

Flight Manual LS1-f

0 Amendments, list of effective pages, table of contents

0.1 Amendments

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.

No.	Page	Description	Date	Inserted Signature
1	0.0-7.6	Combination of the initial flight manuals of the Variants LS1-f and LS1-f (45), new standardized format	May 2011	
2	1.1 -1.4, 2.1, 2.2, 2.6 – 2.9, 3.1 – 3.3, 4.1 – 4.14, 5.1, 5.2, 6.1 – 6.5, 7.1 – 7.5, 8.1 – 8.4, 9.1	Miscellaneous changes to the contents of the latest amendments of the initial flight manuals	May 2011	

Flight Manual LS1-f

Page intentionally left blank

Flight Manual LS1-f

0.2 List of effective pages

Section	page	issued	replaced	replaced	replaced
0	0.1	May 11			
	0.2	"			
	0.3	"			
	0.4	"			
	0.5	"			
	0.6	"			
	0.7	"			
1	1.1	May 11			
	1.2	"			
	1.3	"			
	1.4	"			
2	2.1	May 11			
	2.2	"			
	2.3	"			
	2.4	"			
	2.5	"			
	2.6	"			
	2.7	"			
	2.8	"			
	2.9	"			
	2.10	"			
3	3.1	May 11			
	3.2	"			
	3.3	"			
4	4.1	May 11			
	4.2	"			
	4.3	"			
	4.4	"			
	4.5	"			
	4.6	"			
	4.7	"			
	4.8	"			
	4.9	"			
	4.10	"			
	4.11	"			

Flight Manual LS1-f

List of effective pages cont.

Section	page	issued	replaced	replaced	replaced
4	4.12	May 11			
	4.13	"			
	4.14	"			
5	5.1	May 11			
	5.2	"			
	5.3	"			
6	6.1	May 11			
	6.2	"			
	6.3	"			
	6.4	"			
	6.5	"			
7	7.1	May 11			
	7.2	"			
	7.3	"			
	7.4	"			
	7.5	"			
8	8.1	May 11			
	8.2	"			
	8.3	"			
	8.4	"			
9	9.1	May 11			

Flight Manual LS1-f

0.3 Table of contents

Section	Content	page
0	Amendments, list of effective pages, table of contents	0.1
0.1	Amendments	0.1
0.2	List of effective pages	0.3
0.3	Table of contents	0.5
1	General	1.1
1.1	Introduction	1.1
1.2	Certification basis	1.1
1.3	Warnings, cautions and notes	1.2
1.4	Descriptive data	1.3
1.5	Three view drawing	1.4
2	Limitations	2.1
2.1	Introduction	2.1
2.2	Airspeed	2.2
2.3	Airspeed Indicator Markings	2.3
2.3.1	LS1-f	2.3
2.3.2	LS1-f (45)	2.3
2.4	Mass (weight)	2.4
2.5	Centre of gravity	2.4
2.6	Approved manoeuvres	2.4
2.7	Flight crew	2.5
2.8	Kinds of operation	2.5
2.9	Minimum equipment	2.5
2.9.1	Normal operation	2.5
2.9.2	In addition for cloud flying	2.5
2.10	Aerotow, winch and autotow launching	2.6
2.10.1	Weak links	2.6
2.10.2	Towing cable for aerotow	2.6
2.10.3	Max. towing speeds	2.6
2.10.4	Min. towing speeds for aerotow	2.6
2.10.5	Tow Release	2.6
2.11	Tyre Pressure	2.6
2.12	Waterballast	2.7
2.13	Limitations placards	2.8
2.13.1	Limitations placards LS1-f	2.8
2.13.2	Limitations placards LS1-f (45)	2.9
2.13.3	LS1-f and LS1-f (45)	2.10
3	Emergency procedures	3.1
3.1	Introduction	3.1
3.2	Canopy jettison	3.1
3.3	Bailing out	3.1

Flight Manual LS1-f

Section Content	page
3.4 Stall characteristics and stall recovery.....	3.1
3.5 Spinning characteristics and Spin Recovery.....	3.2
3.6 Recovery from unintentional cloud flying.....	3.2
3.7 Emergency wheel up landing.....	3.2
3.8 Emergency ground loop.....	3.2
3.9 Emergency landing on water	3.3
4 Normal procedures.....	4.1
4.1 Introduction.....	4.1
4.2 Rigging and derigging, filling and dumping the watertanks	4.1
4.2.1 Rigging.....	4.1
4.2.2 Handling and securing the L'Hotellier control quick connectors.....	4.2
4.2.3 Filling the water ballast tanks	4.3
4.2.4 Dumping the waterballast	4.3
4.2.5 Derigging	4.4
4.3 Daily Inspection.....	4.5
4.3.1 Inspection prior to rigging:	4.5
4.3.2 Inspection after rigging - Walk around the aircraft	4.6
4.3.3 Daily inspection after flight operation	4.8
4.3.4 Pre-flight inspection.....	4.8
4.4 Normal procedures and recommended speeds	4.9
4.4.1 Aerotow.....	4.9
4.4.2 Winch launch	4.9
4.4.3 Free flight.....	4.10
4.4.4 Approach and landing.....	4.11
4.4.5 Flight with water ballast.....	4.12
4.4.6 Flight at high altitude and at low temperatures	4.13
4.4.7 Flights in rain and thunderstorms	4.14
4.4.8 Cloud flying	4.14
4.4.9 Aerobatics	4.14
5 Performance	5.1
5.1 Airspeed indicator system calibration.....	5.1
5.2 Stall speeds.....	5.2
5.3 Demonstrated crosswind performance	5.2
5.4 Gliding performance	5.2
5.5 Flight polar.....	5.3
6 Mass (weight) and balance	6.1
6.1 Introduction.....	6.1
6.2 Weighing procedures	6.1
6.3 Weighing record.....	6.1
6.4 Basic empty mass and C.G.	6.1
6.5 Mass of all non-lifting parts (WNLP).....	6.1
6.6 Max. mass (weight).....	6.1

Flight Manual LS1-f

Section Content	page
6.7 Useful loads (payload).....	6.2
6.8 Loading chart	6.2
6.8.1 Cockpit load	6.2
6.8.2 Baggage.....	6.2
6.8.3 Waterballast in the wing tanks.....	6.2
6.8.4 Weighing report (for section 6.3).....	6.3
6.8.5 Ballast chart (total ballast).....	6.4
7 Sailplane and systems description	7.1
7.1 Introduction.....	7.1
7.2 Airframe	7.1
7.3 Placards	7.1
7.4 Aileron control.....	7.2
7.5 Elevator control, trim.....	7.2
7.6 Rudder Control.....	7.2
7.7 Wheel brake	7.3
7.8 Airbrakes.....	7.3
7.9 Waterballast System.....	7.3
7.10 Cockpit.....	7.3
7.11 Canopy	7.3
7.12 Tow hooks.....	7.3
7.13 Rudder pedal adjustment.....	7.4
7.14 Seat, back rest and safety harness.....	7.4
7.15 Instrument panel.....	7.4
7.16 Baggage compartment	7.4
7.17 Oxygen system.....	7.4
7.18 Landing gear	7.4
7.19 Pitot-/Static pressure system.....	7.5
7.20 Canopy emergency release	7.5
8 Sailplane handling, care and maintenance.....	8.1
8.1 Introduction.....	8.1
8.2 Inspection period, maintenance	8.1
8.3 Alterations or repairs.....	8.1
8.4 Tie Down, Parking	8.2
8.5 Transport	8.2
8.6 Towing on the ground.....	8.3
8.7 Cleaning and Care.....	8.3
8.7.1 Hints for care.....	8.3
8.7.2 Plexiglas canopy	8.4
8.7.3 Metal parts.....	8.4
9 Supplements	9.1

Flight Manual LS1-f

1 General

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 LS1-f and LS1-f (45).

This manual includes the material required to be furnished to the pilot by the airworthiness requirements. It also contains supplemental data supplied by the glider manufacturer.

1.2 Certification basis

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

Airworthiness requirements:

“*Airworthiness requirements for Sailplanes* “ LFS, issued 1966

and

Standards for Structural Substantiation of Glass Fibre Reinforced Plastic Components for Sailplanes, issued March 1965

Type certified by EASA Type Certificate EASA A.095 Type LS-sailplanes.

Date of certification: 30.08.2010

Initial type certification by LBA (Luftfahrt Bundesamt) with Type Certificate No. 262.

Date of certification:

Variant LS1-f: 30.08.1974

Variant LS1-f (45): 21.05.1976

Category of Airworthiness: "Utility"

Flight Manual LS1-f

1.3 Warnings, cautions and notes

This manual was produced according to the flight manual specimen from the actual valid certification specifications CS22.

It contains much more information than the initial manual.

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. |

Flight Manual LS1-f

1.4 Descriptive data

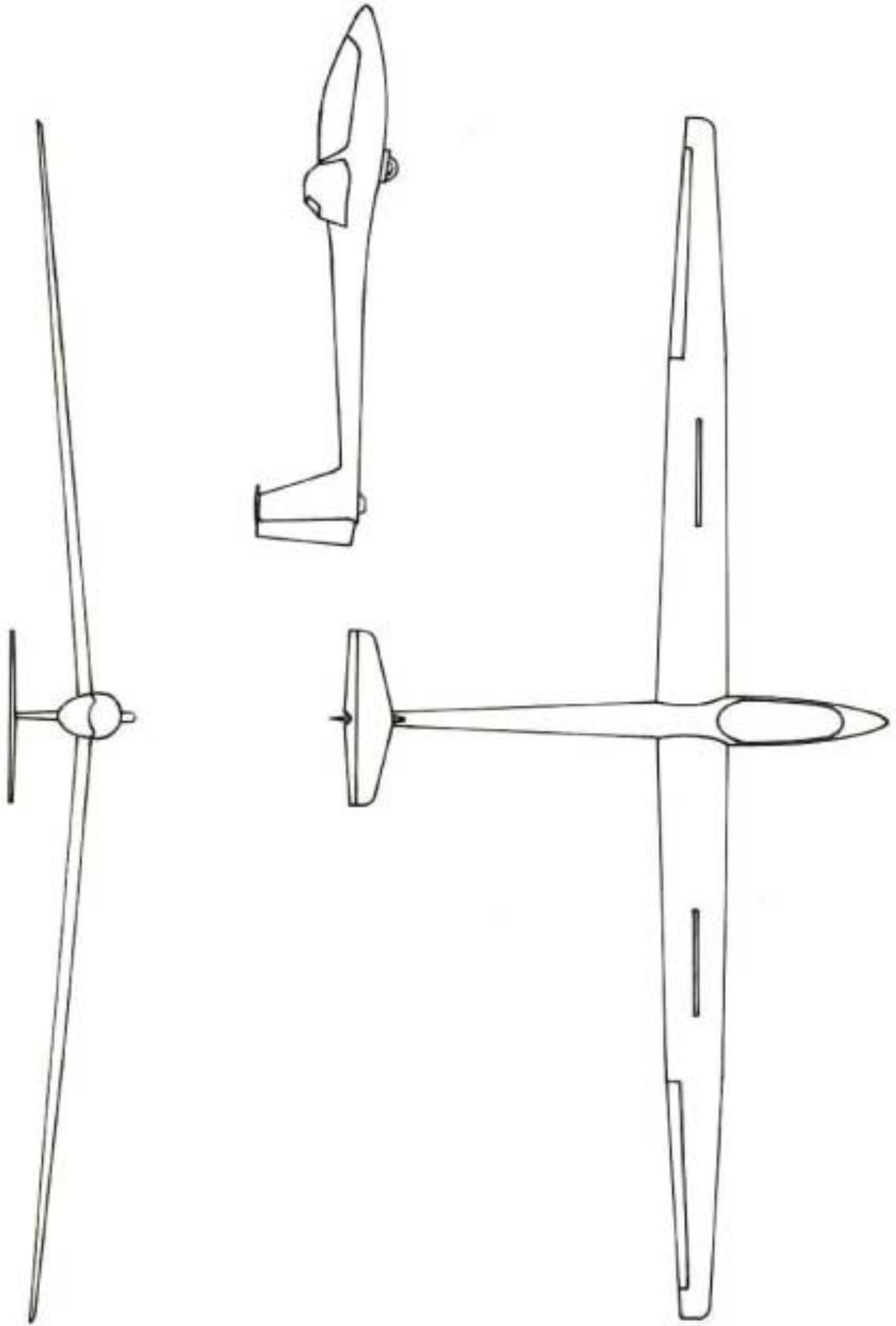
The LS1-f and LS1-f (45) are single-seater high performance sailplanes with conventional T-type horizontal tailplane.

Technical details

- Comfortable seating, backrest adjustable at ground.
- Large canopy for good in-flight vision.
- Sealed airbrake- and landing gear boxes.
- Retractable main wheel, spring mounted. Wheel with drum brake actuated via the airbrake handle.
- Waterballast in the wings in waterbags

Technical data	units	LS1-f	LS1-f (45)
Wing span	m	15	
Wing surface	m ²	9,75	
Aspect ratio	/	23,1	
Length	m	6,75	
Fuselage hight	m	0,83	
Fuselage width	m	0,62	
Horizontal tail span	m	2,2	
Horizontal tail surface	m ²	0,98	
Waterballast	kg (ltr.)	max. 2* 45	max. 2*90
Empty mass with min. equipment	kg	approx. 230	aprox. 235
Wing loading (with 80kg payload)	kg/m ²	approx. 32	approx. 32
max. mass	kg	390	439
max. wing loading	kg/m ²	40	45
Max. speed VNE	km/h	250	270
Aerobatics	/	Not approved	

1.5 Three view drawing



Flight Manual LS1-f

2 Limitations

2.1 Introduction

Section 2 includes operating limitations, instrument markings and basic placards necessary for safe operation of the gliders LS1-f and LS1-f (45), its standard systems and standard equipment.

The limitations included in this section have been approved.

Flight Manual LS1-f

2.2 Airspeed

Airspeed limitations and their operational significance are shown below

	Speed	IAS km/h (kts.)	Remarks
V _{NE}	Never exceed speed	LS1-f: 250 (135) LS1-f (45): 270 (146)	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection.
V _{RA}	Rough air speed	LS1-f: 250 (135) LS1-f (45): 270 (146)	Do not exceed this speed except in smooth air and then only with caution. Rough air is in lee-wave rotors, thunderclouds, visible whirlwinds or over mountain crests etc. Do not use more than 1/3 of control deflection.
V _A	Manoeuvring speed	170 (92)	Do not make full or abrupt control movement above this speed, because under certain conditions the sailplane may be overstressed by full control movement.
V _W	Maximum winch-launching speed	130 (70)	Do not exceed this speed during winch- or auto-tow-launching
V _T	Maximum aero-towing speed	170 (92)	Do not exceed this speed during aerotowing.
V _{LO}	Maximum landing gear operating speed	LS1-f: 250 (135) LS1-f (45): 270 (146)	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 V_{NE} is reduced with altitude according to the table below, see also section 4.4.6.

Note: The strength of the airframe is proved for ± 10 m/s gusts at max. speed V_{NE}. This means that combination of such a gust at V_{NE} and positive manoeuvring load at the same time may overstress the airframe

Flight Manual LS1-f

2.3 Airspeed Indicator Markings

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

2.3.1 LS1-f

Marking	(IAS) value or range km/h (kts.)	Significance
Green Arc	80 – 170 (43 - 92)	Normal Operating Range (Lower limit is maximum weight 1.1*VS1 at most forward c.g. with flaps neutral. Upper limit is rough air speed.)
Yellow Arc	170 -250 (92 – 135)	Manoeuvres must be conducted with caution and only in smooth air
Red Line	250 (135)	Maximum speed for all operations

2.3.2 LS1-f (45)

Marking	(IAS) value or range km/h (kts.)	Significance
Green Arc	80 – 170 (43 - 92)	Normal Operating Range (Lower limit is 1.1*VS1 at maximum weight and most forward c.g.. Upper limit is rough air speed.)
Yellow Arc	170 -270 (92 – 146)	Manoeuvres must be conducted with caution and only in smooth air
Red Line	270 (146)	Maximum speed for all operations

Flight Manual LS1-f

2.4 Mass (weight)

Maximum take off and landing weight with waterballast

LS1-f: 390 kg (860 lbs.)

LS1-f (45): 439 kg (968 lbs.)

Caution: It is recommended to dump the waterballast before landing on airfields. Dump the ballast before an outlanding in any case.

Maximum take-off and landing mass without waterballast:

$$W = W_{NLP} + W_{wings}$$

W_{NLP} = Maximum mass of the non lifting parts (see below)

W_{wings} = actual mass of the wings

Maximum weight of the non lifting parts = 230 kg 507 lbs.

Maximum mass in baggage compartment: 12 kg 26.5 lbs.

Caution: Heavy pieces of baggage must be secured to the baggage compartment floor.

Maximum waterballast

Variant	mass kg (litres)	mass US.gal.	mass lbs.
---------	------------------	--------------	-----------

LS1-f	2 x 45	2 x 11.9	2 x 99
--------------	--------	----------	--------

LS1-f (45)	2 x 90	2 x 23.8	2 x 198
-------------------	--------	----------	---------

The max. take off mass is not to be exceeded.

Warning: Follow the loading procedures see section 6.

2.5 Centre of gravity

Centre of gravity range in flight is:

220mm (8.66 in.) up to 420mm (16.53 in.) behind datum.

Datum= wing leading edge at the rootrib.

Reference line= underside of aft fuselage boom horizontal.

C.G. diagrams and loading chart see sect. 6.

2.6 Approved manoeuvres

This sailplane is certified for normal gliding in the "Utility" category.

Aerobatics are not approved.

Flight Manual LS1-f

2.7 Flight crew

Max. load in the seat: 110 kg (242 lbs.) unless limited by the max. permissible mass of the nonlifting parts (230 kg, 507 lbs).

Min. load in the seat (pilot + parachute): 60 kg (132 lbs.).

If necessary the min. cockpit load may be increased according to maintenance manual section 2.2.1 and value entered in section 6.8.4.

With these loads, the C.G. range given under section 2.5 will be kept within the limits when the empty weight C.G. is within its limits. See loading chart in section 6.

Caution: With lower pilot weights lead ballast must be added to the seat. Ballast put on the seat (lead ballast cushion) must be fastened at the safety belt anchor points.

2.8 Kinds of operation

Flights according to VFR (daylight)

Aerotow

Winch- and auto-tow launching

Aerobatics are not permitted

Cloud flying (daylight): permitted when properly instrumented (see below).

2.9 Minimum equipment

As minimum equipment only the instruments and equipment specified in the equipment list (see Maintenance Manual section 6) are admissible.

2.9.1 Normal operation

- a) **Airspeed indicator:** Range: 0-300 km/h (0-135kts.);
Speed range markings see sect. 2.3
- b) **Altimeter:** Range: 0 – min. 10.000 m (0 – min. 30000 ft),
Altimeter with fine range pointer, 1 turn max. 1000 m (3000 ft.)
- c) **Four piece symmetrical safety harness**
- d) **Parachute** automatic or manual type or a suitable firm back cushion compressed approx. 8 cm (3 in.) thick
- e) **Required placards, check lists, Flight manual.**

2.9.2 In addition for cloud flying

(Not permitted in the USA, Canada and Australia)

Magnetic compass (compensated in the aircraft)

VHF - transceiver (ready for operation)

Variometer

Turn and bank indicator or artificial horizon

Note: Experience has shown that the installed airspeed indicator system may be used for cloud flying.

Caution: The weight of the upper part of the instrument panel shall not exceed 4 kg (8.8 lbs.).

Flight Manual LS1-f

2.10 Aerotow, winch and autotow launching

2.10.1 Weak links

	Winch launch	aero tow
max.	5500 N (1240 lbs.)	5500 N (1240 lbs.)
recommended	5000 N \pm 500 N (1120 \pm 112 lbs.)	5000 N \pm 500 N (1120 \pm 112 lbs.) behind aircraft 3000 N \pm 300 N (670+ 67 lbs.) behind ultralight aircraft or powered sailplanes

2.10.2 Towing cable for aerotow

Length: 30-70 m (100 - 230 ft)

Material: hemp- or plastic fibres

2.10.3 Max. towing speeds

		maximum	maximum
Aerotow	$V_T =$	170 km/h	92 kts.
Winch- and autotow	$V_W =$	130 km/h	70 kts.

2.10.4 Min. towing speeds for aerotow

LS1-f and LS1-f (45)	No waterballast	100 km/h	54 kts.
LS1-f	With waterballast	110 km/h	59 kts.
LS1-f (45)	With waterballast	120 km/h	65 kts.

2.10.5 Tow Release

The C.G. tow release (installed in front of the main wheel at the LG fork) is suitable for winch and auto-tow launching as well as for aerotow.

Warning: When towing at the C.G. hook don't retract the landing gear.

Caution: If an additional front hook is installed according to TN59 this hook is to be used for aerotow.

In case to pitot pressure port is installed in the fuselage nose the ASI indication may be lower than real during aerotow depending on cable ring position.

2.11 Tyre Pressure

Main wheel	3,0 bar	(43.5 psi)
------------	---------	------------

2.12 Waterballast

Filling the water ballast is only allowed with a filling system which enables determination of the exact amount of ballast filled, e.g. water gauge or calibrated canisters. Only symmetrical loading is allowed.

After filling, balance the wings by dumping enough water from the heavy wing.

Warning: Follow the loading chart, see section 6.8.

Don't try to fill more water into the tanks than the specified values.

The max. take off weight must not be exceeded.

Flight Manual LS1-f

2.13 Limitations placards

2.13.1 Limitations placards LS1-f

Cockpit Checklist
This sailplane must be operated in compliance with operating limitations as stated in the form of markings, placards and flight manual.
<ol style="list-style-type: none"> 1. Trim ballast (for under weight pilot)? 2. Loading plan regarded? 3. Parachute worn properly, static line connected? 4. Seat back and rudder pedals in comfortable position ? 5. Safety harness buckled ? 6. All controls and instruments in reach? 7. Air brakes cycled and locked? 8. Trim position ? 9. Altimeter adjusted? 10. Positive control check ? (One person at the control surfaces). 11. Tail dolly removed ? 12. Tow release checked? 13. Canopy locked?
Clearly visible at right cockpit wall

Type: LS1-f			
Serial No.:	_____	Registration:	_____
Airspeed limits:			
Winch launch and auto tow	130 km/h	81 mph	70 kts.
Aero tow	170 km/h	106 mph	92 kts.
Manoeuvring	170 km/h	106 mph	92 kts.
Rough air	250 km/h	155 mph	135 kts.
Never exceed	250 km/h	155 mph	135 kts.
Aerobatic manoeuvres are prohibited			
Max. take-off mass	390 kg	860 lbs.	
Pilot weight incl. max:	110 kg	242 lbs.	
Parachute min:	60 kg	132 lbs.	
With lower pilot weight necessary ballast must be added.			
Clearly visible at right cockpit wall			

Altitude in [m]	0-2000	3000	4000	5000	6000	7000	8000	9000	10000
VNE IAS km/h	250	237	225	214	202	191	180	170	160
Altitude in [ft]	0-6560	9843	13124	16405	19685	22966	26247	29528	32809
VNE IAS kts.	135	128	122	115	109	103	97	92	86

Flight Manual LS1-f

2.13.2 Limitations placards LS1-f (45)

Cockpit Checklist
This sailplane must be operated in compliance with operating limitations as stated in the form of markings, placards and flight manual.
<ol style="list-style-type: none"> 1. Trim ballast (for under weight pilot)? 2. Loading plan regarded? 3. Parachute worn properly, static line connected? 4. Seat back and rudder pedals in comfortable position ? 5. Safety harness buckled ? 6. All controls and instruments in reach? 7. Airbrakes cycled and locked? 8. Trim position ? 9. Altimeter adjusted? 10. Positive control check ? (One person at the control surfaces). 11. Tail dolly removed ? 12. Tow release checked? 13. Canopy locked?
Clearly visible at right cockpit wall

Type: LS1-f (45)			
Serial No.: _____	Registration: _____		
Airspeed limits:			
Winch launch and auto tow	130 km/h	81 mph	70 kts.
Aero tow	170 km/h	106 mph	92 kts.
Manoeuvring	170 km/h	106 mph	92 kts.
Rough air	270 km/h	167 mph	146 kts.
Never exceed	270 km/h	167 mph	146 kts.
Aerobatic manoeuvres are prohibited			
Max. take-off mass	439 kg	968 lbs.	
Pilot weight incl. max:	110 kg	242 lbs.	
Parachute min:	60 kg	132 lbs.	
With lower pilot weight necessary ballast must be added.			
Clearly visible at right cockpit wall			

Altitude in [m]	0-2000	3000	4000	5000	6000	7000	8000	9000	10000
VNE IAS km/h	270	256	243	231	218	206	195	184	173
Altitude in [ft]	0-6560	9843	13124	16405	19685	22966	26247	29528	32809
VNE IAS kts.	146	138	131	125	118	111	105	99	93

Clearly visible at right cockpit wall

Flight Manual LS1-f

2.13.3 LS1-f and LS1-f (45)

Min. Cockpit Load: _____ kg If not 60 kg, clearly visible at instrument panel

Tyre pressure
3,0 – 3,5 bar
43,5 – 51 psi On right landing gear door

Baggage load
Max. 12 kg (26.5 lbs.) At baggage compartment

Weak link
max. 550 daN (1213 lbs.) On left landing gear d

3 Emergency procedures

3.1 Introduction

Section 3 provides a checklist and amplification for coping with emergencies that may occur.

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

3.2 Canopy jettison

To bail out pull the red canopy emergency release handle until the canopy hinge disengages and moves downwards, then open canopy locking handles. Then push the canopy upwards with both hands.

If TN 61-LS has been executed:

To bail out open both canopy locking handles, then pull the red canopy emergency release handle until the canopy hinge disengages.

A spring at the canopy hinge lifts the canopy in at the front end.

Only in case the canopy doesn't separate by itself from the fuselage, you have to push the canopy upwards with both hands on the Plexiglas.

The latch on the rear of the canopy is held back by a spring in the fuselage.

This creates a point of rotation to ensure a safe separation of the canopy.

3.3 Bailing out

First jettison the canopy, then unlock the safety harness and bail out. The low cockpit walls allow for a quick push-off exit.

3.4 Stall characteristics and stall recovery

When reaching the stall the aircraft begins to oscillate around its longitudinal axis and one wing may drop. The pilot may prevent the wing drop by using the ailerons.

Pronounced rudder deflection in the direction of the lower wing will result in a full stall. If the C.G. is in a rearward position this may result in a spin.

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 section 4.4.3.

3.5 Spinning characteristics and Spin Recovery

Spins are significantly influenced by the C.G. position. When the C.G. is in a forward position sustained spinning is not possible. When the C.G. is in a mid or rearward position sustained spinning is possible.

Air flow during the spin may push the rudder to maximum deflection. In this case full rudder must be used opposite to the direction of spin.

Stopping the spin: Apply full opposite rudder against direction of spin. Then ease stick forward until the rotation ceases, at aft C.G. positions at which the glider spins with the nose up, it is necessary to apply full stick forward.

Centralise 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 spinning is prohibited. Recover immediately from an unintentional spin.

3.6 Recovery from unintentional cloud flying

Spins are not to be used to loose altitude.

In an emergency, pull out the airbrakes fully before exceeding a speed of 170 km/h (92 kts.) and fly with max. 170 km/h (92 kts.) until leaving the cloud.

At higher speeds up to V_{NE} pull out the airbrakes very carefully because of high aerodynamic and g-loads.

Retraction and extension of the airbrakes is possible up to V_{NE} .

3.7 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 touch down with small angle of attack.

3.8 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!
- At the same time try to decrease tail load by pushing the stick forward.

3.9 Emergency landing on water

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

Therefore an emergency landing on water should be the last choice.

Caution: In the case of a water landing extend the landing gear.

Recommended procedures :

On downwind leg of the landing pattern: Extend the landing gear, unlock the parachute harness (not the seat harness)

Touch down: With landing gear extended and airspeed as low as possible.

At point of touch-down: Use your left arm to protect your face against possible canopy fracture.

After touch down: Unfasten seat belt harness and undo parachute.

Leaving the cockpit under water: If the canopy has not fractured, opening the canopy may be possible only after the forward fuselage is almost completely filled with water.

Note: Always try to land parallel to the shore. If there is a flow always land with the flow.

Flight Manual LS1-f

4 Normal procedures

4.1 Introduction

This section provides checklist and amplification 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 and dumping the watertanks

4.2.1 Rigging

Caution: When rigging the glider from the trailer be sure to have enough clearance when extending the landing gear to avoid the wheel touching the ground. Lifting the fuselage with the landing gear will result in damage of the landing gear control system.

1. Execute the inspection prior to rigging see section 4.3.
2. Clean and lube the pins and bushings.
3. Open the canopy, extend the landing gear.
4. With a helper on the wingtip, push left wing into place, care for correct dihedral.
5. With a helper on the wingtip, push right wing into place, care for correct dihedral.
6. Sight through the wing main pin bushings to determine alignment. Push the main pins in as far as possible.
7. Secure the main pins by pulling the securing hooks to the front, rotate the handles of the pins upwards and secure the handles with the hooks.
8. Connect the airbrake quick connectors and secure the connectors according to section 4.2.2. Check manually by pulling upwards.
9. Connect the aileron quick connectors and secure the connectors according to section 4.2.2. Check manually by pulling upwards.
10. Install the horizontal tail and secure with the safety nut against the tapered bolts.
11. Install TE-probe and secure with tape against rotation.
12. Install and secure equipment like a Logger in the baggage compartment.
13. In case of an automatic parachute fix rip cord to the ring mounted to the left hand shoulder harness attachment.
14. Tape the gaps of the wing-fuselage junction and at the tailplane.
15. Execute a positive control check, one helper is needed to hold firmly the control surfaces.

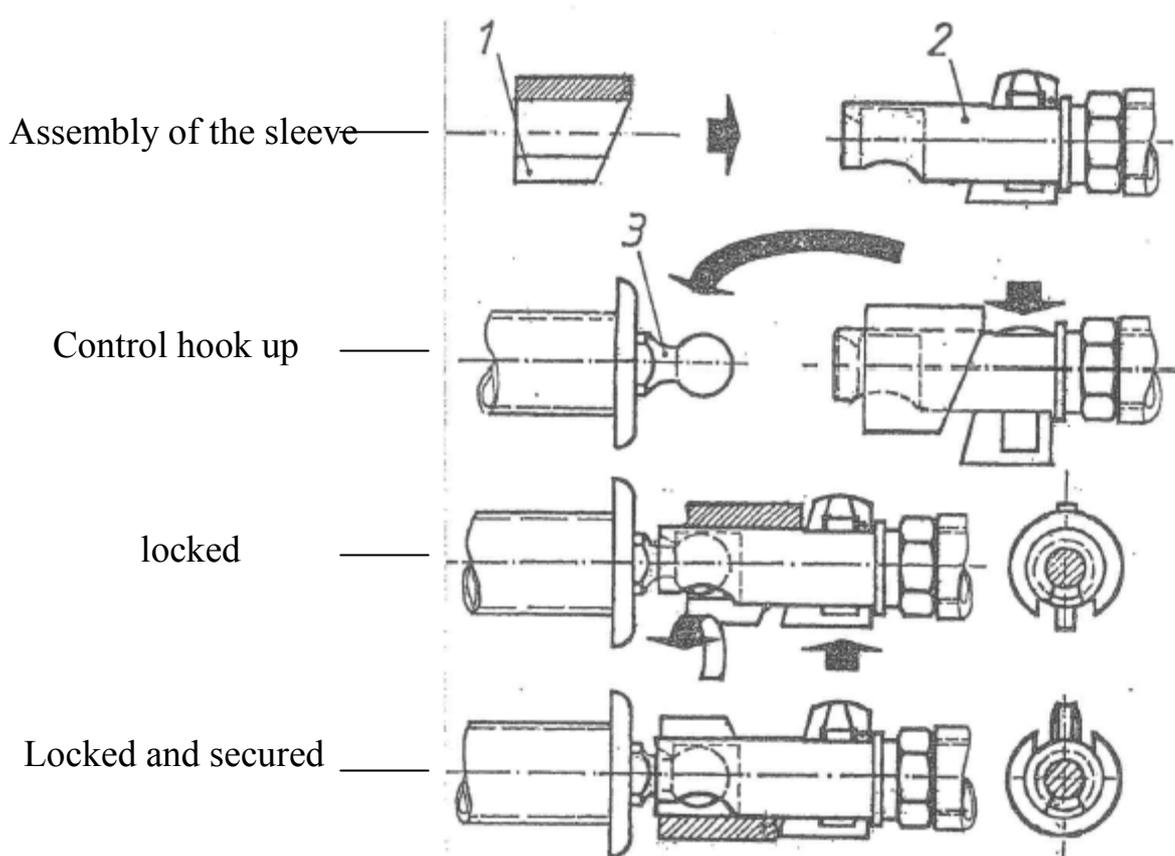
4.2.2 Handling and securing the L'Hotellier control quick connectors

Prior to assembly you should be familiar with the function of the L'Hotellier control quick connectors.

With the locking plate fully pressed, each connector <2> must engage fully on the ball <3>.

TN56 executed: Using the securing sleeve <1> hook up is only possible with the slot of the sleeve facing down. After proper connection and turning the sleeve 180° the quick connector is secured see sketch.

The sleeve should always stay on the connector.



Caution: If no securing sleeve is installed you have to secure the locking plate with a safety needle or spring pin instead.

Warning: With connectors unsecured, the locking plate may open under load temporarily.

The locking plate should never be greased.

4.2.3 Filling the water ballast tanks

1. Close dump valve.
2. Rest the wing tip of the wing to be filled on the ground.
3. Connect loading funnel and load water carefully, respect section 2.12.
Do not fill tank completely, as too much water would drain into fuselage when connecting the waterhose to the dump valve.
4. Connect the waterhose to the dump valve (dump valve still closed).
5. Now proceed with the other wing, see items 2 – 4.
6. Test hoses for leaks and check drain holes.
7. After loading ballast, level wings and check for imbalance. Correct imbalance by draining the required amount from the heavy wing.
8. Grease the threads of the PVC parts every now and then, otherwise they may be hard to open again, because they tend to lock with water.

Warning: Never fill the wing tanks from a main pressure water supply. Filling the wing tanks with excessive pressure (more than 0.2 bar, 3 psi) will definitely burst the wing shell!

The same applies for the fin tanks.

4.2.4 Dumping the waterballast

Dumping is via one central valve located on top of the landing gear box through the landing gear box.

On the ground you may dump water from one tank if you rest the opposite wing on the ground.

1. Extend the landing gear.
2. Open dump valve, complete dumping takes about 2 minutes (LS1-f) or 4 minutes (LS1.f(45)).
3. Leave dump valve open to avoid pressure difference in waterballast-system when changing altitude.

Caution: As the water drains through the landing gear box always extend the landing gear prior to dumping the water. Otherwise the landing gear box will be filled with water and the wheel brake might become wet and will not brake sufficiently.

Flight Manual LS1-f

4.2.5 Derigging

Derigging follows the reverse of rigging, see section 4.2.1.

Waterballast must be dumped first.

Caution: Lift wings far enough that you can turn the main pins. The resulting dihedral shall be maintained during the whole derigging procedure of the wings to avoid damage to the fuselage

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 imposed on your sailplane, you must execute a complete inspection referring to maintenance manual sect. 3.2 prior to the next take off. If you detect any damage, don't operate your aircraft before the damage is repaired. If the maintenance manual doesn't give adequate information, please contact the manufacturer.

4.3.1 Inspection prior to rigging:

1. Wing roots and spar ends
 - a) Check for cracks, delamination etc.;
 - b) Check the lift pins and their glued connection in root ribs and the bushes in the spar ends for wear;
 - c) Check the balls of the control quick connectors at the rootrib for wear and corrosion;
 - d) Check if the drain holes in the root ribs are not clogged;
 - e) Check the hoses and screwed joints of the waterballast system
2. Fuselage at wing connection
 - a) Check the lift bushes for wear and corrosion;
 - b) Check the control quick connectors for wear and corrosion.
 - c) Check the dump valve of the waterballast system
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 that the ball of the rod end of the front tailplane mount is glued fix.

Warning: Don't operate the glider with a loose ball.

4. Horizontal tailplane

Check the mounting points and the elevator control hook up for wear and corrosion.

Flight Manual LS1-f

4.3.2 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 section 7.20 (not each day, but min. every 3 month);
 - c) Check the main pin securing;
 - 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 for wear and function;
 - h) Check if the correct battery is installed, secured and connected
 - i) Check all fuses incl. the fuse at the battery
3. Function check of the control quick connectors of ailerons and airbrakes:

After the positive control check try to turn and move the connectors in all possible directions and pull with a force of 50 N (10lbs.) upwards. If you can't pull off the connectors from the balls the controls are connected properly.

Additional securing should be done with LS- securing sleeves „White“ part No. 4R10-188 according to TN56 or with safety needles or spring pins.
4. C.G. Tow hook
 - a) Check the ring muzzle of the C.G. hook for wear and function;
 - b) Check both tow hooks (if installed) for cleanliness and corrosion;
5. Landing gear
 - 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 centre the next time!;
 - b) Check the tyre pressure;
3 - 3.5 bar (43.5 - 51 psi);
 - c) Check wheel brake and cable for wear;
 - d) Check wheel brake function:
 - e) Check if drain holes in front and behind landing gear box are open;

Flight Manual LS1-f

Inspection after rigging cont.

6. Left wing
 - a) Check the aileron for excessive free play;
 - b) Check the aileron drive if loose;
 - c) Check airbrake, airbrake box and control rod for wear and free play. It must be possible to retract the airbrake, even if it is pressed backwards in direction of flight. If there is any water in the airbrake box, this has to be removed;
 - d) Check the wing shells for dents, delaminations and cracks, especially close to the wing spars;
 - e) Check leading and trailing edges for damage;
 - f) Check aileron seals, see section 4.5 MM.
7. Tail skid
 - a) Check for good glued joint to fuselage, check if the skid is mounted in the correct direction, the cable deflector and the corresponding cut out in the skid plate must be at the front end;
 - b) Check if drain hole in front of tail skid are open;
8. 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;
9. 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;
 - c) Check the securing of the of the tailplane (spring or ratched according to TN51);
 - d) Check the horizontal tail for free play;
 - e) Check leading and trailing edges for damage;
 - f) Check ports for total/Pitot pressure (if installed) and TE-probe for free passage;
 - g) Check the TE probe for correct insertion and fix it with tape;
 - h) Check elevator seals, see MM section 4.5.
10. Right wing see item 6.
11. Fuselage nose
Check the ports for the static pressure and the pitot pressure for cleanliness.

4.3.3 Daily inspection after flight operation

1. Remove bugs and dirt.
2. Remove any water from the airbrake boxes.
3. Check if waterballast is dumped completely.

4.3.4 Pre-flight inspection

1. Trim ballast (for under weight pilot)?
2. Loading plan regarded?
3. Parachute worn properly, static line connected?
4. Seat back and rudder pedals in comfortable position ?
5. Safety harness buckled ?
6. All controls and instruments in reach?
7. Airbrakes cycled and locked?
8. Trim position ?
9. Altimeter adjusted?
10. Positive control check performed? (One person at the control surfaces).
11. Tail dolly removed ?
12. Tow release checked?
13. Canopy locked?

4.4 Normal procedures and recommended speeds

4.4.1 Aerotow

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

If only a C.G. release is installed, then the aerotow is to be executed with this one.

Set trim to full nose down for aerotow.

Hold the stick in the forward position.

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.

Normal towing speed is 110-130 km/h (59-70 kts.).

For a cross country tow the speed can be as high as 170 km/h (92 kts.).

Caution: If an additional tow release for aerotow is installed according to TN59, only this release should be used for aerotow. Adjust the trim for aerotow to fully nose down position.

In case the pitot pressure port is installed in the fuselage nose the ASI indication may be lower than real during aerotow depending on cable ring position.

4.4.2 Winch launch

Winch launch is only allowed at the C.G. tow hook!

Set trim to nose down for a winch launch.

Use the normal winch launch procedure. After reaching safety altitude gradually pull back on the stick so that the glider will not pick up excessive speed.

After reaching release altitude pull the tow release knob.

The recommended winch launch airspeed is 110-120 km/h (60-65 kts.).

Caution: Seat harness should be tightened firmly prior to take off. Backrest and headrest should be adjusted to avoid the pilot sliding backwards due to acceleration and during climb.

During the acceleration phase and initial climb the control stick must be held in the forward position, to avoid excessive nose-up pitching rotation.

Warning: Due to the low position of the C.G. hook there is a tendency for pitching nose up during the initial launch. This tendency is more pronounced with high take-off mass (e.g. full waterballast) and rear C.G. position. An abrupt initial pulling of the winch increases the pitching-up tendency of the glider and should be avoided.

Caution: Do not fly at less than 100 km/h (54 kts.) or not more than 130 km/h (70 kts.). Don't retract the landing gear during launch as the tow release is mounted at the landing gear.

4.4.3 Free flight

Stalling characteristics (straight and turning flight)

When reaching the stall the aircraft begins to oscillate around its longitudinal axis and one wing may drop. The pilot may prevent the wing drop by using the ailerons. Aileron effectiveness is still available, but reaction speed is reduced.

Pronounced rudder deflection in the direction of the lower wing will result in a full stall. If the C.G. is in a rearward position this may result in a spin. The glider can be recovered from the stall by easing the stick forward and with sufficient rudder opposite to direction of turn

Loss of height is approx. 40m (130ft). For stall airspeeds see section 5.2.

Caution: With empty water tanks, leave dump valve open to avoid pressure pick-up in waterballast-system due to changes of altitude. system when changing altitude.

Caution: Flights in conditions conducive to lightning strikes must be avoided.

High speed flying

The LS1-f / LS1-f (45) can be trimmed almost up to high speeds.

Nevertheless don't release the stick at any time.

Watch airspeed indication because red line speed may easily be exceeded inadvertently due to the shallow descent angle and low wind noise.

Warning: Do not exceed the max. permissible airspeeds (see sect. 2.2).

Caution: If redline speed is exceeded for any reason, extend the airbrakes cautiously

Retraction and extension of the airbrakes is possible up to VNE.

Flight Manual LS1-f

4.4.4 Approach and landing

It is recommended to dump the waterballast before landing on airfields.

Dump the ballast before an outlanding in any case.

Abeam the landing point extend the landing gear.

In calm weather approach with approx. 90 km/h (49 kts.) (ballast dumped!).

With strong wind fly faster!

The effective airbrakes allow wide control of the glide angle.

Caution: Stall speed increases about 10 km/h (5 kts.) when airbrakes are extended.

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.

Note: When the C.G. is in a forward position and airbrakes are extended side slipping should be avoided as elevator effectiveness is not sufficient to fly with low speed.

Caution: You should land also on soft fields with the landing gear extended, as there is no tendency of nosing over, if the stick is pulled backwards.

Note: Clean the landing gear and G.G. tow release after landing in a muddy field. Dirt in the struts can keep the landing gear from locking over centre next time.

Landing with the landing gear retracted

Wheel-up landing is not recommended see emergency procedures, section 3.8.

After a wheel-up landing check the fuselage belly and the C.G. tow hook for damage.

Flight Manual LS1-f

4.4.5 Flight with water ballast

Recommended ballast for smooth thermals:

	rate of climb		ballast	
	m/s	fpm	litres	U.S. gallons
below	1	200		none
	1 – 2	200 - 400	30	8
	2 - 4	400 - 800	60	16
more than	4	800		max. ballast

Do not exceed the maximum gross weight when loading water ballast. The maximum quantity of water allowed depends on empty weight and cockpit load (see section 6).

Warning: If there is the risk of freezing, dump all water before you reach freezing altitude, latest at +2°C (36°F), or descend to lower altitudes. Don't dump water below freezing temperature as the water will freeze behind the valve and thus you can dump only a part of the ballast. Frozen water along the aft fuselage boom may shift the C.G. behind the rear limit.

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 sections 4.2.3. During 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

See section 4.2.4.

In flight the water drains at approx. 0.75 lt./sec. (1.65 lbs./sec).

Caution: As the water drains through the landing gear box always extend the landing gear prior to dumping the water. Otherwise the landing gear box will be filled with water and the wheel brake might become wet and will not brake sufficiently.

Flight Manual LS1-f

4.4.6 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.

Operate the controls regularly to prevent ice build-up.

Warning: 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 V_{NE} is reduced according to the following table:

Table for LS1-f

Altitude in [m]	0-2000	3000	4000	5000	6000	7000	8000	9000	10000
VNE IAS km/h	250	237	225	214	202	191	180	170	160
Altitude in [ft]	0-6560	9843	13124	16405	19685	22966	26247	29528	32809
VNE IAS kts.	135	128	122	115	109	103	97	92	86

Table for LS1-f (45)

Altitude in [m]	0-2000	3000	4000	5000	6000	7000	8000	9000	10000
VNE IAS km/h	270	256	243	231	218	206	195	184	173
Altitude in [ft]	0-6560	9843	13124	16405	19685	22966	26247	29528	32809
VNE IAS kts.	146	138	131	125	118	111	105	99	93

3. Dump the water ballast before you reach freezing altitude or descend to lower altitudes.
4. Do not fly below 0°C (32°F) when your glider is wet (e.g. after rain).

4.4.7 Flights in rain and thunderstorms

Rain drops, frozen fog and ice cover may change the wing section characteristics to such an extent, that flight characteristics will decrease. The minimum stall speed rises considerably. Therefore the approach speed must be increased.

Warning: Flights and especially winch launches in the vicinity of thunder storms must be avoided. In case of a lightning strike the composite structure may be damaged or destroyed. The sailplane is not equipped with a lightning protection system.

4.4.8 Cloud flying

Cloud flying is only permitted without waterballast!

Take care to fly smoothly and coordinated. It is prohibited to use a spin as a method for losing altitude in cloud. In case of emergency, pull out the airbrakes fully before exceeding a speed of 170 km/h and dive with max. 170 km/h (92 kts.) to leave the cloud.

At higher speeds up to V_{NE} pull out the airbrakes very carefully because of high aerodynamic and g-loads.

You may extend the landing gear in addition to increase the sink rate.

Warning: Flight in thunderstorm clouds is prohibited.

4.4.9 Aerobatics

Aerobatic manoeuvres are prohibited

Flight Manual LS1-f

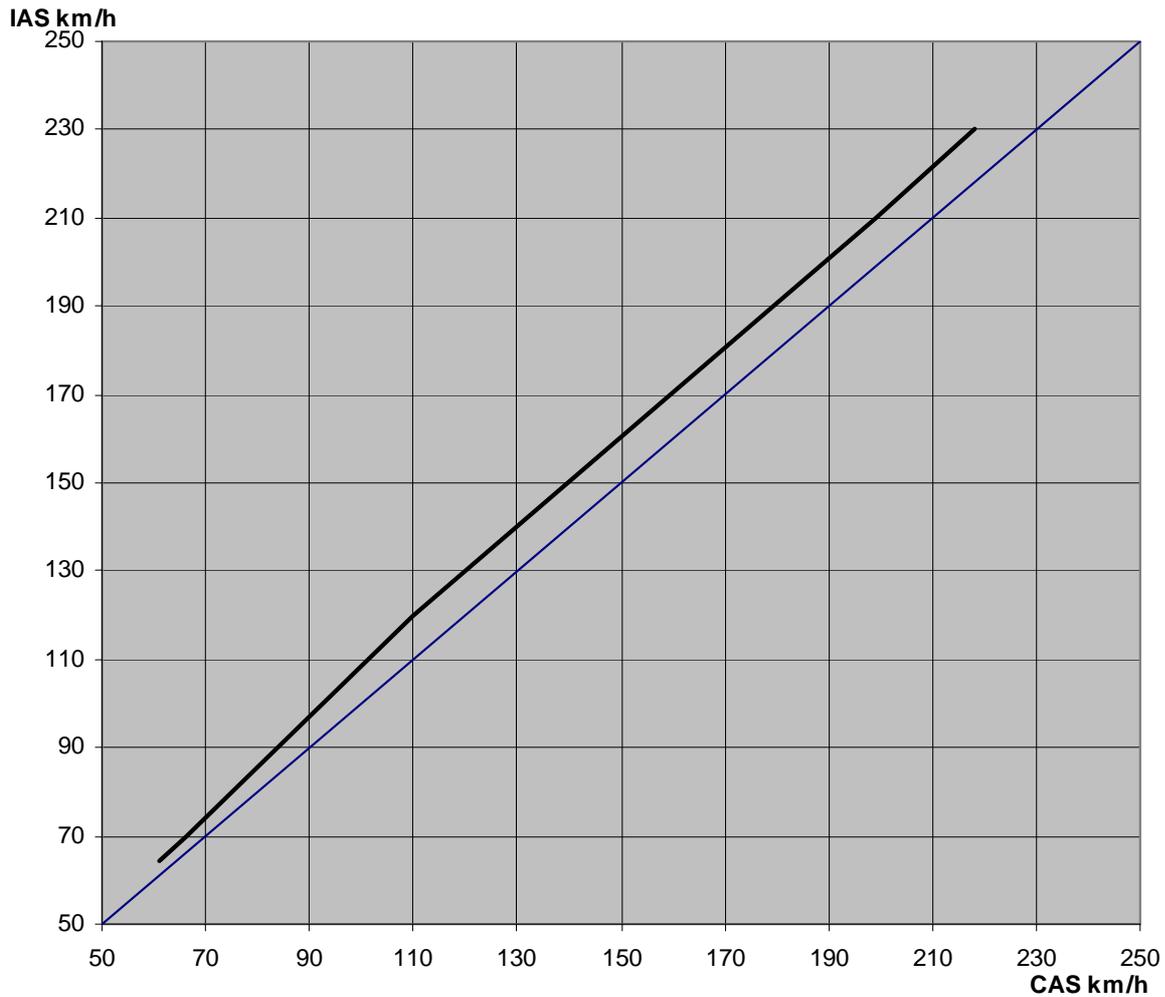
5 Performance

5.1 Airspeed indicator system calibration

IAS= indicated airspeed

CAS= calibrated airspeed

Caution: The airspeed indicator is to be connected to the static ports at the front fuselage.



Flight Manual LS1-f

5.2 Stall speeds

The given speeds are the minimum achievable speeds during level flight in km/h and (kts.).

LS1-f:

Airbrakes retracted: 70 – 65 km/h (38 – 35 kts.) without waterballast
80 – 75 km/h (43 – 40 kts.) with waterballast
Airbrakes extended: 80 – 75 km/h (43 – 40 kts.) without waterballast
90 – 85 km/h (49 – 46 kts.) with waterballast

LS1-f (45):

Airbrakes retracted: 70 – 65 km/h (38 – 35 kts.) without waterballast
85 – 80 km/h (46 – 43 kts.) with waterballast
Airbrakes extended: 80 – 75 km/h (43 – 40 kts.) without waterballast
95 – 90 km/h (51 – 49 kts.) with waterballast

5.3 Demonstrated crosswing performance

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

5.4 Gliding performance

Wing loading	kg/m ²	32	35	40	45
Min. sink at V	m/s	0,6	0,65	0,7	0,75
	km/h	72	80	85	90
Max. L/D at V	/	37	37,5	38	38,5
	km/h	85	90	95	100

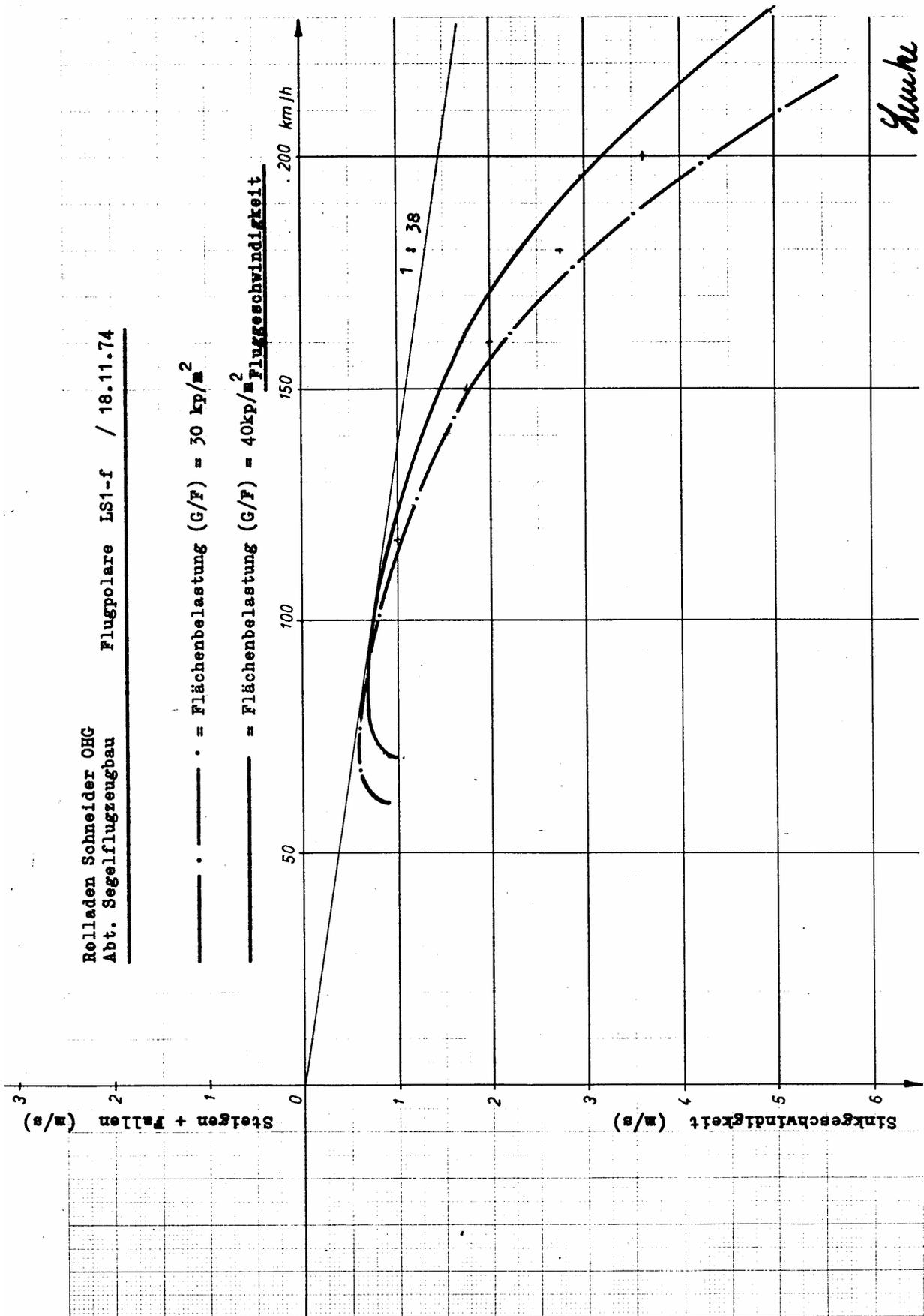
The wing fuselage joint, the horizontal tailplane - fin joint and the cutout for the tailplane fixing nut should be taped and the aircraft thoroughly cleaned to obtain maximum performance.

The polars apply to a "clean" aircraft.

With dirty wings, especially at the leading edge, or flight in rain the performance drops accordingly.

5.5 Flight polar

1 m/s = 1 kts, = 197 t/min 1 kts := 1.852 km/h



Flight Manual LS1-f

6 Mass (weight) and balance

6.1 Introduction

This section contains the payload range within which the sailplane may be safely operated.

A procedure for calculating the in-flight C.G. is also provided.

A comprehensive list of all equipment available for this sailplane is contained in the maintenance manual.

6.2 Weighing procedures

See maintenance manual LS1-f section 2.

Datum: Wing leading edge at the root rib.

Reference line: Lower side of aft fuselage boom horizontal.

6.3 Weighing record

The result of each C.G. weighing is to be entered in section 6.8.4. If the min. cockpit load has changed this data is to be entered in the cockpit placard as well.

6.4 Basic empty mass and C.G.

Actual data see section 6.8.4. With the empty weight C.G. and the cockpit loads within the limits of the table in section 2.3 of the MM, the in-flight 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 230 kg (507 lbs.).

WNLP is to be determined as follows:

$WNLP = WNLP \text{ empty} + \text{cockpit load (pilots, parachute, baggage, trim ballast, removable items of equipment etc.)}$.

$WNLP \text{ empty} = \text{Total empty weight incl. permanently installed equipment minus weight of the wings}$.

6.6 Max. mass (weight)

Maximum take off weight and landing weight:

Variant LS1-f: 390 kg (860 lbs.)

Variant LS1-f (45): 439 kg (968 lbs.)

Max. mass without waterballast: Maximum take-off and landing mass =

$W_{NLP} + W_{\text{wings}}$

$W_{NLP} = \text{Maximum mass of all non lifting parts (see above)}$

$W_{\text{wings}} = \text{actual mass of the wings}$

Flight Manual LS1-f

6.7 Useful loads (payload)

Max. payload **without** waterballast
= max. weight without waterballast - empty weight

Max. payload **with** waterballast
= max. weight with waterballast - empty weight

The data is recorded in section 6.8.5.

6.8 Loading chart

6.8.1 Cockpit load

Cockpit load see weighing report section 6.8.4.

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 connections of the safety belts.

6.8.2 Baggage

max. 12 kg (26.5 lbs)

Heavy pieces of baggage must be secured to the baggage compartment floor.

The added load in the fuselage must not exceed the max. payload without waterballast (W.B.) see weighing report section 6.8.4.

6.8.3 Waterballast in the wing tanks

Max. capacity:

Variant LS1-f: 90 kg (198 lbs.), (23.8 US.gal.)

Variant LS1-f (45): 180 kg (198 lbs.), (17.6 US.gal.)

Warning: Filling the water ballast is only allowed with a filling system which enables determination of the exact amount of ballast filled, e.g. water gauge or calibrated canisters. Don't try to fill more water into the tanks than the specified values. It is only allowed to fly with symmetric wing ballast!

The total amount of ballast is dependent on the empty mass and the fuselage load and can be determined from the tables in section 6.8.5.

Flight Manual LS1-f

6.8.4 Weighing report (for section 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:						
Empty mass						
Empty mass C.G.						
Max. mass without W.B.						
Max. payload without W.B.						
Max. mass with W.B.						
Max. payload with W.B.						
Min. cockpit load						
Max.cockpit load						
Inspector, signature, stamp						

Flight Manual LS1-f

6.8.5 Ballast chart (total ballast)

To determine the max. allowable total waterballast.

Fuselage load = pilot + baggage etc. but without waterballast.

All values in kg (l) 1 kg = 2.2046 lbs. 3.785 kg (l) = 1 US gal.

a) Ballast chart (total ballast) LS1-f: payload fuselage/ empty mass

	200	205	210	215	220	225	230	235	240	245	250
60	179	174	169	164	159	154	149	144	139	134	129
65	174	169	164	159	154	149	144	139	134	129	124
70	169	164	159	154	149	144	139	134	129	124	119
75	164	159	154	149	144	139	134	129	124	119	114
80	159	154	149	144	139	134	129	124	119	114	109
85	154	149	144	139	134	129	124	119	114	109	104
90	149	144	139	134	129	124	119	114	109	104	99
95	144	139	134	129	124	119	114	109	104	99	94
100	139	134	129	124	119	114	109	104	99	94	89
105	134	129	124	119	114	109	104	99	94	89	84
110	129	124	119	114	109	104	99	94	89	84	79

Example: Empty mass 230 kg, Pilot + parachute 95 kg => max. amount of waterballast 65 kg, in case the wing tanks can take up this amount.

Flight Manual LS1-f

b) Ballast chart (total ballast) LS1-f (45):
payload fuselage/ empty mass

	228	230	232	234	236	238	240	242	244	246
60	151	149	147	145	143	141	139	137	135	133
65	146	144	142	140	138	136	134	132	130	128
70	141	139	137	135	133	131	129	127	125	123
75	136	134	132	130	128	126	124	122	120	118
80	131	129	127	125	123	121	119	117	115	113
85	126	124	122	120	118	116	114	112	110	108
90	1210	119	117	115	113	111	109	107	105	103
95	116	114	112	110	108	106	104	102	100	98
100	111	109	107	105	103	101	99	97	95	93
105	106	104	102	100	98	96	94	92	90	88
110	101	99	97	95	93	91	89	87	85	83

Example: Empty mass 230 kg, Pilot + parachute 95 kg => max. amount of waterballast 114 kg, in case the wing tanks can take up this amount.

Flight Manual LS1-f

7 Sailplane and systems description

7.1 Introduction

Section 7 describes the operation of the sailplane including its systems.

M.M. = Maintenance manual

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

7.2 Airframe

The LS1-f is a single-seater high performance glider with 15 m wingspan.

Construction:

Wings	GFRP-foam-sandwich-shell
Wing spars	Double T-spar, GFRP-roving spar caps, GFRP-foam-sandwich shear web
Ailerons	GFRP-shell
Rudder	GFRP-shell
Horizontal stabilizer	GFRP-foam sandwich-shell without spar
Elevator	GFRP -shell
Fuselage	GFRP-shell with GFRP bulkheads

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

Colours: All parts exposed to sunlight except for registration marks and anti-collision paint must be white.

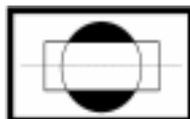
7.3 Placards

Airspeed indicator markings see section 2.3.

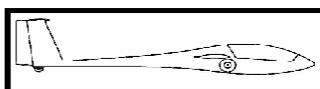
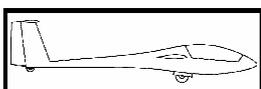
Data placard, Checklist and limitation placards see section 2.16



at the master switch

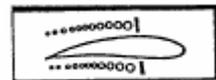
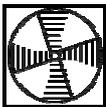
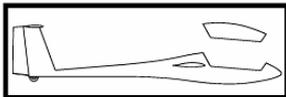
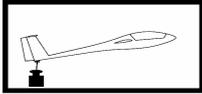
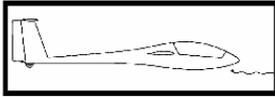


at the waterballast handle



Further placards see next page.

Placards cont.



All placards without given position must be glued next to the respective control handle.

7.4 Aileron control

Activation via pushrods, connection with L'Hotellier connectors with additional securing device according to section 4.2.2 and L'Hotellier balls at wingside pushrods.

Ailerons partly mass balanced.

7.5 Elevator control, trim

Conventional tailplane, elevator activated via pushrods. Automatic coupling during assembly of horizontal tail, mass balance in the vertical control pushrod inside the fin.

Trim: Spring trim system with handle at left hand cockpit wall.

7.6 Rudder Control

Activation via steel cables, mass balance at rudder.

Flight Manual LS1-f

7.7 Wheel brake

Activation via steel cable coupled to the airbrake control.

The brake begins to function with airbrakes nearly fully extended.

The wheel brake is an emergency brake and should be used only when necessary to minimize wear.

Wheel with drum brake type Tost Liliput

7.8 Airbrakes

Schempp-Hirth type airbrakes on upper wing surface.

Activation via pushrods, connection with L'Hoteller swivel joints with additional securing device according to section 4.2.2 and L'Hotellier balls at wingside pushrods.

Overcentre-locking in fuselage, spring mounted airbrake caps.

7.9 Waterballast System

Waterbags, capacity:

Variant LS1-f: 90 kg (198 lbs.), (23.8 US.gal.)

Variant LS1-f (45): 180 kg (198 lbs.), (17.6 US.gal.)

Dump valve on landing gear box. Dumping is via the landing gear box.

7.10 Cockpit

Fiberglass shell.

Controls for landing gear (black), trim (green) and divebrakes (blue) are located on the left side of the cockpit.

Controls for tow release (yellow) and pedal adjustment (black) at left hand side of instrument panel; canopy emergency release and ventilation are located at right hand side of instrument panel.

Canopy lock (red) on both sides of canopy.

Water ballast valve control (black) located on right side of cockpit.

Backrest adjustable at ground..

7.11 Canopy

One piece hinged up front, assisted by a gas-strut. Instrument cover accommodates compass.

Material Plexiglas clear or optionally light blue.

Emergency release see section 7.20.

7.12 Tow hooks

"Safety release Europa G72, G73 or G88" for winch- and aerotow installed near the C.G..

Additionally (Option TN59): "nose release E72, E75 or E85" installed in the fuselage nose, only for aerotow.

Both hooks are operated by the same handle.

7.13 Rudder pedal adjustment

Adjustment is possible in flight and on the ground. Release pressure of pedals and unlock pulling the black handle. Push pedals forward into desired position, using feet pressure. To move backwards pull pedals with handle into desired position. Release handle for locking.

7.14 Seat, back rest and safety harness

The seat pan is removable. The backrest is adjustable on the ground. A cushion above the back rest acts as head rest.

The LS1-f must be equipped with a 4 point safety harness fixed at the provided fixing points.

7.15 Instrument panel

Fixed installation. Normally with hinged upper part, optionally fixed according to TM29. Up to 8 instruments plus radio may be installed.

Max. mass installed in the upper part: 4 kg (8.8 lbs.).

7.16 Baggage compartment

Max. load 12 kg (26.5 lbs)

Heavy pieces of baggage must be secured to the baggage compartment floor. Otherwise load only soft and light items.

7.17 Oxygen system

A fiberglass receptacle is installed in the right hand side of the main bulkhead for 3 or 4 Litre oxygen bottles of 100 mm (3.94 in) in diameter. Bottles must be fixed with the designated clamp (P/N.: 4R8-41c)

7.18 Landing gear

Retractable landing gear, installed in a GFRP Box. The box is totally closed with landing gear up. Drum brake. Operating handle on left hand side.

The landing gear may be retracted and extended at any speed up to VNE.

A brisk movement of the handle facilitates retraction.

Tyre: 4.00-4 Tost Aero 8pr

Tyre pressure: 3,0 -3,5 bar (43.5 - 51 psi)

Handle to the front: retracted

Handle to the rear: extended

7.19 Pitot-/Static pressure system

Pitot pressure port installed in fuselage nose (red), with optionally nose tow release (TN59) the pitot pressure port is installed in the fin.

Static pressure ports at lower front fuselage (blue).

Airspeed indicator and altimeter must be connected to these ports.

Port for TE probe in the fin.

Additional static ports in the aft fuselage and optionally in the upper front fuselage to connect variometers or gliding computers.

7.20 Canopy emergency release

Check proper function of canopy locking and emergency release (not daily, but to be completed at minimum every 3 months):

a) "Pilot" in seat, both canopy locking handles opened. One person at the front end to lift the canopy from the fuselage.

After pulling the emergency canopy release handle the canopy must be freely moveable at the front.

With TN61-LS executed: The canopy must be lifted at the front by the spring at the hinge by about 30 mm <1.2 in.>.

b) After pulling the emergency canopy release handle the pilot pushes the canopy up at the rear to disengage the LS-Latch (Röger hook) from the spring on the fuselage.

c) Then the pilot lifts the canopy at the rear end up as far as possible, the person at the front end holds the canopy.

Caution: The person at the front end should not lift the canopy too far up. Otherwise this would unduly deform the spring of the LS-Latch (Röger hook) located at the fuselage.

Note: b) and "Caution*" apply only if **TN61-LS** LS-Latch (Röger Hook) has been completed

Reinstalling the canopy:

2 persons are needed

a) Pull the canopy hinge up to the open position.

b) One person (at the front end) holds with one hand the emergency release lock in open position and places the canopy with the other hand onto the hinge. The other person holds the canopy rear end so far up that it matches the canopy hinge.

With TN61-LS executed: The spring fixed at the canopy must be inserted into the ring at the canopy lifting mechanism. When pressing down the canopy make sure that the spring doesn't buckle.

c) The front person engages the canopy by turning the emergency release lock to the stop.

8 Sailplane handling, care and maintenance

8.1 Introduction

Section 8 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 LS1-f have to be followed.

Before each rigging all the connecting pins and bushes should be cleaned and greased.

Once a year all the bearings and hinges should be cleaned and greased. See the lubrication schedule of the maintenance manual section 3.4.

Each year the control surface displacements, adjustments and general condition must be checked. (See the maintenance manual section 3).

8.3 Alterations or repairs

It is essential that the responsible airworthiness authority be contacted prior to any alterations on the aeroplane, to ensure that the airworthiness of the sailplane is not impaired.

It is prohibited to perform alterations without 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 perform no alterations 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 LS1-f maintenance manual section 10.

No repairs should be carried out without referring to the manual.

8.4 Tie Down, Parking

Use textile ropes or straps to tie down the wing tips. The fuselage should be tied down just ahead of the fin.

Water ballast can be left in the wings for a few days only, but not when there is the possibility of freezing! On sunny days the canopy should be closed and covered.

Note: Longer parking with exposure to sun and humidity will cause premature ageing of the external surfaces of your sailplane.

8.5 Transport

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

Approved fitting points:

Wings:

1. Wing spar as close to wing rootrib as possible or a rootrib wing cradle.
2. A wing cradle at the taper change.

Horizontal tailplane:

Cradles as desired

Fuselage:

1. A felt lined fibreglass nose cap which does not extend over the canopy, secured to floor.
2. Fuselage dolly in front of the undercarriage or a support attached to the lift pins bushes, use plastic or brass pins.
3. Tail skid-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 parts:

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

Whenever possible tow at walking speed only.

- a) by towing at the tow hook using a rope with the standard double ring approved for the hook.
- b) by using a tow bar which is fixed to the tail dolly and a wing tip wheel.

8.7 Cleaning and Care

Remove any water from inside the airbrake boxes.

Exterior surfaces of the fibre-reinforced plastic parts

The surfaces are coated by a UP-gelcoat or Polyurethane paint (Option).

This surface 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 often leave your aircraft outside, this may be necessary every half year!

8.7.1 Hints for care

- Wash the surface only with clean water using a sponge and chamois.
- 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 silicone-free, wax containing car polishes (e.g. 1Z Extra, Meguiars in USA).
- Long-term dirt and shading can be removed by applying a new hard wax coat (see maintenance manual sect. 3.1).
- 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 sections 8.4 and 8.5.
- Remove any water that has entered and allow the aircraft to dry out.
- Never store your wet aircraft in a trailer.

8.7.2 Plexiglas canopy

- Use clean 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).

8.7.3 Metal parts

- Pins and bushes for rigging the aircraft are not surface protected and must be covered with grease at all times, see maintenance manual section 3.4.
- Other metal parts, especially the control stick and all handles should occasionally be preserved with metal polishes.

9 Supplements

Section not effective