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## FLIGHT MANUAL

# LS4-a

This manual should be carried in the sailplane at all times.

This Flight Manual is FAA approved for U.S. registered sailplanes in accordance with the provisions of 14 CFR Section 21.29 and is required by FAA Type Certificate Data Sheet No. G 45 EU.

Registration Signs: \_\_\_\_\_ Serial Number: \_\_\_\_\_

Owner: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

German edition of Flight Manual approved under § 12(1)2. LuftGerPO.

Published | 15. Nov. 83

Because of responsibility of information a change of ownership should be reported to the manufacturer immediately.

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



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15. Nov. 1983

LOG OF REVISIONS

Revision No.	Pages affected	Description	LBA approval signature	Date

LS4-a Manuals can be ordered from

- Dr. Horst H. Eschenberg  
 1, Plantation Court  
 Rockville MD 20852

or

Rolladen Schneider Flugzeugbau GmbH  
 Mühlstrasse 10  
 D-6073 Egelsbach

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DESCRIPTION

The LS4 is a Standard Class single seater sailplane with T-tail, retractable landing gear and upper wing surface air brakes.

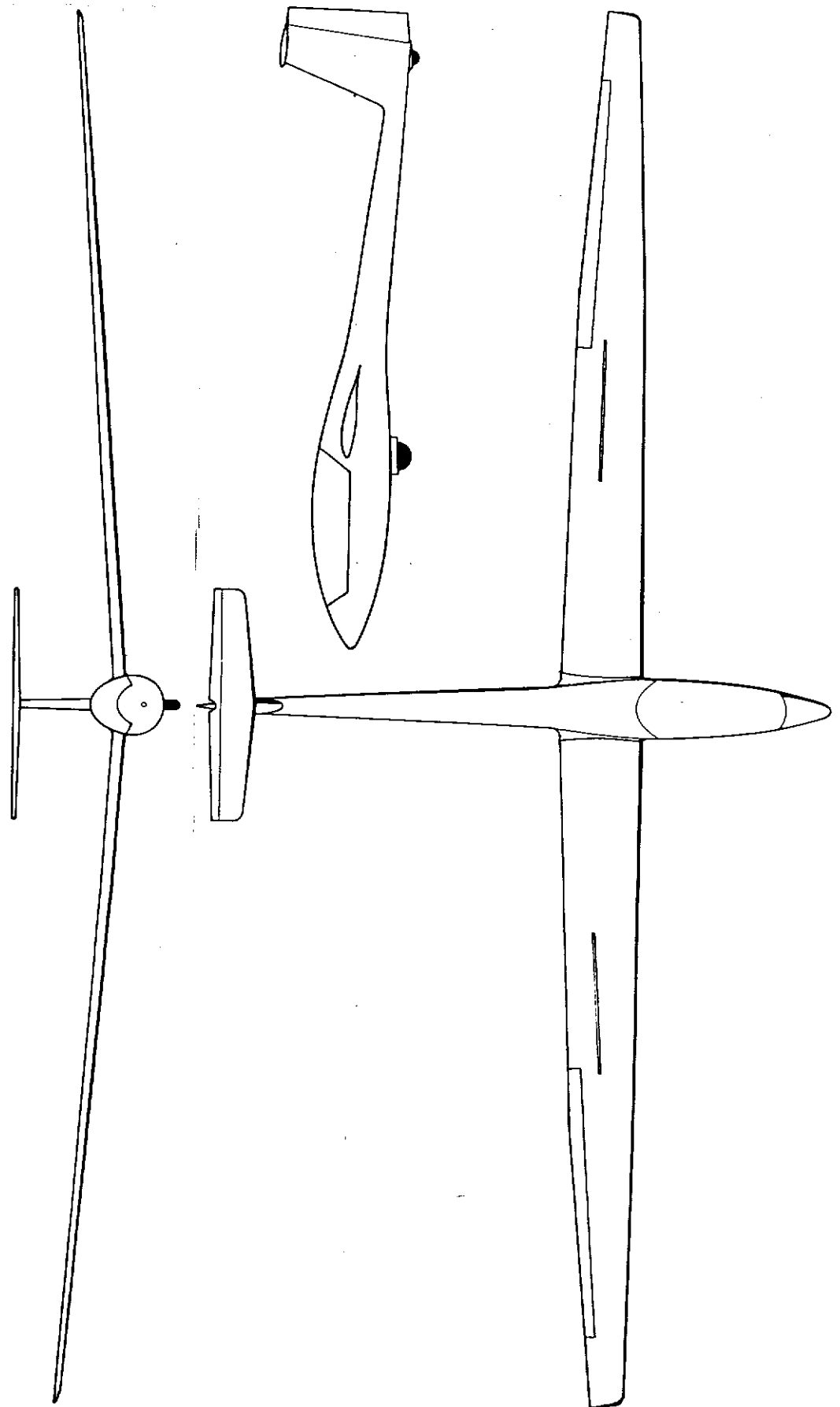
This sailplane has been produced using the latest technology of industrial glass-fibre design.

It is designed for training and competition flights - high performance combined with excellent handling characteristics.

Technical data

Wing span	15 m ( 49,21 ft)
Length	6.79 m (22.27 ft)
Height	1.32 m ( 4.31 ft)
Wing area	10.5 m <sup>2</sup> (113.0 sq.ft)
Wing aspect ratio	21.4
Maximum gross weight	525 kg (1157 lbs)
Maximum wing loading	50 kg/m <sup>2</sup> (10.2 ppsf)
Airfoil	Wortmann modified

THREE DIMENSIONAL DRAWING



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GENERAL

The sailplane is designed and originally approved according to LFSM regulations. The safety margin - ratio of ultimate loads to permissible loads, which may occur some times - is only 1.5 . This means that ultimate loads will be achieved when exceeding permissible load factors by 50 %. When exceeding permissible speeds, the safety margin is much lower !

Maximum permissible loads should not be achieved by the pilot's control surface deflections - they result from severe turbulence and the necessary control surface deflections to maintain the desired attitude.

Severe turbulence would include wave rotors, flying in cumulonimbus clouds, dust devils and when crossing mountain ridges in strong winds.

AIRSPPEED LIMITS

All airspeed limits are indicated airspeeds (IAS)

Never Exceed $V_{NE}$	km/h	kts	mph
from sea level up to 6500 ft .....	280	151	174
up to 9800 ft .....	266	144	165
up to 19700 ft .....	227	123	141
up to 32800 ft .....	179	97	111
Manoeuvring Speed $V_A$ .....	190	103	118
Limit Speed in "Severe Turbulence".....	190	103	118
Winch Launch $V_W$ .....	140	76	87
Aero Tow $V_T$ .....	190	103	118
Landing Gear $V_{Lo}$ and $V_{LE}$ ....	280	151	174
Air Brakes .....	280	151	174

For "Severe Turbulence" see above.

NOTE: When flying at altitude, the lower limit IAS is always authoritative.



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AIRSPEED INDICATOR MARKINGS

Green Arc: 100-190 km/h (54-103 kts, 62-118 mph)

Within this speed range it is not possible to overload the sailplane by "Severe Turbulence" and the necessary maximum control surface deflections to maintain the desired attitude.

Yellow Arc: 190-280 km/h (103-151 kts, 118-174 mph)

Within this speed range "Severe Turbulence" or control surface deflections of more than 1/3 of possible travel may exceed the design limit and should be avoided. Manoeuvring loads, gust loads and loads due to control surface deflections should not be encountered simultaneously.

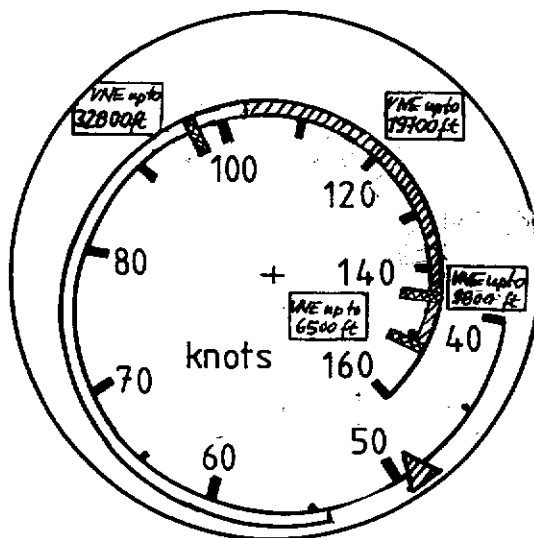
Red Line: 280 km/h (151 kts, 174 mph)




Never exceed up to 6500 ft above MSL flying altitude. For higher altitudes see page 2-1.

Yellow Triangle: 90 km/h (49 kts, 56 mph)

Minimum recommended approach to landing speed without water ballast.

Example: Airspeed Indicator  
Winter 6 FMS 4-2



-  Red
-  Green
-  Yellow

Placards see  
page 2-7



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WEIGHT LIMITS

Maximum gross weight . . . . . 525 kg (1157 lbs)

Maximum weight of non-lifting parts . . . . . 230 kg (507 lbs)

The term "non-lifting parts" includes the following: fuselage inclusive permanently fitted equipment, canopy and main pins plus horizontal tail plus maximum cockpit load.

Maximum cockpit load . . . . . 110 kg (242 lbs)

The term "cockpit load" includes the following: Pilot, parachute, baggage and temporary equipment

Maximum cockpit load may be limited by weight of non-lifting parts. See entry on page 9-1.

Minimum load for club use

Pilot and parachute . . . . . 70 kg (154 lbs)  
No baggage, no temporary equipment, no trim ballast fitted

Pilot and parachute . . . . . 55 kg (121 lbs)  
3 trim weights fitted, no baggage, no temporary equipment

One trim weight corresponds to 5 kg (11 lbs) of pilot weight

If the sailplane does not fly in a club, it may be trimmed for higher minimum cockpit load. See instructions on page 9-3.

For minimum cockpit load see entry on page 9-1.

Maximum water ballast weight . . . . . 170 kg (375 lbs)

Loading instructions see page 4-7.

Maximum baggage weight . . . . . 5 kg (11 lbs)

Loading instructions see page 4-6.

Maximum instrument weight installed in

upper portion of instrument panel . . . . . 4 kg (8.8 lbs)



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CENTER OF GRAVITY LIMITS

Position of C.G. in flight (without water ballast)

Maximum allowable:

forward C.G. position . . . . . 225 mm (8.86 in) aft of DP

rearward C.G. position . . . . . 400 mm (15.75 in) aft of DP  
without water ballast

. . . . . 330 mm (13 in) aft of DP with  
170 kg (375 lbs) water ballast

Datum Point (DP): Leading edge of wing at root, when under side of  
fuselage boom placed horizontal.

NOTE: Loading ballast will move the plane's C.G. forward, unless the  
C.G. is already at its maximum forward position.

MANOEUVRE LIMITS

Acrobatic manoeuvres not approved.

Spins not approved.

FLIGHT LOAD FACTOR LIMITS

At 190 km/h (103 kts, 118 mph) 5.3 G positive and 2.65 G negative.

At 280 km/h (151 kts, 174 mph) 4.0 G positive and 1.5 G negative.

KINDS OF OPERATION LIMITS

The LS4-a sailplane is approved for Day VFR. Minimum equipment see  
page 2-5.

Night VFR, IFR and Flight into known icing conditions are not approved.

Use of water ballast limited to non-freezing conditions.

CATEGORY OF AIRWORTHINESS

U (Utility) according to JAR 22.



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**MINIMUM EQUIPMENT LIST**

1. Airspeed Indicator, scale 50-300 km/h (27-162 kts, 31-186 mph)  
Colour markings see page 2-2  
Approved types see Master Equipment List page 9-4  
Pressure pick-ups: Fuselage nose pitot (without nose release) or vertical tail fin pitot (with nose release) and forward fuselage side statics.
2. Altimeter in ft
3. Magnetic compass
4. Four piece seat belt harness
5. Back cushion or parachute in compressed form should not be thinner than 80 - 100 mm (3 - 4 in).
6. Checklist, type placard, data and loading placard, operating placards. For placards see pages 2-6 and 2-7.
7. LS4-a **Flight Manual**

} See Master Equipment List  
on pages 9-4 to 9-6

**BREAK AWAY LINK IN TOW CABLE**

Break away link in tow cable for winch launch and aero tow  
maximum 600 kg (1323 lbs).

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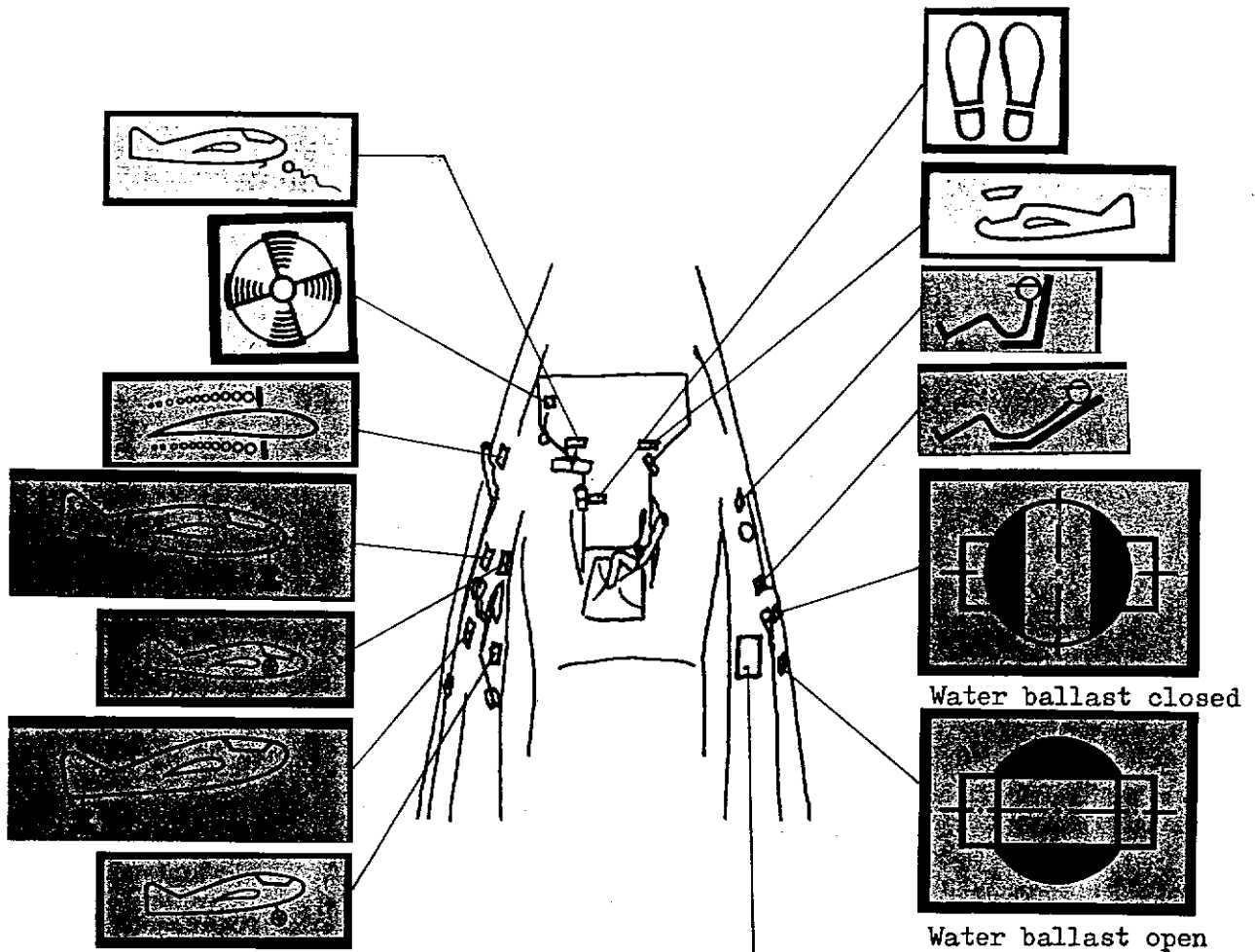
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OPERATING PLACARDS



**ROLLADEN SCHNEIDER FLUGZEUGBAU GMBH**  
**Typ. LS4-a Serial No.**

AIR SPEED LIMITS (KAS)	km/h (MPH)		
Never Exceed (VNE)	280	174	151
In Rough Air (VR)	190	118	103
Maneuvering (VA)	190	118	103
Stall Speed (Vs)	190	118	103
Minimum Speed (VM)	140	87	76
Flap Takeoff	280	174	151
Landing Gear (VL)	280	174	151

**BATTERY** in fin  
in baggage compartment

**Maximum Weight** 525 kg (1157 lbs)  
including water ballast  
No aerobically maneuvers approved

**Weight Limitation:** kg lbs  
 Max.    
 Min.

Pilot/Plots must compensate for weight as suggested in Flight Manual

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OPERATING PLACARDS

VNE up to  
6500 ft

VNE up to  
9800 ft

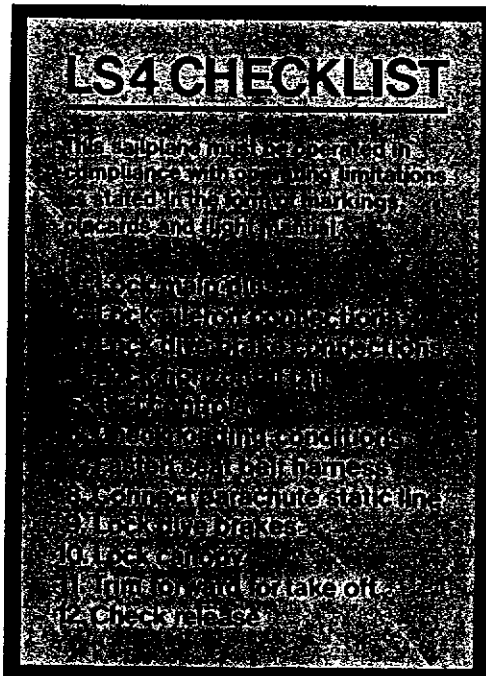
VNE up to  
19700 ft

VNE up to  
32800 ft

Airspeed Indicator Placards

Refer to page 2-1 for speeds and page 2-2 for positioning diagram

# Minimum Cockpit Load kg

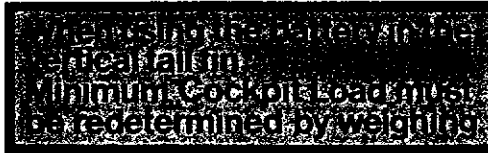


Under Instrument Panel Cover

Under Instrument Panel Cover



Canopy Release  
on both canopy frames



Under battery box cover of  
vertical tail fin



Baggage Compartment Placard



Near Altimeter, when  
range is 20000 ft



Electrical switch positions

Tyre Pressure  
3-3.5 bar (43-50 psi)

On left main  
wheel door

Tyre Pressure  
2.5-3.5 bar (36-50 psi)

Near tailwheel,  
if fitted

Rolladen Schneider Flugzeugbau GmbH	
Type	LS 4-a
Serial No.	_____
FAA TC	_____
Reg. No.	_____
Made in West-Germany	

Type Placard at main bulkhead

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SPIN RECOVERY

- Rudder - Opposite to spin rotation
- Elevator - Neutral or slightly forward
- Aileron - Neutral
- Smooth pull-out
- Altitude loss - About 50 m (150 ft)

EMERGENCY CANOPY RELEASE AND EXIT

- Canopy locks - Open both
  - Emergency canopy  
release handle - Pull to stop
  - Canopy - Push off
  - Seat harness - Open
  - Exit - Lift with elbows over cockpit rim
- } Reverse sequence possible also

OTHER EMERGENCIES

STALLS

- Warning - Slight tail shudder prior to entry
- Aileron - Effectiveness reduced by about 50 %
- Sinkrate - Increases considerably
- Termination - Stick forward to neutral

SPIRAL DIVE

At high speeds stable against spiral dive (250 km/h (135 kts, 157 mph) and load factor 2 G).

At low speeds slight tendency.

- Elevator - Pull
- Rudder - Opposite to dive rotation
- Aileron - Opposite to angle of bank



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LIMITATION OF HIGH SPEED FLIGHT

If there are indications while flying under large cloudbanks that the maximum permissible rough air speed ( $V_A$ ) will be exceeded, air brakes should be extended carefully before 190 km/h (103 kts, 118 mph) is reached. In emergencies, air brakes can also be extended up to a speed of 280 km/h (151 kts, 174 mph).

When air brakes are extended during descent after high altitude wave flights, a speed of 190 km/h (103 kts, 118 mph) should not be exceeded because of possible severe turbulence.

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DAILY INSPECTION

- ① Forward fuselage
  - Pitot pressure port, if no nose release is fitted, for clogging
  - Nose release, if fitted, working properly
- ② Landing gear
  - Recommended tyre pressure 3.5 bar ( 50 psi)
  - Slip mark and tyre condition
  - C.G. release including automatic release working properly
  - Water drain orifices in front of and behind landing gear box free from clogging (See also page 8-6)
- ③ Wings
  - Water drain orifices at root and tip free from clogging
  - Condition, damage or cracks
  - Attachment
  - Air brakes working properly
  - Ailerons for unobstructed movement and free from play
- ④ Fuselage
  - Condition, damage or cracks
  - Rear static ports at fuselage boom free from clogging
  - Recomm. tail wheel tyre pressure, if fitted, 2.5-3.5 bar (36-50 psi)
  - Water drain orifice in front of tail wheel, if fitted, free from clogging
  - Tail skid for proper adhesion, if fitted
- ⑤ Tail unit
  - Condition, damage or cracks
  - TE port at upper end of vertical tail fin leading edge free from clogging
  - Pitot pressure port half way down vertical tail fin leading edge free from clogging (only if nose release is fitted)
  - Charged rear battery connected, if used
  - Horizontal tail properly installed
  - Horizontal tail for damage or pressure marks
  - Tail control surfaces movement unobstructed and free from play

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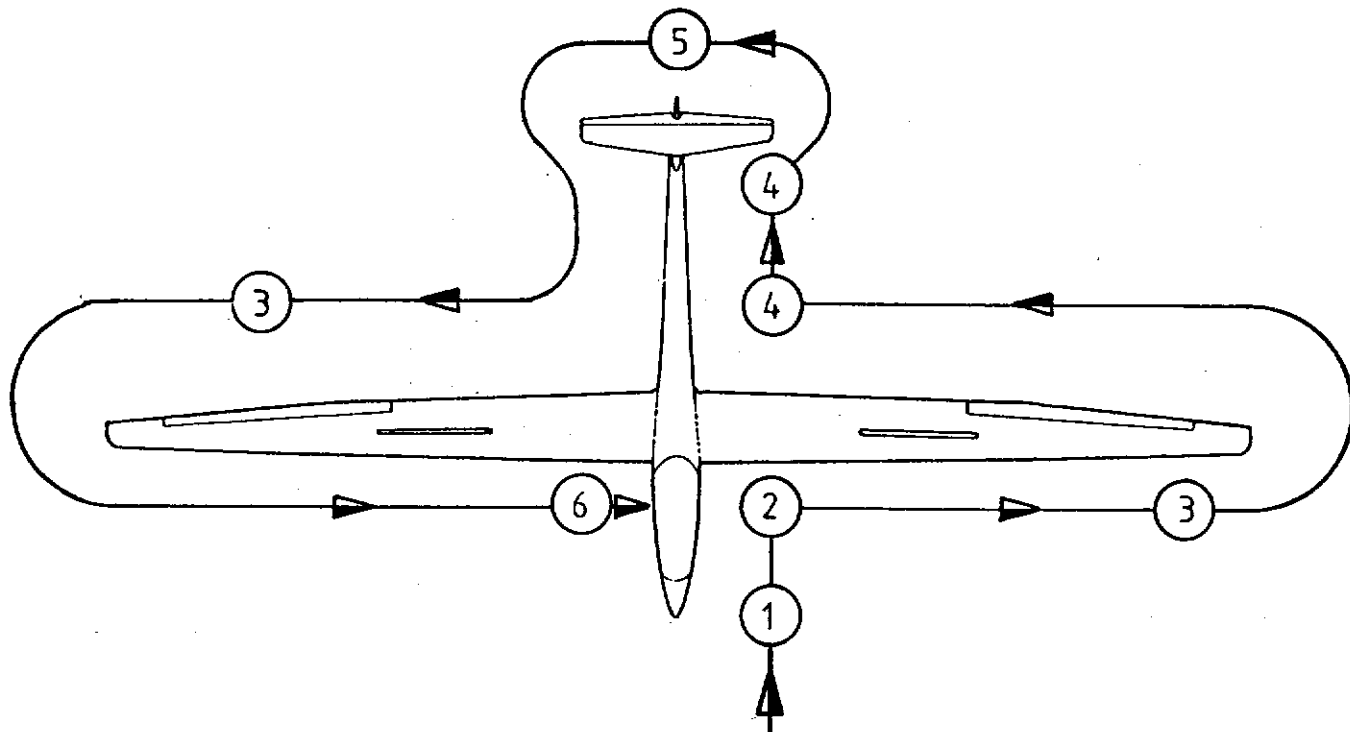
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DAILY INSPECTION continued

⑥ Cockpit

- Canopy cleaned, if required
- Canopy locking and emergency release working properly
- Main pins properly secured
- Check proper connection of aileron and airbrake systems through baggage compartment rear door via mirrors
- Secure connections of aileron and airbrake systems using LS-sleeve and colour marking (See page 4-3 for LS-sleeve)
- Close baggage compartment rear door
- Charged battery fixed in baggage compartment and connected

For assembly and disassembly procedures see Chapter 8



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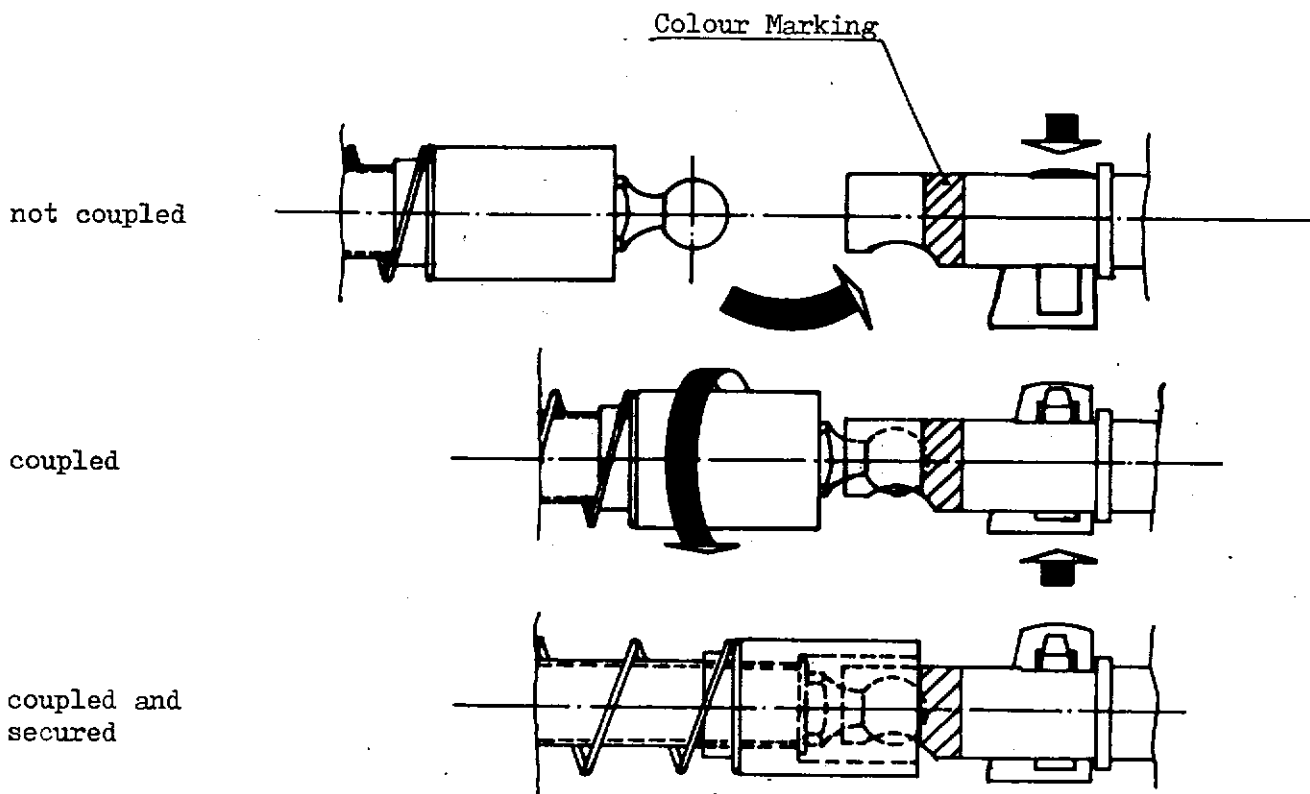
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AILERON AND AIR BRAKE CONNECTION

Connection of aileron and air brake systems using LS-sleeve  
and colour marking :

Wing pushrod

Fuselage ball snap joint



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Page 4-3

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PREFLIGHT CHECK

Daily inspection	- performed
Water ballast system	- check for leaks,if filled
Total energy tube	-fitted and connection properly sealed
Weight and balance, especially Minimum and Maximum Cockpit Loads, trim weights and battery position	- checked
Altimeter	- set
Other instrumentation	- checked, normally indicating zero
Radio	- operation check
Backrest	- adjusted
Rudder pedals	- adjusted
Papers (C of A, Logbook, etc.)	- complete and valid
Before take off	- perform cockpit checklist procedure

POSTFLIGHT CHECK

Electrical instruments	- switch off
Battery	- recharge,if necessary
Insects and dust	- remove, using water and sponge and chamois leather
Air brake boxes	- check, if moisture has accumulated and remove with sponge
Water ballast system	- check proper dumping

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ADJUSTMENT OF RUDDER PEDALS

- possible in flight or on the ground
- release pressure on pedals
- unlock pawl by pulling black pedal release handle
- forward adjustment : push pedals forward with feet into desired position and lock
- rearward adjustment: pull pedals with release handle into desired position and lock

ADJUSTMENT OF BACKREST

Lower bracket adjustable only on the ground, allows use of various

- types of parachutes
- pull cable through slot for unlocking
- lock in desired position

Slope adjustment possible in flight or on the ground

Forward adjustment:

- slacken shoulder straps
- release pressure of backrest
- push ratchet at right cockpit rim forward and outward into desired position and lock
- check proper locking of ratchet
- retighten shoulder straps

Rearward adjustment:

- release pressure of backrest
- push ratchet at right cockpit rim slightly forward and outward
- push backrest backward into desired position and lock
- check proper locking of ratchet
- tighten shoulder straps



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### AUTOMATIC PARACHUTE RIPCHORD

- attach to red main bulkhead portion at left rear of pilot
- use special loop only

### LANDING GEAR

- extension or retraction permitted over the whole approved speed range
- handle forward - gear up
- handle rearward - gear down
- avoid gear operation, when air brakes are extended, because air brake lever inhibits travel of gear lever
- retract gear after releasing tow cable, because C.G. release is fitted to gear fork

### WHEEL BRAKE

- press rudder pedals with heels to activate wheel brake

### TRIM SYSTEM

- Trim locking lever on control stick - pull to free trim lever
- Trim lever at left cockpit side
  - forward for nose down
  - rearward for nose up
- Fix trim setting - release locking lever
- Indication of trim setting - indicated by position of trim lever relative to neutral mark

### BAGGAGE COMPARTMENT

Baggage compartment should be used for soft and light materials which would not obstruct the pilot after negative accelerations or injure the pilot in crash landings.

Permanent installation of equipment see page 9-3.



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WATER BALLAST

- each wing holds a maximum of 85 liters (22.45 US-gallons,  
18.7 Imp-gallons)
- maximum permissible load depends on loading conditions, see page 9-2  
for water ballast loading instructions
- filling of water tanks:
  - Dump valve operating levers are marked R and L
  - open appropriate dump valve by shifting its lever  
backwards
  - lay wingtip on the ground
  - suck residual air from water bag through dump orifice  
using connection hose
  - connect funnel to dump orifice
  - fill desired amount of water, use clean water only to  
avoid destroying gasket of valve and consequent leaking
  - during filling disconnect funnel several times to allow  
residual air to escape
  - never use more than 0.1 bar of water pressure (funnel  
max. 1 m (3.3 ft) above wing)
  - close valve by shifting lever forward
  - repeat procedure for other wing
- dumping of water:
  - open both valves simultaneously by shifting levers  
backwards
  - 10 liters (2.6 US gal, 2.2 Imp. gal) will be dumped  
in approximately 10 seconds
  - if aileron stick force is needed to maintain level  
flight after dumping, this may indicate unequal dumping
  - to avoid ground looping in case of unequal dumping  
apply aileron in the direction as noticed before shortly  
after touchdown
- use of water ballast limited to non freezing conditions, see also  
Flight Manual page 2-4



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WINCH LAUNCH

- adjust backrest properly (See page 4-4) } to avoid sliding backwards
- tighten seat belt harness } during acceleration and steep climb
- trim slightly forward, trim lever just before reference mark
- when water tanks are partially filled, keep wings horizontal before take off to avoid unequal water distribution
- break away link in tow cable max. 600 kg (1323 lbs)
- ask winch operator to avoid too high acceleration, the higher the initial acceleration, the higher is the pitch up tendency
- use wheel brake during tightening of tow cable to avoid rolling over tow cable
- pronounced forward stick pressure is required during transition arc
- minimum winch launch speed
  - without water ballast .... 90 km/h (49 kts, 56 mph)
  - with water ballast ..... 110 km/h (59 kts, 68 mph)
- retract landing gear after tow, because C.G. release is fitted to landing gear fork

AERO TOW

- adjust backrest properly and tighten seat belt harness
- trim slightly forward, trim lever just before reference mark
- additional aileron effectiveness during initial take off roll may be achieved by extending air brakes, retract air brakes before leaving ground
- when water tanks are partially filled, keep wings horizontal before take off to avoid unequal water distribution
- break away link in tow cable max. 600 kg (1323 lbs)
- use wheel brake during tightening of tow cable to avoid rolling over tow cable
- minimum tow speed without water ballast ... 100 km/h (54 kts, 62 mph)
  - with water ballast ... 120 km/h (65 kts, 75 mph)
- recommended tow cable length 30 - 80 m (100 - 260 ft)
- either nose or C.G. release can be used. While using the C.G. release, the landing gear may not be retracted during tow, because release is fitted to landing gear fork

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FREE FLIGHT

- Stalling speed for straight and level flight
  - without water ballast 65 - 70 km/h (35-38 kts, 40-44 mph)
  - with water ballast 80 - 85 km/h (43-46 kts, 50-53 mph)
- Stalling speeds for banked flight see table below
- best glide angle between 90 - 100 km/h (49-54 kts, 56-62 mph)
- high speed flight
  - trim high speeds
  - check speed indication regularly to avoid exceeding limit values
- observe airspeed limits versus altitude
- CAUTION: When flying with empty water tanks, leave dump valve in open position to avoid pressure built up inside tanks at altitude

Banked flight stalling speeds

Angle of bank (Deg)	Stalling speed without water ballast, wingloading 33 kg/m <sup>2</sup> (6.76 ppsf)			Stalling speed with water ballast, wingloading 50 kg/m <sup>2</sup> (10.2 ppsf)		
	(km/h)	(kts)	(mph)	(km/h)	(kts)	(mph)
0	65-70	35-38	40-44	80-86	43-47	49-54
20	67-72	36-39	42-45	82-89	44-48	52-55
30	70-75	38-41	44-47	86-92	47-50	54-58
40	74-80	40-43	46-50	91-98	49-53	56-62
45	77-83	42-45	48-52	95-102	52-55	59-64
50	81-87	44-47	50-54	100-107	54-58	61-65
60	92-99	50-53	57-62	113-122	61-65	70-76

Banked flight stalling speeds are calculated from straight flight data



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### SIDESLIP

Sideslip speed range: up to  $V_A = 190 \text{ km/h}$  (103 kts, 118 mph)

During sideslip rudder control force decreases to almost zero force.

For a straight and steady sideslip 100 % rudder and between 50 to 75 % aileron deflection are necessary.

Degradation in airspeed system goes down to zero airspeed indication. Depending on airspeed indicator, negative values may be indicated. (Fuselage nose pitot and forward fuselage side statics used).

### LANDING

- Always extend landing gear, especially in case of an emergency outlanding. Only the sprung landing gear absorbs much landing impact energy.
- Water ballast should normally be dumped prior to landing.
- Recommended minimum approach speed without water ballast and air brakes fully extended: 90 km/h (49 kts, 56 mph).
- Air brakes allow control of glide angle within wide limits.
- Side slipping is not necessary to control glidepath.

As extending of air brakes makes the LS4-a nose heavy, side slipping with air brakes extended should be avoided, especially at low speeds and with forward C.G. positions, because of limited elevator effectiveness.

- **WARNING:** Landing in rain
  - Increase approach speed by at least 10 km/h (5 kts, 6 mph).
  - Raindrops change airfoil and reduce performance

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Erstellt: 15. April 83

Ersetzt:

Geprüft: 15. 4. 83 *khapka*

HIGH ALTITUDE FLIGHTS

Increasing altitude yields higher true airspeed than indicated airspeed and this difference increases with increasing altitude. This does not influence loads on the structure, which means that colour markings on airspeed indicator are valid unless limited by red lines.

However, as structural limitation depends on true airspeed, this should never be above 280 km/h IAS (151 kts, 174 mph) up to 2000 m (6500 ft) above MSL.

Using the table on page 2-1, maximum permissible airspeeds depending on altitude, the pilot is able to avoid flying faster than true airspeed of 280 km/h CAS (151 kts, 174 mph).

EXAMPLE: Indicated airspeed of 227 km/h (123 kts, 141 mph) at 6000 m (19700 ft) altitude corresponds to 280 km/h (151 kts, 174 mph) true airspeed.

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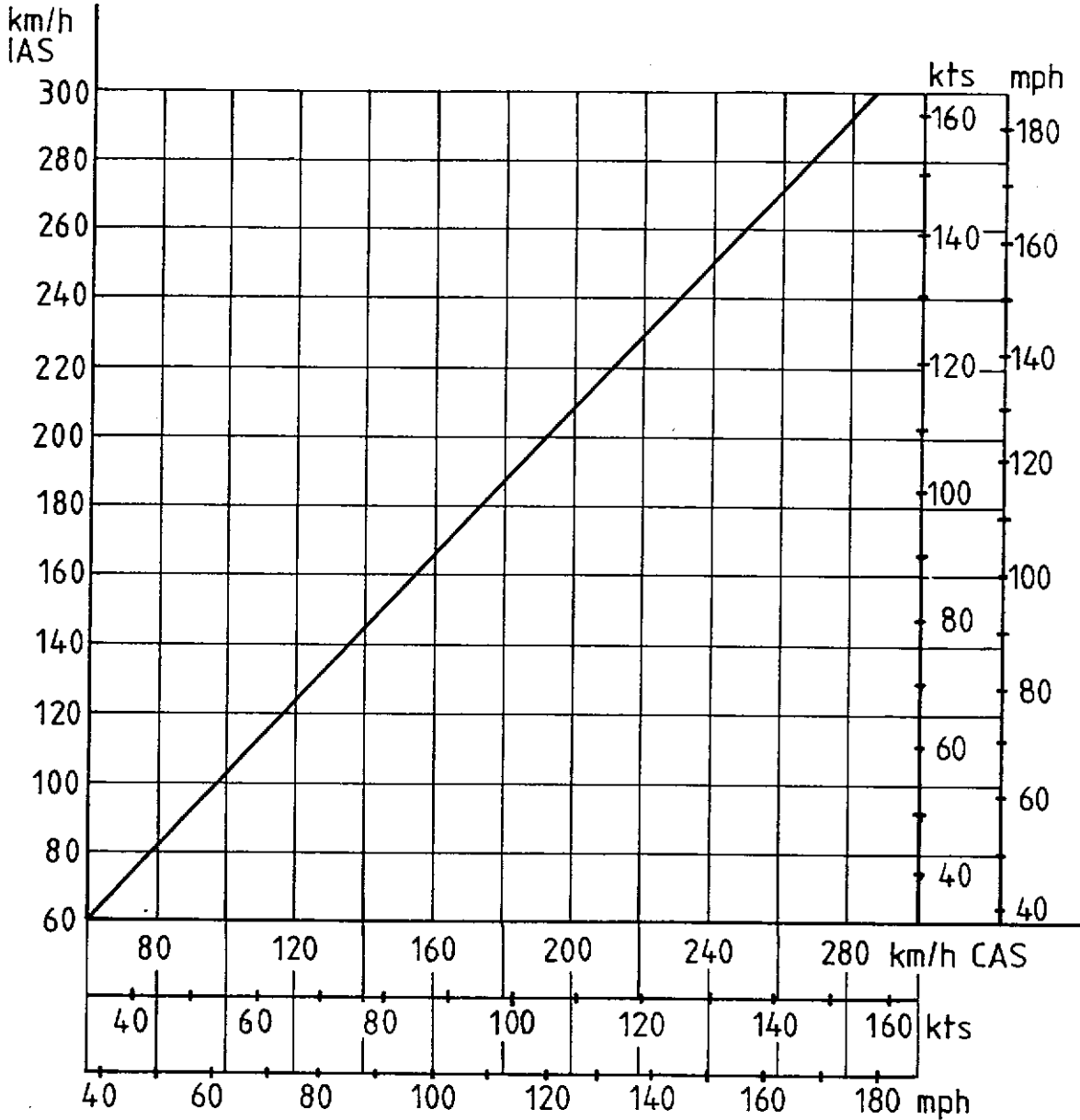
Erstellt: 15. April 83 *Le*

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Geprüft: 15. 4. 83 *khapha*

AIRSPEED SYSTEM CALIBRATION

This diagram shows airspeed indicator error due to position of pressure ports.



Pressure ports: Fuselage nose pitot (without nose release)  
Vertical tail fin pitot (with nose release)  
Forward fuselage side statics

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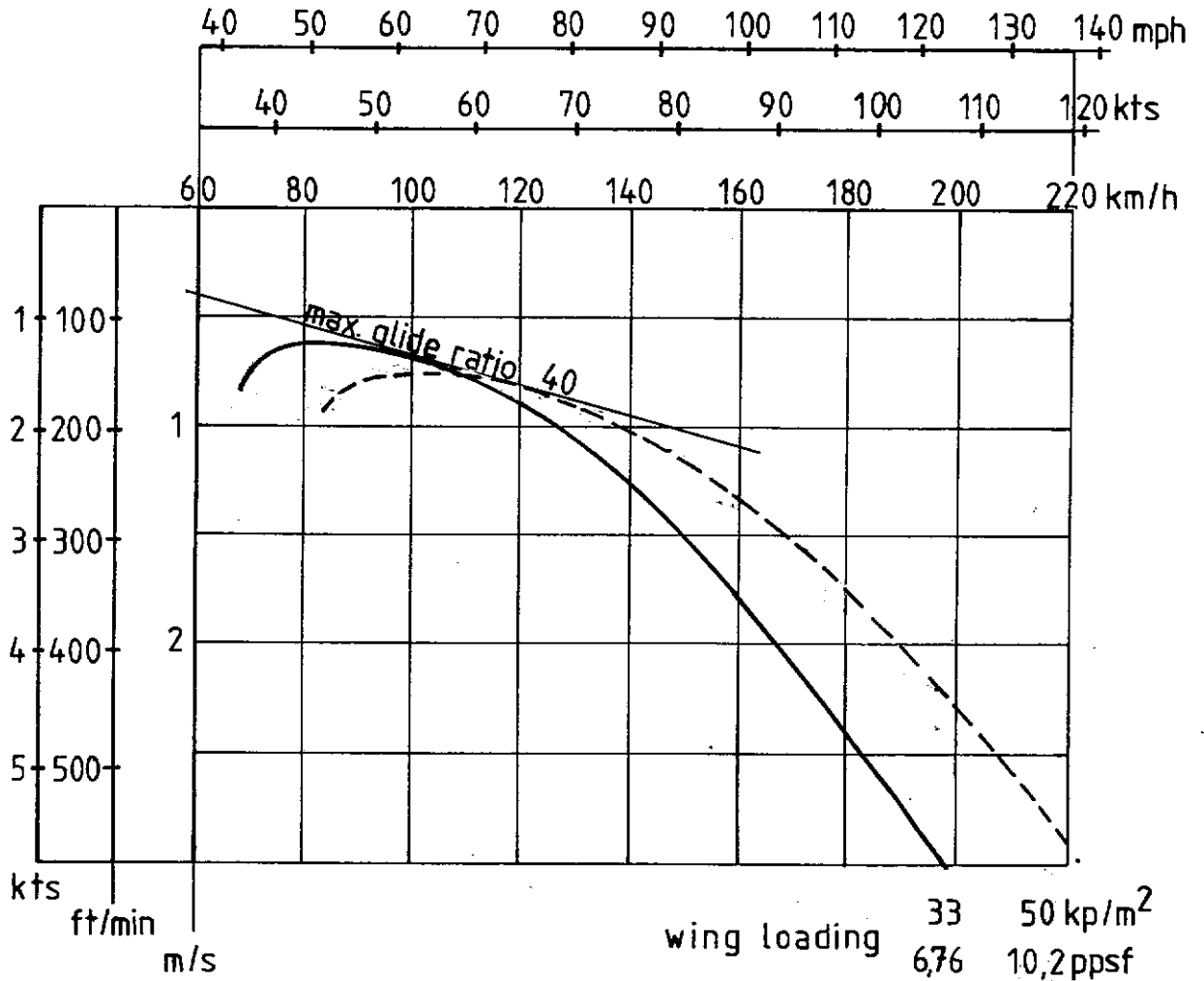
Erstellt: 15. April 83 *Le*

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Geprüft: 15. 4. 83 *Wapha*

FLIGHT POLAR

The flight polar gives forward speed versus sinking speed related to wing loading.



The flight polar is valid for "clean" wing.  
Insects and raindrops on wing decrease performance and handling,  
see page 4-10 Landing.

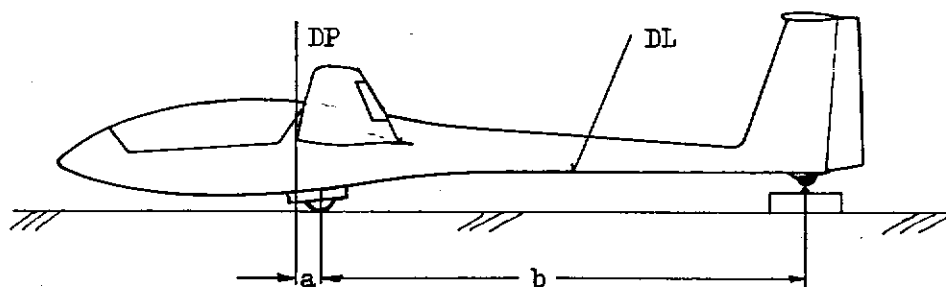
WEIGHING PROCEDURE

To determine in-flight C.G. position, the empty weight C.G. position must be known.

1. Determine weight by weighing all parts and adding together.
2. Assemble sailplane.
3. Raise tail on weighing machine until datum line level using wooden blocks or adjustable jack.
4. Weigh gross tail weight.
5. Measure distance b from tail support to center of landing gear axis.
6. Using plumb lead, determine points on floor perpendicular to left and right datum points, and points on floor perpendicular to center of landing gear axis. Measure distance a from axis to datum point.
7. Determine tare tail weight (Weight of additional material used under 3).
8. Calculate nett tail weight = gross tail weight - tare tail weight
9. Calculate empty weight C.G. position:

$$X_{cg} = \frac{\text{nett tail weight} \times b}{\text{empty weight}} + a$$

10. When battery is fitted in vertical tail fin, weighing must be done in this configuration.



DATUM LINE (DL): under side of fuselage boom placed horizontal.  
DATUM POINT (DP): leading edge of wing at root.

CALCULATION OF LOADING LIMITS

1. Determine Minimum Cockpit Load from table "Empty Weight C.G. Limits".

When being used in a club, Minimum Cockpit Load should be 70 kg (154 lbs). If it is higher, permanent ballast may be fitted under forward seat portion. See page 9-3.

Minimum Cockpit Load should be entered in the following places:

- 1) in weighing report of inspection
- 2) in Flight Manual, page 9-1
- 3) under instrument panel cover
- 4) on Data Placard in cockpit

2. Maximum Cockpit Load normally is 110 kg (242 lbs), as given in empty weight C.G. table.

It may be lower due to excessive equipment or repairs. Calculate Maximum Cockpit Load by deducting weight of fuselage (including permanently fitted equipment, canopy and main pins) and horizontal tail from maximum weight of nonlifting parts. (230 kg, 242 lbs)

Maximum Cockpit Load should be entered in the following places:

- 1) in weighing report of inspection
- 2) in Flight Manual, page 9-1
- 3) on Data Placard in cockpit

3. Empty Weight (perhaps increased by weight of permanently fixed ballast) should be entered in the following places:

- 1) in weighing report of inspection
- 2) in Flight Manual, page 9-1 for calculation of maximum permissible water ballast weight.

4. Battery position during weighing should be entered in the following places:

- 1) in equipment list of inspection
- 2) on Data Placard in cockpit



EMPTY WEIGHT C.G. LIMITS

Empty Weight (kg)	Cockpit Load Range (kg)						
	Empty Weight C.G. Limits (mm)						
	60-110	65-110	70-110	75-110	80-110	85-110	90-110
230	625-650	625-670	625-690	625-710	625-731	625-752	625-773
231	623-649	623-669	623-689	623-709	623-730	623-750	623-771
232	621-648	621-668	621-688	621-708	621-728	621-749	621-770
233	620-647	620-667	620-687	620-706	620-727	620-747	620-768
234	618-646	618-666	618-685	618-705	618-725	618-746	618-767
235	616-645	616-664	616-684	616-704	616-724	616-744	616-765
236	615-644	615-663	615-683	615-703	615-723	615-743	615-763
237	613-643	613-662	613-682	613-701	613-721	613-741	613-762
238	611-642	611-661	611-681	611-700	611-720	611-740	611-760
239	610-641	610-660	610-679	610-699	610-719	610-739	610-759
240	608-640	608-659	608-678	608-698	608-717	608-737	608-757
241	607-639	607-658	607-677	607-696	607-716	607-736	607-756
242	605-638	605-657	605-676	605-695	605-715	605-734	605-754
243	603-637	603-656	603-675	603-694	603-713	603-733	603-753
244	602-636	602-655	602-674	602-693	602-712	602-732	602-752
245	600-635	600-654	600-673	600-691	600-711	600-730	600-750
246	599-634	599-653	599-671	599-690	599-710	599-729	599-749
247	597-633	597-652	597-670	597-689	597-708	597-728	597-747
248	596-632	596-651	596-669	596-688	596-707	596-726	596-746
249	594-631	594-650	594-668	594-687	594-706	594-725	594-744
250	593-630	593-649	593-667	593-686	593-705	593-724	593-743
251	591-629	591-648	591-666	591-684	591-703	591-722	591-742
252	590-628	590-647	590-665	590-683	590-702	590-721	590-740
253	588-627	588-646	588-664	588-682	588-701	588-720	588-739
254	587-626	587-645	587-663	587-681	587-700	587-719	587-738
255	586-625	586-644	586-662	586-680	586-699	586-717	586-736
256	584-625	584-643	584-661	584-679	584-698	584-716	584-735
257	583-624	583-642	583-660	583-678	583-696	583-715	583-734
258	581-623	581-641	581-659	581-677	581-695	581-714	581-732
259	580-622	580-640	580-658	580-676	580-694	580-712	580-731
260	579-621	579-639	579-657	579-675	579-693	579-711	579-730
261	577-620	577-638	577-656	577-674	577-692	577-710	577-729
262	576-619	576-637	576-655	576-673	576-691	576-709	576-727
263	575-619	575-636	575-654	575-671	575-690	575-708	575-726
264	573-618	573-635	573-653	573-670	573-688	573-707	573-725
265	572-617	572-634	572-652	572-669	572-687	572-705	572-724
266	571-616	571-634	571-651	571-668	571-686	571-704	571-722
267	569-615	569-633	569-650	569-667	569-685	569-703	569-721
268	568-614	568-632	568-649	568-666	568-684	568-702	568-720
269	567-614	567-631	567-648	567-665	567-683	567-701	567-719
270	566-613	566-630	566-647	566-664	566-682	566-700	566-718

EMPTY WEIGHT C.G. LIMITS (lbs, inches)

Empty Weight (lbs)	Cockpit Load Range (lbs)			Empty Weight (kg)
	Empty Weight C.G. Limits (inches)			
	176-242	187-242	198-242	
507	24.600-28.785	24.600-29.600	24.600-30.430	230
509	24.531-28.728	24.531-29.540	24.531-30.366	231
511	24.464-28.672	24.464-29.480	24.464-30.303	232
514	24.397-28.617	24.397-29.421	24.397-30.241	233
516	24.330-28.562	24.330-29.363	24.330-30.179	234
518	24.265-28.507	24.265-29.305	24.265-30.117	235
520	24.199-28.453	24.199-29.247	24.199-30.056	236
522	24.135-28.400	24.135-29.190	24.135-29.996	237
525	24.070-28.347	24.070-29.134	24.070-29.936	238
527	24.007-28.294	24.007-29.078	24.007-29.877	239
529	23.944-28.242	23.944-29.022	23.944-29.818	240
531	23.881-28.190	23.881-28.967	23.881-29.760	241
534	23.819-28.138	23.819-28.913	23.819-29.702	242
536	23.757-28.087	23.757-28.858	23.757-29.644	243
538	23.696-28.037	23.696-28.805	23.696-29.587	244
540	23.636-27.987	23.636-28.751	23.636-29.531	245
542	23.576-27.937	23.576-28.699	23.576-29.475	246
545	23.516-27.887	23.516-28.646	23.516-29.419	247
547	23.457-27.839	23.457-28.594	23.457-29.364	248
549	23.398-27.790	23.398-28.543	23.398-29.309	249
551	23.340-27.742	23.340-28.491	23.340-29.255	250
553	23.283-27.694	23.283-28.441	23.283-29.201	251
556	23.225-27.647	23.225-28.390	23.225-29.148	252
558	23.168-27.600	23.168-28.340	23.168-29.095	253
560	23.112-27.553	23.112-28.291	23.112-29.042	254
562	23.056-27.507	23.056-28.242	23.056-28.990	255
564	23.001-27.461	23.001-28.193	23.001-28.939	256
567	22.946-27.415	22.946-28.144	22.946-28.887	257
569	22.891-27.370	22.891-28.096	22.891-28.836	258
571	22.837-27.325	22.837-28.049	22.837-28.786	259
573	22.783-27.280	22.783-28.001	22.783-28.736	260
575	22.730-27.236	22.730-27.954	22.730-28.686	261
578	22.677-27.192	22.677-27.908	22.677-28.637	262
580	22.624-27.149	22.624-27.861	22.624-28.588	263
582	22.572-27.106	22.572-27.816	22.572-28.539	264
584	22.520-27.063	22.520-27.770	22.520-28.491	265
586	22.469-27.020	22.469-27.725	22.469-28.443	266
589	22.418-26.978	22.418-27.680	22.418-28.395	267
591	22.368-26.936	22.368-27.635	22.368-28.348	268
593	22.317-26.895	22.317-27.591	22.317-28.301	269
595	22.267-26.853	22.267-27.547	22.267-28.255	270
	80-110	85-110	90-110	(kg)

EMPTY WEIGHT C.G. LIMITS (lbs, inches)

Empty Weight (lbs)	Cockpit Load Range (lbs)				Empty Weight (kg)
	Empty Weight C.G. Limits (inches)				
	132-242	143-242	154-242	165-242	
507	24.600-25.587	24.600-26.385	24.600-27.179	24.600-27.970	230
509	24.531-25.545	24.531-26.339	24.531-27.130	24.531-27.917	231
511	24.464-25.502	24.464-26.293	24.464-27.081	24.464-27.865	232
514	24.397-25.460	24.397-26.248	24.397-27.032	24.397-27.813	233
516	24.330-25.419	24.330-26.203	24.330-26.984	24.330-27.761	234
518	24.265-25.378	24.265-26.159	24.265-26.936	24.265-27.710	235
520	24.199-25.337	24.199-26.114	24.199-26.888	24.199-27.659	236
522	24.135-25.297	24.135-26.071	24.135-26.841	24.135-27.609	237
525	24.070-25.256	24.070-26.027	24.070-26.795	24.070-27.559	238
527	24.007-25.217	24.007-25.984	24.007-26.749	24.007-27.510	239
529	23.944-25.177	23.944-25.942	23.944-26.703	23.944-27.461	240
531	23.881-25.138	23.881-25.899	23.881-26.657	23.881-27.412	241
534	23.819-25.099	23.819-25.857	23.819-26.612	23.819-27.364	242
536	23.757-25.061	23.757-25.816	23.757-26.568	23.757-27.316	243
538	23.696-25.023	23.696-25.775	23.696-26.523	23.696-27.269	244
540	23.636-24.985	23.636-25.734	23.636-26.479	23.636-27.222	245
542	23.576-24.947	23.576-25.693	23.576-26.436	23.576-27.175	246
545	23.516-24.910	23.516-25.653	23.516-26.392	23.516-27.129	247
547	23.457-24.873	23.457-25.613	23.457-26.349	23.457-27.083	248
549	23.398-24.836	23.398-25.573	23.398-26.307	23.398-27.037	249
551	23.340-24.800	23.340-25.534	23.340-26.265	23.340-26.992	250
553	23.283-24.764	23.283-25.495	23.283-26.223	23.283-26.947	251
556	23.225-24.728	23.225-25.456	23.225-26.181	23.225-26.903	252
558	23.168-24.693	23.168-25.418	23.168-26.140	23.168-26.859	253
560	23.112-24.657	23.112-25.380	23.112-26.099	23.112-26.815	254
562	23.056-24.623	23.056-25.342	23.056-26.058	23.056-26.772	255
564	23.001-24.588	23.001-25.305	23.001-26.018	23.001-26.729	256
567	22.946-24.553	22.946-25.267	22.946-25.978	22.946-26.686	257
569	22.891-24.519	22.891-25.230	22.891-25.939	22.891-26.644	258
571	22.837-24.486	22.837-25.194	22.837-25.899	22.837-26.601	259
573	22.783-24.452	22.783-25.158	22.783-25.860	22.783-26.560	260
575	22.730-24.419	22.730-25.121	22.730-25.821	22.730-26.518	261
578	22.677-24.385	22.677-25.086	22.677-25.783	22.677-26.477	262
580	22.624-24.353	22.624-25.050	22.624-25.745	22.624-26.436	263
582	22.572-24.320	22.572-25.015	22.572-25.707	22.572-26.396	264
584	22.520-24.288	22.520-24.980	22.520-25.669	22.520-26.356	265
586	22.469-24.256	22.469-24.945	22.469-25.632	22.469-26.316	266
589	22.418-24.224	22.418-24.911	22.418-25.595	22.418-26.276	267
591	22.368-24.192	22.368-24.877	22.368-25.558	22.368-26.237	268
593	22.317-24.161	22.317-24.823	22.317-25.522	22.317-26.198	269
595	22.267-24.130	22.267-24.809	22.267-25.486	22.267-26.159	270
	60-110	65-110	70-110	75-110	(kg)

INFLIGHT C.G. POSITION

When loading within limits determined from empty weight C.G. weighing, inflight C.G. position is always within certified range. However, it might be interesting to know the actual inflight C.G. position, which can be obtained by two methods:

- 1) Weigh as described on page 6-1, but place pilot into seat.  
Add pilot weight to empty weight.  
Redetermine values a and b, because of altered suspension level.  
This method yields exact values.
- 2) The analytical method yields maximum and minimum inflight C.G. values, because pilot leverage varies according to weight and size of the pilot. Therefore, calculation for inflight C.G. position  $X_{cg_F}$  must be performed twice to find the C.G. range within which the exact inflight C.G. value is.

$$X_{cg_F} = \frac{(X_{cg} \times W) - (X_p \times W_p)}{W + W_p}$$

with  $X_{cg}$  = empty weight C.G. position  
 $W$  = empty weight  
 $X_p$  = pilot leverage  
 $W_p$  = pilot weight

Pilot leverage in relation to pilot weight:

Pilot weight		Leverage for foremost C.G. position		Leverage for rearmost C.G. position	
(kg)	(lbs)	(mm)	(in)	(mm)	(in)
60	132	598	23.543	533	20.984
65	143	595	23.425	531	20.906
70	154	592	23.307	529	20.827
75	165	590	23.228	527	20.748
80	176	588	23.150	527	20.748
85	187	587	23.110	527	20.748
90	198	586	23.071	528	20.787
95	209	585	23.031	530	20.866
100	220	585	23.031	533	20.984
105	231	585	23.031	537	21.142
110	242	586	23.071	543	21.378

For approved inflight C.G. limit values see page 2-4

DESCRIPTION OF SYSTEMS

Airframe

Fuselage structure is a pure fiberglass shell partly reinforced by stiffening frames. The cockpit portion is a double fiberglass shell.

Wing structure is a fiberglass-foam sandwich, a double T section spar carrying bending load

Horizontal tail structure is a fiberglass foam sandwich, carrying all loads without a spar.

Flight Controls

Aileron system activated via pushrods guided in longitudinal motion ball bearings. Connection of system by ball snap joints in fuselage, LS-securing sleeve on wing side pushrod. Aileron partly mass balanced.

Elevator system activated via pushrods guided in longitudinal motion ball bearings. Automatic coupling during assembly of horizontal tail unit. Mass balance in vertical tail fin. Longitudinal trim by adjustable spring system, trim locking lever on control stick, trim lever at left side of cockpit.

Rudder system activated via steel cables, no closed control circuit. 100 % mass balance at rudder.

Instrument Panel

Panel mounted on floor of cockpit. Depending on version allows for installation of up to 8 instruments plus radio. Weight limitation on instruments installed in upper portion of panel see page 2-3.

Air Brakes Activated via pushrods guided in plain bearings. Connection of system by ball snap joints in fuselage, LS-securing sleeve on wing side pushrod. Upper surface airbrakes of double height, flexible cover blades.

Landing Gear is sprung and retractable, housed in a closed box. Tail skid or tail wheel optional.

Baggage Compartment behind pilot's shoulders is for light and soft materials only. For maximum weight of baggage see page 2-3. For permanent installation of batteries etc. see page 9-3.

Seat Adjustment of backrest see page 4-5.

Water Ballast System Two tanks per wing, maximum total capacity 85 liters (22.45 US-Gal., 18.7 Imp.Gal.). Loading and dump valve on under side of wing. Automatic coupling of valve operating mechanism during assembly.

### Cockpit

Double fiberglass shell. Controls for landing gear and air brakes located on left cockpit side. Trim lever located on left side of landing gear control, trim release lever on control stick. Controls for tow release, pedal adjustment, canopy emergency release and ventilation are located on instrument panel, water ballast valve control and backrest slope control on right side of cockpit.

### Canopy

One piece hinged up front with cover for instrument panel. Canopy frame includes 6 mm metric threads for camera mounts.

### Oxygen Installation

Fiberglass receptacle for 3 liter oxygen bottles of 100 mm (3.94 in) diameter.

Rolladen Schneider Flugzeugbau GmbH	FLIGHT MANUAL 8 - Handling, Servicing and Maintenance	LS4-a	Page 8-1 USA
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HANDLING, SERVICING AND MAINTENANCE

INTRODUCTION

- a) For service and information not contained within this manual, it is recommended to contact agent or manufacturer.
- b) All correspondence regarding the sailplane should carry its serial number.
- c) The serial number can be found on the type placard, on the right side of the main bulkhead.
- d) A Maintenance Manual is issued with each sailplane. To keep this up to date, a special product information service may be subscribed. Contact the manufacturer for this information service, which too includes Technical Bulletins and general information.

AIRPLANE INSPECTION PERIODS

- a) FAA required annual inspection according to checklist provided in Maintenance Manual after performance of annual maintenance procedure.
- b) Manufacturer recommended daily inspection.
- c) Manufacturer recommended extraordinary inspection, depending on circumstances (rough landings, ground loops etc.) as provided in Maintenance Manual.
- d) Other inspections may be required by the issuance of airworthiness directives applicable to the aircraft or components.

It is the responsibility of the owner/operator to determine that all applicable airworthiness directives are complied with.

When inspections are repetitive, inadvertent noncompliance may be prevented by adding them to the end of the annual inspection checklist or by a special inspection schedule.

- e) Life limited parts, such as tow release system components or seat belt harness may require other inspections.

Agency or personnel accomplishing the required inspections and most of the manufacturer recommended inspections must be properly certificated. In case of doubt, consult agent, manufacturer or FAA.

PREVENTIVE MAINTENANCE that may be accomplished by a  
certificated pilot

- a) A certificated pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited preventive maintenance on his airplane. Refer to FAR Part 43 for appropriate list.
- b) All other maintenance required is to be accomplished by appropriately licenced personnel.
- c) Preventive maintenance should be accomplished in accordance with the appropriate airplane Maintenance Manual, to be sure that proper procedures are followed. A Maintenance Manual is delivered with each sailplane, carrying the serial number.

ALTERATIONS OR REPAIRS

- a) Alterations or repairs must be accomplished by licenced personnel.
- b) Prior to any alterations the FAA should be contacted to insure that airworthiness of the airplane is not violated.
- c) For alterations or repairs a written approval from the manufacturer is required (Special advice, drawings etc.).

GROUND HANDLING

Assembly Procedure

- clean and grease all pins and matching holes
- insert left spar end into fuselage and watch for angle of dihedral
- insert right spar end into fuselage and watch for angle of dihedral
- insert main pins when holes are lined up correctly
- secure main pins by placing handle behind spring loaded peg
- connect air brake system with ball snap joints
- secure ball snap joints of air brake system by turning LS-sleeve over joint as far as possible. Check securing by trying to disassemble connectors. See also drawing on page 4-3.
- connect aileron system with ball snap joints
- secure ball snap joints of aileron system by turning LS-sleeve over joint as far as possible. Check securing by trying to disassemble connectors. See also drawing on page 4-3.
- use built in mirrors and colour markings at aileron and air brake system connections as an additional visual aid to check positioning of LS-sleeve only
- insert battery into vertical tail fin if weighing was performed in this configuration (see Data Placard in cockpit), connect to system and check operation.



GROUND HANDLING

Assembly Procedure continued

- install horizontal tail and secure with slotted nut against tapered pins using a suitable coin until red marking on attachment bracket is invisible.
- install total energy tube, battery (if not already in vertical tail fin) and barograph.
- connect automatic parachute to red marked portion of main bulkhead using special loop only
- seal wing fuselage intersection by taping on upper and lower sides
- seal access hole on upper side of horizontal tail by taping
- perform Daily Inspection

Disassembly Procedure

- reverse assembly sequence, except before removing main pins turn LS-sleeves away from ball snap joints and disconnect aileron and air brake systems

SUPPORTING AREA FOR ROAD TRANSPORT

- Fuselage
- tail skid or tail wheel
  - main wheel
  - shell in front of landing gear, minimum width of support 300 mm (11.8 in)
- Wing
- right spar at inner or outer main pin hole
  - left, forked spar at inner main pin hole. At outer main pin hole only, if both fork ends are supported
  - shell at root, minimum width of support 150 mm (5.9 in)
  - shell near inner aileron end, minimum width of support 250 mm (10 in)
- Horizontal Tail Unit
- at any place, minimum width of support 80 mm (3.2 in)

SUPPORTING AREA TO LIFT WHOLE SAILPLANE

- under wing spar, never under nose section
- under fuselage shell in front of wing
- under fuselage shell behind wing

LONG TERM STORAGE

Preparation for Long Term Storage

- remove instrumentation and store separately
- close external pressure ports (see page 8-6) and inner tube ends
- protect all metal parts using spray oil and vaseline
- close all orifices without preventing air circulation using wire cloth or similar means to prevent entry of small animals

Return to Service

- Inspection according to Annual Inspection (See Maintenance Manual page 2-1 and Chapter 8)
- inspect inside of wings and fuselage for small animals (mice, birds etc.) and/or nests

CLEANING AND CARE

These recommendations are according to paint manufacturer Lesonal's note dated 7.7.81

Suitable

- water with washing-up liquid added in recommended quantities
- car polish with or without silicone
- car hardwax

Suitable with reservations

- tar remover for cars based on petrol and white gasoline
- alcohol like spirit or isopropyl alcohol

|| Reservations are, that these liquids should only be used for wiping off, not for soaking with rags.

Unsuitable

- strong solvents and thinners (acetone)

|| These items may decompose gelcoat and cause local shrinking.

Completely unsuitable

- trichloroethylene
- carbon tetrachloride or similar hydrocarbon chlorides

|| These liquids destroy the gelcoat.

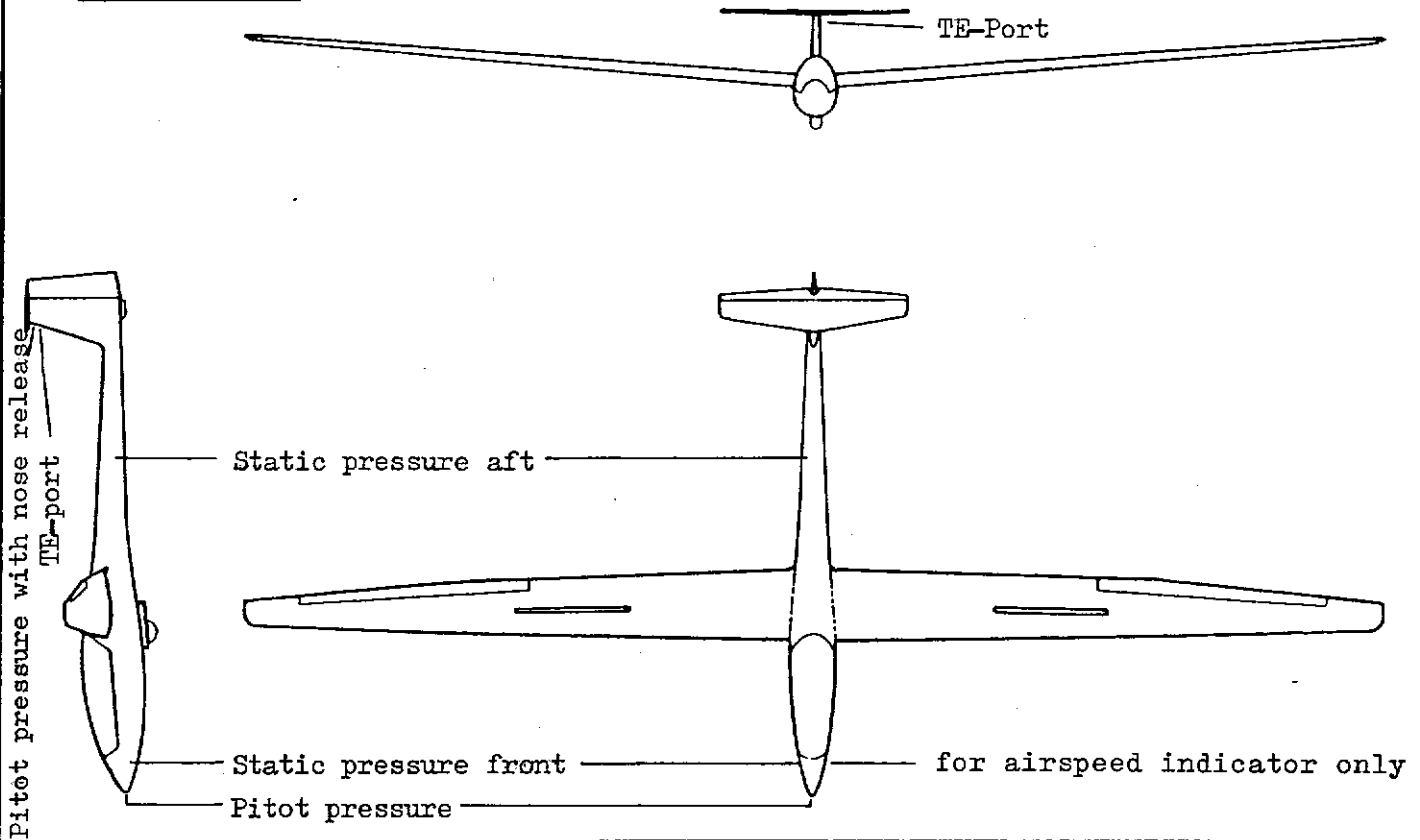
**Warning:**

Unless regularly polished with hardwax, sanded gelcoat shows distinctive weathering marks due to changes of temperature, ultra violet radiation and humidity.

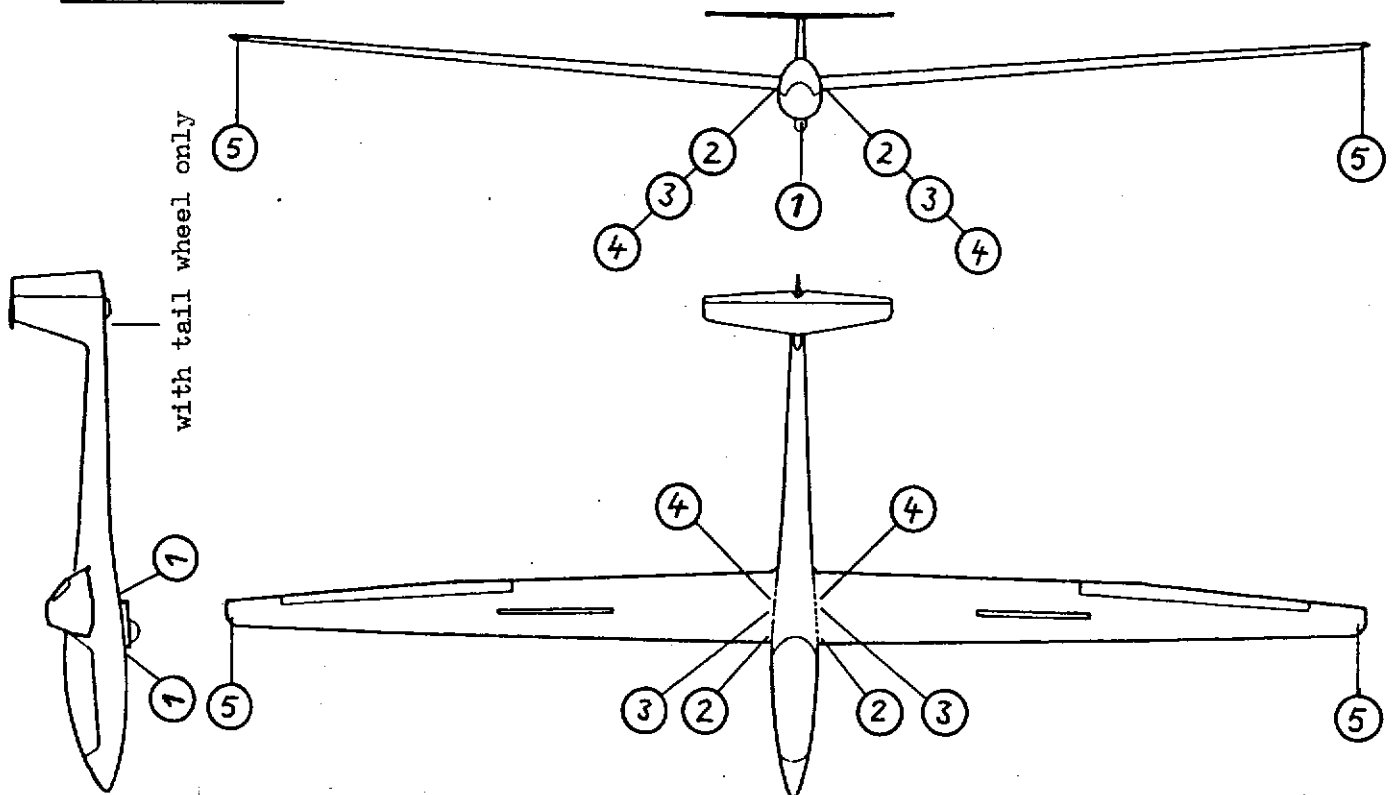
Longitudinal motion pushrod bearings

Never grease these bearings, they will be destroyed soon due to collection of small foreign matter. Longitudinal motion bearings are used in elevator and aileron control systems.

PRESSURE PORTS



DRAIN ORIFICES



COCKPIT LOADING PLAN

New entry with each annual inspection and when changing equipment.  
Should be calculated in accordance with chapter 6. Abbreviate battery  
position as follows: 0 = None, B = Baggage Compartment, V = Vertical  
Tail Fin.

Empty Weight	Maximum Per- missible Load	Minimum Per- missible Load	Permanently Fixed Ballast		Battery Position	Date	Inspector
			forward	aft			

Erstellt: 15. April 83 *le* Ersetzt: Geprüft: 15. 4. 83 *whapha*

WATER BALLAST LOADING INSTRUCTIONS

Maximum capacity 85 kg ( 187 lbs) per wing.

Maximum total capacity 170 kg (375 lbs).

Table provides maximum water ballast weight in relation to empty weight and cockpit load. Baggage and temporary equipment reduce maximum water ballast weight accordingly.

Pilot and Parachute (kg)	Empty weight (kg)									
	230	235	240	245	250	255	260	265	270	275
70	170	170	170	170	170	170	170	170	170	170 kg
75	170	170	170	170	170	170	170	170	170	170 kg
80	170	170	170	170	170	170	170	170	170	170 kg
85	170	170	170	170	170	170	170	170	170	165 kg
90	170	170	170	170	170	170	170	170	165	160 kg
95	170	170	170	170	170	170	170	165	160	155 kg
100	170	170	170	170	170	170	165	160	155	150 kg
105	170	170	170	170	170	165	160	155	150	145 kg
110	170	170	170	170	165	160	155	150	145	140 kg

Pilot and Parachute (lbs)	Empty Weight (lbs)									
	507	518	529	540	551	562	573	584	595	606
154	375	375	375	375	375	375	375	375	375	375 lbs
165	375	375	375	375	375	375	375	375	375	375 lbs
176	375	375	375	375	375	375	375	375	375	375 lbs
187	375	375	375	375	375	375	375	375	375	364 lbs
198	375	375	375	375	375	375	375	375	364	353 lbs
209	375	375	375	375	375	375	375	364	353	342 lbs
220	375	375	375	375	375	375	364	353	342	331 lbs
231	375	375	375	375	375	364	353	342	331	320 lbs
242	375	375	375	375	364	353	342	331	320	309 lbs

EXAMPLE: When empty weight is 260 kg (573 lbs) and pilot and parachute weight is 110 kg (242 lbs), maximum permissible water ballast weight is 155 kg (342 lbs).

PERMANENT INSTALLATION OF FIXED BALLAST

If empty weight C.G. position is too far behind to allow 70 kg (154 lbs) as Minimum Cockpit Load, permanent installation of ballast (trim weights, 2.45 kg (5.4 lbs) each) under instrument panel portion of seat is possible. A trim weight holder can be ordered as optional equipment. Weights should be fixed in flight direction using large washers and selflocking nuts such that vibrations may not cause them to turn round. One weight of 2.45 kg (5.4 lbs) shifts empty weight C.G. position approximately 17 mm (0.669 in) forward.

After permanent installation of fixed ballast empty weight C.G. position should be redetermined by weighing. See chapter 6.

In special cases empty weight C.G. position may be shifted rearward to allow heavy pilots to fly with rearward C.G. positions. Therefore it is possible to fit a battery (Dryfit, measurements 232 x 90 x 50 mm (9.134 x 3.543 x 1.969 in), weight 2.7 kg (5.95 lbs) ) into the vertical tail fin battery box. Installation of lead weight is not allowed in battery box.

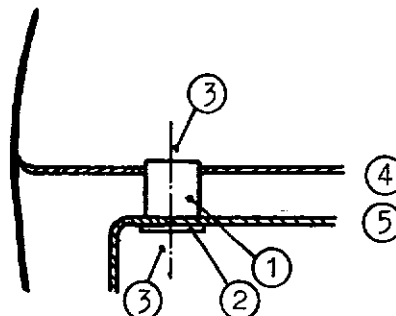
After installation of battery in vertical tail fin battery box empty weight C.G. position should be redetermined by weighing. See chapter 6.

INSTALLATION OF EQUIPMENT IN BAGGAGE COMPARTMENT

Equipment must be attached to landing gear box using threaded spacers, three of which are necessary per unit.

Baggage compartment cover has to be cut to avoid spacers. See sketch.

- ① Spacer, diameter 18-20 mm (0.7-0.8 in), length 15 mm (0.6 in).
- ② Washer B5.3 DIN 9021-St outer diameter 15 mm (0.6 in)
- ③ Screw M5x10 DIN 85-A2
- ④ Baggage compartment cover
- ⑤ Landing gear box



MASTER EQUIPMENT LIST

SPECIFICATIONS FOR BASIC EQUIPMENT

1) AIRSPEED INDICATOR

Original certification was carried out using a Winter 6FMS4-2  
airspeed indicator with a range of 30 to 300 km/h and colour marking  
according to Flight Manual page 2-2.

A similar FAA approved airspeed indicator to meet TSO C2 reading to  
300 km/h (160 kts, 180 mph) may be used. Maximum instrument error  $\pm 2\%$ .  
Colour marking must be according to Flight Manual page 2-2.

Examples: AID 11-1002-1 or KI 8000

2) ALTIMETER

Original certification was carried out using a Winter 4FGH-10  
altimeter with a range of 0-1000-10000 meters. (approx. 33000 ft)

A similar FAA approved altimeter to meet TSO C10 with a range of  
approximately 33000 ft and a mercury or millibar subscale may be  
used.

When an altimeter of up to 20000 ft only is being used, a placard  
must be near the altimeter stating: Maximum flying altitude 20000 ft.  
(See also Flight Manual page 2-7).

Examples: Kollsman Type 378222 or AID 13-2000-1 or AID 13-2000-5

3) MAGNETIC COMPASS

Original certification was carried out using no compass.

Any FAA approved magnetic compass (non-stabilized type) to meet  
TSO C7 may be used.

Examples: Airpath C 2300 or Airpath C 2400 or PZL BS-1 or PZL KJ-13A

4) SEAT BELT HARNESS

The following types are certified:

Gadringer	lap belt	Bagu	IV-E/2	
	shoulder strap	Schugu	II/C	
Gadringer	lap belt	Bagu	V-BB/2	(multiple point buckle)
	shoulder strap	Schugu	II-C/V	
Autoflug	lap belt	Bagu	FAG-7H	(multiple point buckle)
	shoulder strap	Schugu	FAG-7H	



MASTER EQUIPMENT LIST continued

5) OPTIONAL INSTRUMENTS

a) Mechanical Variometer (Vertical Speed Indicator)

Winter 5StV5 or 5StVM5                      Bohli 68PVF1  
PZL        WRS-5D                                      Schuemann SV or CV

b) Electrical Variometer (Vertical Speed Indicator)

Blumenauer all models  
Cambridge all models  
Flexum all models  
Peschges all models  
Westerboer all models  
Zander all models

c) Turn and Bank Indicator

Gauting WZ 4o2/31                                      PZL EZS-3  
RC Allen 12W2D2A or 12W2D2S

d) Horizon Reference Indicator (Electrical Gyro Horizon)

Gauting 6532/6  
AIM 5oo-DCF  
RC Allen RCA 26 AK-4

6) ELECTRICAL INSTALLATION

- a) Battery Only life sealed batteries are recommended (Gel cell or Nickel-Cadmium types).  
Battery size must be chosen in relation to power requirements to guarantee 8 hours of continuous service. For "German" type radio plus electrical variometer 12V/6.5Ah are adequate. Power requirement for average "German" type radio is 1.5 A for transmitting, 0.4 A for receiving voice and 0.06 A for standby.

Examples: Dittel (Dryfit) 12V 6.5Ah including battery holder  
Battery installation see Flight Manual page 9-3

- b) Switches Marquardt 2A 250V or other manufacturers

- c) Fuses or Microfuse 2ox5 mm DIN 41571

Circuit Breakers Klixon 7277-2 or 7274-2 or similar

Ratings: 3.15 A quick acting: Master  
2 A quick acting: Radio Dittel FSG 4oS  
1 A quick acting: Electrical variometer  
Turn and bank indicator

MASTER EQUIPMENT LIST continued

d) Radio           Walter Dittel   FSG 4oS, FSG 5o, FSG 6o models  
                  Avionic Dittel   ATR 72o models  
                  Becker           AR 2000 and AR 3000 models  
Antenna           Dittel antenna for vertical fin, 118-136 MHz

7) LANDING GEAR

Main wheel       Tost Kobold 1o3/2o,4 inch in diameter  
Tyre             Continental 4.oo-4 4PR  
Tube             Continental 4.oo-4  
Tail wheel       Streifeneder 21o x 65  
Tyre             Continental 21o x 65  
Tube             Continental 21o x 65

8) RELEASE MECHANISM

C.G. release     Tost G 73  
Nose release     Tost E 75

COLOUR CODE OF INSTRUMENT TUBING

The following colour code is used for instrument tubes:

- Red = pitot pressure
- Blue = static pressure forward for airspeed indicator only
- Yellow = static pressure aft
- Green = total energy tube pressure

In addition three clear tubes are installed from the vacuum bottle stowage compartment to the instrument panel.