
Power plant

The engine features a single-ignition system by means of magnetos (contactless) - a 12 V power source, attached to the steel tube transverse frame as shown on page 7.12.3 “ELECTRTCAL SYTEM - POWER PLANT", is only necessary for pylon spindle drive, fuel gauge and the ILEC control unit with its RPM-indicator.

This power source is controlled by the main switch and its voltage is displayed by the ILEC control unit.

By using a selector switch, it may also be used for the gliding avionics.

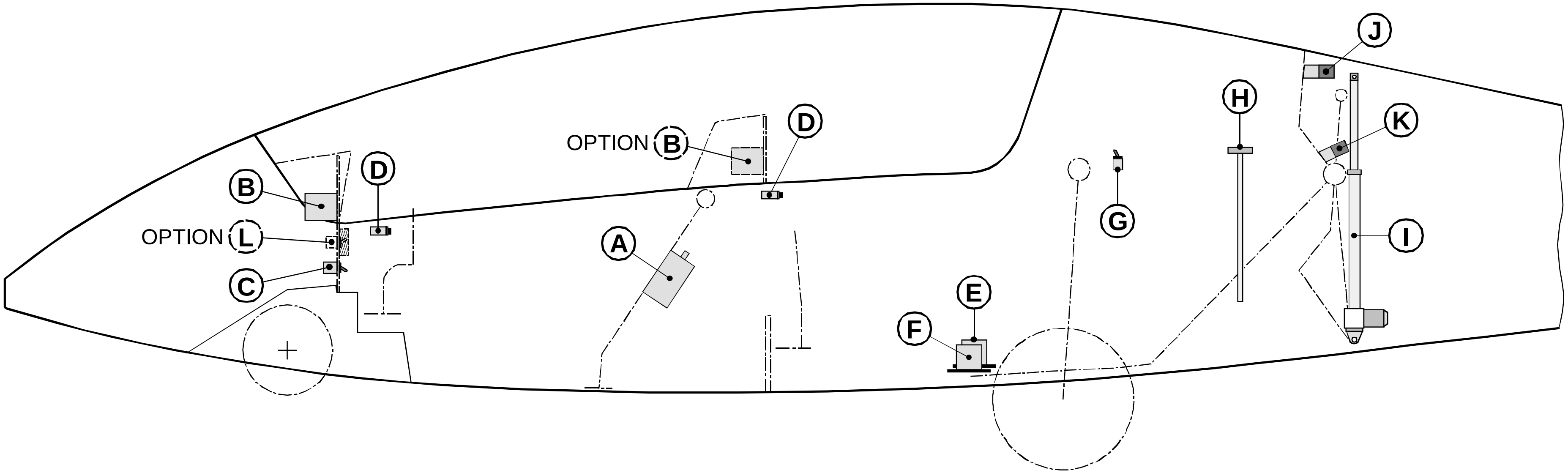




- **Ⓐ Power plant battery - 12V / 17Ah**
- **Ⓑ Avionic battery - 12V / 1x7.2Ah (OPTION 2x7.2Ah)**
- **Ⓒ Main switch**
- **Ⓓ Battery selector switch**
- **Ⓔ Fuses**
- **Ⓕ VHF-transceiver**
- **Ⓖ Loudspeaker**
- **Ⓗ PTT button**
- **Ⓘ Boom microphone**

NOTE: **Wiring of VHF-transceiver and other additional equipment must comply with the manufacturer's instructions. All instruments to be fused indiviually.**

ELECTRICAL SYSTEM - AVIONICS
M08 RE 811



ELECTRICAL SYSTEM
POWER PLANT
M08 RE 820

- **(A) Power plant battery - 12V / 17Ah**
- **(B) ILEC power plant control unit**
- **(C) Master switch**
- **(D) Fuel pump button**
- **(E) Electrical fuel pump**
- **(F) Electrical refueling pump**
- **(G) Fuel pump ON/OFF switch**
- **(H) Fuel level transmitter**
- **(I) Spindle drive (actuator)**
- **(J) Limit switch - power plant extended**
- **(K) Limit switch - power plant retracted**
- **(L) Priority switch (OPTION)**

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 T" 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 T” 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

8.1 Introduction

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

It also identifies certain inspection and maintenance requirements which must be followed if the powered 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 T" Maintenance Manual.

8.2 Powered sailplane inspection periods

(for details concerning the maintenance of this powered 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.

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

Power plant maintenance

Propeller:

Maintenance work on the propeller is to be conducted after every 25 hours of engine time or at least once every year and must comply with the instructions given in propeller manual.

Engine:

Maintenance work on the engine is required after every 25 hours of engine time or at least once every year and must comply with the instructions given in the engine manual.

For all other power plant accessories (pylon, pivoting mechanism, fuel system etc.), maintenance work is also required after every 25 hours of engine time or at least once every year.

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 powered 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 powered 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 T" 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 T" 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 powered 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 powered 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 powered 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 powered 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 powered 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!

- For cleaning those fuselage and tailplane areas that are facing the wake of the propeller, the use of a water soluble degreaser (e.g. FLEET - MAGIC EXTRA by Messrs. Chemsearch) is recommended.

  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 powered 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 powered 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 powered 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

9.1 Introduction

This section contains the appropriate supplements necessary to safely and efficiently operate the “Duo Discus T” 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
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