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FLIGHT MANUAL

for the

SAILPLANE

DG-500 ELAN Orion

Model: DG-500 ELAN Orion

German Data Sheet No.: 348

Factory Serial No.: _____

Registration No.: _____

Date of Issue: November 1995

Pages as indicated by "App." are approved by:

(Signature) _____

(Authority) Anerkannt durch Luftfahrt-Bundesamt

(Stamp) _____

(Original date of approval) 10. Nov. 95

This sailplane is to be operated in compliance with information and limitations contained herein.
The original German Language edition of this manual has been approved as operating instruction according to "Paragraph 12(1) 2. of Luft-Ger Po".
Approval of translation has been done by best knowledge and judgement.

Warnings

All sailplanes, especially those with retractable powerplants, are very complex technical devices. If you don't use yours as it is intended and within the certified operating limitations or if you fail to carry out proper maintenance work, it may harm your health or place your life in danger.

Prior to flying the aircraft read all manuals carefully and regard especially all **warnings, caution** remarks and **notes** given in the manuals.

- Never take off without executing a serious pre-flight inspection according to the flight manual!
- Never take-off with a motorglider without checking the max. engine RPM and the ignition circuits!
- Always respect the relevant safety altitudes!
- With a motorglider never rely completely on the engine extending and starting. Plan your flight path so that you are always able to carry out a safe outlanding if necessary. Be aware that with the engine extended but not running the rate of sink increases remarkably. This means that with a motorglider you have to decide earlier for an outlanding than with a pure sailplane.
- Selflaunch only if you are sure that with an engine failure during the initial climb there is the possibility to execute a safe outlanding or to return to the airfield.
- Respect the stall speeds and always fly with a safety margin above the stall speed according to the flight conditions, especially at low altitudes and in the mountains.

- Use only the types of fuel and oil for your motorglider as specified in the flight manual.
- Use only the battery chargers as specified in the flight manual.
- Don't execute yourself any work on the control system except for greasing.
- Repairs and maintenance work should only be accomplished by the manufacturer or at certified repair stations rated for this type of work. A list of stations which have experience with DG aircraft may be obtained from DG Flugzeugbau..
- Even if no annual inspections are required in your country, have your aircraft checked annually, see maintenance manual section 2.

0.1 Record of revisions

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

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

Rev. No.	Affected pages / section	Description	Issue Date	LBA Approval Date	Inserted Date Signature
1	0.3, 0.4, 1.4, 2.8, 4.11, 6.4, 6.8	TN 348/8 Ser.no 5E155-159 +5E164 only	Jan. 96	02.04.96	
2	0.3, 4.11	ÄM 500/9/96 not for Ser.no 5E155-159 +5E164	Mar. 96	12.06.96	
3	0.3, 0.4, 4.2, 4.18, 5.6, 6.7, 7.1, 7.9, 7.10	TN 348/9	Oct. 97	26.11.97	
4	0.1, 0.3, 0.4, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 4.7, 4.16, 4.18, 6.6, 7.6	Manual revision TN 348/14	March 2000	09.05.00	
4	0.3,0.4, 4.7, 7.6, 8.2	TN 348/15	Jan. 2001	07.02.01	

0.1

Rev. No.	Affected Pages/ section	Description	Issue Date	LBA Approval Date	Inserted Date Signature

0.2 List of effective pages

Section		page	issued	replaced	replaced
0		0.0	July 95		
		0.1	/		
		0.2	/		
		0.3	see record of revisions		
		0.4	"		
		0.5	July 95		
1		1.1	"		
		1.2	Nov. 95		
		1.3	July 95		
		1.4	"		
		1.4	Jan. 96 (only ser.no. 5E155-159)		
		1.5	July 95		
2	App.	2.1	"		
	"	2.2	"		
	"	2.3	"	March 00	
	"	2.4	"	March 00	
	"	2.5	"	March 00	
	"	2.6	"	March 00	
	"	2.7	"	March 00	
	"	2.8	"	Jan. 96	March 00
	"	2.9	"		
3	"	3.1	"		
	"	3.2	"		
	"	3.3	"		
	"	3.4	"		
4	"	4.1	"		
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	"	4.3	"		
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	"	4.10	"		
	App.	4.11	"		
		4.11	Jan. 96 (only ser.no. 5E155-159)		
	"	4.12	July 95		
	"	4.13	"		
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	"	4.16	"	March 00	
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	"	4.18	"	Oct. 97	March 00
	"	4.19	"		
	"	4.20	July 95		

0.2 List of effective pages (cont.)

Section		page	issued	replaced	replaced
5	"	5.1	July 95		
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		5.6	"	Oct. 97	
6		6.1	"		
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		6.8	"		
		6.8	Jan. 96	(only ser.no. 5E155-159)	
		6.9	July 95		
7		7.1	"	Oct. 97	
		7.2	"		
		7.3	"		
		7.4	"		
		7.5	"		
		7.6	"	March 00	Jan. 01
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		7.8	"		
		7.9	"	Oct. 97	
		7.10	"	Oct. 97	
8		8.1	"		
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0.3 Table of contents

Section 1

1.1 Introduction

The sailplane flight manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the DG-500 ELAN ORION sailplane.

This manual includes the material required to be furnished to the pilot by JAR Part 22. It also contains supplemental data supplied by the sailplane manufacturer.

1.2 Certification basis

This type of glider has been approved by the Luftfahrt-Bundesamt (LBA) in accordance with:

JAR Part 22 sailplanes and powered sailplanes Change 4, issued 7th May, 1987, including amendments 22/90/1, 22/91/1 and 22/92/1.

The Type Certificate No. 348 for the model DG-500 ELAN ORION was issued November 10, 1995.

Category of Airworthiness: "Utility" or "Aerobatic" with 17.2 m and 18 m wingspan without waterballast and if equipped properly.

1.3 Warnings, cautions and notes

The following definitions apply to warnings, cautions and notes used in the 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 procedure 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 DG-500 ELAN ORION is a twoplace high performance sailplane for training, performance flying and aerobatic training.

- wings in carbonfibre construction
- endplates for 17.2 m wingspan and wingtip extensions with winglet for 20 m span.
  18 m winglets are optional.
- automatic hook ups for all controls
- comfortable seating and modern cockpit design similar to the DG-single seaters - safety cockpit
- large 2 piece canopy for very good inflight visibility
- draught free canopy demist and 1 adjustable swivel air vent for each pilot
- sealed airbrake- and landing gear box
- retractable main wheel, spring mounted
- nose wheel and tail wheel

Technical data for all wingspans	
length	8.66 m / 28.4 ft
height	1.82 m / 6.0 ft
waterballast	160 kg / 353 lbs
max. TOW	750 kg / 1653 lbs
VNE	270 km/h / 146 kts

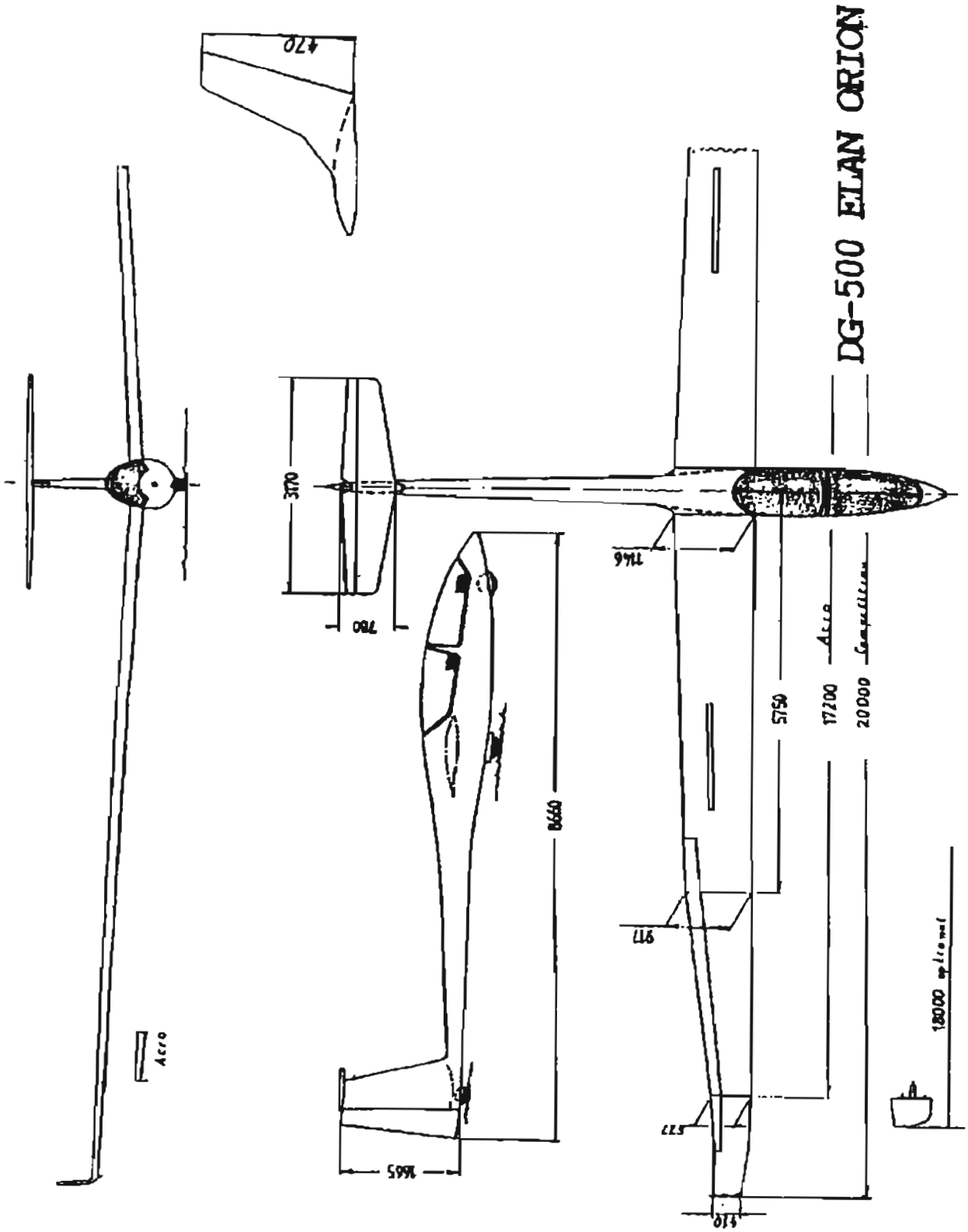
Technical data with 20 m span	
wing span	20 m / 65.6 ft
wing surface	17.6 m² / 189 ft²
aspect ratio	22.7
empty weight with batteries and. min. instr.	410 kg / 904 lbs
wingloading W/S (payload 85 kg / 187 lbs)	28.1 kg/m² / 5.76 lbs/ft²
maximum W/S	42.6 kg/m² / 8.72 lbs/ft²
stall speed (W = 525 kg / 1157 lbs)	68 km/h / 36.7 kts
best L/D (W = 750 kg / 1653 lbs at 110 km/h / 59 kts)	over 44
min. sink (W = 625 kg / 1378 lbs 60 km/h / 32 kts)	0.56 m/s / 149 ft/min.

Technical data with 18 m span	
wing span	18 m / 59.1 ft
wing surface	16.6 m² / 178.7 ft²
aspect ratio	19.5
empty weight with batteries and. min. instr.	400 kg / 882 lbs
wingloading W/S (payload 85 kg / 187 lbs)	28.2 kg/m² / 5.96 lbs/
maximum W/S	45.2 kg/m² / 9.26 lbs/
stall speed (W = 525 kg / 1157 lbs)	69 km/h / 37.3 kts
best L/D (W = 750 kg / 1653 lbs at 110 km/h / 59 kts)	over 40
min. sink (W = 625 kg / 1378 lbs 80 km/h / 43 kts)	0.65 m/s / 175 ft/min.

Technical data with 17.2 m span	
wing span	17.2 m / 56.4 ft
wing surface	16.2 m² / 174 ft²
aspect ratio	18.3
empty weight with batteries and. min. instr.	400 kg / 882 lbs
max. TOW for aerobatics	625 kg / 1378 lbs
wingloading W/S (payload 85 kg / 187 lbs)	29.9 kg/m² / 6.13 lbs/
stall speed (W = 525 kg / 1157 lbs)	70 km/h / 38.0 kts

A system with 2 fin ballast tanks is optional.
Tank A) to compensate the the C.G. shift due to wing water ballast, max. 6.6 kg.
Tank B) to compensate the mass of the rear pilot, max. 12.3 kg.
When dumping the wing tanks only tank A) will be emptied, the compensation of the rear pilot's mass remains even when flying without wing ballast. Tank B can only be emptied on the ground via the filling hose. For a detailed description refer to sect. 7.10.2.

1.5 3 view drawing



Section 2

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2.2 Airspeed

2.3 Airspeed Indicator Markings

2.4 Section not effective

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2.7 Weight

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2.17 Water ballast

2.18 Fin water ballast (Option)

2.19 Limitations Placards

2.1 Introduction

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

The limitations included in this section have been approved by the LBA.

2.2 Airspeed

Airspeed limitations and their operational significance are shown below:

	Speed	(IAS) km/h (kts)	Remarks
VNE	Never exceed speed	270 (146)	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection.
VRA	Rough air speed	190 (103)	Do not exceed this speed except in smooth air and then only with caution Rough air is in lee-wave rotor, thunderclouds etc.
VA	Manoeuvring speed	190 (103)	Do not make full or abrupt control movement above this speed, because under certain condition the sailplane may be over-stressed by full control movement.
VW	Maximum winch-launching speed	140 (76)	Do not exceed this speed during winch- or auto-tow-launching
VT	Maximum aero-towing speed	190 (103)	Do not exceed this speed during aerotowing
VLO	Maximum landing gear operating speed	190 (103)	Do not extend or retract the landing gear above this speed

Warning: At higher altitudes the true airspeed is higher than the indicated airspeed, so VNE is reduced with altitude see sect. 4.5.9.

2.3 **Airspeed Indicator Markings**

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

Marking	(IAS) value or range km/h	(kts)	Significance
Green Arc	90 -	190	**Normal Operating Range** (Lower limit is maximum
	(48.5 -	103)	weight 1.1 VS1 at most forward C.G. Upper limit is rough air speed.)
Yellow Arc	190 -	270	Manoeuvres must be conducted with caution and
	(103 -	146)	only in smooth air.
Red Line	270	(146)	Maximum speed for all operations.
Yellow Triangle	100	(54)	Approach speed at maximum weight

2.7 Mass (weight)

A) Category Aerobatic
Maximum Take-off mass: 625 kg, 1378 lbs.
Maximum landing mass: 625 kg, 1378 lbs.
B) Category Utility
Maximum Take-Off mass: 750 kg, 1653 lbs.
Maximum landing mass: 750 kg, 1653 lbs.
Maximum mass of all non lifting parts = 445 kg (981 lbs.)

Maximum mass in baggage compartment = 15 kg(33 lbs.)
Caution: Heavy pieces of baggage must be secured to the baggage compartment floor (screwing to the floor or with belts). The max. mass secured on one half of the floor (left and right of fuselage centre line) should not exceed 7,5 kg (16.5 lbs.).
Warning: Follow the loading procedures see sect. 6.

2.8 Center of gravity

Center of gravity range in flight is

185 mm (7.28 in.) up to 480 mm (18.9 in.) behind datum.

datum = wing leading edge at the rootrib

reference line = aft fuselage centre line horizontal
C.G. diagrams and loading chart see sect.6.

Warning: Flying is only allowed with the battery Z 07 installed in the fin as otherwise the forward C.G. limit may be exceeded. A suitable weight of 4.3 kg (9.5 lbs.) may be used instead of a battery.

2.9 Approved manoeuvres / Airworthiness category "Utility":

This sailplane is certified for normal gliding and simple aerobatics. Aerobatics is approved only without water ballast **in the wing tanks (and fin tank A)**. The following aerobatic manoeuvres are approved for all wingspan.

Manoeuvre	recommended entry speed IAS km/h	kts.
Spins	/	/
Inside Loop	200	108
Stall Turn	200	108
Lazy Eight	200	108
Chandelle	200	108

Approved manoeuvres Category Aerobatic:
(wingspans 17.2 m and 18 m, only without water ballast **in the wing tanks (and fin tank A)**)
All manoeuvres approved for category Utility and:

Inverted flight	recommended speed 140-200 km/h (76-108 kts.)
Slow roll	entry speeds 180-200 km/h (97-108 kts.)
Half roll and half loop	170-180 km/h (92-97 kts.)
Half loop and half roll	220 km/h (119 kts.)

2.10 **Manoeuvring load factors**
The following load factors are not to be exceeded:

Airworthiness category:		Utility	Aerobatic
at manoeuvring speed	VA	+5.3 -2.65	+7.0 -5.0
at max. speed	VNE	+4.0 -1.5	+7.0 -5.0
with airbrakes extended		+3.5	+3.5

2.11 **Flight crew**
a) single seated

max. load in the front seat	110 kg 242 lbs.
min. load in the front seat	see placard in cockpit and weighing report page 6.5

b) two seated
Max. cockpit load is 210 kg (463 lbs.) with a max. of 105 kg (231 lbs.) in the front seat or 110 kg (242 lbs.) in the front seat and 90 kg (198 lbs.) in the rear seat.
Min. cockpit load in the front seat is the min. cockpit load see a) minus 40% of the load in the rear seat.
This means that for every 10 kg (22 lbs.) in the rear seat the front seat load may be correspondingly 4 kg (8.8 lbs.) lower.
With these loads, the C.G. range given under 2.8 will be kept in the limits if the empty weight C.G. is in its limits.
see loading chart in sect. 6.

Caution: With lower pilot weights the necessary lead ballast must be added to the seat. Ballast put on the seat (lead ballast cushion) must be fastened at the safety belt anchorage points.
Installation for removable trim ballast see sect. 7.16.1.

Note: For Australia the min. load in the cockpit should not exceed 66 kg (146 lbs.). A provision for removable ballast see sect. 7.16.1 is mandatory.

2.14 Aerotow, winch and autotow launching

2.14.1 Weak links

10 000 N ± 10%
2 200 lbs. ± 10%

2.14.2 Length of the towing cable

for aerotow 30-70 m (100 - 230 ft)
Material: hemp- or plastic fibres

2.14.3 Max. towing speeds

Aerotow	VT = 190 km/h,	103 kts.
Winch- and autotow	VW = 140 km/h,	76 kts.

2.14.4 Tow Release

The C.G. tow release (installed in front of the main wheel) is suitable only for winch- and auto launching.
The nose hook is to be used only for aerotow.

2.14.5 Winch launching with fin tanks (option) filled

is prohibited if the tail-wheel does not rest on the ground at the beginning of the launch.
Note: If the tail-wheel doesn't stay on the ground by itself, press down the tail at the horizontal tail-plane from behind and hold it in this position.

2.15 Crosswinds

The maximum crosswind component according to the airworthiness requirements for take-off and landing is 15 km/h (8 kts).

2.16 Tyre Pressure

Main wheel	2.5 bar	36	psi
Nose wheel	2.5 bar	36	psi
Tail wheel	4 bar	58	psi

2.17 Water ballast in the wing tanks

Only symmetrical loading is allowed.
After filling balance the wings by dumping enough water from the heavy wing.
It is not allowed to fly with leaking watertanks, as this may result in asymmetrical loading condition.
Follow the loading chart, see sect. 6.8.
Max. capacity 80 l (21.2 US gal.) per wing.

2.18 Water ballast in the fin tank (Option)

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

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

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

2.12 **Kinds of operation**

A) with water ballast

- Flights according to VFR (daylight)
- Aerotow
- Winch- and auto-launching

B) only without water ballast in the wing tanks (and fin tank A)

- Cloud flying (daylight): permitted when properly instrumented (see below).
- Simple aerobatics see sect. 4.5.12 (Category Utility)
- Aerobatics see sect. 4.5.12 (Category Aerobatic) if properly instrumented (see below), only with 17.2 m and 18 m wing span.

Note: Cloud flying is not permitted in the USA, Canada and Australia.

2.13 **Minimum equipment**

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

a) **Normal operation**

Airspeed indicator
Range: 0-300 km/h (0-165 kts.)
Speed range markings see sect. 2.3
Altimeter
Altimeter with fine range pointer,
1 turn max. 1000 m (3000 ft.)
Magnetic compass (compensated in the aircraft, only required in Canada)
Four piece symmetrical safety harness
VHF - transceiver (ready for operation) with noise absorbing earphones
Battery Z 07 or a ballast weight of 4.3 kg (9.5 lbs.) installed in the fin.
Parachute automatic or manual type or a back cushion approximately 8 cm (3 in.) thick.
Required placards, check lists and this flight manual
With optional fin waterballast tanks: **OAT gauge** with blue markings for temperatures below 2° C.

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

Magnetic Compass (compensated in the aircraft)
Variometer
Turn and bank indicator
Remark: Experience has shown that the installed airspeed indicator system may be used for cloud flying.

c) **In addition for aerobatics** (Category Aerobatic):

Accelerometer capable of retaining max. and min. g-values with markings red radial lines at +7 g and -5 g.
Safety bows at the rudder pedals (standard equipment)

2.19 Limitations placards

ELAN FLIGHT - Slovenija

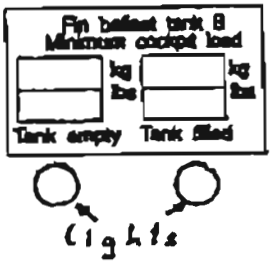
Type: DG - 500 ELAN Orion Year of construction:

Serial No. 5E X

Maximum airspeeds	km-h	kts.
Winch launch	140	76
Aero - tow	190	102
Manoeuvring V_A	190	102
Rough air	190	102
Landing gear operating	190	102
Maximum speed V_{NE}	270	146

Approved aerobatic manoeuvres (category utility U):
pos. Loop, Stall Turn, Chandelle, Spin
In addition category A:
Spans 17,2 or 18 m, only without waterballast
half loop and half roll, half roll and half loop, slow roll, inverted flight.

with optional fin tanks



Gepäck max. 15kg
Baggage max.33lbs.

Maximum mass: 625 kg (1378 lbs.) Category A
750 kg (1653 lbs.) Category U

Loading chart

Cockpit load:
(parachute included) front seat rear seat

maximum	110 kg	242 lbs	90 kg	198 lbs
or maximum	105 kg	231 lbs	105 kg	231 lbs
	kg	lbs		

Sollbruchstelle 10000 N
Rated load 2200 lbs.

Alt.	m	0-2000	3000	4000	5000	6000
VNE	Km/h	270	256	243	230	218
Alt.	ft	0-6500	10000	13000	16000	20000
VNE	Kts	146	138	131	124	117

Cockpit Check
1. Lead ballast (for under weight pilot)?
2. Parachute worn properly?
3. Safety harness buckled?
4. Front seat : pedals adjusted?
   Rear seat: seat height adjusted?
5. All controls and knobs in reach?
6. Altimeter?
7. Dive brakes cycled and locked?
8. Positive control check?
   (One person at the control surfaces)
9. Fin ballast tanks emptied or correct amount filled in?
10. Trim?
11. Both canopies locked?

Reifendruck 2,5 bar
Tyre pressure 36 psi

nose wheel

Reifendruck 3 bar
Tyre pressure 44 psi

main wheel

Reifendruck 4 bar
Tyre pressure 58 psi

tail wheel

limits for use of the fin waterballast tank						
minimum ground temperature	°C	13,5	17	24	31	38
	°F	56	63	75	88	100
maximum flight/altitude	m	1500	2000	3000	4000	5000
	ft.	5000	6500	10000	13000	16500

Other cockpit placards see sect. 7.

Section 3

3. Emergency procedures

3.1 Introduction

3.2 Canopy jettison

3.3. Bailing out

3.4 Stall recovery

3.5 Spin recovery

3.6 Spiral dive recovery

3.7 Recovery from unintentional cloud flying

3.8 Flight with asymmetric water ballast

3.9 Emergency wheel up landing

3.10 Ground loop

3.11 Emergency landing in water

3.1 Introduction

Section 3 provides a checklist and amplification for coping with emergencies that may occur. Emergency situations can be minimized by proper preflight inspections and maintenance.

Caution: Canopy jettison and bailing out should be practiced several times on the ground before flying the aircraft.

3.2 Canopy jettison

To bail out the white-red canopy opening handle (left) has to be operated with your right hand. Open the canopy as far as possible. If the canopy is not blown away by the oncoming air, you may release the open canopy by operating the red emergency release handle (right) with your left hand. The retaining line will tear off.

3.3 Bailing out

First open - jettison both canopies, then open the safety harness and bail out.
The low walls of the front cockpit allow for a quick push-off exit.

3.4 Stall recovery

By easing the stick forward and picking up a dropping wing with sufficient opposite rudder the glider can be recovered from the stall.
To recognize and prevent the stall, please refer to sect. 4.5.4.

3.5 Spin Recovery

Apply full opposite rudder against direction of the spin, pause, then ease stick forward until the rotation ceases, centralize the controls and carefully pull out of the dive. The ailerons should be kept neutral during recovery.

Caution: To prevent unintentional spinning do not stall the sailplane. Fly with enough speed reserve especially in gusty conditions and in the landing pattern.

Intentional spins with waterballast are not permitted.

Height loss during recovery	m	50-100
	ft	160-330
max. speed during recovery	km/h	200
	kts	108

3.6 Spiral dive recovery

Apply rudder and aileron in opposite direction and carefully pull out of the dive.

Spiral dive occurs only when spinning more than 2 turns with medium C.G. positions, see sect. 4.5.12.

To prevent spiral dives intentional spinning should only be executed at the C.G. positions specified in sect. 4.5.12 without waterballast.

Recovery from unintentional spinning should be done immediately.

3.7 Recovery from unintentional cloud flying

Spins are not to be used to lose altitude. In an emergency, pull out the dive brakes fully before exceeding a speed of 200 km/h and fly with max. 200 km/h (108 kts) until leaving the cloud.
At higher speeds up to VNE, pull out the dive brakes very carefully because of high aerodynamic and g-loads.

3.8 Flight with asymmetric waterballast

If you suspect that the waterballast does not dump symmetrically you have to close the dump valves of the wingtanks immediately, to avoid greater asymmetry.

Asymmetry can be verified by the necessary aileron deflection in straight flight at low airspeeds.

When flying with asymmetric waterballast you have to increase the airspeed, especially in turns, so that you can avoid a stall at all costs.

If however the aircraft does enter a spin, you have to push the stick forward during recovery.

Fly the landing pattern and touch down appr. 10 km/h (6 kts) faster than usual and after touch down control carefully the bank angle to avoid the wing touching the ground too early.

3.9 Emergency wheel up landing

It is not recommended to execute a wheel up emergency landing, as the energy absorption capability of the fuselage is much smaller than that of the landing gear.
If the landing gear can't be extended use wing flap setting L and touch down with small angle of attack.

3.10 Emergency ground loop

If there is the risk of overshooting the landing strip you have to decide at least 40 m (130 ft) before the end of the field to execute a controlled ground loop.
If possible turn into the wind and lift the tail by pushing the stick forward.

3.11 Emergency landing on water

From the experience with emergency water landing we know, that it is likely that the sailplane will dive into the water, cockpit first.

Therefore an emergency landing on water should be the last choice.
In the case of a water landing, however, extend the landing gear.

Section 4

4.1 Introduction

Section 4 provides checklist and amplified procedures for the conduct of normal operation. Normal procedures associated with optional systems can be found in section 9.

4.2 Rigging and derigging, filling the watertanks

4.2.1 Rigging

1. Open the rear canopy.

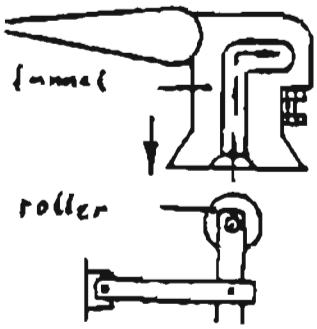
2. Clean and lube the pins, bushings and the control connections.

3. Rigging the inboard wing panels.
   All controls hook up automatically. Therefore set the wing flap handle into zero position and the airbrake handle to the forward stop. The airbrakes must be locked. Screw one of the rear wing securing pins on the tool W 38/2. Close the rear canopy. Push the right wing panel into place. Insert the rear securing pin with the tool at the rear attachment fitting. Push in the tool so far that the upper surface of the brass part of the tool is flush with the wing surface. Screw off the tool. Check if the locking device for the securing pin has engaged. Screw the other securing pin on to the tool. Open the rear canopy. Push in the left wing. Mount and check the left securing pin by the same method as the right side.
   Push in the two main pins as far as possible. Place the handles horizontal or upright. Release the wings. Finally screw in the securing screws in the main pins. When the screws are fastened press the handles of the screws into the clips at the main pin handles.

4. Rigging of the stabilizer
   Check if the battery is installed in the fin and is connected. Operating the glider without the battery or without a ballast weight of 4.3 kg (9.5 lbs.) is not permitted as the forward C.G. limit may be exceeded.
   Set the trim nose down.
   Screw the tool W 38/2 into the securing plate (near the top of the left surface of the fin). Pull out the securing plate with the tool, move it downwards to engage in the rigging position.

4. ff
   Set the stabilizer on, so that the roller at the fuselage side push rod is inserted into the funnel at the elevator.

   Watch carefully the procedure.



   When the stabilizer is set down and laying on the fin, push it aft. The roller will slide forward in the funnel if you hold the elevator in the pertinent position.

   Release the securing device by pulling out with the tool and engage the securing device by lifting the tool. The securing plate must be flush with the surface of the fin. Screw out the tool.

   Check for correct elevator connection by looking from the rear into the gap at the right hand side of the rudder.

5. **Rigging and derigging the endplates for 17.2 m span**
   The endplates are to be fixed to the wings with 2 flathead screws M10 x 40 DIN 7991-8.8 zn. The screws must therefore be inserted into the front and rear lift pin bushes and to be fastened with a 6 mm Allen key.

6. **Rigging and derigging the wing tip extensions and of the 18 m tips** (Option)
   1. Insert the wing tip extensions into the wing. Press in the locking pin with your finger. Insert the wing tip so far that the aileron connectors starts to slide into the flaperon slots. Strike firmly with the palm of your hand on to the wing tip to lock in the wing tip extension.
   2. Disassembling of the wing tip
      Use a 6 mm diameter pin for pressing in the locking pin on the wings upper side.

7. Tape the gaps of the wing-fuselage junction.

8. Positive control check.

4.2.2 Filling the wing water ballast tanks

With an optional fin tank first push forward the handle for the fin tank.
To fill the water ballast, pull back the respective handle (top-right tank, bottom-left tank) in the cockpit.
Place one wingtip on the ground. Attach the hose supplied with your glider in the water outlet on the lower surface of the wing.
Warning: Fill the hose from your water containers but never from a mains pressure water supply. Filling the wing tanks with excessive pressure (more than 0.2 bar, 3 psi) will definitely burst the wing shell!
Caution: If the tanks are to be filled up completely you must suck the air out of the tanks with the filling hose.
Fill with the desired amount of water regarding the loading chart see sect. 6. After filling close the valve with the water ballast handle and remove the hose. Place the other wingtip on the ground and fill the other tank.
In case a valve leaks slightly, you may try to pull out the PVC pushrod of the valve to stop the leak. If this cannot be done successfully refer to maintenance manual 1.8.2. and 4.1.
It is not allowed to fly with leaking watertanks,as this may result in asymmetrical loading condition.
After filling the tanks, check to see if the wings are balanced. If one wing is heavier, dump enough water to balance the wings.

4.2.3 Filling the fin waterballast tanks (Option)

Wing ballast compensation tank (Tank A)

a) This tank must be filled after filling the wingtanks.
Determine the amount see sect. 6.8.5a).
Connect the transparent funnel equipped filling hose (supplied with the aircraft) via the hose connector GRS 10-12 to the hose which comes out of the left rear end of the fuselage. The funnel can be suspended at the top of the rudder.
Fill with clean water using a graduated measuring vessel.
In addition, the loaded quantity can be checked by holding the filling hose to the scale at the fin (communicating tube).
After filling, close the fin tank dump lever.
Then remove the filling hose with the hose connector.

b) **Rear Pilot mass compensation tank (Tank B)**

Connect the short hose with nipple to the hose connector of the funnel equipped filling hose which is also used for filling Tank A.

Determine the amount see sect. 6.8.5a).

Rotate the coupling out of the lower side of the fuselage (in front of the tailwheel).
To rotate the coupling press upwards the forward end of the cover.
Move upwards the cap ring of the coupling and plug in the nipple into the coupling.
The funnel can be suspended at the top of the rudder.
Fill with clean water using a graduated measuring vessel.
In addition, the loaded quantity can be checked by holding the filling hose to the scale at the fin (communicating tube).

After filling remove the nipple. The coupling closes automatically. Check to see if the control light in the front instrument panel displays "tank filled". The "tank empty" light must be off.

4.2.4 **Draining the fin tank B**

Rotate the coupling out of the lower side of the fuselage, same as for filling the tank. Plug in the nipple with the short hose (without the long hose with funnel) into the coupling. Let the water drain out of the tank.

4.2.5 **Derigging**

Derigging follows the reverse of rigging.
Water ballast in the wings must first be emptied.
Lock the airbrakes.
For disassembling the wing securing pins the tool W 38/2 must be screwed into the bolt completely.
The brass part of the tool will then disengage this bolt.
It is recommended to leave the securing bolt in the right wing while you derig the left wing.

4.3 Daily Inspection

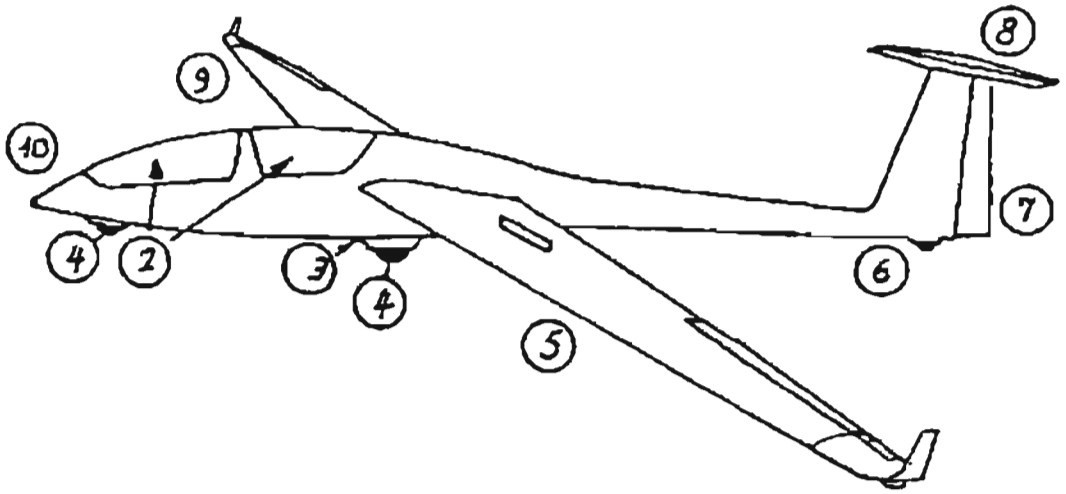
Please keep in mind the importance of the inspection after rigging the glider and respectively each day prior to the first take off. It is for your safety.

Caution: After a heavy landing or if other high loads have been subjected to your sailplane, you must execute a complete inspection refering to maintenance manual sect. 2.3 prior to the next take off. If you detect any damage, don't operate your aircraft before the damage is repaired. If the maintenance- and repair manual don't give adequate information, please contact the manufacturer.

A Inspection prior to rigging

1. Wing roots and spar ends
   a) check for cracks, delamination etc.
   b) check the bushes and their glued connection in root ribs and the spar ends for wear
   c) check the control hook ups at the rootrib for wear and corrosion
   d) check the strings which hold the waterbags for sufficient tension (see maintenance manual sect. 4.1)
2. Fuselage at wing connection
   a) check the lift pins for wear and corrosion
   b) check the control hook ups including the water-dumpsystem for wear and corrosion
3. Top of the vertical fin
   a) check the mounting points of the horizontal tailplane and the elevator control hook up for wear and corrosion
   b) check if the battery is installed in the fin and connected
4. Horizontal tailplane
   check the mounting points and the elevator control hook up for wear and corrosion
5. Rigging points for the outboard wing panels
   Check the lift pins and bushes for wear and corrosion and check their glued connections. Check the securing pin for function and enough spring force.

B Inspection after rigging
Walk around the aircraft



1. All parts of the airframe
   a) check for flaws such as bubbles, holes, bumps and cracks in the surface
   b) check leading and trailing edges of the wings and control surfaces for cracks
2. Cockpit area
   a) check the canopy locking mechanism
   b) check the canopy emergency release see sect. 7.15 (not each day, but min. every 3 month)
   c) check the main pin securing
      check the securing ropes of the headrest in the rear cockpit for wear and function
   d) check all controls for wear and function, incl. positive control check
   e) check the tow release system for wear and function incl. cable release check
   f) check for foreign objects
   g) check the instrumentation and radio for wear and function
   h) check the radio and other electrical equipment for function. If there is no electric power it must be assumed, that the battery is not in-stalled in the fin. **Flying is only allowed with the battery in the fin as otherwise the forward C.G. limit** may be exceeded.
   i) check the brake fluid level
   j) check if the fin tank is empty
3. C.G. Tow hook
   a) c heck the ring muzzle of the C.G. hook for wear and function
   b) check for cleanliness and corrosion
4. Main landing gear and nose wheel
   a) check the struts, the gear box, the gear doors and the tyre for wear; dirt in the struts can hinder the landing gear from locking over center the next time!

4.3 B ff

b) check the tyre pressure
mainwheel: 3.0 bar - 44 psi
nose wheel: 2.5 bar - 36 psi

c) check wheel brake and cable for wear and function

5. Left wing
   a) check locking of the outboard wing or screwed joint of the endplates
   b) check the aileron for excessive free play
   c) check airbrake and box and control rod for wear and free play. It must be possible to retract the airbrake, even if it is pressed in backward direction. If there is any water in the airbrake box this has to be removed.
   d) check the locking of the rear wing attachment pin
6. Tail wheel
   a) check for wear, free play and excessive dirt in the wheel box. Remove excessive dirt prior to take off!
   b) check tyre pressure: 4 bar -58 psi
7. Rear end of the fuselage
   a) check the lower rudder hinge and the connection of the rudder cables for wear, free play and correct securing
   b) check the bulkhead and fin trailing edge shear web for cracks and delamination
8. Fin - horizontal tail
   a) check the upper rudder hinge for wear and free play
   b) check the elevator for free play and correct control hook up, look from the rear into the gap at the right hand side of the rudder
   c) check the securing of the stabilizer
   d) check the horizontal tail for free play
   e) check the TE or Multiprobe for correct insertion
9. Right wing
   see detail 5.
10. Fuselage nose
   a) check the ports for the static pressure and the pitot pressure for cleanliness.
   b) if the sailplane was parked in rain, you have to empty the static ports by sucking out the water at the ports.
   c) check the nose hook for cleanness and corrosion

4.4 Preflight inspection

1. Lead ballast (for under weight pilot)?
2. Parachute worn properly?
3. Safety harness buckled?
4. Front seat: pedals adjusted?
   Rear seat: seating height adjusted?
5. All controls and knobs in reach?
6. Altimeter?
7. Dive brakes cycled and locked?
8. Positive control check? (One person at the control surfaces).
9. Fin ballast tanks emptied or correct amount filled?
10. Trim?
11. Both canopies locked?

4.5 Normal procedures and and recommended speeds

4.5.3 Launch

Due to the towhook position being in the middle of the fuselage and the excellent effectiveness of the ailerons and rudder, the possibility of wing dropping or ground loops, even on a slow starting aerotow is reduced. Take-off with strong crosswind is possible.

Aerotow

a) Aerotow is permitted only using the nose tow release. Set trim to neutral for aerotow.

b) Pull the stick until the nose wheel lifts off from the ground. Then control the airplane so that nose wheel and tail wheel don't touch the ground. Don't try to lift off before you reach an airspeed of 80 km/h (43 kts) (without ballast).
On a rough airfield hold the control stick tight. The undercarriage can be retracted at safety height during the tow.

Normal towing speed is 120-130 km/h (65 - 70 kts).

For a cross country tow the speed can be as high as 190 km/h (103 kts).

Warning: Aerotow with high take off weight requires a powerful tow plane. Many tow planes are not certified to tow gliders with high take off weights. Reduce the take off weight if necessary!

Winch launch (only allowed at the C.G. release)

Set the trim fully nose down for winch launch. To accomplish this, operate trimmer lever on the control column and push the control knob on the left cockpit wall to its forwardmost position.

Caution: During ground roll and initial take-off (especially when flying solo) push the control stick to its forwardmost position or fully nose-down to prevent excessive nose up pitching rotation during initial take-off.

After reaching safety altitude gradually pull back the stick, so that the glider will not pick up excessive speed. Don't pull too hard.

After reaching release altitude pull the tow release knob.

Recommended winch launch airspeed 110-120 km/h (60-65 kts).

Caution: Do not fly at less than 90 km/h (49kts) or not more than 140 km/h (76 kts).

Caution:
To avoid a strong impact at the tail-wheel due to surging of the winch cable the tail-wheel should rest on the ground at the beginning of the winch launch. If the tail-wheel doesn't stay on the ground by itself, it is recommended to press down the tail at the horizontal tail-plane from behind and hold it in this position.

Warning: Winch launch with high take off weight requires a powerful winch!

4.5.4 Free flight

Stalling characteristics (level and turning flight)
When stalled the DG-500 ELAN ORION will continue to fly level with high sink rate and buffeting.
If the stick is pulled further the DG-500 ELAN ORION will drop the nose or drop one wing.
During the stall a large angle of attack will be reached.
At forward C.G. positions the DG-500 ELAN ORION can be flown in stall without wing or nose dropping.
When reaching the minimum speed, the angle of attack has to be increased significantly before the DG-500 ELAN ORION stalls. Therefore stalled flight is easy to recognize.
With stick forward and opposite rudder if required the DG-500 ELAN ORION can be recovered without much loss of height. Rain does not influence this behaviour noticeably. The loss of height is ca. 30 m. Stall airspeeds see sect. 5.2.2.

Caution
Flight in conditions conductive to lightning strikes must be avoided.

4.5.7 **Approach and landing**

Abeam the landing point extend the landing gear (Option).
In calm weather approach with approx.100 km/h (54 kts). With strong wind fly faster!

The very effective Schempp-Hirth dive brakes make a short landing possible. A slip is therefore not necessary as a landing technique.

Caution: While slipping, the rudder is sucked in its displaced position. So it is recommended to practice slipping at a higher altitude.

Strong crosswind offers no problem.
Do not approach too slowly with fully extended airbrakes otherwise the aircraft may drop during flare out.
When flaring out keep the airbrake setting you were using, opening them further may drop the sailplane.
Clean the landing gear and tow release after landing in an muddy field. Dirt in the front strut (Option retractable landing gear) can keep the landing gear from locking over center next time. Simply hosing with water is the best cleaning method.

Landing with the landing gear retracted
Wheel up landing is not recommended see emergency procedures sect. 3.9..

After wheel up landing check the fuselage belly, the tow hook and the tow hook bulkheads for damage.

Landing with asymmetric waterballast
See emergency prodcedures sect. 3.8..

4.5.8 Flight with water ballast

Wing tanks

recommended ballast for smooth thermals:

rate of climb			ballast		
	m/s	fpm	kts	ltr.	U.S. gallo
below	1,5	300	3	none	
	1,5-3	300-600	3-6	100	26
more than	3	600	6	max. ballast	

Do not exceed the maximum gross weight when loading the water ballast.
The maximum quantity of water allowed is dependent on the empty weight and the cockpit load (see sect.6). In flight, the water drains at approx.0,5 ltr./sec. (1.1 lbs/sec).

Fin water ballast tanks (Option)

For optimal thermaling performance and handling water ballast in the fin tanks should be used to compensate the forward movement of C.G. due to the water ballast in the wings and due to the mass of the rear pilot. Please refer to sect. 6.
If there is the risk of freezing, dump all water before you reach freezing altitude, latest at +2°C, or descend to lower altitudes.
If you suspect a tank is leaking, dump all water immediately.
Water ballast raises the approach speed, so it is recommended to dump the waterballast before landing. Dump the ballast before an outlanding in any case.

Filling the waterballast see sect. 4.2

After filling level the wings and check if the dump valves are tight. It is not allowed to fly with leaking watertanks as this may result in an asymmetric loading condition.

Dumping of the waterballast

Open the fin tank handle first.
Then open both wing ballast tanks together. To avoid an asymmetric loading condition, do not empty one wing tank after the other.

Valves leaking, servicing

Please refer to the maintenance manual sect. 1.8 and 4.1.

4.5.9 **Flight at high altitude and at low temperatures**
With temperatures below 0°C (32°F), for instance when wave flying or flying in winter, it is possible that the control circuits could become stiffer. Special care should be taken to ensure that there is no moisture on any section of the control circuits to minimize the possibility of freeze up.
It could be advantageous to apply vaseline along all the edges of the airbrake cover plates to minimize the possibility of freezing closed.

Apply the controls in short periods.
It is not allowed to carry waterballast.

Caution:
1. At temperatures below -20°C (-4°F) there is the risk of cracking the gelcoat.
2. Attention must be paid to the fact that at higher altitudes the true airspeed is greater than the indicated airspeed.
   The max. speed VNE is reduced. See the following table:

Altitude in metres	0-2000	3000	4000	5000	6000
VNE IAS km/h	270	256	243	230	218

Altitude in ft.	0-6600	10000	13000	16000	20000
VNE IAS kts.	146	138	131	124	117

3. Do not fly below 0°C (32°F) when your glider is wet (e.g. after rain).

4.5.10 **Flight in rain**
With light rain the stall speed and the sink rate increase slightly and the approach speed has to be increased.

4.5.11 **Cloud flying**
Take care to fly smoothly and coordinated. It is prohibited to use a spin as a method for loosing altitude in the clouds. In case of emergency, pull out the dive brakes fully before exceeding a speed of 200 km/h and dive with max. 200 km/h (108 kts) to leave the cloud.

4.5.12 **Aerobatics** ("Utility" Category)
Execute only the approved manoeuvres.
Approved manoeuvres
(Utility Airworthiness Category, all wing spans, no water ballast in the wings and fin tank A)

1. Spins			
2. Inside Loop	Entry Speed	200 km/h	(108 kts.)
3. Stall turn	Entry Speed	200 km/h	(108 kts.)
4. Chandelle	Entry Speed	200 km/h	(108 kts.)
5. Lazy Eight	Entry Speed	200 km/h	(108 kts.)

Spins:
Note: Prolonged spinning is best at **aft C.G. positions**. To perform prolonged spinning with 2 persons on board it is recommended to compensate the weight of the second pilot using fin tank B see sect. 6.8.5.b).

It is not necessary to extend the dive brakes during spin recovery. The DG-500 ELAN ORION shows a very large nose down pitch after leaving the spin, so you have to flare out correspondingly.
With **forward C.G. positions** prolonged spinning is not possible. The DG-500 ELAN ORION will terminate the spin by itself after a certain number of turns dependent on the C.G. position. The nose down pitch and speed will be high so with these C.G. positions not more than 1 turn spins should be executed, to avoid high g-loads.
With **medium C.G. positions** there is a tendency that the spin will turn into a spiral dive after approx. 3 turns. Reaching this state you have to recover immediately.
With 20 m span the tendency for spiral dive can be reduced if the spin is induced by applying aileron and rudder in the direction of the spin. With the other wing spans spin with aileron neutral only.
Inducing the spin: (Normal procedure)
Gradually bring the sailplane into a stall. When it starts to burble, pull the stick back completely and kick in full rudder in the spin direction.
Recovering from the spin:
Apply full opposite rudder against direction of the spin, pause, then ease the stick forward until the rotation ceases, neutralize the controls and carefully pull out of the dive. The ailerons should be kept neutral during recovery.
Height loss during recovery is approx. 50-80 m (160-260 ft), the max. speed is max. 200 km/h (108 kts.).

Stallturn

To fly a stallturn safely, please proceed as follows:

After reaching the entry speed pull back the stick quickly, but not abruptly. During the pull out, shortly before reaching the vertical flight path initiate rotation with the rudder. Push the rudder quickly, but not abruptly. Also, at the highest point of the turn, the glider should still have a positive airspeed above stalling speed.

Be careful not to exceed the airspeed for max. control surface deflection as indicated in section 2.2.

When reaching the vertical dive, flare out immediately to minimize speed increse and g-load.

Caution:
A classical stallturn with almost no airspeed at the highest point of the turn is very difficult to fly with a glider with larger wingspan, due to the high moment of inertia.

This effect is taken into account when using the above mentioned procedure.

Warning:
If the rudder is pushed too late and the rotation is insufficient, it is possible that the glider tailslides (falls tailwards).
If this happens, it is important to hold all controls firmly, preferably at one of the stops, until the nose swings down. Then flare out immediately.

Aerobatics Category A, Aerobatic
only with 17.2 m or 18 m span and without water ballast in the wings and fin tank A
Execute only the approved manoeuvres.
Don't execute aerobatics below the safety altitude required by national law.
Approved manoeuvres (Aerobatic Category):
All manoeuvres approved for Utility category and:

Inverted flight	recommended speed 140-200 km/h (76-108 kts.)
Slow roll	entry speeds 180-200 km/h (97-108 kts.)
Half roll and half loop	170-180 km/h (92-99 kts.)
Half loop and half roll	220 km/h (119 kts)

Caution: The DG-500 ELAN ORION is a high performance sailplane. Therefore the speed increase in the dive, especially in inverted flight is high. Therefore training aerobatics should only be executed after a rating with an experienced pilot or if you can master the manoeuvres on other sailplane types.
In any case don't try to execute the manoeuvres with entry speeds other than those listed above.

Inverted flight:
The speed in inverted flight should preferably be choosen between 140-200 km/h (76-108 kts.). At speeds greater than 190 km/h (103 kts.) no full control deflections are allowed.

Warning: When the speed is reduced below the minimum speed (depending on weight and c.g. position 120 - 135 km/h, 65-73 kts.) the DG-500 ELAN ORION enters an inverted stationary stall with high sink-rate. This will be indicated by buffeting of the tailplane.
The aircraft nose may point far below the horizon and the airspeed may show 130 - 150 km /h (70 - 81 kts). The efficiency of the ailerons and rudder will be reduced considerably.
Note:
The inverted stalled flight must be recovered by neutralizing the stick until the buffeting of the tailplane stops. The airspeed will increase very quickly. As soon as this condition is reached, raise the glider nose above the horizon by gradually pushing the stick forward.
Regain normal flight by a half roll.

4.5.12 cont.

Half loop and half roll:
After reaching the entry speed of 220 km/h (119 kts) pull the stick quickly, but not abruptly until reaching the inverted position, where the speed should still be 130 to 140 km/h (70-75 kts). Then return the stick to neutral and keep the nose slightly above the horizon. Then apply full aileron in the desired direction. After the wing passes the vertical position apply upper rudder to keep the nose above the horizon until normal flying position is reached.

Note:
If the nose is raised too much above the horizon or the inverted speed is too slow, a stall can occur when the wing reaches the vertical position and the glider finishes the rolling motion as a "flicked" roll into normal flying position.

Half roll and half loop:
After reaching the entry speed of 170-180 km/h (92-97 kts) the nose must be raised to 10 - 20° above the horizon. After returning the stick to neutral apply full aileron into the desired direction to start the half roll. After the wing passes vertical position the stick has to be pushed slightly (never abruptly) forward to keep the nose above the horizon. When reaching inverted flight the ailerons must be neutralized and the speed must be reduced to 130-140 km/h (70-76 kts) by pushing the stick forward before starting the half loop to level out.

Note:
If during the entry the nose is raised too high or the entry speed is too low, it could be that it is impossible to stop the rotation in the inverted position and the glider continues the roll into normal position.

4.5.12 cont.

Slow roll:

After reaching the entry speed of 180 - 200 km/h (97-108 kts) the nose must be raised slightly above the horizon. After returning the stick to neutral, full aileron has to be applied in the desired direction. After the wing has passed the first vertical position the stick is to be pushed slightly (never abruptly) forward to keep the nose above the horizon. When the wing passes the second vertical position the rudder must be applied upwards to keep the nose above the horizon until normal flying position is reached.

Note:

If during the inverted flight the nose is raised too high above the horizon and the speed is reduced too much a stall could occur when the wing reaches the second vertical positon and the roll is finished as a "flicked"

The stall is indicated by buffetting of the tailplane.

Section 5

5. Performance

5.1 Introduction

5.2 Approved Data

5.2.1 Airspeed indicator system calibration

5.2.2 Stall speeds

5.3. Non approved further information

5.3.1 Demonstrated crosswind performance

5.3.2 Gliding performance

5.3.3 Flight Polar

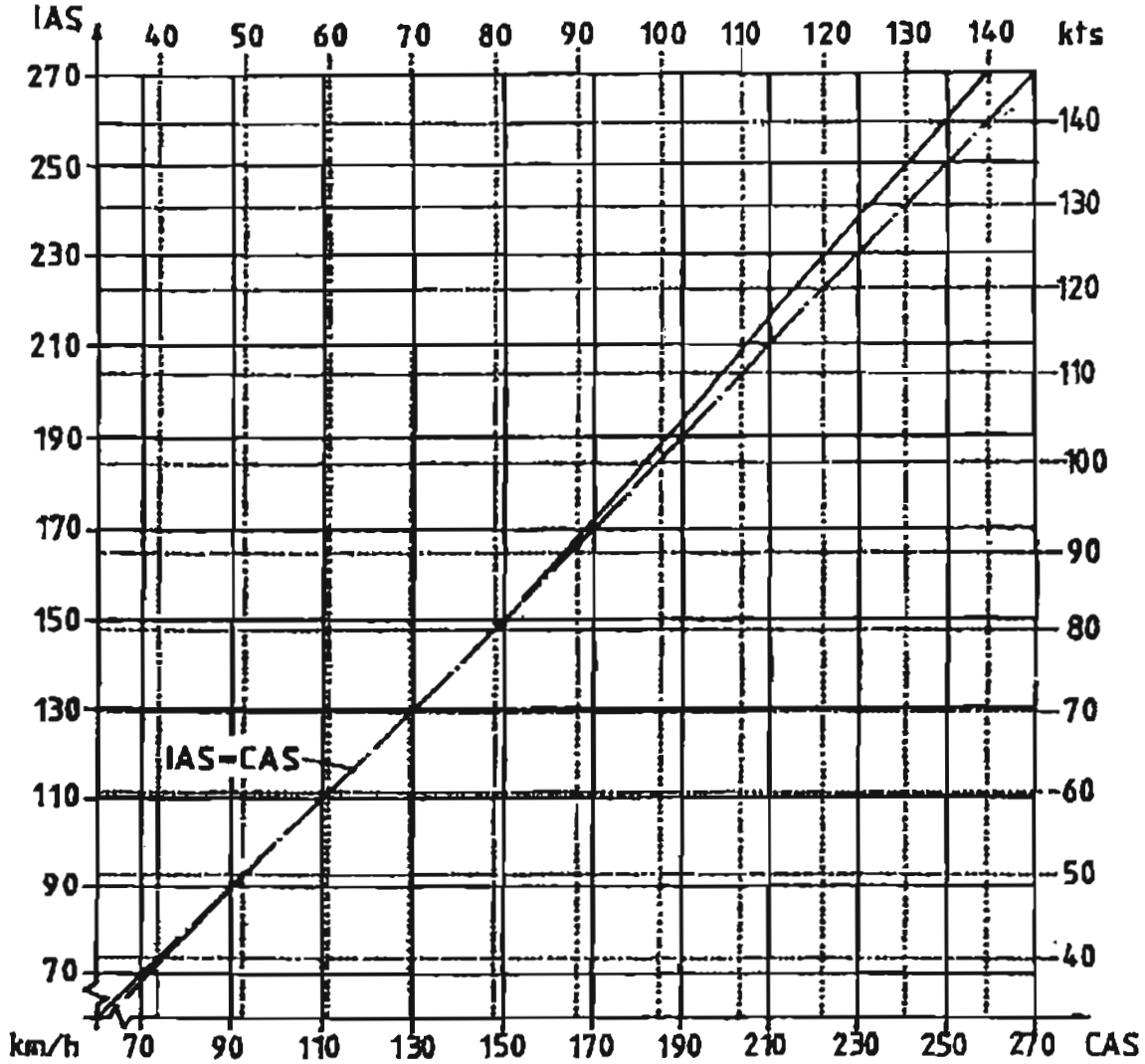
5.1 Introduction

Section 5 provides approved data for airspeed calibration, stall speeds and non-approved further information.

The data in the charts has been computed from actual flight tests with the sailplane in good and clean condition and using average piloting techniques.

5.2 Approved data

5.2.1 Airspeed indicator system calibration



IAS = indicated airspeed
CAS = calibrated airspeed

Caution: The airspeed indicator is to be connected to the static ports and pitot probe in the fuselage nose.

5.2.2 **Stall speeds**
Minimum airspeeds in level flight

Airbrakes retracted

Wing loading	28	33	37	40	43	46	kg/
	5.7	6.8	7.6	8.2	8.8	9.4	lbs/f
Stall speed	66	71	75	78	81	84	km/
	36	38	40	42	44	45	kts

Airbrakes extended

Wing loading	28	33	37	40	43	46	kg/
	5.7	6.8	7.6	8.2	8.8	9.4	lbs/f
Stall speed	70	76	80	83	86	89	km/
	38	41	43	45	46	48	kts

Flight mass		Wing loading kg/m²			lbs/ft²		
kg	lbs						
Span (m)		17.2	18	20	17.2	18	20
470	1036	29.0	28.2	26.7	5.9	5.7	5.5
500	1102	30.9	30.0	28.4	6.3	6.1	5.8
550	1213	34.0	33.0	31.2	7.0	6.8	6.4
600	1323	37.0	36.0	34.1	7.6	7.4	7.0
650	1433	40.1	39.0	36.9	8.2	8.0	7.6
700	1543	43.2	42.2	39.8	8.8	8.6	8.2
750	1653	46.3	45.2	42.6	9.5	9.3	8.7

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

5.3 Non approved further information

5.3.1 Demonstrated crosswind performance

The demonstrated crosswind velocity is 15 km/h (8 kts) according to the airworthiness requirements.

5.3.2 Gliding performance

Performance data		18 m wingspan		
Wing loading kg/m²	(lbs/ft²)	30(6.1)	38(7.8)	45(9.2)
min.sink rate m/s	(ft/min)	.58/114)	.65(128)	.71(140
at V	km/h(kts)	74(40)	83(45)	90(49)
best glide ratio /		39.4	39.7	40
at V	km/h(kts)	90(49)	101(55)	110(59)

Performance data		20 m wingspan		
Wing loading kg/m²	(lbs/ft²)	30(6.1)	35(7.2)	42.6(8.
min.sink rate m/s	(ft/min)	.51(100)	.55(108)	.61(120
at V	km/h(kts)	74(40)	80(43)	88(48)
best glide ratio /		43.5	43.8	44
at V	km/h(kts)	92(50)	100(54)	110(59)

A variation in speed by + 10 km/h (5 kts) from th above will decrease the best glide angle by 0.5 glide points and increase the min. sink rate by 1 cm/sec. (2 ft/min).

The polar curves can be seen on the next page.

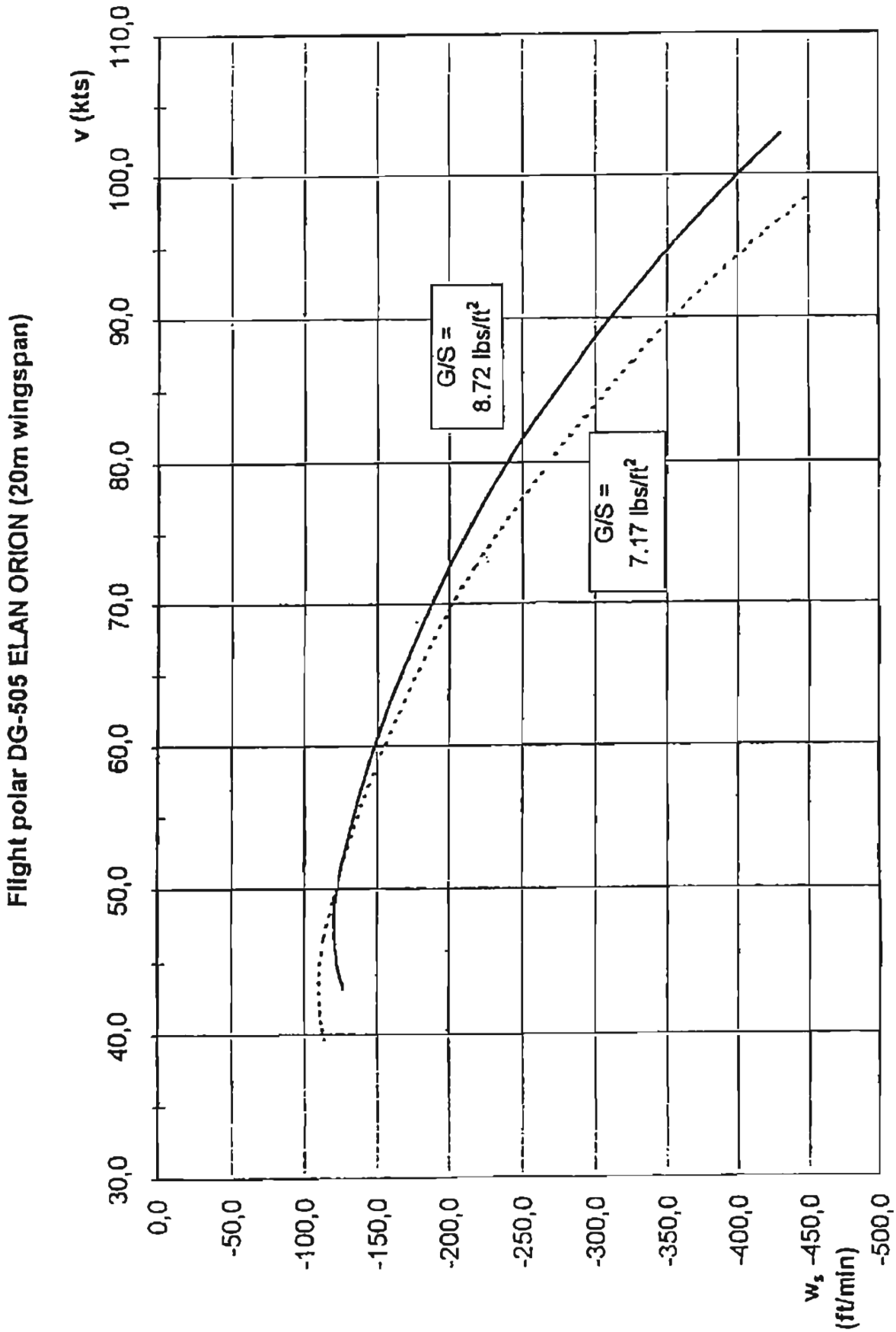
For optimum performance, the aircraft should be flown with a C.G. towards the rear of the allowable range. This especially improves thermaling performance.
However the aircraft will be more pitch sensitive

The wing fuselage joint and the tailplane fin joint should be taped up and the aircraft thoroughly cleaned to obtain maximum performance.

The polars apply to a "clean" aircraft.

With dirty wings or flight in rain, the performance drops accordingly.

5.3.3 Flight polar



Section 6

6.1 **Introduction**
This section contains the payload range within the sailplane may be safely operated.
A procedure for calculating the inflight C.G. is also provided.
A comprehensive list of all equipment available for this sailplane and the installed equipment during the weighing of the sailplane are contained in the maintenance manual.

6.2 **Weighing procedures**
See maintenance manual DG-500 ELAN ORION.
Datum: Wing leading edge at the rootrib.
Reference line: aft fuselage centre line horizontal.
The weighing is to be executed with the battery installed in the fin (Z07 mass 4.3 kg, 9.5 lbs) and all tanks emptied.

6.3 **Weighing record**
The result of each C.G. weighing is to be entered on page 6.5. If the min. cockpit load has changed this data is to be entered in the cockpit placard as well When altering the equipment, the new data can be gathered by a C.G. calculation.(see sect.6.9).
The actual equipment list is enclosed in the maintenance manual.

6.4 **Basic empty mass and C.G.**
Actual data see page 6.5.
With the empty weight C.G. and the cockpit loads in the limits of the diagram on page 6.6, the inflight C.G. limits will not be exceeded.

6.5 **Mass of all non-lifting parts (WNLP)**
The max. mass of all non-lifting parts is **445 kg (981 lbs)** for category 'Utility'.
WNLP is to be determined as follows:
WNLP = WNLP empty + cockpit load (pilot, parachute, baggage, barograph, cameras etc.).
WNLP empty = Total empty weight minus weight of the wings.

6.6 **Max. mass (weight)**
A) **Category Aerobatic** Max. weight 625 kg (1378 lbs)
B) **Category Utility**
Max. weight = 750 kg (1653 lbs)
Max. weight without waterballast = WNLP + W wings

6.7 **Useful load with waterballast**
Max. load with water ballast = max. weight - empty weight (only category 'Utility').
Max. load without waterballast = max. weight without waterballast - empty weight.

The data is recorded on page 6.5.

6.8 Loading chart

6.8.1 **Cockpit load** see table on page 6.5.

a) single seated

max. load in the front seat	110 kg	242 lbs
min. load in the front seat	see placard in cockpit and weighing report page 6.5	

b) two seated

max. cockpit load is 210 kg (463 lbs) with a max. of 105 kg (231 lbs) in the front seat or 110 kg (242 lbs) in the front seat and 90 kg (198 lbs) in the rear seat.
min. cockpit load in the front seat is the min. cockpit load see a) minus 40% of the load in the rear seat.
With these loads, the C.G. range given under 2.8 will be kept in the limits if the empty weight C.G. is in its limits.
With lower pilot weight necessary ballast must be added in the seat. Ballast put on the seat (lead ballast cushion) must be fastened at the connectio of the safety belts.

6.8.2 **Removable Ballast** (Option) see sect. 7.16.1.

6.8.3 **Baggage:** max. 15 kg (33 lbs)
Heavy pieces of baggage must be secured to the bag gage compartment floor (screwing to the floor or with belts). The max. mass secured on one half of the floor (left and right of fuselage centre line) should not exceed 7,5 kg (16.5 lbs).

6.8.4 **Battery in the fin:**
Only the use of the factory supplied battery Z 07, (12 V, 10 Ah, Mass 4.3 kg, 9.5 lbs) is permitted.
Warning: Flying is only allowed with the battery in the fin as otherwise the forward C.G. limit may be exceeded.
Instead of the battery a suitable weight of 4.3 kg (9.51 lbs) may be used.

6.8.5 **Waterballast in the wing tanks:**
The tanks have a capacity of 80 l (21.2 US gal) pe wing.
The allowed amount of waterballast
is dependent on the empty weight and of the load i the fuselage and **can be determined from the diagra on page 6.7 "ballast chart".**
It is only allowed to fly with symmetric wing ballast!

6.8.5 **Fin ballast tanks (option)**

a) Wing Ballast Compensation Tank (Tank A)

Water ballast in the fin tank should be used to compensate the forward move of C.G. due to the water ballast in the wings.

The amount of ballast in the fin is dependent on the amount of water in the wing tanks and to be determined from the following table.

water ballast in the wings		water ballast in the fin tank	
kg	lbs	kg	lbs
20	40	0.8	1.6
40	80	1.6	3.3
60	120	2.5	4.9
80	160	3.3	6.5
100	200	4.1	8.2
120	240	4.9	9.8
140	280	5.7	11.5
160	320	6.6	13.1
/	350	/	14.3

b) Rear Pilot Mass Compensation Tank (Tank B)

The C.G. shift due to the rear pilot can be compensated by filling the ballast tank B). This is possible even without using wing ballast. The amount of ballast is to be determined from the following table.

Mass of rear pilot		water in the fin tank	
kg	lbs.	kg	lbs
60	120	7.4	14.7
70	140	8.6	17.2
80	160	9.8	19.7
90	180	11.0	22.1
100	200	12.2	24.03
/	220	/	26.9

Warning:

When flying solo tank B) must be emptied!

Otherwise you will fly with a dangerous C.G. position.

The compensation of 100 kg pilot weight (rear seat) raises the min. cockpit load in the front seat by 40 kg!

The resulting value (min. cockpit load in front seat from weighing without ballast + 40 kg) must be entered in the table on page 6.5 as value XX and also on the placard at the indication lights for the fin tank on the front instrument panel.

When using the fin tanks make sure not to exceed the max. weight of 750 kg (1653 lbs).

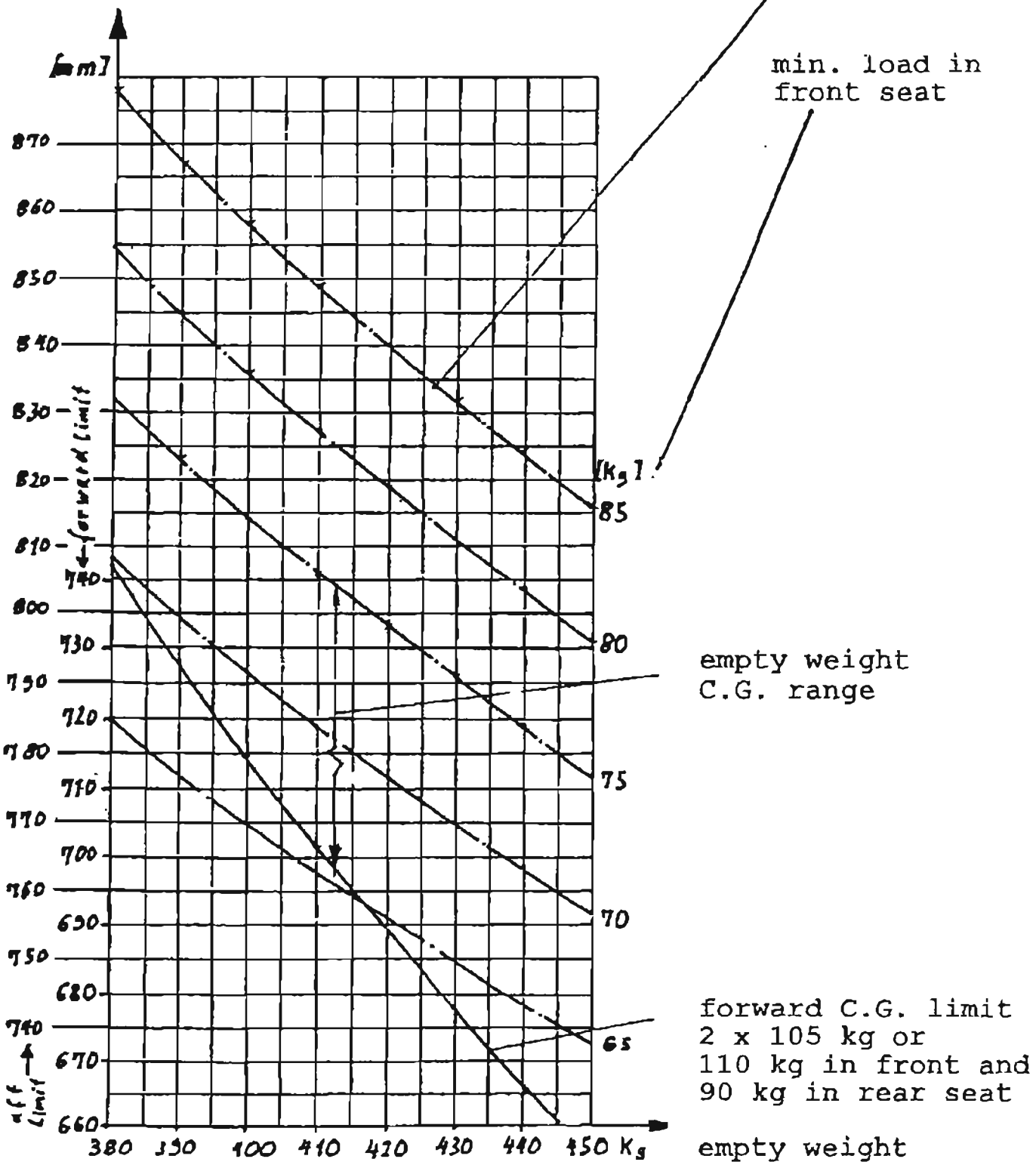
Weighing report (for 6.3)
Distances in mm, masses in kg
25.4 mm = 1 inch 1 kg = 2.2046 lbs.

Date of weighing:						
executed by:						
Date of equipment list:						
Span		20 m	17.2 m			
Empty mass						
Empty mass C.G.						
max. mass without water ballast	U					
	A	/	625 kg			
max. load without water ballast	U					
	A	/				
max. mass with W.B.	U	750 kg	750 kg			
max. load with W.B.	U					
min. cockpit load in front seat						
max. load in both seats	U	210 kg	210 kg			
	A	/				
with optional fin tanks XX						
Inspector signature, stamp						

XX = min. load in front seat for solo flying with fin tank B filled.
U= category U
A= category A

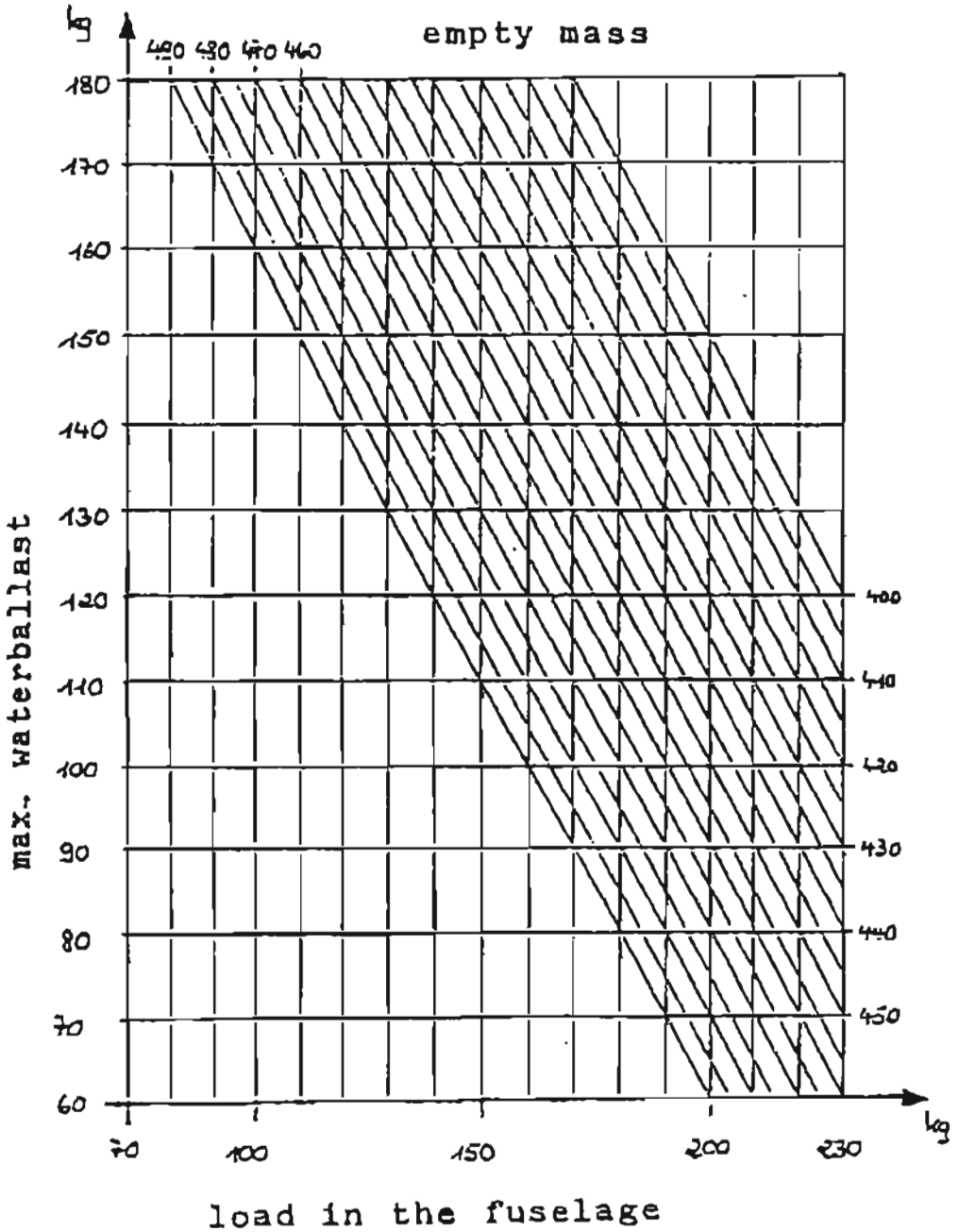
1. Weighing is to be executed with the battery (Z 07, mass 4.3 kg - 9.5 lbs) installed in the fin.
2. Weighing was executed with tailwheel with:
   plastic hub brass hub (see 7.16.4)
   (delete the inapplicable)

for 6.4 **Empty weight C.G. limits**



25.4 mm = 1 in., 1 kg = 2.2046 lbs.

DG-500 ELAN ORION ballast chart (for 6.8)
to determine the max. allowable waterballast in the wing tanks.



1 kg = 2.2046 lbs

3.785 kg (l) = 1 US gal.

6.9 C.G. calculation

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

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

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

Item	mass kg	C.G. behind datum m	moment m kg
aircraft empty	400	0.74	296.0
Pilot front	75	- 1.35	- 101.25
rear	100	- 0.24	- 24.00
Water ballast			
in the wings	100	0.243	24.3
fin tank A	4.1	5.032	20.63
fin tank B	12.3	5.160	63.47
Sum	**691.4**	XS=0.404	**279.15**
		CG=moment/mass	

The limits of the inflight C.G. 0.185 m - 0.48 m should not be exceeded!

The most important C.G. positions (behind datum):

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

$$XP = (XSF \quad MF - XSE \quad ME)/MP$$

MF = flight mass XSF = flight C.G. MP = pilot mass
ME = empty mass XSE = empty C.G.

If the actual pilot C.G. is not known, you have to take the values from the following table:

flight: f = near the forward C.G.
r = near the aft C.G.

Pilot mass (kg)	pilot C.G. (m) front cockpit f	front cockpit r	rear cockpit f	rear cockpit r
110	-1,348	-1,295	-0,277	-0,232
105	-1,350	-1,296	-0,278	-0,233
100	-1,351	-1,297	-0,279	-0,234
95	-1,352	-1,298	-0,280	-0,235
90	-1,353	-1,300	-0,281	-0,236
85	-1,355	-1,301	-0,283	-0,237
80	-1,356	-1,302	-0,284	-0,238
75	-1,357	-1,303	-0,285	-0,239
70	-1,359	-1,304	-0,286	-0,240
65	-1,360	-1,305	-0,288	-0,241
60	-1,361	-1,306	-0,289	-0,242
55	-1,362	-1,307	-0,290	-0,243

Further C.G. positions:

Baggage or battery in baggage compartment:	0.31 m
Instruments in front panel:	- 1.870 m
Instruments in rear panel:	- 0.700 m
Tail wheel	5.345 m
Removable Ballast (Option see 7.16.1):	- 1.920 m
Battery in fin (see sect. 6.8)	5.306 m
Water ballast in the wings	0.243 m
Fin ballast tanks (option)	
Tank A compensation of wing ballast	5.032 m
Tank B compensation of rear pilot	5.160 m

Section 7

7.1 Introduction

This section provides description and operating of the sailplane and its systems.

Refer to section 9 "Supplements" for details of optional systems and equipment.

M.M. = Maintenance manual

7.2 Airframe

The DG-500 ELAN ORION is a twoseater high performance sailplane.

Construction

Wings,	CFRP-foam-sandwich-shell CFRP-Rovingspar caps
Ailerons	CFRP/AFRP-foam-sandwich-shell
Horizontal tailplane and rudder	GFRP-foam-sandwich-shell
Fuselage	GFRP-shell, fuselage boom with Tubus core

Canopy

Two canopies hinged at the right fuselage side. Canopy glass made from clear Plexiglas or Plexiglas GS green 2422 as option.

Tailplane

T-Tail with conventional stabilizer-elevator and spring trim.

Color Airframe: white

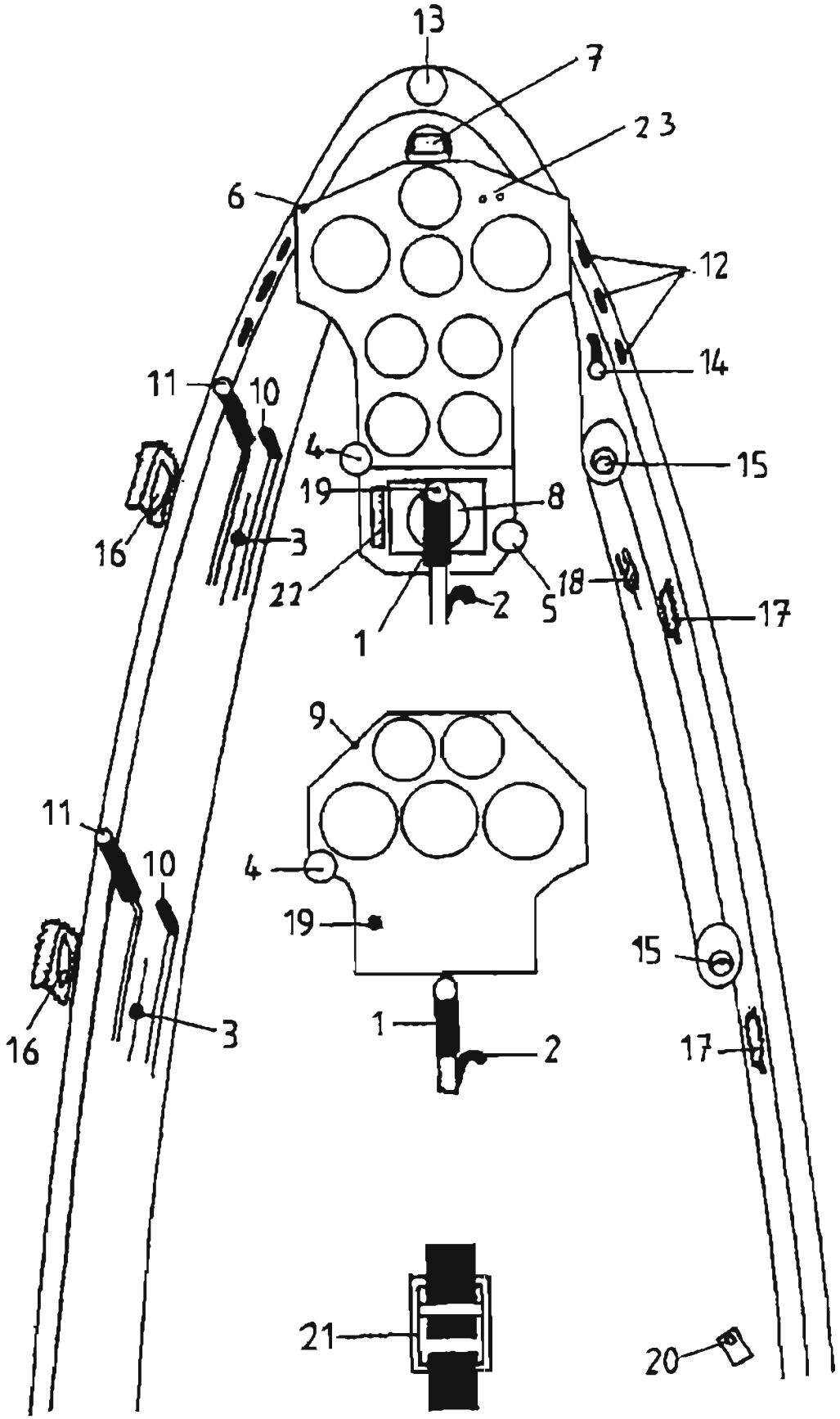
registration numbers: grey RAL 7001

or red RAL 3020

or blue RAL 5012

or green RAL 6001

7.3 Cockpit, cockpit controls and placards



1) Control Column
The rear control stick is removable. Therefore open the snap shakle at the trim release lever and disengage the trim cable. Pull out the stick after opening the cap nut.

2) Release lever for the trim mechanism - green.
Operation see sect. 7.4 elevator control.

3) Trim position indicator and trim preselection lever

4) Tow release knob - yellow.

5) Rudder pedal adjustment knob - black
(only in front cockpit)

By pulling on the knob, the locking pin will be disengaged and the rudder pedals can be pulled back towards the pilot or pushed forward away from the pilot.

6) Front instrument Panel
After removing the side screws at the base 2 x M 6 and after removing the screws attaching the cover to the panel 6 x M 4, the cover can be removed towards the front. The panel remains in the aircraft.

7) Compass installation position.

8) Radio installation position.

9) Rear Instrument Panel
After removing the side screws attaching the panel to the cover (4 x M 4) the panel can be hinged backwards into the cockpit (take out the control stick first!).

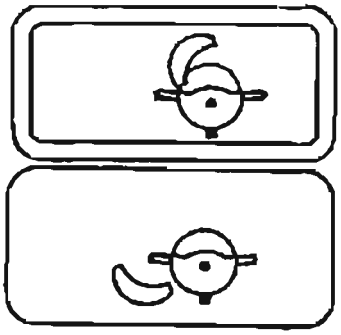
10) Undercarriage retraction - extension handle (Option) black
forward - undercarriage down
back - undercarriage retracted

The undercarriage is locked in the extended position by an overcentre locking arrangement and an additional safety catch. The handle is to be turned towards the cockpit wall, so that the locking catch will engage.

11) Airbrake handle - blue
The wheel brake is operated at the end of the air-brake handle travel.

12) Constantly open anti-fogging air vents
13) Main air vent
14) Main air vent operating knob
pushed in - closed
pulled out - open

15) Swivel air vents
16) Canopy opening handle - white-red
towards the nose - closed
into cockpit - open
17) Canopy emergency release handle - red
towards the nose - closed
into cockpit - open
Emergency release procedure see sect. 3.2.



18a) Water ballast dump handles - silver
upper handle - right hand water bag
lower handle - left hand water bag
forward - valve closed
into the cockpit - valve open

18b) Fin ballast tank dump handle for Tank A (option)
to the front - open
The wing ballast can't be dumped before dumping the fin tank (tank A).

19) Push to talk button (Option)
20) 12 V socket for charging the batteries.
21) Adjustment strap for the rear seat shell
(to be operated on the ground)
22) Outside-air temperature gauge (required with fin tanks)
23) Indication lights for the fin ballast Tank B (compensation of weight of the rear pilot) (required with fin tanks)
With Tank B empty - the light is on near the placarted value of the min. cockpit load for empty tank.
With ballast in Tank B (partly or completely filled) the other light is on near the value for the min. cockpit load with Tank B filled completely. There is no indication for intermediate values.

7.4 Flight controls

Rudder control:
See diagram 2 M.M
Cable system with adjustable pedals in the front cockpit.

Elevator control:
See diagram 1 M.M.
All pushrods slide in maintenance free nylon ball guides.
Automatic control hook up system. Spring trimmer with release lever at the control stick and control knob at the left cockpit wall. To trim, you have to operate the release lever at the control stick and place the control knob to the desired position.

Aileron control:
See diagram 3 and 4 M.M
Pushrods slide in maintenance free nylon ball guides.
Automatic control hook up system..

7.5 Airbrakes

See diagram 3 and 4 M.M.
Double storey Schempp-Hirth type airbrakes on the upper wing surface. The wheel brake is operated by the airbrake system. Pushrods in the wings slide in maintenance free nylon ball guides. Automatic control hook up system.

7.6 Landing gear

See diagram 7 M.M.

a) Main wheel: retractable, assisted by a gas strut. Spring mounted with steel compression springs, locked in retracted position by an overcentre locking device. Fully sealed landing gear box, hydraulic disc brake.
Tyre 380 x 150 6 PR
Diameter 380 mm (15.0 in.)
Tyre pressure 3.0 bar (44 psi)

b) Tailwheel:
Tyre 200 x 50 2 PR
Diameter 200 mm (7.87 in)
Tyre pressure 4 bar (58 psi)

c) Nosewheel:
Tyre 260 x 85
Diameter 260 mm (10.2 in.)
Tyre pressure 2.5 bar (36 psi)

7.7 **Tow hooks** see diagram 5 M.M.
Safety release "Europa G 88" for winch launch installed near the C.G.

"nose release E 85" installed in the fuselage nose for aerotow.
Both hooks are operated by the same handle.

7.8 **Seats and safety harness**
The front seat is constructed as an integral inner shell.
The rear seat is height adjustable. The adjustment is by means of a strap similar to the shoulder harness.
As safety harness only symmetric 4-point harnesses fixed at the given fixing points are allowed.

7.9 **Baggage compartment**
Max. load 15 kg (33 lbs).
Heavy pieces of baggage must to be secured to the floor.

7.10 **Waterballastsystem** see diagram 6 M.M.

7.10.1 **Wing tanks**
The wingtanks are constructed as double wall bags with a capacity of 80 l (21.1 U.S.gal) per wing.
The dump valves are mounted in the wings and the control is hooked up automatically when rigging the glider. The upper handle is for the right and the lower handle is for the left wing tank.

7.10.2 **Fin ballast tanks (Option)**

a) Wing ballast compensation tank (Tank A)
max. 6.6 kg (14.31 lbs)
This is an integral tank with ventilation tube. Filling is via the dump valve. The dump valve is opened by a cable. If you overfill the tank, the excess water drains via the ventilation.
The handle for the dump valve (wide plate) covers the wing tank handles, so that the wing tanks can only be emptied after opening the fin tank.
Warning: It is prohibited to change this system.

b) Tank B (compensation of the mass of the rear pilot) max. 12.3 kg (27.0 lbs)
Contruction similar to tank A. Filling via a quick connector which closes by itself. Tank B can only be emptied on the ground via the filling hose, see sect. 4.2.4.

When dumping the wing tanks only tank A will be emptied, the compensation of the rear pilots mass remains even when flying without wing ballast.

7.13 **Electrical System**

Battery in the fin

For C.G. reasons the battery is installed in the fin. Only the use of the factory supplied battery Z 07 (12 V, 10 Ah, mass 4.3 kg, 9.5 lbs) is permitted.

The battery fuse is installed at the battery, type: G fuse 250 V with indicator 5 x 25 medium slow / 4 A.

After inserting the connector plug in the fin the battery is connected to the electrical system of the glider. If the battery shall be charged inside the glider this can be done via socket 20, see section 7.3.

To charge the battery to its full capacity an automatic charger with 14.4 V max. charging voltage is necessary (normal automatic chargers charge only up to 13.8 V).

Such a charger is available through Glaser-Dirks code no. Z 08.

All current - carrying wiring confirms to LN aeronautical specifications.

7.14 **Pitot and static system** see diagram 8 M.M.

Pitot probe in fuselage nose, and static ports a short distance behind fuselage nose.

The airspeed indicator and the altimeter are to be connected to these ports and probe.

Additional holder for a Multiprobe in the fin is to operate variometer and flight computersystems.

To preserve the sealings inside the holder the end of the probe should be greased with vaseline from time to time.

7.15 **Canopy emergency release**

To bail out the red canopy emergency release handle (right) and the white-red canopy opening handle (left) have to be operated simultaneously. Push canopy upwards. The retaining lines will tear off.

Reinstalling the canopy.

Open emergency release and canopy locking lever. Place canopy in vertical direction onto the fuselage. Close emergency release. Open canopy and snap in retaining cable.

7.16 Miscellaneous equipment (Options)

7.16.1 Removable ballast

The ballast box (Option) at the right hand side of the instrument console underneath the carpet can accomodate 3 lead ballast weights of min 2.2 kg (4.85 lbs) each. Each weight compensates a pilot mass of 2.9 kg (6.4 lbs). With 3 weights 8.7 kg (19.2 lbs) missing pilot mass can be compensated. The lead ballast weights are to be fixed in the box with a M 8 wingnut.

7.16.2 Oxygen system

a) **Oxygen bottle installation**

Max. size of oxygen bottle is 7 l capacity with diameter 140 mm (5.5 in.)- If a bottle with less diameter is used, this bottle must be wrapped with plastic to come to the same diameter of 140 mm. The bottle must be fixed at its neck with a bracket Z 14 (available at DG-Flugzeugbau GmbH).

b) **Installation of the oxygen equipment**

To ensure a safe installation ask DG-Flugzeugbau GmbH for an installation instruction.
For the installation of the Dräger Höhenatmer E 20088 you will find an installation plan 5 EP 34 in the maintenance Mamual.

7.16.3 ELT Emergency Locator Transmitter

To ensure a safe installation ask DG-Flugzeugbau GmbH for an installation instruction.
For the Pointer Inc. ELT Model 3000 you will find an installation plan 5 EP 30 in the maintenance manual.

Caution: Concerning 7.16.2 and 7.16.3
The installation of such equiment has to be accomplished by the aircraft manufacturer or by an approved service station and to be inspected and entered in the aircraft log book by a licensed inspector.

7.16.4 Heavy tailwheel

Instead of the standard tailwheel with plastic hub a tailwheel with brass hub S 27/1 may be installed. The installation kit S 27/4 is available at DG-FLUGZEUGBAU GMBH.
The difference in mass between both hubs is 3.1 kg (6.84 lbs). With the brass hub, the min. front cockpit load is increased by 8.5 kg (18.74 lbs). This higher value must be entered in the cockpit data placards and on page 6.5. Even if the heavy tailwheel is installed only sometimes, the higher min. cockpit load must be entered.

Section 8

8. Sailplane handling, care and maintenance

8.1 Introduction

8.2 Inspection periods and maintenance

8.3 Alterations or repairs

8.4 Parking

8.5 Trailering

8.6 Towing on the ground

8.7 Cleaning and care

8.1 Introduction

This section contains manufacturer's recommended procedures for proper ground handling and servicing of the sailplane. It also identifies certain inspection and maintenance requirements which must be followed if the sailplane is to retain that new-plane performance and dependability. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered.

8.2 Inspection period, maintenance

The "Instructions for continued airworthiness (maintenance manual) for the DG-500 ELAN ORION have to be followed.

A Before each rigging all the connecting pins and bushes should be cleaned and greased. This includes the control connectors.

B The contact surfaces of the canopies to the fuselage are to be rubbed with colourless floor-polish (canopy and fuselage side) to reduce grating noise in flight. Polish at the beginning of the flight season and then every month.

C Once a year all the bearings and hinges should be cleaned and greased. See the greasing programme of the maintenance manual.
Each year the control surface displacements, adjustments and general condition must be checked. (See the maintenance manual).

8.3 Alterations or repairs

It is essential that the responsible airworthiness authority be contacted **prior to** any alterations on the airplane, to ensure that the airworthiness of the sailplane is not impaired. It is prohibited to execute the alteration without the approval of the airworthiness authority. The manufacturer will not be liable for the alteration or for damages resulting from changes in the characteristics of the aircraft due to alteration. So it is strongly recommended to execute no alternatives which are not approved by the aircraft manufacturer.
External loads such as external camera installations are to be regarded as alterations! Repair instructions can be found in the DG-500 ELAN ORION repair manual. No repairs should be carried out without referring to the manual.

8.4 Tie Down, Parking

To tie down the wings use the wing cradles of your trailer. The fuselage should be tied down just ahead of the fin. On sunny days the cockpit should be closed and covered.

Note: Longer parking with exposure to sun and humidity will cause premature aging of the skin of your sailplane.

8.5 Trailering

It is recommended to carry this valuable sailplane in a factory approved enclosed trailer.

Approved fitting points:

Wing panels:

1. Wing spar as close to wing rootrib as possible or a rootrib wing cradle.
2. A wing cradle at the taper change.
3. 20 m wing tips-
   in a cradle on the fuselage in front of the fin (drawing available) or in cradles fixed to the roof of the trailer. Tips to be fixed at the spar end and in a cradle at their outboard ends.

Stabilizer:

Cradles as desired.

Fuselage:

1. A felt lined fiberglass nose cap which does not extend over the canopy, secured to floor.
2. Fuselage dolly in front of the tow hook.
3. Tail wheel well in trailer floor. Secure fuselage with a belt in front of the fin or hold it down with the trailer top (soft foam in top).

All aircraft structures should not be subject to any unusual loads. With high temperatures that can occur inside trailers, these loads in time can warp any fibre reinforced plastic sailplane.

The trailer should be well ventilated so as to prevent moisture build up which could result in bubbles forming in the gelcoat.
A solar powered ventilator is recommended.

8.6 Towing on the ground

a) by towing from the nose hook using a rope with the standard double ring authorized for the release.

b) by using a tow bar which is fixed at the tail dolly and a wing tip wheel.

The tow bar and wing tip wheel may be ordered through the Glaser-Dirks factory.

8.7 Cleaning and Care

Exterior surfaces of the fibrereinforced plastic parts

The surfaces are coated by a UP-gelcoat. This gelcoat is protected by a hard wax coating which has been applied during production with a rotating disc ("schwabbel" procedure). Do not remove the wax, because this would lead to shading, swelling and cracking of the surface. In general, the wax coat is very resistant. As soon as the wax coat is damaged or worn, a new coat has to be applied (see maintenance manual sect. 3.1). If you store your aircraft often outside, this may be necessary every half year!

Hints for care:

- Wash the surface only with clear water using a sponge and chamois.

- The adhesive remains of tape may be removed with petroleum ether (pure petroleum spirit) which should be applied and removed immediately, otherwise this may lead to swelling of the gelcoat.

- More stubborn dirt which cannot be removed by washing may be cleaned off with siliconefree, wax containing car polishes (e.g. 1Z Extra, Meguiars in USA)

- Longterm dirt and shading can be removed by applying a new hard wax coat (see maintenance manual sect. 3.1).

8.7 **cont.**

- Never use alcohol, acetone, thinner etc.. Do not use detergents for washing!

- Protect the surface from intense sunlight.

- Protect the aircraft from water and moisture. See sect. 8.4 and 8.5.

- Remove water that has entered and allow the aircraft to dry out.

- Never store your wet aircraft in a trailer.

Plexiglas canopy:

- Use clear water and a chamois for cleaning.

- Stubborn dirt and small scratches can be removed by use of the "schwabbel procedure" (see maintenance manual sect. 3.1).

Metal parts:

The pins and bushes for rigging the aircraft are not surface protected and must be covered with grease all the time.
The other metal parts, especially the control stick and all handles should be preserved with metal polish occasionally.

Section 9

9. Supplements

Section not effective