

Maintenance Manual LS1-f

0 General

0.1 Manual amendments

No.	Page	Description	Date
0.1	all	Combination of the initial Maintenance Manuals of the Variants LS1-f and LS1-f(45), new standardized format	May 2011
0.2	0.8, 1.1 up to 1.3, 2.1 up to 2.4, 2.6, 3.1 up to 3.7, 4.1 up to 4.17, 5.1, 5.2 6.1 up to 6.3, 7.1, 7.2 8.1 up to 8.4, 9.1, 9.2 10.1 up to 10.8, 11.1, 11.2, 12.1 up to 12.8	Miscellaneous changes to the contents of the latest amendments of the initial maintenance manuals	May 2011
1	0.1, 0.3, 0.4, 2.2 – 2.4, 6.1 – 6.5, 12.1	TN63-LS: Winglets, increase of max. mass of non-lifting parts	May 2017

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0.2 List of effective pages

Section	page	issued	replaced	replaced	replaced
0	0.1	May 2011	See manual amendments		
	0.2	"			
	0.3	"			
	0.4	"			
	0.5	"			
	0.6	"			
	0.7	"			
	0.8	"			
1	1.1	May 2011			
	1.2	"			
	1.3	"			
2	2.1	May 2011			
	2.2	"	May 2017		
	2.3	"	May 2017		
	2.4	"	May 2017		
	2.5	"			
	2.6				
3	3.1	May 2011			
	3.2	"			
	3.3	"			
	3.4	"			
	3.5	"			
	3.6	"			
	3.7				
4	4.1	May 2011			
	4.2	"			
	4.3	"			
	4.4	"			
	4.5	"			
	4.6	"			
	4.7	"			
	4.8	"			
	4.9	"			
	4.10	"			
	4.11	"			
	4.12	"			
	4.13	"			

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List of effective pages cont.

Section	page	issued	replaced	replaced	replaced
	4.14	May 2011			
	4.15	"			
	4.16	"			
	4.17	"			
5	5.1	May 2011			
	5.2	"			
6	6.1	May 2011	May 2017		
	6.2	"	May 2017		
	6.3	"	May 2017		
	6.4	"	May 2017		
	6.5	May 2017			
7	7.1	May 2011			
	7.2	"			
8	8.1	May 2011			
	8.2	"			
	8.3	"			
	8.4	"			
9	9.1	May 2011			
	9.2	"			
10	10.1	May 2011			
	10.2	"			
	10.3	"			
	10.4	"			
	10.5	"			
	10.6	"			
	10.7	"			
	10.8	"			
11	11.1	May 2011			
	11.2	"			
12	12.1	May 2011	May 2017		
	12.3	"			
	12.4	"			
	12.5	"			
	12.6	"			
	12.7	"			
	12.8	"			

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Weighing Procedure continued

7. Calculate C.G. position

$$X_{cg} = \frac{\text{tail load} * b}{\text{total mass}} + a$$

8. Operating limits

Max. TOW: LS1-f:	390 kg (860 lbs.)
LS1-f(45):	439 kg (968 lbs.)
Max. mass of non lifting parts, all variants GNT _{limit} :	230 kg (507 lbs.)
Max. cockpit load nominal, all variants:	110 kg (243 lbs.)

9. Repeat the weight and balance at least every 4 years.

10. Execute a new weight and balance whenever the equipment was changed.

11. Calculate loading limits according to section 2.2.

2.2 Calculation of loading limits

2.2.1 Minimum cockpit load

The higher values in the Empty mass C.G. table (section 2.3) are for a minimum cockpit load of 60 kg (132 lbs.). In case the empty mass C.G. value determined from the weight and balance is higher than the value from the table the min. cockpit load may be raised according to the following equation (all distances in mm, 25.4mm= 1 in.):

$$GP_{\min} = \frac{(XL-420)*GL}{1020}$$

XL= empty mass C.G. from weighing
420= aft inflight C.G. limit
GL= empty mass from weighing
1020= 420 + 600 (pilot lever arm)
GP_{min}= new min. cockpit load

Round up GP_{min} to next plain number in kg or lbs..

For club operation the min. cockpit load should not exceed 60 kg.

The new cockpit load must be entered:

1. in the weighing report
2. in the cockpit data placard
3. in the table in the flight manual section 6.8.4

Calculation of loading limits continued

2.2.2 Maximum cockpit load

The lower values in the Empty mass C.G. table (section 2.3) are for a maximum cockpit load of 110 kg (243 lbs.). In case the empty mass C.G. value determined from the weight and balance is lower than the value from the table permanent ballast must be installed in the tail according to section 7.1.

The maximum cockpit load may be limited by the max. payload without water ballast according to section 2.2.4.

The resulting maximum cockpit load must be entered:

1. in the weighing report
2. in the cockpit data placard
3. in the table in the flight manual section 6.8.4

2.2.3 Max mass without water ballast

$G_{\text{max oW}}$ = without water ballast

$G_{\text{max oW}} = G_{\text{wings}} + G_{\text{NT max}}$, but not higher than the max. TOW

$G_{\text{NT max}} = 230 \text{ kg } 507 \text{ lbs}$ **without Option winglets.**

$G_{\text{NT max}} = 250 \text{ kg } 517 \text{ lbs}$ **with Option winglets.**

2.2.4 Max. payload without water ballast

Max. payload without water ballast = $G_{\text{max oW}} - G_{\text{empty}}$

2.2.5 Max. payload with water ballast

Max. payload with water ballast = $G_{\text{max}} - G_{\text{empty}}$

Note: Enter the locations of all batteries installed during weight and balance in the weighing report and in the equipment list.

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2.2.6 Example for calculation of loading limits (LS1-f)

Note: This example is valid for LS1-f without Option winglets.

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

1) Min. cockpit load

a) Empty mass 242 kg. empty mass C.G. 648 mm, the empty mass C.G. is in the limits of the table section 2.3. This means, that the min. cockpit load is 60 kg (limit 673 mm > 648 mm).

b) Empty mass 242 kg. empty mass C.G. 720 mm, the empty mass C.G. is outside the limits of the table section 2.3. This means, that the min. cockpit load must be raised according to the equation in section 2.2.1 to 71.2 kg , rounded up to **72 kg** (limit 673 mm < 720 mm).

2) Max. mass without water ballast

Wings 115 kg

Max. mass of non-lifting parts 230 kg

Sum= Max. mass without water ballast **345 kg**

3) Max. pay load without water ballast

Max. mass without water ballast **345 kg**

Empty mass 242 kg

Difference= Max. pay load **103 kg**

4) Entry in flight manual section 6.8.4 (for min. cockpit load example b))

Empty mass 242 kg

Max. cockpit load 103 kg

Max. mass without water ballast 345 kg

Max. pay load with water ballast 148 kg

Max. mass with water ballast 390

kg

Min. cockpit load 72 kg

Entry in flight manual section 6.8.4 for LS1-d (example)

Empty mass	242 kg				
Empty mass C.G.	720 mm				
Max. pay load without water ballast.	103 kg				
Max. mass without water ballast	345 kg				
Max. pay load with water ballast	148 kg				
Max. mass with water ballast	390 kg				
Min. cockpit load	72 kg				

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6 Placards and markings

6.1 Placards and markings LS1-f

Without Option winglets

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.	
Lighter pilots must compensate lack of weight as suggested in Flight Manual.			

Clearly visible at right cockpit wall

with Option winglets

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.			
If the sailplane will be operated with winglets the use of water ballast is 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

Clearly visible at right cockpit wall

Airspeed indicator markings

green arc	yellow arc	red line
80 - 170 km/h	170 - 250 km/h	250 km/h
50 - 106 mph	106 - 156 mph	156 mph
43 - 92 kts	92 - 135 kts	135 kts

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6.2 Placards and markings LS1-f(45)

Without Option winglets

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

With Option Winglets

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 without winglets	270 km/h	167 mph	146 kts.
“ with winglets	250 km/h	155 mph	135 kts.
Never exceed without winglets	270 km/h	167 mph	146 kts.
“ with winglets	250 km/h	155 mph	135 kts.
Aerobatic manoeuvres are prohibited.			
If the sailplane will be operated with winglets the use of water ballast is 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

Airspeed indicator markings without Winglets

green arc	yellow arc	red line
80 - 170 km/h	170 - 270 km/h	270 km/h
50 - 106 mph	106 - 168 mph	168 mph
43 - 92 kts	92 - 146 kts	146 kts

Airspeed indicator markings with winglets

green arc	yellow arc	red line
80 - 170 km/h	170 - 250 km/h	250 km/h
50 - 106 mph	106 - 156 mph	156 mph
43 - 92 kts	92 - 135 kts	135 kts

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LS1-f(45) continued

Without Option winglets

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

With Option Winglets

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

Clearly visible at right cockpit wall

6.3 Placards and markings for all variants

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. Lead ballast (for underweight 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 knobs in reach? 7. Dive 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

Min. cockpit load: ____ kg

If not 60 kg, clearly visible at instrument panel

**Baggage load
Max. 12 kg**

At baggage compartment

**Weak link
max. 550 daN**

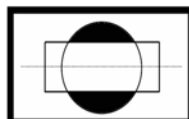
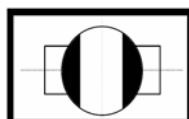
On left landing gear door

**Tyre pressure
3,0 bar
43,5 psi**

On right landing door



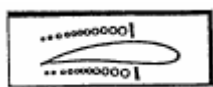
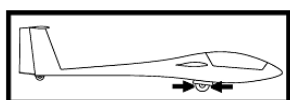
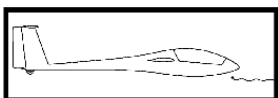
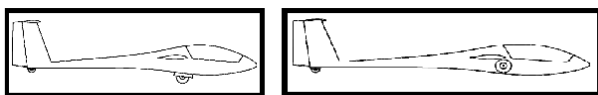
bei elektrischer Installation am Hauptschalter



Close to ballast dump handle (if installed)

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Placards and markings for all variants cont.



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

