Alexander Schleicher GmbH & Co. Segelflugzeugbau
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Flight Manual

for the self-sustaining powered sailplane ASW 27-18E

„ASG 29 Es"

Model:	ASW 27-18 E
Serial Number:	2 9 7 0 7
Registration:	F - C L B L
Data Sheet No.:	EASA.A.220
Issue:	01.12.2007

Pages identified by "Appr." are approved by EASA within the scope of type certification.

This sailplane is to operate only in compliance with the operating instructions and limitations contained herein.

The translation has been done by best knowledge and judgment. In any case the original text in German is authoritative.

Section 0

Published by AS with contributions from Gerhard Waibel, Lutz-Werner Jumtow and Michael Greiner.

IMPORTANT NOTE:

The text given in this Manual (including figures, descriptions and operational or handling information) was produced by the authors with great care. However mistakes or misprint as well as misunderstanding can never be excluded. Therefore the authors must state, that juristic responsibility or guaranty or any other warranty which results from mistakes, misprints or misunderstanding cannot be given. The authors however are very grateful to accept advice for corrections.

0.1 Record of Revisions

Any revision of the present manual, except actual weighing data, must be recorded in the following table and in case of approved Sections endorsed by the responsible airworthiness authority. The new or amended text in the revised page will be indicated by a black vertical line in the left hand margin, and the Revision No. and the date will be shown on the bottom of the page.

Record of Revisions

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TN 7	2 3 7	2.6 3.6, 3.7 7.21, 7.23 - 7.25, 7.28	08.10.10	21.10.10	Feb. 2011	mg
TN 13	 2 3 4 7	cover 2.5 - 2.7, 2.11, 2.13 3.6 - 3.9 4.12, 4.22 - 4.24, 4.29 7.15, 7.18 - 7.21, 7.23 – 7.28	03.09.15	02.09.15	Sep. 2015	

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0.3 Table of Contents

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Section 1

1. General

1.1 Introduction

1.2 Type Certification Basis

1.3 Warnings, Cautions and Notes

1.4 Description and Technical Data

1.5 Three View Drawing

1.6 Why "ASW 27-18 E" and not "ASG 29 E" in manuals and placards

1.1 Introduction

This Flight Manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the ASW 27-18 E sailplane.

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

1.2 Type Certification Basis

This type of sustaining powered sailplane has been approved by the European Aviation Safety Agency (EASA) in accordance with JAR-22 including Amendment 6 issued 2001.

Additionally the following requirement had to be complied with:
"Guidelines for the substantiation of the stress analysis for sailplanes and powered sailplanes made from glass and carbon fiber reinforced plastics", issued 1991.

The Type Certificate has the number EASA.A.220
Category of Airworthiness: Utility.
“Utility” refers to sailplanes and powered sailplanes used in normal gliding operation.

1.3 Warnings, Cautions and Notes

The following definitions apply to warnings, cautions and notes used in the Flight Manual:

"WARNING" *means that the non-observation of the corresponding procedure leads to an immediate or important degradation of the flight safety.*

"CAUTION" *means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of the flight safety.*

"NOTE" *draws the attention on any special item not directly related to safety, but which is important or unusual.*

1.4 Description and Technical Data

The ASW 27-18 E is a high performance, single-seat, flapped sailplane with a retractable sustainer engine and exchangeable wingtips for 15m and 18m span. This makes it possible to fly within FAI 15m Class or 18m Class specifications.
The ASW 27-18 E is suitable for record breaking and competition flying. Not least, its pleasant flying characteristics make the ASW 27-18 E suitable for use in performance-orientated clubs.

The ASW 27-18 E is a shoulder wing glider with T-tail (fixed stabilizer plus elevator) and sprung, retractable landing gear with hydraulic disc brake. Detachable 0.5m high winglets are installed at the wing tips.

A two-cylinder, two stroke engine can be extracted from the fuselage and help the glider over areas of few or no lift.

Technical Data:

(Metric system)

Span	18,0	15.0	m
Fuselage length	6.59	6.59	m
Height (Fin and Tail Wheel)	1.3	1.3	m
Max.Take-Off Mass	600	550	kg
Wing chord (mean aerodynamic)	0.624	0.648	m
Wing area	10.5	9.22	m^2
Wing loadings: -			
- minimal	about 38	about 42	kg/m^2
- maximal	57.1	59.6	kg/m^2

(British and US system)

Span	59.06	49.21	ft
Fuselage length	21.60	21.60	ft
Height (Fin and Tail Wheel)	4.27	4.27	ft
Maximum Take-Off Weight (Mass)	1322	1212	lbs
Wing chord (mean aerodynamic)	20.47	21.26	ft
Wing area	113	99.2	ft^2
Wing loading			
- minimum	about 7.8	about 78.6	lbs/ft^2
- maximum	11.69	12.21	lbs/ft^2

General View:

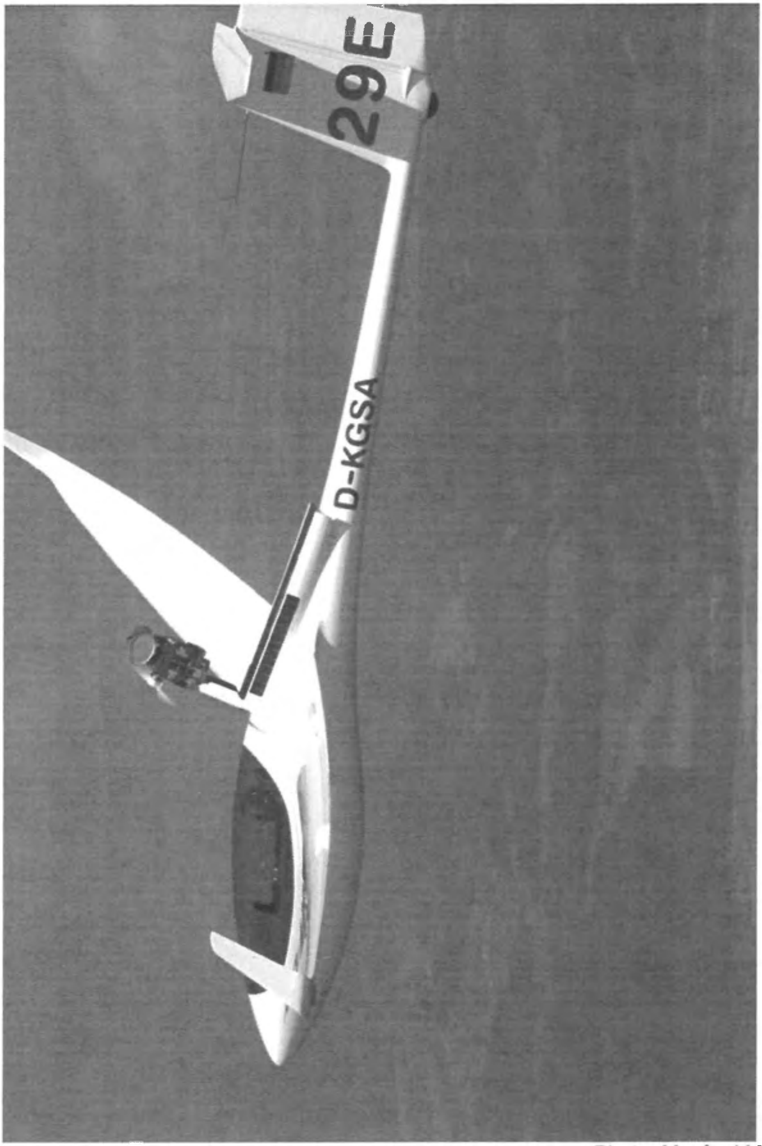
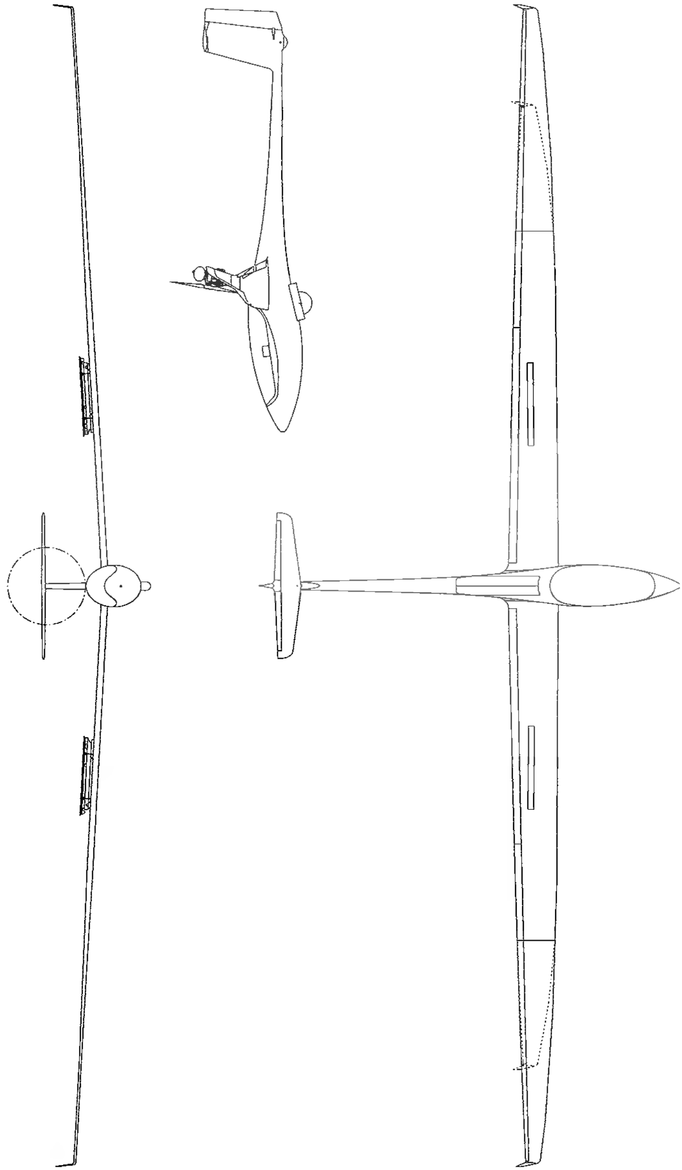


Photo: Manfred Münch

1.5 Three View Drawing



1.6 Why “ASW 27-18” and not “ASG 29” on manuals and placards

This sailplane model clearly derives from the ASW 27. Well-proven features were taken over and details with potential for improvement were reconsidered.

Nevertheless AS decided to announce her, and publicly refer to her as ASG 29(E). This has two reasons: The whole glider has been searched for aspects worth improving. And it prevents confusion: a 29 with 15m tips and a 27 can clearly be distinguished with the denomination.

On the other hand, we decided to bring this model on the same type certificate as the ASW 27, to not further increase the number of type certificates hold by AS. There has to be a reference from the designation to the type certificate, thus the denomination when referring to authorities is ‘ASW 27-18’.

The airworthiness requirements used are certainly the latest valid at the time of application for certification.

Section 2

2. Limitations

2.1 Introduction

2.2 Air Speed

2.3 Airspeed Indicator Markings

2.4 Power plant, fuel and oil

2.5 Power plant instrument markings

2.6 Masses (Weights)

2.7 Center of Gravity

2.8 Approved Maneuvers

2.9 Maneuvering Load Factors

2.10 Flight Crew

2.11 Types of Operation

2.12 Minimum Equipment

2.13 Approved Launch Methods

2.14 Limitations Placards

2.1 Introduction

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the ASW 27-18 standard systems and standard equipment as provided by the manufacturer.

2.2 Airspeed

Airspeed limitations (indicated airspeed IAS) and their operational significance are shown below:

	Speed	IAS	Remarks
V_{NE}	Never exceed speed	270 km/h 145 kts 167 mph	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection.
V_{RA}	**Rough air speed**	210 km/h 113 kts 130 mph	Do not exceed this speed except in smooth air, and then only with caution. Examples of rough air are lee-wave rotors, thunderclouds, visible whirlwinds, or over mountain crests.
V_A	**Manoeuvring speed**	210 km/h 113 kts 130 mph	Do not make full or abrupt control movement above this speed, because under certain conditions the sailplane may be overstressed by full control movement.

	Speed	IAS	Remarks
V_{FE}	Maximum **Flap Extended speeds**	1 – 2 – 3 270 km/h 145 kts 167 mph 4 – 5 – 6 200 km/h 108 kts 124 mph L 160km/h 86 kts 100 mph	Do not exceed these speeds with the flap in position of the given numbers
V_W	Maximum **Winch-launching speed**	140 km/h, 75.5 kts 87 mph	Do not exceed this speed during winch- or autotow launching
V_T	Maximum **Aero-towing speed**	170 km/h 91 kts 105 mph	Do not exceed this speed during aerotowing.
V_{LO}	Maximum **Landing Gear Operating speed**	200 km/h 108 kts 124 mph	Do not extend or retract the landing gear above this speed.
	Maximum **speed with engine ex-tended**	140 km/h 75.5 kts 87 mph	Do not exceed this speed with the engine extended
V_{PO} max	Maximum speed **for extending and retracting the en-gine**	140 km/h 75.5 kts 87 mph	Do not extend or retract the retractable powerplant out-side of this speed range
V_{PO} min	Minimum speed **for extending and retracting the en-gine**	85 km/h, 45 kts, 52 mph	

2.3 Airspeed Indicator Markings

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

Marking	(IAS) value or range	Significance
White Arc	96 - 200 km/h 51 -108 kts 59 – 124 mph	Positive Flap Operating Range
WK 4/5/6	200 km/h 108 kts 124 mph	Maximum Speed in Flap Settings 4, 5, 6
WK L	160km/h 86 kts 100 mph	Maximum Speed in Landing Flap Setting
Green arc	104 - 210 km/h 56 - 113 kts 65 – 130 mph	Normal Operating Range
Yellow arc	210 - 270 km/h 113 - 145 kts 130 – 167 mph	Manoeuvres must be conducted with caution and only in smooth air.
Red line	270 km/h 145 kts 167 mph	Maximum speed for all operations.
Yellow triangle	100 km/h 54 kts 62 mph	Approach speed at maximum weight **without** water ballast.
Blue line	95 km/h 51 kts 59 mph	Best rate-of-climb speed V_y at maximum weight **without** water ballast.

2.4 Power-plant, fuel and oil

Engine manufacturer:	SOLO Kleinmotoren GmbH
Engine model:	SOLO Typ 2350e
Max. power, take-off:	*Not applicable*
Max. engine rpm, take-off:	*Not applicable*
Max. power, continuous:	24 PS / 18kW
Max. engine rpm, continuous:	5400 rpm
Max. cylinder head temperature:	275°C
Fuel:	2-stroke mixture from AVGAS 100LL or unleaded MOGAS 95 ROZ
Oil grade:	Fuel-oil mixture 1:40 2-stroke oil Castrol RS 2T, Castrol Super TT, Castrol TTS or Castrol Go!2T. If none of these oils is availiable, alternatively two stroke oil with the designation JASO FC can be used.
Total quantity of usable fuel	10,5 Ltrs in the fuselage tank
Propeller manufacturer:	Alexander Schleicher GmbH & Co
Propeller model:	AS2F1-3/L100-56-N2

2.5 Power-plant instrument markings

The following table explains the meaning of the different lights of the power plant instrument:

Symbol	Green light	Yellow light	Red light
RPM	4400 to 5200 rpm	5200 to 5400 rpm	> 5400 rpm, continuous alarm, ignition is switched off

BAT	Flashes red: Battery voltage below11,5 V
	Green light: power-plant is extended
	Flashes red, alarm sound: pay attention to LCD display! (also see section 3.7) "SWITCH R" or "SWITCH E": Time for extension or retraction was too long, probably an end switch is faulty. "INS_TANK": Connection to fuel tank sensor is broken; probably the fuel tank is not fitted in properly. "FUSE": Circuit breaker of the jackscrew disconnected "MOT LOCK": Starter motor blocked "ERROR CAN_MISS": Connection of the CAN-Bus between power-plant instrument and starter motor controller broken. "ERROR SENSOR": missing sensor signal of the starter motor "MANUALLY FUELCOCK": manual fuel valve operation
	Green light: power plant is retracted

A continuous alarm sound points to a limit being violated (e.g. rpm, fuel capacity...). A pulsing alarm points to a handling note. See LCD display for explanation.

The permanent display of the power-plant instrument LCD indicates the RPM (four digits on the left side) and the fuel quantity of the fuselage tank in liters (two digits on the right side, in steps of half liters):

`4500 6,0`

By pressing the white button, switching to further displays is possible:

Press once, engine battery voltage

`12,8V`

Press twice, starter battery voltage

`Um 13,5V`

Press three times, starter motor current

`Imot 62A`

Press four times, starter motor temperature

`StaT 61°`

Press five times, starter motor controller temperature

`PwrT 54°`

Press six times, propeller position

`Pos: 5`

Press seven times, engine elapsed time indication

`7,56h`

Press eight times, value of tank calibration (only with retracted engine)

`[100]`

Press nine times, tank calibration (only with retracted engine)

`Calibr.?`

Tank-calibration is described in section 7.

2.6 Weight (Mass)

Span:		18m / 59ft	15m / 49ft
Maximum Take-Off Mass	with water ballast	600 kg 1322 lbs	550 kg 1212 lbs
	for cloud flying	400 kg 882 lbs	400 kg 882 lbs
Maximum Landing Mass:		600 kg 1322 lbs	550 kg 1212 lbs
Max. mass of all non-lifting parts		285 kg 628.3 lbs	
Max. mass in the compartment behind headrest (if flying without fuel tank)		12 kg 26 lbs	
Max. mass in the baggage compartment left side of landing gear box		5 kg 11 lbs	

NOTE: Water ballast in the fuselage belongs to the non-lifting parts !

2.7 Centre of Gravity

Centre of gravity range (for flight):

Span:	18m / 59ft	15m / 49ft	
foremost limit	217 mm 8.54 inch	213 mm 8.38 inch	aft of RP
rearmost limit	330 mm 12.6 inch	335 mm 13.1 inch	aft of RP

"RP" stands for "Reference Point"(Datum), which is located at the leading edge of the wing at the wing root rib. An example of a C.G. position calculation as well as a table of c.g. ranges at different empty weight is shown in Section 6.

2.8 Approved maneuvers

This sailplane is certified for use in normal gliding operation according to Airworthiness Category U, "Utility"; see also sections 2.7, 2.9, and 2.10.

Aerobatic figures are not approved.

2.9 Manoeuvring Load Factors

Maximum permissible manoeuvring load factors:

maximum positive load factor	+ 5.3
maximum negative load factor	- 2.65
at an air speed of:	210 km/h (113 kts, 1304 mph)

At increasing air speeds, these values will be reduced to:

Airbrake setting:	closed	open
maximum positive load factor	+ 4	+ 3.5
maximum negative load factor	- 1.5	- 0
at an air speed of:	270 km/h (145 kts, 167 mph)	

With flap in landing setting:

maximum positive load factor	+ 4
at an air speed of:	160 km/h (86 kts, 100 mph)

2.10 Flight crew

The crew of the ASW 27-18E is one pilot.
Pilots weighing less than 70 kg = 154,5 lbs (incl. parachute) must use additional trim ballast plates. Please refer to the "Weight (mass) and balance form" in Section 6 and the description of trim ballast plates in Section 7.11 .
In addition the minimum cockpit load is shown in the Operating Limitations Placard in the cockpit (DATA and LOADING PLACARD).

2.11 Kinds of operation

Flights may be carried out in daylight, in accordance with visual flight rules (VFR).
Cloud flying is permitted:

- if appropriate instrumentation is fitted (see section 2.12)
- regarding the weight limit (see section 2.6)
- and if regulations currently in force are complied with.

In Canada cloud flying is prohibited !

2.12 Minimum Equipment

Minimum Equipment consists of:
1 ASI indicating up to at least 300 km/h (162 kts)
1 Altimeter
1 Magnetic Compass
1 4-part safety harness (symmetrical)
1 Parachute or cushion for back rest (~ 8 cm thickness)

With the engine installed:
1 Power-plant instrument, ILEC MCU type ASG 29Es

Additionally (in Germany) for flights at airfields with air traffic control and also for cross-country flights:
1 VHF-Transceiver (COM)

Additional minimum equipment for ASW 27-18E registered in **Belgium** or **France**:
1 Variometer
1 Side slip indicator

For cloud flying the following additional equipment must be fitted:
1 Turn-and-Slip indicator
1 Variometer

Approved equipment is listed in the Maintenance Manual in Section 12.1. The manufacturer recommends installing a yaw string on top of the canopy

2.13 Approved Launch Methods

Approved are Aerotow-, Winch- and Autotow-Launch.
The ASW 27-18E is not approved for take-off by sole means of its own power. Launches have to be performed with the engine retracted.

The maximum permissible launch speeds are:

aerotowing	170 km/h (92 kts, 106 mph)
winch launch	140 km/h (75.5 kts, 86 mph)

For winch launch, a weak link of 850 daN ±10% (1910 lbs, brown) must be used in the launch cable or tow rope. Without water ballast, a weak link of 750 daN ±10% (1686 lbs, red) may be used.

For Aero Tow, a weak link according to the tow plane must be used, not stronger than 750 daN ±10% (1686 lbs, red). Besides other regulations, which may exist, the tow rope must be a textile rope not less than 40 m = 130 ft or more than 60 m = 200 ft in length.

Weak link colours are not binding; this information refers to the colour scheme of the Tost company..

2.14 Limitations Placards

This placard is fixed to the right-hand cockpit side wall and contains the most important mass (weight) and speed limitations.

Segelflugzeugbau A. Schleicher GmbH & Co. Poppenhausen

Model: **ASW 27-18E "ASG 29 Es"** Serial No.:

DATA and LOADING PLACARD

	15 m	18 m
Empty mass:	kg lbs	kg lbs
Max take-off mass:	550 kg 1213 lbs	600 kg 1322 lbs
Min. Seat Load:	lbs	kg
Max. Seat Load:	lbs	kg

Max. Permissible Speeds:

Calm Air:	145 kts	270 km/h
Winch Launch W/L:	75 kts	140 km/h
Aerotow A/T:	91 kts	170 km/h
Extending Landing Gear:	108 kts	200 km/h
Maneuvering Speed:	113 kts	210 km/h

Speed limits with Power-Plant:

for Extension/Retraction:	48 - 75 kts	90 - 140 km/h
with Power-Plant extended:	75 kts	140 km/h

Weak Link for Winch Launch	850 ±10% daN
Weak Link for Aerotow appropriate for towing airplane, max.	750 ±10% daN

Tire Pressure			
	Main Wheel:	49 - 52 psi	3,4 - 3.6 bar
	Tail Wheel:	34 - 37 psi	2,4 - 2.6 bar

This placard is to be glued near the data placard:

Reduced minimum Cockpit Load
<u>without</u> Trim Ballast in the Fin:
see Flight Manual Page 6.4 !

This placard is to be glued near the data placard.

> Cloud flying is only approved
> up to a flight-mass of
> 400kg / 882lbs
>
> Aerobatics are not permitted

This placard is to be glued near the data placard, if only a c.g. tow release is installed.

> Only approved for winch-
> and autotow-launching!

This placard is to be glued near the data placard, if only a forward tow release is installed.

> Only approved for
> aerotowing!

Section 3

3. Emergency Procedures

3.1 Introduction

3.2 Canopy Jettison

3.3 Bailing Out

3.4 Stall Recovery

3.5 Spin Recovery

3.6 Spiral Dive Recovery

3.7 Engine failure

3.8 Fire

3.9 Other Emergencies

3.1 Introduction

This section 3 provides checklists and procedures coping with emergencies that may occur.

Brief head-words are followed by a more detailed description.

EMERGENCY PROCEDURES

Canopy Jettison

① Pull both the left and right-hand red levers at the canopy frame back all the way
② pull canopy REARWARD and UP!

Bailing Out

① Push instrument panel UP
② release safety harness
③ roll over cockpit side
④ push off strongly
⑤ watch out for wings and tail surfaces!
⑥ pull parachute!

Spin Recovery

① apply opposite rudder and *at the same time*
② relax back pressure on stick until rotation stops
③ center rudder and immediately pull out gently from dive !

Note: *Aileron neutral supports recovery*

3.2 Jettisoning of Canopy

Pull canopy jettison (red levers mounted left and right at canopy frame) and pull canopy rearwards and up!

3.3 Bailing Out

If bailing out becomes inevitable, first jettison canopy and only then release safety harness.

Push instrument panel UP (if this was not done in the course of jettisoning the canopy). Get up or simply roll over cockpit side.
When jumping, push yourself away from the aircraft as strongly as possible. Try to avoid contact with wing leading edges or tail surfaces!

3.4 Stall Recovery

In straight or circling flight, relaxing of back pressure on the stick will always lead to recovery.

Due to its aerodynamic qualities the ASW 27-18 will immediately re-gain airspeed.

When the glider drops a wing, do not try to counteract rolling motion with the aileron. Relax back pressure on the stick and use the rudder.

3.5 Spin Recovery

① Apply opposite rudder (this means: in the direction opposite to the rotation of the spin) and *at the same time*

② relax back pressure on the stick until rotation stops

③ center the rudder and gently pull out of the dive.

CAUTION: *Furthermore, spin recovery will be accomplished more quickly if flap deflection is reduced. It is advisable to reduce the circling flap setting to neutral (flap setting 4).*

Spinning is not noticeably affected by extending the air brakes, but this increases the height loss and reduces the permissible load factor during recovery. It is therefore advisable to keep the airbrakes retracted.

WARNING: *Spinning in the landing-flap setting is strictly prohibited. If a spin should inadvertently develop while in this flap setting, the flaps should immediately be set to neutral (flap setting 4) before the limits of flap setting L are reached (maximum speed of 160km/h and maximum load factor of 4g)*

NOTE: *Waterballast has no noticeable influence on spinning qualities except that recovery speeds are higher and as a consequence greater losses in altitude are experienced.*

3.6 Spiral Dive Recovery

Depending on the aileron position in a spin with forward C.G. positions (i.e. the C.G.- range with the ASW 27-18 not more sustaining a steady spin) it will immediately or after a few turns develop a spiral dive, or a slipping turn similar to a spiral dive.

In contrast to a spin, a spiral dive is characterized by high g-loads. Therefore do not pull further, but

① release stick
② reduce bank angle with rudder and aileron against direction of turn
③ gently pull out of the dive

3.7 Engine Failure

Failure at safe Altitude

Check the following points:

- Error message from power-plant instrument?
- Engine switch at middle position "ON" ?
- Fuel content in fuselage tank?

If the above points check out correctly, the fault cannot be rectified in flight. Retract power-plant according to checklist and continue flight as pure sailplane.

If on the power-plant instrument the red light next to flashes, a pulsing alarm sounds and the LCD-display shows the following:

SWITCH E: While the engine was being extracted, the power-plant instrument did not get a signal from the end switch for too long. Possible causes are a weak battery or a defective gas spring. Pressing the white button on the power plant instrument restarts the extraction.

INS_TANK: The electric connection to the tank sensor is broken. This alone is no reason for a engine failure (as long as the tank is on board and the fuel lines are connected).

MANUALLY FUELCOCK: The manual fuel valve was triggered. Press fuel valve manually open button, confirm the message at the power-plant instrument and try to start the engine again.

FUSE: The circuit breaker of the jackscrew has disconnected. Pressing the white button on the power-plant instrument stops the alarm sound, and – if the power-plant shall be extended or retracted– resets the circuit breaker.

CAUTION: *Do not fly faster than 120 km/h (65 kts) in an emergency situation without working power-plant instrument, because there is no control of rpms any more.*

Failure at low Altitude

If no terrain suitable for a safe landing can be reached any more, the power-plant should be retracted as far as possible:

① Reduce airspeed (100 km/h, 54 kts)
② Engine switch to "OFF"
③ Close fuel valve manually and confirm the corresponding warning message at the power-plant instrument (white button).
④ Prior to touch-down, toggle main switch off

Retracting the engine not only improves gliding performance but also reduces the risk in case of a crash landing.

Heavy Vibrations of the Power-Plant

Shut down and retract the engine as normal. The propeller has possibly been damaged, causing an imbalance. Do not re-start the power-plant

Low Engine or Starter Battery Voltage

If the BAT-light on the power-plant instrument starts to flash, the motor battery is discharged. There is usually enough energy left to retract the engine. The power consumption of the power-plant instrument is also very low.

CAUTION: *With an empty engine battery the engine does not cease running. But since there is no control for the rpms any more, a speed of 120 km/h (65 kts) must not be exceeded. Bring yourself to a safe terrain for landing, because the engine cannot be retracted any more.*

If on the power-plant instrument the red LED next to ↯ is flashing and "Um 11,0V" (or lower) is shown at the display, the state of charge of the starter battery is too low. Then it is neither possible to extract nor to retract the power-plant, because the vertical alignment of the propeller can not be ensured. Also the starter is blocked, to avoid damage of the starter battery.
In contrast it has no consequences, if the voltage of the starter battery drops during start up.

WARNING: *A stopped power-plant, not retractable any more, decreases the glide ratio dramatically.*

3.8 Fire

If a fire is detected in the engine bay or at the engine,

① Engine switch to "OFF"

② Reduce speed (100 km/h, 54kts)

③ Close fuel valve manually and confirm the corresponding warning message at the power-plant instrument (white button).

④ Land as quick as possible

⑤ Extinguish fire

Retracting the engine not only improves gliding performance but also reduces the risk in case of a crash landing.

3.9 Other Emergencies

Jammed Elevator Control System

If the flap control system is jammed, the ASW 27 is converted into an aircraft with a fixed wing profile.

On the other hand, it does not always occur to the pilot that, with the elevator control system jammed, the flaps still afford some measure of pitch control for improving the situation for bailing out or even perhaps eliminating the need to do so.

Emergency Landing with retracted Landing Gear

Emergency landings with retracted landing gear are not advised in principle, as the capacity for energy absorption of the fuselage is many times less than that of the sprung landing gear. If the wheel cannot be lowered, the ASW 27-18 should be touched down with flaps in position 6 or L and the airbrakes closed as far as possible, at a shallow angle and without stalling on to the ground.

Keep in mind that you will touch down in a lower position.

Groundloops

If the aircraft threatens to roll out beyond the intended landing area, the decision should be made not less than 40 m = 130 ft before reaching the end of the landing area to initiate a controlled ground loop.

- If possible, turn into wind!
- When putting down a wing, at the same time push the stick forward and apply opposite rudder!

Emergency Landing on Water

A landing on water with a composite glider with wheel retracted has been experimentally tried out. The experience gained on that occasion suggests that the aircraft will not skim on the water surface, but that the whole cockpit area will be forced under the surface. If the depth of the water is less than 2 m = 6,5 ft, the pilot is in the greatest danger. Touching down on water is, therefore, recommended **only with extended landing gear,** and **only** as the very last resort.

Flying with Defective Water Ballast Drainage

The water ballast dump valve operation ensures that the tanks in both wings are drained at the same time, when water ballast is jettisoned,. If the optional ballast tank in the tail fin is installed, this tank is opened simultaneously. This is necessary for reasons of flight characteristics.

When jettisoning water ballast in flight, it should be positively ensured that the water is draining from both wings. Small pilots may see the water outflow directly from inside the cockpit. Tall pilots may use a back view mirror or use the mirror effect of their sun glasses.

If a failure of the valves should cause asymmetric loads, the flight should be terminated with extreme care, maintaining an adequate margin above stalling speed as incipient or full spins with asymmetric ballast load are not permissible. Special care should be taken to avoid turning and slipping in the direction of the heavier wing.

If a wing drain valve does not open, the matching valve on the opposite side must be closed, as a landing at a higher landing weight is to be preferred compared to a landing with an uneven load.

If a wing drain valve does not close, dump all water ballast.

The correct operation of the fuselage water ballast cannot be checked from within the cockpit. In case the water remains unintentional in the fuselage tank, this results in a slightly higher stall speed, but no further hazard.

Section 4

4. Normal Procedures

4.1 Introduction

4.2 Rigging and De-rigging

4.3 Daily Inspection

4.4 Pre-Flight Inspection

4.5 Normal Procedures and Recommended Speeds

- 4.5.1 Winch Launch
- 4.5.2 Aero Tow
- 4.5.3 Flight (including inflight engine start/stop procedures)
- 4.5.4 Approach
- 4.5.5 Landing
- 4.5.6 Flight with Water Ballast
- 4.5.7 High Altitude Flight
- 4.5.8 Flight in Rain
- 4.5.9 Aerobatics

4.1 Introduction

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

4.2 Rigging and Derigging

To rig: The ASW 27-18 can be rigged without use of rigging aids by three people, or by two people when a fuselage cradle and a wing stand are used.

1. Clean and lubricate all pins, bushings and control connections.

2. Support fuselage and keep upright. If the wheel is lowered, check that the landing gear is securely locked down.

3. Remove the fuel tank. For this purpose, free the hoses, which are clipped to the sidewall at the couplings. You then can place the tank in the cockpit without separating the couplings.

4. Set the flap lever to flap setting 1 or 2, push the airbrake lever forward and centre the stick.

WARNING: *When the flap lever is in position L for landing the automatic flap control connection may fail to engage properly. Better design of this detail was tried but ended in lack of stiffness and excessive play of this connection. Misrigging is easily detected in preflight checks as the flap lever cannot be actuated at all and is blocked in full negative flap setting where a take-off is impossible.*

5. Begin with the right inner wing and insert its spar fork into the fuselage. If available, support the wing with a wing stand. While rigging, unlock the airbrake over-centre lock in the wing with the special tool (AS-P/N 270.05.0002, the grey, metal lever).

CAUTION: *At the wing root, there is a drain hole of the water tank in front of the forward lift pin bushing. This hole has to be closed with a matching bolt or an plug attached to the fuselage.*

NOTE: *The wing stand must not obstruct the movement of the flap !*

6. Insert left wing spar root and line up the main pin bushings. Insert and lock main pins. Only now - and not before - may the wing weight be relaxed. If the aircraft is still supported in a fuselage cradle, it is recommended that the landing gear should be extended at this stage and locked. Complete rigging with the aircraft standing on its main wheel.

7. Screw the provided tool (AS-P/N 290.05.0010, the red, T-shaped handle) into the hole at the outer end of the inner wing leading edge. Pull the safety pin. Align the outer wing and slide its spar stub into the inner wing. Both the lift pins and the ailerons must connect. When the safety pin lines up with its corresponding bushing, push it in to its distinct stop and lock it. Now the outer wing can be relieved and the tool be screwed off.

NOTE: *To lock the safety pin, turn the top of the tool in the direction to the wing tip.*
To unlock the safety pin, turn the top of the tool in the direction of the fuselage

NOTE: *Before finally pushing the outer wing into its position, check that the ventilation from the inner wing connects to the outer wing (silicon hose and brass tube).*

NOTE: *Check the safety pins extension vanishing completely under the airfoil contour.*

NOTE: *It goes without saying that only mating wing tips may be rigged*

8. The winglets are installed into their pockets in the wing tips and secured by the self engaging spring loaded bolt. Adhesive tape seals the gap and secures the winglet additionally.

   Screw the cover of the water ballast filling/ventilation opening on the upper wing surface in place and secure it with self adhesive white tape.

9. Prior to rigging the horizontal tail, check if a trim weight or -battery in the fin compartment is needed, or already installed! After cleaning and lightly lubricating the elevator studs and sockets, the tailplane is pushed onto the fin from the front. Each half-elevator must be guided into the elevator connections. The elastic lip seal covering the elevator gap must be placed on top of the elevator control tongue. Use the rigging aid (AS-P/N 99.000.4657, a bent piece of sheet metal) to do so. This sheet metal part is held between elastic seal and the elevator actuator! Now push the tailplane home until the hexagon socket head bolt at the leading edge will engage its thread. The bolt must be fully and firmly tightened. It is secured by means of a spring ball catch, whose ball must engage in the grooves on the side of the bolt head.

10. Insert the multi probe into the fin up to the stop and secure it with adhesive tape.

11. A considerable performance improvement can be achieved with little effort by taping all gaps at the wing junctions with plastic adhesive tape (on the non-moving parts only).

NOTE: *The ventilation ports of the water tanks must be kept open in any case!*

	Ventilation port location
Inner wing water tank	*lower side of the wing, below the winglet*
Optional tail water tank	*atop the left side of the vertical tail*

The fin-tailplane junctions should also be sealed with tape. The canopy rim must never be taped over, so as not to impair bail-out.
It is recommended that appropriate areas should be thoroughly waxed beforehand, so that the adhesive tape can afterwards be cleanly removed without lifting the paint finish.

12. Refill the fuel tank

13. Now use the Check List (see the following Section 4.3) to carry out the pre-flight check.

To de-rig: proceed in the reverse order of rigging starting with the horizontal tail, winglets, wing tips and inner wings. We would add the following suggestions:

1. Drain all water ballast. To properly do so screw off the cover from the wing water tank on the upper wing surface. Ensure that all the water has emptied out by putting down alternative wing tips several times. Despite technical provisions, the wing surfaces might suffer from humidity on the long run.

   At the wing root there is a drain hole in front of the forward lift pin bushing. Ensure these holes are open, when wings are put in the trailer, so that remaining water can spill out.

2. If the tailplane is very firmly located in its rear seating, it will be more easily dismantled by two people alternately pushing it forwards by the tips.

4.3 Daily Inspection

Before commencing flying operations, the aircraft must be thoroughly inspected and its controls checked; this also applies to aircraft kept in the hangar, as experience shows them to be vulnerable to hangar-packing damage and vermin

Daily Inspection of the Glider

① - Open canopy and check canopy jettison

- Main pins inserted up to the handle and secured?
- Check positive control connections - ailerons, flaps and air-brakes - in fuselage/wing intersection as far as visible.
- Check cockpit and control runs for loose objects or components.
- Check all batteries for firm and proper attachment (up to two slots in the fuel tank compartment and one between the pilot's knees through the seat pan)
- Put fuel tank back in. Check, that both lock pins left and right are fully home. Clip hose couplings to the sidewall behind back-rest.
- Check full, free and stress-free operation of all controls. Hold controls firmly at full deflection while loads are applied to control surfaces.
- Check ventilation opening and pitot tube in fuselage nose.
- Check condition and operation of towing hook(s). Release control operating freely? Do not forget release checks!

- Check wheel brake for operation and leaks. With airbrake paddles fully extended the resilient brake pressure from the main brake cylinder should be felt through the brake handle.

② - Check both upper and lower wing surfaces for damage.

- Check the water ballast valves to be correctly seated.

- Check the wing tips to be correctly installed: the safety pin extension vanishes under the airfoil contour, and the ailerons are properly connected without loose play

③ - Flaps and Ailerons:
Check condition and full and free movement (control surface clearances). The gap between the inboard/outboard edge of the aileron and the fixed wing must have a clearance of min. 1.5 mm (1/16 in). This clearance is necessary to ensure that these surfaces do not foul the wing cut-out edges when deformed under load in flight. Check linkage fairing for clearance. The friction areas of the elastic seals must be cleaned from any dirt!

- Check the cover for the filling and ventilation opening of the water ballast tank on the upper wing surface for proper seating and safety by elastic tape.

- Are the winglets undamaged and secured? Is the ventilation port of the wing water ballast tank unobstructed?

④ - Airbrake paddles:
Check condition and control connections. Do both sides have good over-centre lock? Check both airbrake boxes for loose objects, stones, water etc.

- The seat areas of the airbrake cover plates must be carefully cleaned!

⑤ - Check inflation and condition of tires:
Main wheel : 3.5 bar ± 0.1 bar (= 50,8 psi +/- 1,5 psi)
Tail wheel : 2.5 bar ± 0.1 bar (= 35,6 psi +/- 1,5 psi)

⑥ - Check fuselage, especially underside, for damage.

⑦ - Check static ports in the fuselage tail boom for obstructions (moisture?).

⑧ - Check the pressure port in the fin:
Is the probe properly seated, tight and secured by elastic tape?

- Check tail water ballast tank drain hole and the ventilation hole to be clean.

⑨ - Check that the tailplane bolt is tight and locked.

- Is a trim weight or battery installed inside the fin compartment? Elevated minimum cockpit load, see mass and balance form, section 6.2.

⑩ - Check that rudder, tailplane and elevator are correctly fitted, and check for damage or excessive play.

The numbers against the above points correspond with those in the following illustration "Tour of Inspection".

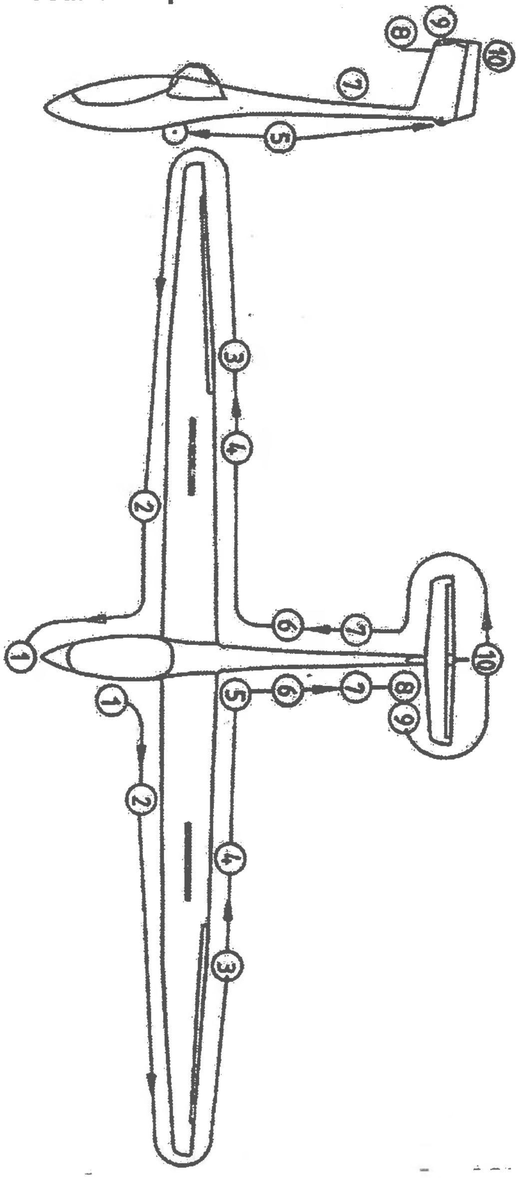
NOTE: *Finally, check the water ballast system for leaks, after it has been filled.*

These points are briefly repeated on a checklist on the cockpit sidewall:

Pre Flight Check

1. Main pins fully home and secure?
2. Check for foreign matter in the cockpit!
3. Outer wings pins and tailplane bolt secure?
4. Check controls for positive connections, freedom of movement and allowed slack.
5. Visible damage on towing hooks, landing gear or surface?
6. Multi prope inserted into fin until stop?
7. Static pressure openings dry and unobstructed?
8. Check tyre pressure!
9. Trial of tow hooks!
10. Water tank outlets und ventilation openings clean?
11. Observe mass and balance data!
12. Fuel content checked?
13. Power-plant checked as per the manual?

Tour of Inspection round the Aircraft



Daily Inspection of the Power-Plant

1. Engine switch to **"OFF"**. Toggle main switch on, check engine <u>and</u> starter battery voltage on the power-plant instrument. Engine <u>and</u> starter battery charged?
2. Extract engine and pay attention to unusual noise and stiffness of operation. Check for full stretch of the toggle lever. The green light on the power-plant instrument must beam.

CAUTION: *Is the engine switch **"ON"** also the ignition is ON! Therefore it is recommended for all work at the engine to turn the main switch off after the engine was extended and toggle the engine switch back to **"OFF"**.*

3. Check for proper placement and lock of the electric line connectors at the front end of the engine bay.

CAUTION: *If the upper connector is loose, ignition is automatically ON!*

4. Check condition and function decompression valves.
5. Inspect engine according to engine manual
6. Retract engine halfway. Check all visible bolted connections (standard stop nuts and thermag-nuts). Are the rubber elements, which hold the engine, intact?
7. Inspect electric lines for signs of chaffing and kinks. Check end switches for correct seating. Toggling the end switches must result in beaming of the appropriate green light at the power-plant instrument. Check for proper seating of the spark plug connectors.
8. Check fuel hoses for visible damages and leakage. In the impulse line to the membrane pump must be no fuel.
9. Muffler: Check screw connection to the crank case. Check weld seams at the exhaust manifold and silencer for visible cracks (they might be detected by leakage oil).
10. Visible inspection of engine bay doors. Are the elastic cords and engine support in good condition?
11. Remove the safety pin ("remove before flight"-tag) of the engine switch – only after completion of the daily inspection!

NOTE: *Align the propeller vertical <u>before</u> switching on the main switch again to retract (refer also to page 7.20).*

Daily Inspection of the tank system

1. Press drainer and release condensation, if present (Use a cup, do not spill fuel into the environment). If possible do this before moving the fuselage. Watch carefully that the drainer afterwards closes tightly again. The drainer is located below the left landing gear bay door.
2. Check fuel tank ventilation opening for dirt. It is located next to the drainer.
3. Check fuel tank content. Check that the power plant instrument shows a fuel content (If the tank is not full, the power plant instrument shows no correct value, because it is calibrated for flight attitude)
4. Check that the hose connections to the fuel tank are secure and tight.

Daily Inspection of the propeller

1. Visual inspection of the propeller mounting. Check proper condition of lock wire.
2. Visual inspection of the propeller according to propeller manual

4.4 Pre-Flight Inspection

The following Check List containing the most important points is affixed within easy view of the pilot, below the instrument pod:

Pre Take-off Check:

1. Tail dolly removed?
2. Parachute fastened?
3. Rip-chord of automatic parachute connected?
4. Seat comfortable?
5. Safety harness fastened (especially, lap straps tight)?
6. Controls free?
7. Airbrakes closed and locked?
8. Trim set in take-off position?
9. Flap in take-off position?
10. Altimeter correctly set?
11. Radio transmission checked?
12. Landing gear locked?
13. Check wind direction!
14. Close and lock canopy!
15. Procedure for take-off interruption in mind?

4.5 Normal Procedures and Recommended Speeds

4.5.1 Winch Launch

CAUTION: *Winch- and autotow-launches must be conducted using the c.g. tow release in front of the landing gear.*

For winch launch, a weak link of 850 daN ±10% (1910 lbs, brown) must be used in the launch cable or tow rope. Without water ballast, a weak link of 750 daN ±10% (1686 lbs, red) may also be used. (Weak link colours refer to the colour scheme of the Tost company)

For winch-launching flap setting 5 (+20°) is recommended. Without water ballast, flap setting 4 (+12°) may also be used. The trim should be set half-way nose-heavy.

	Recommended	Maximum
Winch-launch airspeed:	110 – 130 km/h 60 – 70 kts 68 – 80 mph	140 km/h 75.5 kts 86 mph

Maximum acceptable crosswind component is 25 km/h (13,5 kts).

During take-off run, rudder and aileron immediately respond, such that it is possible to maintain the wings at zero bank. With the trimmer adjusted as mentioned above, the ASW 27-18 will assume a gentle climb attitude after take-off. Nevertheless every winch launch is different and the pilot must be prepared to correct the flight attitude immediately. After take off pitch and flight path is controllable right away.

NOTE: *Actions necessary after a cable failure are always also subject to wind and airfield circumstances. Apart from this, after a cable failure in the flat phase of a winch launch the pilot must immediately push, and take care of a stabilized flight attitude before further actions.*

Above a minimum safe altitude the climb angle should be increased by applying backpressure on the stick

CAUTION: *After a cable failure in the steep part of the winch launch immediate and full push must be applied ("1st push stick, 2nd release tow hook, 3rd consider situation"). Not the pitch attitude, but only the airspeed indicator can ascertain, whether a safe airspeed has been reached.*

NOTE: *The landing gear may **not** be retracted during the launch*

CAUTION: *Winch launches with water ballast are only recommended with strong winches. The winch driver must be informed of the total take-off mass.*

CAUTION: *Before Take-Off, check seating position and that controls are within reach. The seating position, especially when using cushions, must preclude the possibility of sliding backwards during initial acceleration or steep climb. To do so bring the back rest in the most upright position which is comfortable in order to provide the shoulder straps holding the pilot down in the seat.*

WARNING: *We expressly warn against attempting any launch by an under-powered winch in a tail wind!*

NOTE: *Naturally, the engine has to be retracted during winch launch.*

4.5.2 Aero Tow

CAUTION: *The sailplane is only certificated for aerotow operation when the forward tow release is used.*

For aerotows, flap setting 4 or 5 is recommended. The trim should be set half-way nose-heavy. The minimum length of the tow-rope is 40m (130ft). A length of 40m to 60m (130 to 200ft) is recommended. A textile rope must be used.

Experienced pilots start their take-off run in flap setting 2. This flap setting offers better lateral control. During ground run the flap setting is steadily increased to 5 or, for short take-off runs or when carrying much water ballast, to setting 6. For the remaining tow, flap setting 4 or 5 is selected in safe height.

It is equally possible to remain in flap setting 4 throughout the whole aerotow.

NOTE: *Before start, inform the tug pilot of the recommended towing speed.*

Wing loading	Recommended Towing Speed
35 kg/m^2 7.17 lbs/ft^2	115 km/h 62,0 kts 71,5 mph
45 kg/m^2 9.22 lbs/ft^2	120 km/h 64,8 kts 74,6 mph
55 kg/m^2 11.26 lbs/ft^2	135 km/h 72,9 kts 84,9 mph

Maximum acceptable crosswind component: 25 km/h = 13,5 kts.

NOTE: *Sustainer engines are not suitable to improve the take-off performance of an aero tow, because they have not the necessary level of dependability.*

4.5.3 Flight (including inflight engine start/stop procedures)

CAUTION: *Flights in conditions conducive to lightning strikes must be avoided as the ASW 27-18 is not approved for such conditions under JAR 22 requirements.*

Flaps

Flap control allows adaptation of the aircraft to changing flight attitudes. See diagram in section 5.3.3 for correct flap setting.

Flap settings 1 through 4 are straight flight settings. Setting 1 is for high speed flight, setting 2 is mostly used between thermals. In flap setting 2 the lower wing surface contour is flush and the low drag laminar boundary layer can pass the hinge line to the blowing holes. Flap setting 3 proofed favorable in operational experience. In flap setting 4 low drag is achieved for slow level flight at best L/D.

Flap settings 5 and 6 are purely for use while circling. Flap setting 5 is designed for centering into thermals and circling in turbulent lift. Flap setting 6 should be selected when the conditions warrant strong and tight lift in the core of a thermal.

Because the flap setting directly influences the amount of lift generated over the whole of the wing, a sudden, jerky operation of the flaps will cause a sudden drop or climb; therefore, care should be exercised in this respect, especially when flying close to the ground or circling near other sailplanes.

Low Speed Flight, Stalls and Spins

The ASW 27-18 behaves normally in slow and stalled flight. In all C.G. positions, reduced control forces together with flow separations at the fuselage coinciding with an unrest in the stick will give warning of an impending stall. Approaching stall, the glider can be brought back to a normal flight attitude any time by releasing stick back pressure.

When stalling, the glider may drop a wing. This reaction is more pronounced with more rearward C.G.-positions and more positive flap settings. In positive flap settings and rear C.G. positions, loss of height may be up to 70m and pitch below horizon may be up to 50°. Depending on how fast airbrakes are retracted, loss of height with airbrakes extended can be up to 100m.

At the foremost C.G. position, the stall characteristics become very gentle, as the limited elevator deflection will no longer allow maximum angles of attack to be reached. At this C.G. position, only a gentle stall warning will be experienced, but large aileron deflections can be applied without dropping a wing.

With the engine extended, but stopped or windmilling, there is, but less manifest, a stall warning – because there is already some turbulence in the wake of the engine. With the engine running a strong stall warning comes from the engine, which is running rough at low rpms.

When circling, the stalling speed will increase compared to that in straight flight. As a general guideline, you should expect the stalling speed to increase by 10 % at about 30° bank, and by 20 % at about 45 ° bank.

The ASW 27-18 is well behaving in circling flight. Approaching stall with a bank angle of 45° usually leads into a stable sideslip. But if it happens, that a wing drops, it may be more drastic than in straight flight (at least with rearmost C.G. position, flap setting 6). Before that, there is a significant stall warning.

Violent applications of rudder and/or aileron would result in a spiral dive, spinning or side slipping, depending on C.G. position and control deflection

With the engine extended, but stopped or windmilling, the airspeed approaches stall speed quicker than in clean configuration, due to the increased drag. In straight flight as well as in circling flight, the glider can be controlled with the stick in the rearmost position for some time, but will drop a wing due to a gust or control deflection. In rearmost c.g. positions, with flap settings 6 and L, which have for them already more drag, and the engine extended (stopped or windmilling), spinning might not be avoidable any more in such a case.

More specifically, the following would apply:

C.G. Position	Aileron neutral or in direction of ruder	Rudder & Aileron Crossed
rearmost	steady spin	spin, leading to a side slip after 1-2 turns
middle and foreward	spin, leading to a spiral dive after 1-2 turns	side slip

In all flap settings, the glider behaves quite similar while spinning. Without water ballast, loss of altitude between initiation of recovery and horizontal flight may be 100m (330ft). Especially with water ballast, the glider quickly accelerates after the autorotation was stopped, therefore it is necessary to timely pull out of the dive. With water ballast a loss of altitude of 150m (500ft) may occur.

High Speed Flight (Airspeed Indicator in yellow Range)

The following consequences arise from the airworthiness requirements:

CAUTION: *Exceed the rough-air speed only in calm air (yellow arc of airspeed indicator).*

CAUTION: *Above manoeuvring speed (yellow arc of airspeed indicator), full control deflections must not be applied. At V_{NE} (red radial line) only one third of the full travel is permissible.*

CAUTION: *In the yellow range airbrakes may only be opened under positive g-loads, and only if this g-load is below 3.5g.*

CAUTION: *And generally it applies: Do not utilise the otherwise permissible range of control deflections during strong gust loads. Simultaneous, full gust loads and maneuvering loads can excess the structural strength.*

Inflight Engine Start Procedure

① Power-plant main switch **ON**

② Airspeed below 140 km/h (76 kts)

③ Engine switch  ("ON")

④ Green LED ɧ beaming?

⑤ Engine switch **Start**
and held up (rpms increase to nearly 1500 rpm)

⑥ Release engine switch 
(rpms increase to nearly 3000 rpm)

⑦ Wait until engine starts
(rpms increase above 4400 rpm)

⑧ Slow down to intended airspeed
(95km/h; 51kts; 60mph)

CAUTION: *Always regard the possibility of the engine not starting properly. Therefore, soar in such way, to always be able to reach an outlanding field, despite having an engine. The decision to start the engine must be made in sufficient and safe altitude.*

A minimum safe altitude to extend and start the engine must be maintained. It must be possible to retract the engine again and carry out a normal outlanding if the power-plant malfunctions. A valid value for this minimum safe altitude is about 400m (1300ft); however, this is depending strongly on pilot ability and geographic factors.

Height loss for extenting and starting engine: **usually** about: 15 – 50 m (50 – 170 ft)

Time to extend and start the engine: about 15s

CAUTION: *It may take longer if the fuel lines had been completely empty (e.g. if engine was not used for a long time)*

Speed of best climb-rate for a medium wing loading: 95km/h (51kts, 60mph)

Maximum rpm: 5400 U/min

Remarks:

on ④: If the green light does not appear, but ⚡ flashes red, the LCD display gives more information:
If it says "SWITCH E" the endswitch may be faulty or there was too much resistance for the spindle. Check the position of the engine in the mirror. If it is not fully extended, toggle the engine switch "OFF" and again "ON" and maybe support the spindle with a low-g manoeuvre.

on ⑦: Opening the decompression is necessary in the beginning to overcome the top dead centre. The decompression valves are automatically controlled by the power-plant instrument. After they are shut again the rotational speed further rises.
Thereby engine noise amplifies, but only a glance on the tachometer or the variometer tells, whether the engine already produces power or not. At recommended climb speed (95km/h; 51kts; 60mph) the engine speed should be 4400rpm or higher at sea level and ISA standard conditions.

on ⑧: With cold engine and high airspeed, it is possible that the engine revs reach the limit rpm. In this case the power-plant instrument would switch off the ignition for short times. This must not irritate, it is just necessary to pull away the over-speed.

It is advisable to familiarize oneself with the extending and starting procedures in the first instance within safe reach of an airfield.

Before departing to a cross-country flight it is wise to start the engine for a short time. First, to ascertain of its operational readiness and second it may help in the real thing when the fuel lines have already been filled.

If the engine fails to start, check it over as recommended in the Engine Manual.

WARNING: *Do **NOT** try to start the engine on the ground!*
Usually the engine won't start because of the type of fuel-mixture generation. But if it starts for some reason, it directly runs with full throttle! Thus a non-fixed glider is a incalculable danger to life or property.
For maintenance ground runs refer to the maintenance manual.

Inflight Engine Stop Procedure

① Ignition OFF
(by moving engine switch to position "OFF")

② Reduce airspeed to 100km/h (54 kts, 62mph)

③ Observe in the mirror the correct braking and vertical alignment of the propeller, before he is automatically retracted.

④ When green LED beams,
turn power-plant main switch **OFF**

Remarks:

on ③: The power-plant instrument controls automatically the decompression valves and below 2500rpm the braking and vertical alignment of the propeller. If flown too fast, the braking torque of the starter motor is not high enough to slow down the engine. Also the vertical propeller alignment is inhibited by flying too fast. If the propeller stops <u>not</u> in vertical position, in addition to fly slower it is helpful to turn the propeller a half turn further by means of the starter motor.

Height loss during stopping and retracting the power-plant:
usually about 60 m (200 ft)

Time to stop and retract the power plant: about 30 – 40 s

CAUTION: *Not only for the engine start but also for the braking and propeller alignment power from the starter battery is needed. Therefore a fully charged battery is essential for a safe engine operation. The system has <u>no</u> generator, so that a charged starter battery has to be secured before flight.*

CAUTION: *On the ground the position "Start" of the engine switch has to be locked against faulty operation by means of the safety pin ("remove before flight"-tag).*

Powered Flight

CAUTION: *Medical investigations have shown, how much the interior noise of powered sailplanes with retractable engines can harm the unprotected ear. Therefore* ***always*** *wear ear protection during powered flight. To compensate for this, turn the radio louder.*

The largest cruising range can be achieved with a saw-tooth pattern. That means, to fly under power with the speed of the best climb-rate and glide with retracted engine and the speed of the best glide-ratio.

See section 5.3.6 for performance information.

A detailed description of the power-plant instrument and engine lever is given under section 7.12.

4.5.4 Approach

Make the decision to land in good time, change to flap setting 5 or 6 and lower the wheel at not less than 150 m (~ 500 ft) above ground.

For the remaining circuit, maintain about 100 km/h (54 kts). The yellow triangle on the ASI scale is valid for maximum weight without water ballast. With remaining water ballast, or in turbulence or strong headwind increase the approach speed.

The tripple-paddle air brakes are normally effective in controlling the glide angle.

CAUTION: *Landing flap setting L should only be selected on final approach, when you are quite certain of being able to reach the boundary of the landing area.*

At airspeeds above 100 km/h (54 kts, 62 mph), the control forces required to engage flap setting L will increase. They are generated by the large deflection of the inboard flaps, which deflect downwards +47°, while the outboard aileron deflects only +12° down.

This twist first increases the sink rate, especially at air speeds between 120 and 130 km/h (65 and 70 kts / 75 and 81 mph). Second, it improves the aileron effectivity.

NOTE: *In a strong headwind, use of the landing-flap setting L is NOT recommended, due to the danger of undershooting the landing area!*

If you are not familiar with the use of flaps as a landing aid, you should initially use only flap setting 6 for landing into a headwind.

NOTE: *When in danger of undershooting, a reduction of flaps from L to 6 is possible, because due to the flap twist, the stall speeds are in close proximity. But it must only be employed at a safe speed clearly free of any stall warning, above a safe height (at least 40m, 131 ft), and with conscious control of the airspeed. One should have practiced this maneuver at greater heights.*

CAUTION: *The danger of a sudden drop makes it inadvisable to reduce the flap setting near the ground.*

Side slipping with the ASW 27-18 is very effective and may therefore also be used for controlling the glide angle.
The slip is initiated with airspeed between 90 km/h and 120 km/h IAS (49 to 65 kts) by gently applying aileron control and holding the flight path with the rudder. In a stationary side slip the ASI reading is not usable as it reads between 50 km/h (27 kts) and zero. The correct flying speed is checked by the pitch attitude. The upper edge of the instrument panel must not rise above a horizon position known from thermal flight attitude.

The amount of sideslip is controllable with the size of the control deflections. Associated negative rudder control force gradients can be overcome by moderate pedal forces or by easing the control stick into a more neutral position. Very high negative rudder forces may be a sign of a too high airspeed.

With airbrakes already extended, the slip is more effective and can more easily be initiated.

If the slip is initiated at too high airspeed and with too dynamic control deflections, the glider may react with violent motions. Entry speed should therefore be max. 140 km/h / 76kts / 87mph

CAUTION: *Side slipping should be practiced from time to time at a safe height*

CAUTION: *With a partial but symmetric water ballast load, side slipping is possible!*

WARNING: *When an asymmetric water ballast load is suspected or recognized,* ***emergency procedures*** *according to* ***Section 3*** *are applicable. Side slipping into the direction of the heavier wing must be avoided!*

4.5.5 Landing

In an emergency (e.g. abandoned take-off), structural strength will prove adequate to a landing at maximum all-up mass.
However in normal operation it is strongly recommended that the water ballast is jettisoned before landing, in order to increase the safety margin.

When final approach is flown in flap setting L with some nose-down attitude, remember to round out in time to allow a clean 2-point touch down.

Immediately before touching down, the airbrake setting may be reduced so as to avoid touching down with wheel brake too firmly applied.
During ground run the stick should be held fully back; this gives better directional stability in crosswinds, and prevents the tail from lifting due to hard application of the wheel brake.

The flaps may be left in the landing setting L, because the negative aileron deflection will provide adequate lateral control until the aircraft comes to a stop. If flap setting 6 was used for the landing, it is advisable to engage flap setting 1 after touch down. This will inhibit the sailplane from lifting off again and the aileron effectivity is improved.

When parking the aircraft, engage flap setting 3 to save the plastic sealing strips over the control surface gaps from deformation.

Landing with engine extended

Approach and landing is preferably carried out with the power-plant retracted. If the electric power supply fails, it is possible to land with the engine extended. For that toggle the engine main switch OFF and switch the ignition off (means the engine switch to "OFF" ). In addition close the fuel valve manually.

The increased sink should be borne in mind. As a general guideline, a basic sink speed of about 2 m/s (400 ft/min) at 100 km/h (54 kts) may be assumed. It may be possible to do without airbrakes during the landing, and a firmer round-out will be needed.

4.5.6 Flight with Water Ballast

NOTE: *Ballast will increase the stalling speeds and take-off distance. Ensure that the condition of the airfield, the length of take-off run available and the power of the tug, tow-car or winch permits a safe launch.*

Up to three water ballast tanks can be installed in the ASW 27-18. A tank is part of both inner wings, holding 85 ltrs each. Optionally, a tail tank for 5 ltrs can be installed in the vertical fin.

The tail water tank is intended only to counteract the nose heavy moment of the wing water ballast. Therefore the valves of these tanks are opened with a common lever.

Ballast Limits

See section 6.3 to determine the maximum permissible amount of water ballast

Filling of Water Ballast

NOTE: *When an optional tail water ballast is installed and tail water ballast is needed, the tail tank has to be filled before the wings.*

The lever for the water ballast valves is located on the right hand cockpit arm rest in the landing gear gate. Lever forward is open!

The tail tank is filled through its drain port (in front of the tail wheel). A transparent filling hose is supplied, which can be screwed into the port.

The amount of water in the tail tank can be read from the water level in the hose and the level marks on the fin skin. After having filled the tank, close the valve and remove the hose.

The wing tanks can be filled through the filling/ventilation openings on the upper wing skin. For filling, the wings must be kept level.

Carry out a balancing test to check that the ballast loads are even by levelling the wings.

WARNING: *It is expressly prohibited to use pressurized water (mains, immersion pumps etc.) for filling ballast tanks due to possible damage to the wing structure!*

It is recommended to fill from slightly elevated, non pressurised containers (on wing or car roof etc.). If water under pressure is used, it is essential to interpose an open intermediate vessel (funnel etc.), to ensure that the head-of-pressure cannot rise beyond 1.5 m = 4,9 ft.

WARNING: *When parking the glider with filled ballast tanks, the wings **must be leveled**. Otherwise the water tank may dump slowly through the ventilation of the lower wing.*

CAUTION: *Check the opening cover on the upper wing surface to be properly screwed in and secured by tape.*

CAUTION: *Having filled the tanks, briefly open valves to check their functionality.*

Jettisoning of Water Ballast

To jettison water ballast, the operating lever at the right hand cockpit arm rest (in the landing gear gate) is pushed forward (valve open).

Draining the complete wing water ballast takes 4 minutes. The dump system does not synchronise the water flow from wing and tail tank. The tail tank must unload in less than half the time for safety reasons. Therefore it is not possible to maintain the c.g., when the water load is only partially disposed.

Every time any water is jettisoned, it is most important to check that the water is draining at an equal rate from both valves! Asymmetric control deflections may also indicate unequal loading.

Should the wing ballast fail to drain as intended, the valves should be closed immediately (pull the operation lever backwards); try again to achieve even drainage by operating the valves again or, if icing is suspected, try again after descending into warmer air to achieve a symmetric jettison.

If the valves are to be closed again to retain water in the tanks (partial reduction of wing loading), also check that both valves really close. Otherwise jettison all water.

If you do not achieve a symmetric situation after several attempts the situation should be regarded as an emergency, and instructions in Section 3.9 (Other Emergencies) should be followed.

C.G. Positions of the Water Ballast

The c.g. of the wing water ballast depends on the amount loaded:

Wing ballast	C.G. of wing ballast
20 kg	178 mm
40 kg	186 mm
60 kg	192 mm
80 kg	195 mm
100 kg	198 mm
120 kg	198 mm
140 kg	200 mm
160 kg	202 mm
170 kg	206 mm

The tail tank c.g. is located at x = 4280mm

4.5.7 High Altitude Flight

The ASW 27-18 is structurally limited to an EAS of max. 270 km/h (145kt, 167mph). Simultaneously, flutter prevention restricts true airspeed TAS to max. 321 km/h (174kts, 200 mph). From both restrictions the never exceed airspeed V_{NE} changes with height as follows:

Altitude msl.		V_{NE} Indicated Airspeed		
0 m	0 ft	270 km/h	146 kts	168 mph
3500 m	11483 ft	270 km/h	146 kts	168 mph
4000 m	13123 ft	263 km/h	142 kts	163 mph
5000 m	16404 ft	249 km/h	135 kts	155 mph
6000 m	19685 ft	236 km/h	127 kts	147 mph
7000 m	22966 ft	223 km/h	120 kts	139 mph
8000 m	26247 ft	211 km/h	114 kts	131 mph
9000 m	29528 ft	198 km/h	107 kts	123 mph
10000 m	32808 ft	187 km/h	101 kts	116 mph
11000 m	36089 ft	175 km/h	95 kts	109 mph
12000 m	39370 ft	162 km/h	88 kts	101 mph

The ASI under reads with increasing altitude, thus the true airspeed TAS relative to air mass is sufficient to face even strongest head winds at high altitude.

Placard for airspeed reduction at high altitude:

The appropriate placard has to be installed near the ASI

The units of measurements used to indicate airspeed on placards must be the same as those used on the indicator.

WARNING: *Flights in icing conditions are not advised, especially when the aircraft is wet before climbing through the icing level. Experience suggests that drops of moisture on the surface will be blown back, lodge in the control gaps, and dry comparatively slowly there.*

This may cause the controls to become stiff to operate, or in extreme cases, jammed. A single climb through icing level with a previously dry aircraft, on the other hand, is not likely to impair the use of the controls, if icing-up of wing and tail leading edges occurs.

WARNING: *When carrying water ballast, avoid flying above icing level due to the danger of iced-up outlet valves, or in extreme cases bursting of wings due to ice formation.*

Water ballast must therefore be dumped, before entering altitudes with lower temperatures than 3°C (37°F).

4.5.8 Flight in Rain

Rain drops, frost and ice impair the aerodynamic qualities and also alter the flying behaviour. Therefore in such conditions, the quoted minimum speeds for straight and circling flight should be increased by approx. 10 km/h = 5,5 kts. Air speeds should not be allowed to drop below these values.

CAUTION: *Rain drops should be removed from a wet aircraft before take-off.*

Do not fly into icing conditions with a wet aircraft. In this context, see also Section 4.5.7 above.

4.5.9 Aerobatics

Aerobatics are not approved!

Section 5

5. Performance

5.1 Introduction

5.2 Approved Data

- 5.2.1 Airspeed Indicator System Calibration
- 5.2.2 Stall Speeds
- 5.2.3 Demonstrated Crosswind Performance

5.3 Non-Approved Further Information

- 5.3.1 Flight Polar - Level Flight
- 5.3.2 Flight Polar - Circling Flight
- 5.3.3 Flap Setting Ranges
- 5.3.4 Influence of c.g.-position
- 5.3.5 Diagram for approved c.g.-limits
- 5.3.6 Performance with Engine running
- 5.3.7 Noise data

5.1 Introduction

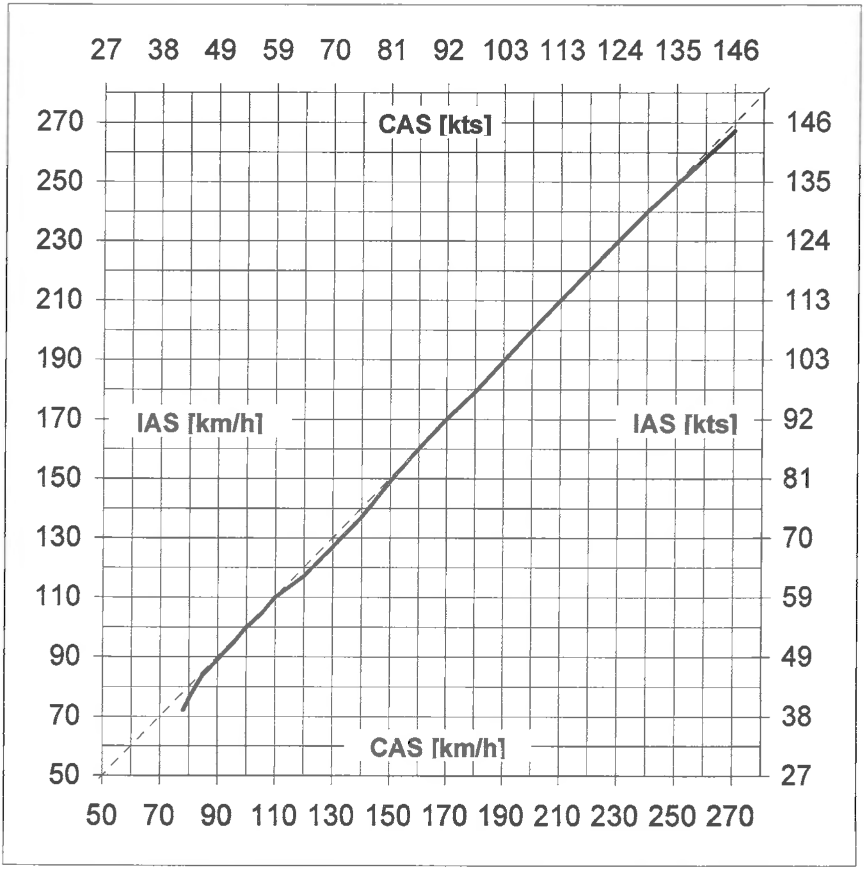
Section 5 provides approved data for airspeed calibration and stall speeds and non-approved additional information.

5.2 Approved Data

5.2.1 Airspeed Indicator System Calibration

The ASI will only show a minimal indication error above an indicated air-speed of 80km/h (43kts, 50mph) without water ballast, or above 90km/h (48,5kts, 56mph) at max. all-up mass. The deviations are within 3km/h (2kts, 2mph).

NOTE: *The ASI must take its pitot pressure from the pitot-tube in the fuselage nose, and its static pressure from the static ports in the fuselage tail boom.*



IAS = Indicated Air-Speed

CAS = Calibrated Air-Speed

5.2.2 Stall Speeds

Stall Speeds in km/h and kts Indicated Air Speed.

18m / 59ft			
Flap Setting	All up weight		
	400 kg / 882 lbs	500 kg / 1102 lbs	600 kg / 1323 lbs
1	78km/h / 42kts	87km/h / 47kts	96km/h / 52kts
2	77km/h / 42kts	86km/h / 46kts	94km/h / 51kts
3	73km/h / 39kts	82km/h / 44kts	89km/h / 48kts
4	70km/h / 38kts	78km/h / 42kts	86km/h / 46kts
5	67km/h / 36kts	75km/h / 40kts	82km/h / 44kts
6	66km/h / 36kts	74km/h / 40kts	81km/h / 44kts
L	64km/h / 34kts	71km/h / 39kts	78km/h / 42kts
L + Airbrake	71km/h / 38kts	79km/h / 43kts	87km/h / 47kts

15m / 49ft			
Flap Setting	All up weight		
	390 kg / 860 lbs	470 kg / 1036 lbs	550 kg / 1213 lbs
1	84km/h / 46kts	93km/h / 50kts	100km/h / 54kts
2	82km/h / 44kts	90km/h / 49kts	98km/h / 53kts
3	80km/h / 43kts	88km/h / 48kts	95km/h / 51kts
4	76km/h / 41kts	84km/h / 45kts	90km/h / 49kts
5	72km/h / 39kts	79km/h / 43kts	86km/h / 46kts
6	71km/h / 38kts	78km/h / 42kts	84km/h / 46kts
L	69km/h / 37kts	76km/h / 41kts	82km/h / 44kts
L + Airbrake	75km/h / 41kts	82km/h / 45kts	89km/h / 48kts

The speeds quoted are valid for the aerodynamically clean glider.

Stall warning in the form of buffeting will commence at about 7-10% above the indicated stall speeds.

Extension of air brakes increases the indicated stall speed in straight flight by 5 - 10km/h (3 - 5 kts). The extension of the landing gear has no influence.

Stall Speeds in Circling Flight

In circling flight the stall speeds increase due to the higher load factors.

Bank angle	0°	30°	45°	60°	75°
Stall speed in turns compared to straight flight	100%	107%	119%	141%	200%

Height loss and Pitch below Horizon

Height loss due to incipient spin from straight or circling flight depends largely on

- the all-up flight mass and c.g. position
- how quickly the pilot reacts
- the flap setting (more loss of height in more positive settings)
- turbulence of the air (lower stall speed achievable in still air, but more drastic wing drop)

Loss of altitude from straight flight: up to 70m (229 ft)

Loss of altitude from straight flight with airbrakes extended: up to 100m (330ft)

The cockpit nose may pitch 10° to 50° below the horizon.

Height loss from circling flight: up to 100 m (about 330 ft)

Stall speed and stall characteristic with engine extended

Extension of the engine does not significantly influence the stall speed.

With the engine running the stall characteristic is more docile. Close to stall, the engine runs rougher and changes its sound, which adds to the stall warning.

With the engine extended, but stopped or windmilling, the stall warning is less pronounced, because there is always some buffeting from wake turbulences of the extracted engine.
While flying at the threshold of stall, with the engine extended and stopped or windmilling, the additional drag can cause the airspeed to drop quicker than usual. Therefore, the time between dropping a wing and getting into a spin is shorter than in other configurations. This is valid especially in rearward c.g. positions, in flap settings 5, 6, L and with airbrakes extended.

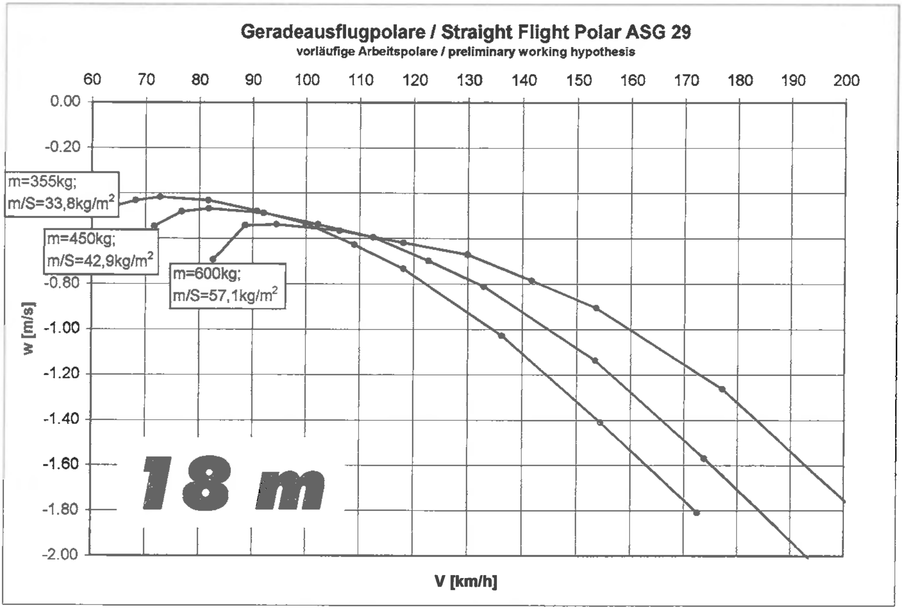
5.2.3 Demonstrated Crosswind Performance

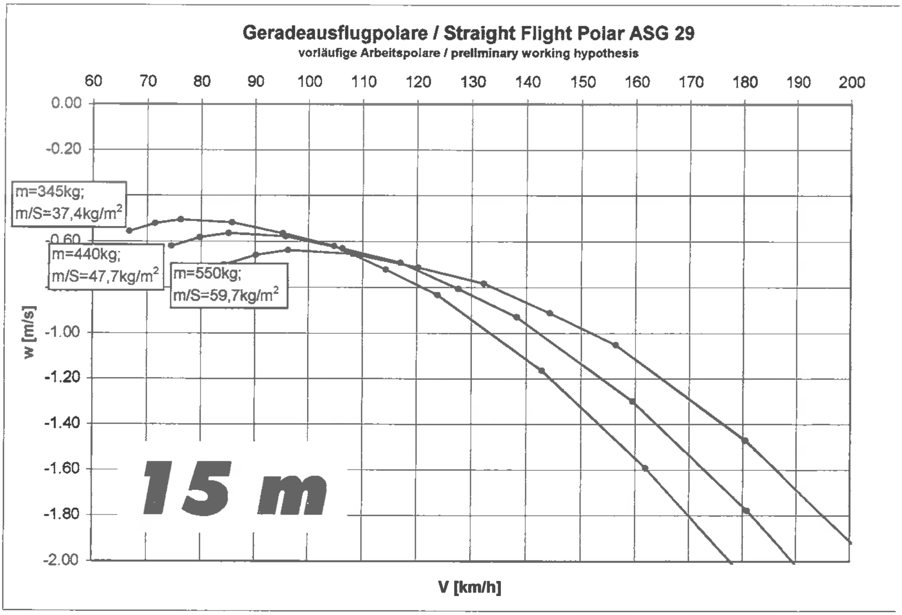
Winch Launch	25 km/h	13.5 kts	15.5 mph
Aerotow	25 km/h	13.5 kts	15.5 mph
Landing	25 km/h	13.5 kts	15.5 mph

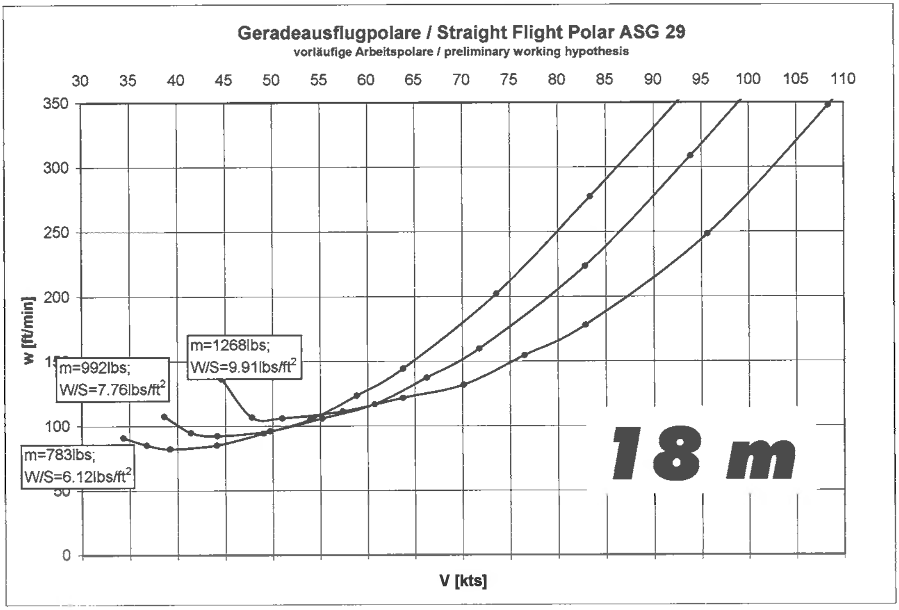
5.3 Non-Approved Further Information

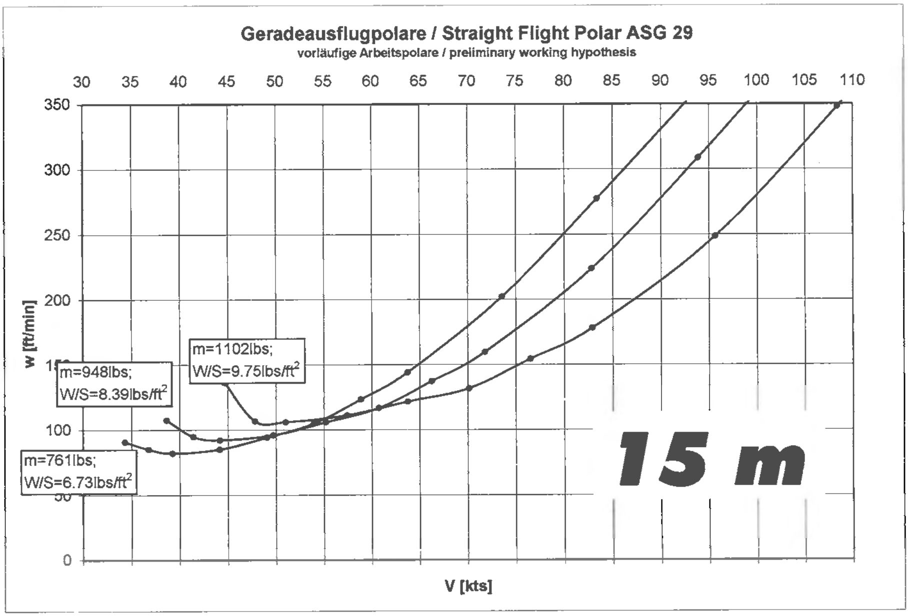
5.3.1 Flight Polar - Level Flight

Only preliminary polars can be supplied:


Geradeausflugpolare / Straight Flight Polar ASG 29
vorläufige Arbeitspolare / preliminary working hypothesis
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
0.00 -0.20 -0.80 -1.00 -1.20 -1.40 -1.60 -1.80 -2.00
w [m/s]
m=355kg; m/S=33,8kg/m2
m=450kg; m/S=42,9kg/m2
m=600kg; m/S=57,1kg/m2
18 m
V [km/h]


Geradeausflugpolare / Straight Flight Polar ASG 29
vorläufige Arbeitspolare / preliminary working hypothesis
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
0.00 -0.20 -0.60 -1.00 -1.20 -1.40 -1.60 -1.80 -2.00
w [m/s]
m=345kg; m/S=37,4kg/m2
m=440kg; m/S=47,7kg/m2
m=550kg; m/S=59,7kg/m2
15 m
V [km/h]

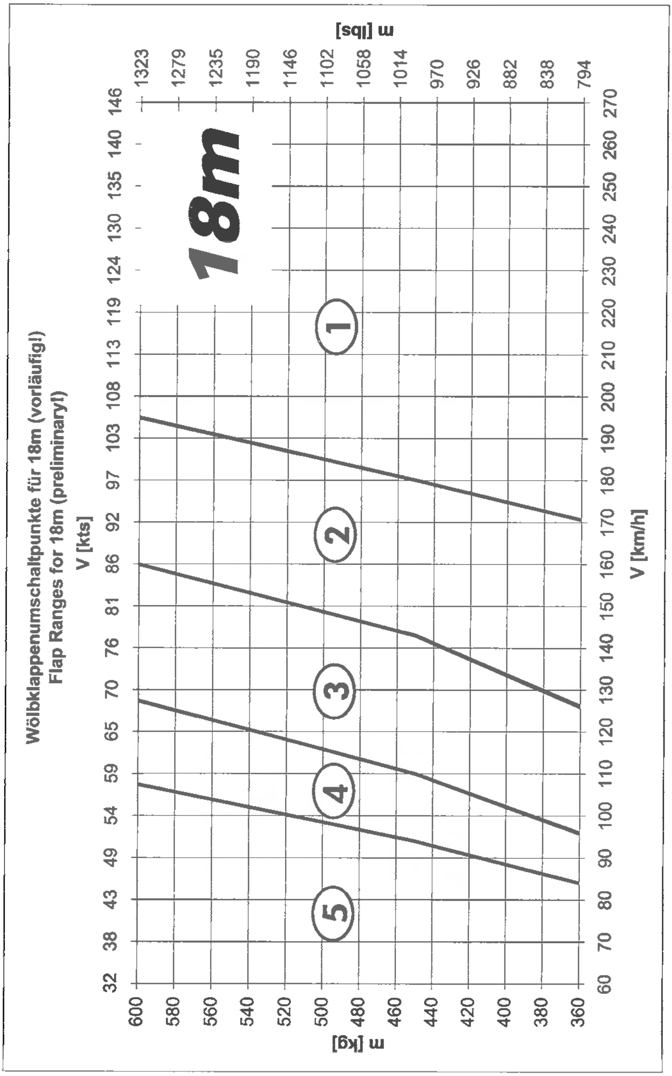

Geradeausflugpolare / Straight Flight Polar ASG 29
vorläufige Arbeitspolare / preliminary working hypothesis
m=1268lbs; W/S=9.91lbs/ft²
m=992lbs; W/S=7.76lbs/ft²
m=783lbs; W/S=6.12lbs/ft²
18 m
w [ft/min]
V [kts]

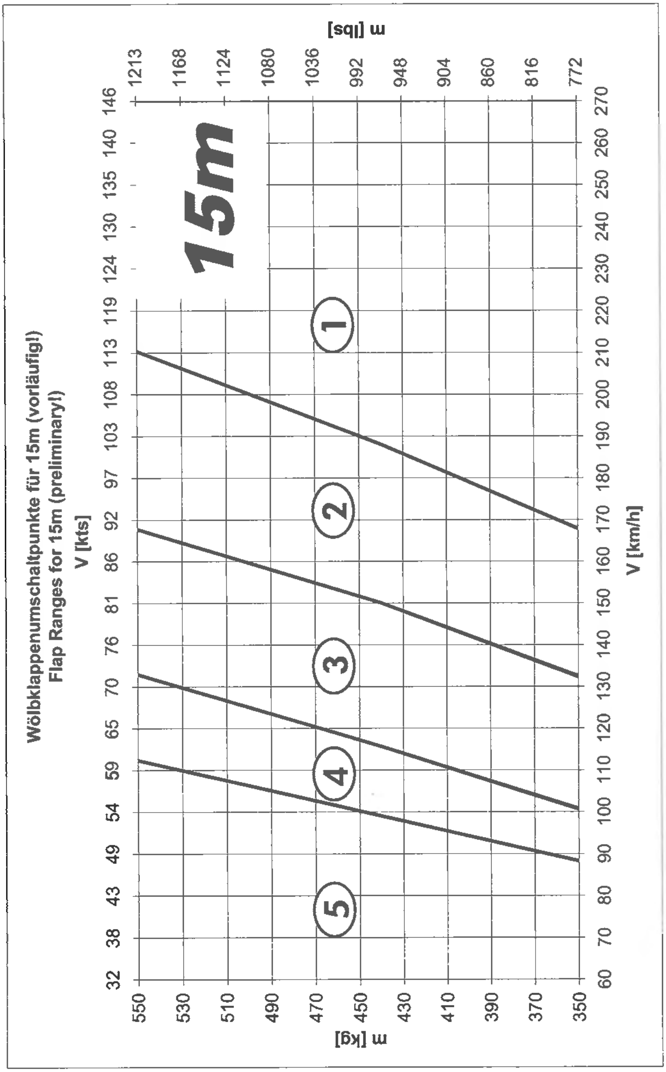

Geradeausflugpolare / Straight Flight Polar ASG 29
vorläufige Arbeitspolare / preliminary working hypothesis
m=1102lbs; W/S=9.75lbs/ft²
m=948lbs; W/S=8.39lbs/ft²
m=761lbs; W/S=6.73lbs/ft²
15 m
w [ft/min]
V [kts]

5.3.2 Flight Polar - Circling Flight

Not yet availiable!

5.3.3 Flap Setting Ranges




Wölbklappenumschaltpunkte für 15m (vorläufig!)
Flap Ranges for 15m (preliminary!)
V [kts]
32 38 43 49 54 59 65 70 76 81 86 92 97 103 108 113 119 124 130 135 140 146
15m
1
2
3
4
5
m [lbs]
1213 1168 1124 1080 1036 992 948 904 860 816 772
m [kg]
550 530 510 490 470 450 430 410 390 370 350
V [km/h]
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270

The above diagrams describe the speed ranges of the various flap settings in straight flight, depending on the mass.

Flap Setting	L	6	5	4	3	2	1
Flap deflection	47°/12°	24°/22°	20°/19°	12°/11°	5°	0°	-2,5°
Description	Landing	Circling	Circling	Neutral	Gliding	Gliding	Gliding

Flap setting 5 has a smaller sink rate than flap setting 6 over most of its speed range. Therefore flap setting 6 is only advisable in tight circles and for landing patterns.

5.3.4 Influence of c.g.-position

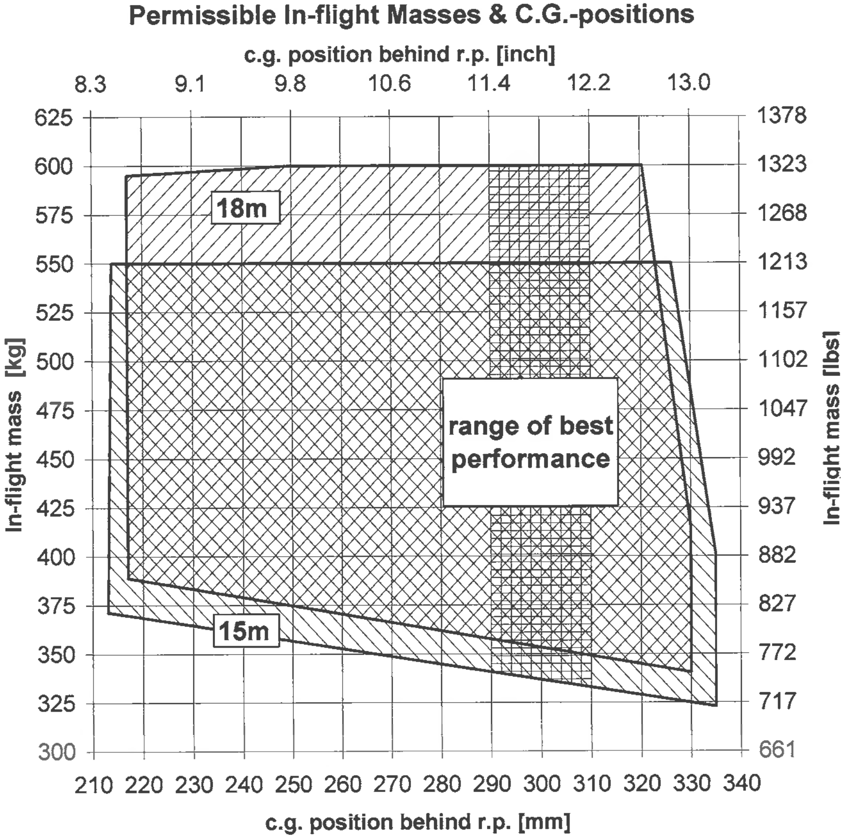
To achieve the best gliding performance the horizontal tail surface must not produce up- or downward lift, for the wing with its high aspect ratio is much more efficient in producing lift at low induced drag than the horizontal tail with its compact plan form.

This optimum cannot be realized over the whole range of airspeeds. Therefore the best choice depends on the proportion of time spent in circling and in gliding.

Generally, a c.g.-range of 290 to 310 mm behind r.p. (11.42 – 12.2 inch) is beneficial. In the special case of flights with a large share of time in flap settings 1 and 2 (e.g. wave flights), a c.g. position of 260 mm may be more adequate.

As a matter of principle the c.g. position has a great influence on longitudinal stability. In foreward c.g. positions, control deflections and hand forces gradients are larger. Thus it is advisable for inexperienced, light pilots to mount more lead on the (optional) attachment in front of the pedals than necessary to comply with the minimum cockpit load.

5.3.5 Diagram for approved c.g.-limits



The permitted c.g.-range is regarded, when

- the maximum weight of non lifting parts is observed
- the c.g. of the dry glider is within the permissible range (see Mass and Balance Form, section 6.2), and
- water ballast is only filled in accordance with section 6.3.

5.3.6 Performance with engine running

The performance depends strongly upon altitude, temperature and wing loading. The following values refer to standard atmosphere and sea level.

Climb

Without water ballast a best climb rate of 1,2m/s (236ft/min) can be achieved at an airspeed of V_Y = 95km/h (51kts; 59mph). Flap setting according to section 5.3.3.

Horizontal flight

The maximum speed for level flight without water ballast at sea level is V_H = 120km/h (64 kts; 75 mph). The airspeed for horizontal flight decreases with height.

An altitude of 2800m (9200 ft) MSL (standard atmosphere) can be maintained with maximum wing loading and an airspeed of $V_H = V_Y$ = 95km/h (51kts; 59mph).

Flight with high wing loading

With full wing loading, the climb rate is considerable lower, therefore it is recommended to dump the water ballast.

Range

A full fuselage tank contains sufficient fuel for at least 50min of powered flight

The largest range is possible in a saw tooth flight, climbing with the speed of the best climb-rate and gliding with retracted engine and the speed of the best L/D.

Regarding density altitude, actual climb-rate and height above ground it is favourable to use the engine in several climb phases in middle height.

From this results a theoretical range of:

In powered flight: 79 km / 42 Nm

Gained altitude: 3600m

Average altitude loss for 3x starting and retracting: 300m

Gliding with the speed of best L/D: 170 km / 92 Nm (18m)
158 km / 85 Nm (15m)

Sum: **249** km / 134Nm (18m)
237 km / 128Nm (15m)

5.3.7 Noise Data

A noise measurement was performed according to „Bekanntmachung der Lärmvorschrift für Luftfahrzeuge (LVL) vom 01.08.04 gem. Nfl II 70/04"

Established value for ASW 27-18E with TN 4 $L_{A\ korr\ max}$	Limit value
XX,X dB(A)	64,0 dB(A)

Section 6

6. Mass (Weight) and Balance / Equipment List

6.1 Introduction

6.2 Mass (Weight) and Balance Form

6.3 Acceptable Water Ballast and Fuel Load

6.1 Introduction

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

Procedures for weighing the sailplane and the calculation method for establishing the permitted payload range and a list of all equipment available for this sailplane are contained in the applicable ASW 27-18E **Maintenance Manual**, Section 6.

A complete list of all equipment installed in the particular sailplane during the last weighing is enclosed in the sailplane records.

It is of vital importance for safe flight not to exceed the limits for the in-flight center of gravity, given in section 2.7.

After repairs, refinishing and fitting additional equipment this weight and balance records have to be updated, either by calculation, or if this is not possible, by weighing.

6.2 Mass (Weight) and Balance Form

The Mass and Balance Form overleaf shows the maximum and minimum cockpit loads, and the total load permitted in the fuselage.

These mass and balance data must be calculated in accordance with the currently valid weighing data. The data and diagrams needed for establishing these are to be found in the ASW 27-18E **Maintenance Manual**, Section 6.

The permissible payload range derived for the glider in 18m span configuration are also valid for the 15m wingtips

This Mass and Balance Form is valid only for the aircraft bearing the Serial No. shown on the title page of this manual.

If pilot mass is less than the minimum stated in the Mass and Balance Form, missing pilot weight can be replaced with trim ballast plates fitted in front of the rudder pedals. See also Section 7.11.

A housing is provided in the upper part of the fin where trim ballast, for instance in the form of a battery, may be fitted.

Of course, if any trim ballast is mounted in the fin, the minimum cockpit load will be increased! This increased minimum cockpit load must also be shown in the DATA and LOADING PLACARD in the cockpit. The lower permissible cockpit load without trim ballast in the fin will be shown only on page 6.4 of the Flight Manual.

In the cockpit, an additional placard is to be affixed:

> Reduced minimum Cockpit Load
> without Trim Ballast in the Fin:
> see Flight Manual Page 6.4 !

Sight apertures in the fin make it easy to check whether any trim ballast has been fitted. Clear view through the fin means: No trim ballast fitted! See also section 7.11 .

MASS AND BALANCE FORM

Date of Weigh-ing	Empty mass [1] (18m)	Empty mass C.G. aft of RP [2] (18m)	Pilot mass incl. parachute [1] (15&18m) min	max	Total useful load in fuselage [1,3] (15&18m)	Inspector´s stamp and signature
28.10.15	336,2	536	80	111,5	111,5	Luftfahrt-Bundesamt - LBA - Ausweis-Nr. 2501 Klasse 3 Lizenzierter Prüfer

1) For U.S.-registered sailplanes show lbs.
2) For U.S.-registered sailplanes show inches.
   Other countries may use metric units
3) Total useful load in fuselage = 285 kg (628 lbs) less empty mass of non-lifting parts

Example of load / C.G. calculation:

A weighing gave the following results:

m_e =	281kg	(619 lbs)	Empty mass
x_e =	0.532m	(20.9 inches)	Empty mass C.G.
m_{nl} =	124kg	(273 lbs)	Weight of non lifting components

A second weighing with a (removable) trim ballast of 5 kg (13,23 lbs) in the fin showed:

m_L =	286kg	(631 lbs)	Empty mass
x_L =	0.595m	(23.4 inches)	Empty mass C.G.

The **Mass and Balance Form** in page 6.4 must be filled out according to the following example :

Date of Weigh-ing	Empty mass[1)] (18m)	Empty mass C.G. aft of RP[2)] (18m)	Pilot mass incl. parachute[1)] (15&18m) max	min	Total use-ful load in fuselage[1,3)] (15&18m)	Inspector´s stamp and signature
xx.xx.xx	281 kg 619 lbs	0.532 m 20.9 in. without trim-ballast in the fin	70 kg 154 lbs	115 kg 253 lbs	161kg 355 lbs	
	286 kg 631 lbs	0.595 m 23.4 in. with 5 kg trim-ballast in the fin	90 kg 198 lbs	115 kg 253 lbs	156 kg 344 lbs	+ + +

1) For U.S.-registered sailplanes show lbs.
2) For U.S.-registered sailplanes show inches.
Other countries may use metric or english units

For details see maintenance manual section 6.

6.3 Acceptable Water Ballast and Fuel Load

The amount of fuel and water ballast is restricted by the following limits:

1. Maximum Take-Off-Weight

Maximum take-off weight may not be exceeded.

Span	18m	15m
Maximum Take-off Weight	600 [kg]	550 [kg]
less - Empty Weight	-xxx [kg]	-xxx [kg]
less - Cockpit Load	-xxx [kg]	-xxx [kg]
= max. total fuel and water load	xxx [kg]	xxx [kg]

2. Maximum Weight of non lifting Components

Maximum weight of non lifting components (285kg / 628lbs) may not be exceeded.

Total useful load in fuselage (from Mass and Balance Form above)	xxx [kg]
less - Cockpit Load	-xxx [kg]
= max. load in tail tank and fuel tank	xxx [kg]

3. C.G. Limit for the Fuel Tank

The influence of the fuel on the inflight c.g. is neglectible.

4. C.G. Limit for the Tail Tank

The tail tank may only be used in combination with the wing tanks. For every 40 ltrs put in the wing tanks, not more than 1 ltr may be filled in the tail tank.

CAUTION: *In case the engine is not installed and only the wings are filled with water ballast, Pilots of 105 kg (231 lbs, including parachute) or more must use the rearmost back rest position. If this is not regarded, the foremost c.g. limit may be exceeded.*

Notes and Recommendations

The integrated wing water ballast tanks in the ASW 27-18E can hold about 170 liters together.

To bring the c.g. into the beneficial range of x=290 to 310mm (see section 5.3.5), exceed the minimum cockpit load by 16kg (35lbs).

The ratio of 1ltr tail ballast per 40ltrs wing ballast also happens to be the necessary ratio to keep the c.g. in the beneficial range.

Avoid foremost c.g. positions when flying close to maximum take-off weight (practically only possible without engine, with a very heavy pilot and water ballast only in the wings). Otherwise a nose down moment may hinder you from applying full wheel brake power, e.g. in case of a take-off interruption.

Examples

To help with the determination of the maximum allowed fuel and water ballast, the following tables were created. The units used in the tables are Liters of water and US-Gallons of water, because they are more practicable. Fuel is lighter than water (density of 0,75kg/Liter / 6,26lbs/gal), which means that 8ltrs (2gal.) of water may be replaced with 10,5ltrs (2,7gal) of fuel.

Maximum Take-Off-Weight

To not exceed the maximum take-off weight, all in all not more than the amount of water given in the following tables may be loaded. (Maximum Take-Off-Weight criterion)

Max fuel and water with 18m wingtips	Pilot + Parachute + Baggage + Trim-weights					
	70 kg 154 lbs	80 kg 176 lbs	90 kg 198 lbs	100 kg 220 lbs	110 kg 243 lbs	120 kg 265 lbs
Empty mass with 18m span: 300 kg 661 lbs	Full	Full	Full	Full	Full	180 ltrs 48 gal
310 kg 683 lbs	Full	Full	Full	Full	180 ltrs 48 gal	170 ltrs 45 gal
320 kg 705 lbs	Full	Full	Full	180 ltrs 48 gal	170 ltrs 45 gal	160 ltrs 42 gal
330 kg 728 lbs	Full	Full	180 ltrs 48 gal	170 ltrs 45 gal	160 ltrs 42 gal	150 ltrs 40 gal
340 kg 750 lbs	Full	180 ltrs 48 gal	170 ltrs 45 gal	160 ltrs 42 gal	150 ltrs 40 gal	140 ltrs 37 gal
350 kg 772 lbs	180 ltrs 48 gal	170 ltrs 45 gal	160 ltrs 42 gal	150 ltrs 40 gal	140 ltrs 37 gal	130 ltrs 34 gal

Max fuel and water with 15m wingtips	Pilot + Parachute + Baggage + Trim-weights					
	70 kg 154 lbs	80 kg 176 lbs	90 kg 198 lbs	100 kg 220 lbs	110 kg 243 lbs	120 kg 265 lbs
Empty mass with **18m** span: 300 kg 661 lbs	Full	178 ltrs 47 gal	168 ltrs 44 gal	158 ltrs 42 gal	148 ltrs 39 gal	138 ltrs 36 gal
310 kg 683 lbs	178 ltrs 47 gal	168 ltrs 44 gal	158 ltrs 42 gal	148 ltrs 39 gal	138 ltrs 36 gal	128 ltrs 34 gal
320 kg 705 lbs	168 ltrs 44 gal	158 ltrs 42 gal	148 ltrs 39 gal	138 ltrs 36 gal	128 ltrs 34 gal	118 ltrs 31 gal
330 kg 728 lbs	158 ltrs 42 gal	148 ltrs 39 gal	138 ltrs 36 gal	128 ltrs 34 gal	118 ltrs 31 gal	108 ltrs 29 gal
340 kg 750 lbs	148 ltrs 39 gal	138 ltrs 36 gal	128 ltrs 34 gal	118 ltrs 31 gal	108 ltrs 29 gal	98 ltrs 26 gal
350 kg 772 lbs	138 ltrs 36 gal	128 ltrs 34 gal	118 ltrs 31 gal	108 ltrs 29 gal	98 ltrs 26 gal	88 ltrs 23 gal

Maximum Weight of non lifting Components

To not exceed the maximum weight of non lifting components, not more fuel and water than given in the following table may be loaded in the fuel and tail tank (Maximum Weight of non lifting Components criterion)

Max fuel and water in fuselage	Pilot + Parachute + Baggage + Trim-weights					
	70 kg 154 lbs	80 kg 176 lbs	90 kg 198 lbs	100 kg 220 lbs	110 kg 243 lbs	120 kg 265 lbs
95 kg 209 lbs	Full	Full	5 ltrs 1 gal.	Over- load	Over- load	Over- load
100 kg 220 lbs	Full	Full	10 ltrs 3 gal.	0 ltrs 0 gal.	Over- load	Over- load
105 kg 231 lbs	Full	Full	Full	5 ltrs 1 gal.	Over- load	Over- load
110 kg 243 lbs	Full	Full	Full	10 ltrs 3 gal.	0 ltrs 0 gal.	Over- load
115 kg 254 lbs	Full	Full	Full	Full	5 ltrs 1 gal.	Over- load
120 kg 265 lbs	Full	Full	Full	Full	10 ltrs 3 gal.	0 ltrs 0 gal.

C.G. Limit for the Tail Tank

Do not fill more than the amount of water given in the following table in the tail tank. (Tail tank c.g. limit):

Max water in tail tank	Water Ballast in the Wings				
	0ltrs 0 gal	40 ltrs 10 gal	80 ltrs 20 gal	120 ltrs 30 gal	160 ltrs 40 gal
Tail tank	0 ltrs 0 gal	1 ltrs ¼ gal	2 ltrs ½ gal	3 ltrs ¾ gal	4 ltrs 1gal

Section 7

7. General Sailplane and Systems Description

7.1 Introduction

7.2 Cockpit Controls

7.3 Instrument Panel

7.4 Landing Gear System

7.5 Seats and safety harness

7.6 Pitot and Static System

7.7 Airbrake System

7.8 Baggage Compartment

7.9 Water Ballast System

7.10 Electrical System of the Instrumentation

7.11 Miscellaneous Equipment
(Removable ballast, Oxygen, ELT etc.)

7.12 Power-plant

7.13 Fuel System

7.14 Electrical System of the Power-plant

7.1 Introduction

This Section provides description and operation of the sailplane and its systems. Refer to Section 9, Supplements, for details of optional systems and equipment.

A detailed technical description of the glider with layout drawings can be found in the Maintenance Manual.

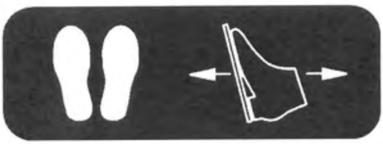
7.2 Cockpit Controls

Aileron and Elevator

Both these controls are operated by means of the control column. The stick is also fitted with the trim release lever for setting the trim, and with the radio transmit button.

Rudder

The rudder pedal is adjustable to suit the length of the pilot's legs.



Pedal Adjustment:
grey knob at right of stick.

To move pedals forward: pull knob and push pedals forward with your heels. Release knob and push again to lock in position.

To move pedals aft: relax pressure on pedals, pull knob back. Then release knob and apply pressure to pedals to lock in position.

WARNING: *When the pedals are in their rearmost position large shoes may interfere with the fuselage structure. Check free movement of the rudder control circuit!*

Flap Control

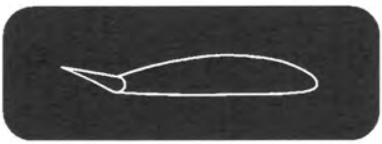
The ASW 27-18E wing is equipped with two trailing-edge flaps on each wing covering the entire span. In flap settings 1 to 6 both flaps are synchronized. In positive settings the inboard flap has a little more positive deflection of for handling reasons. Both flaps also work as aileron, with the inboard flap making only small deflections, for higher lift in circling flight. (Therefore the inner flap is often referred to as "flap", while the outer flap is called "aileron")

When the landing flap setting L is selected, the inboard flap deflects downwards 47° whereas the aileron only deflects downwards 12°. This increases sink rate, improves the aileron effectiveness, and slightly reduces the stall speed.

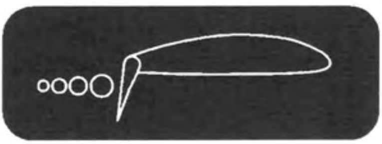
The wing flaps and ailerons are equipped with pneumatic turbulators on the lower surface for the purpose of boundary-layer transition control. NACA inlets integrated on the lower surface supply the air emitted through the capillary holes. This solution is very simple and robust in operation.

Flap settings are selected by means of the black handle on the left cockpit wall. Pivot the handle down to unlock so that it may be moved forwards or backwards.

The flap settings are marked 1, 2, 3, 4, 5, 6 and L above the position pointer.



Negative flap setting for high speed



Flap in landing setting

Trim

There is a trim control for the longitudinal trim. To set the trim, press the trim release lever at the control stick when flying at the desired air speed. A trim indicator is fitted at the left cockpit wall at the seat.

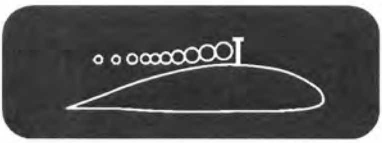
While pressing the stick mounted trim release lever, the trim can also be adjusted by sliding the trim indicator knob to a desired position.

Trim nose heavy

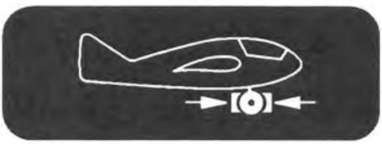
Trim tail heavy

Airbrakes

The airbrakes are operated by a blue handle mounted at the left cockpit wall.



Pull the blue handle to extend the airbrake paddles.



When the airbrake handle is pulled back to its fullest extent, it will also actuate the hydraulic disc brake of the main wheel.

Launch Cable / Towing Hook Release

High on the left cockpit wall you will find the yellow cable release knob.

Yellow T-handle for cable release

Pulling the yellow knob will open one or both of the towing hooks.

To allow the launch cable to be attached, pull the yellow knob back to the stop and then let it go, to allow the towing hook to snap shut and lock.

Opening and Closing the Canopy

The canopy is locked by means of the two **white** lever handles fitted to the canopy frame at the right and left.

White levers for opening the canopy

To open the canopy, both levers are pivoted to the rear and the canopy is pushed up.

Emergency Canopy Jettison

To jettison the canopy, pull jettison levers (red levers mounted at either side of the canopy frame) and pull canopy **up**!

Red levers for jettisoning the canopy

Operating the red jettison levers will automatically open the white locking levers, leaving the canopy resting loose on the cockpit rim.

NOTE: *If possible, do not leave the aircraft parked or unattended with canopy open, because:*

1. *the canopy could be slammed shut by a gust of wind which might shatter the Perspex.*
2. *at certain elevations of the sun the canopy could act as a lens concentrating the sun rays, which might harm instruments and equipment severely.*

NOTE: *Operating the jettison levers allows the canopy to be removed for easy access when inspecting instruments.*

Ventilation

There are two means of ventilation in the cockpit:

A ventilation flap is located at the front of the canopy. This is operated with the small black knob on the instrument panel. This ventilation also serves as a demister for the canopy.

Knob for ventilation
Pull to open

A second ventilation nozzle adjustable in flow rate and direction is fitted on the right cockpit wall. Closing this nozzle increases the demist effect of the front vent.

7.3 Instrument panel

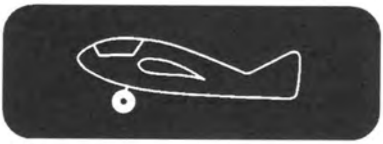
For safety reasons, only a GRP panel made in accordance with the lamination scheme specified by the manufacturer may be used.

Instruments of more than 1kg (2.2 lbs) need additional support beyond the screws provided. This can be done by means of aluminum straps fixed to the box in front of the instrument panel.

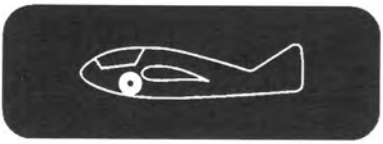
Equipment with operating controls must be fitted conveniently within reach, when the pilot is secured in the seat safely. Flight monitoring instruments, like ASI and altimeter, must be mounted within the pilots field of view from which the ASI should be mounted high in the panel in a preferred position.

7.4 Landing Gear System

The landing gear is extended and retracted, and locked at either position, by means of the black handled lever mounted at the right-hand cockpit wall.



Landing gear extended
(lever forward)



Landing gear retracted
(lever aft)

NOTE: *Remember the crib > <u>Retract</u>able landing gear*
*to **<u>retract</u>** landing gear = **<u>retract</u>** lever.*

<u>Tire pressures:</u> Main wheel: 3.5 bar +/- 0.1 bar (50,8 psi +/- 1,5 psi)
Tail wheel: 2.5 bar +/- 0.1 bar (35,6 psi +/- 1,5 psi)

The Valves of main wheel and tail wheel are on the left hand side.
The vent of the tail wheel is only accessible when the tail wheel is removed from the fuselage. Optionally the fuselage can be modified in such a way, that a gap in the seam of the tail wheel fender allows direct filling (see **Maintenance Manual** Section 2.3.4).

7.5 Seats and Safety Harness

Seat and Seating Positions

Tall and medium sized pilots can sit comfortably and may adjust the back rest on its lower end (three positions with screws) and on the upper end by actuating the eccentric winch in the right cockpit wall. The latter is also possible in flight. The backrest requires the use an appropriate parachute or a rigid foam cushion.

Adjustment winch of the backrest

Optimum seating position is achieved when the upper thighs contact the wedge of the seatpan and the backside fits into the corner to the cockpit floor. The anchor points of the lap straps are fixed in such a relation to the seatpan that submarining (sliding forward from underneath) is extremely remote.

The geometry of the seat is designed such that tall pilots are comfortably seated. We recommend the use of thin parachute packs of the latest type.

Very short pilots must adjust their seating position by means of a firm cushion (energy absorbing, semi-rigid foams are optimum) so that all controls are within comfortable reach, that their view to the outside is improved. A small pilot is positioned high enough when the instrument panel does not restrict the forward view and the headrest contacts your head at eye level. The instrument cover is so designed that the panel edge is in line with the front contour of the canopy glass.

For all sizes of pilots it is very important to adjust and lock the backrest, to prevent being moved backwards during initial take-off acceleration (winch-launch). For the same reason, cushions used must be sufficiently rigid and stiff.

Safety Harness

Correct Fastening in Gliders (recommendation by "TÜV Rheinland")

① sit down in the seat

② put pelvic belts on and fasten them as tightly as possible

③ make sure that the pelvic belts are lying on the pelvis and the buckle is in the middle of the pelvis

④ plug shoulder belts into the central buckle and fasten them with significantly lower tension than the pelvic belts
IMPORTANT: in doing so, the buckle must not be pulled up towards the soft parts of the body!

⑤ when the belt system loosens during the flight: always re-fasten the pelvic belts first and than the shoulder belts.

Check every time that each individual strap is properly secured in the harness lock. Check from time to time if the lock opens easily under simulated load.

Automatic parachute static line

An anchor ring is provided for the static line (ripcord) of an automatic parachute left hand on the main bulkhead beneath the lift pin tube.

7.6 Pitot and Static Systems

A multi-probe is located in the vertical fin, delivering static-, pitot- and TE-pressure. Static ports are located laterally in the tail cone. A pitot tube is located in the fuselage nose. Optionally, a backup static pressure can be gained from interconnected ports below the canopy frame on both sides of the fuselage, at positions defined in Fig 7.6-1.

The airspeed indicator is driven by the pitot pressure from the tube in the fuselage nose and by the static pressure from the tail cone.

The altimeter is connected to the static ports in the tail cone.

Pneumatic and electric variometers are fed from the probe in the vertical fin. It can be practical to switch the variometer to the optional backup static port during powered flight, but variometers are made to be sensitive and some models may suffer permanent damage from this.

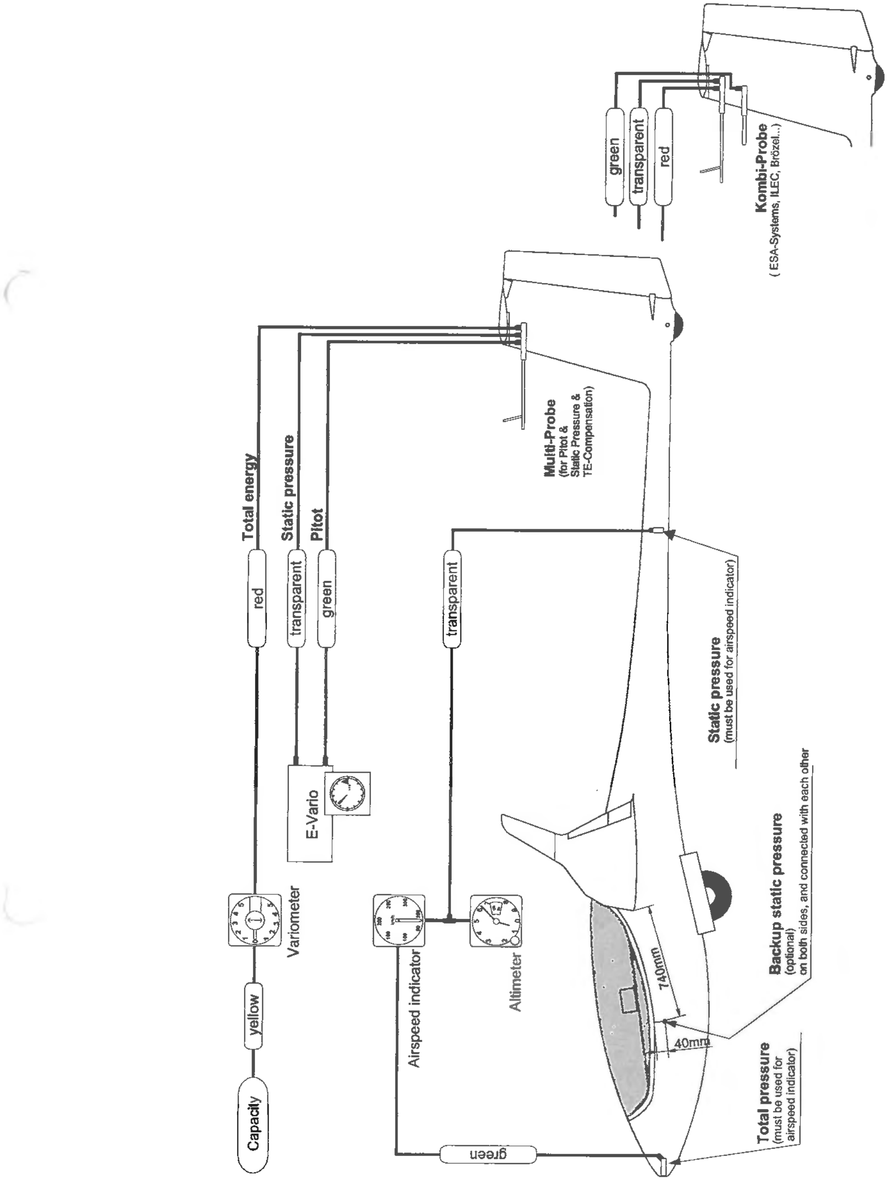
Ensure that the multi-probe is fully pushed home in its seating in the fin. From time to time, the inner end of the probe should be lightly lubricated with Vaseline or a similar lubricant, in order to save the O-ring gaskets from wear.

7.7 Airbrake System

The ASW 27-18E is equipped with Schempp-Hirth type airbrakes on the upper side of each wing. They efficiently increase sink rate, but also increase stall speed by 5-8km/h (3-4kts, 3-5mph). They have only small effect on trim. Hand forces above 170 km/h (91kts, 105 mph) can become larger than 20 daN. If hand forces are too high, reduce airspeed. See section 2.9 for max load factors with airbrakes extended.

The airbrake handle also actuates the hydraulic disk brake of the landing gear, when it is fully pulled back.

Fig. 7.6-1 Pitot and Static Lines and Instrument Connections



7.8 Baggage Compartment

Hard objects may not be carried in the baggage compartments without a suitably designed lashing or anchorage! If, for instance, a barograph is to be carried in this space, a mounting recommended by the manufacturer must be used. Molded containers for 12 V and 5.6 Ah batteries are supplied with the glider as standard equipment.

Left of landing gear box

The baggage load in this compartment may not exceed 5 kg (11 lbs).

In front or on top of the spar

If the fuel tank is not installed, the baggage load in this compartment may not exceed 12 kg (26 lbs).

7.9 Water ballast system

There is a first water ballast system with tanks integrated in the wings with about 170 litres (45 US-gal.). As an option, a tail tank can be installed to counteract the nose heavy moment of the wing water ballast.

There is a lever on the right hand cockpit arm rest in the landing gear lever gate. The valves are operated simultaneously.

Pushing the lever forward opens all valves at the same time.

The tail tank must drain in at least half the time of the wing tanks, to safely prevent the in-flight c.g. from exceeding the rear limit.

On the upper wing surface is an opening for ventilation and drying the water tanks, which may also be used for filling ballast water. A screwed in cover must be safetied with tape in flight.

At front of the root rib there is a hole, which enables water left in the tank to drip out of the wing, when the glider is in the trailer. When the glider is rigged this opening either is closed automatically by a plug attached to the fuselage or must be closed manually with a pin.

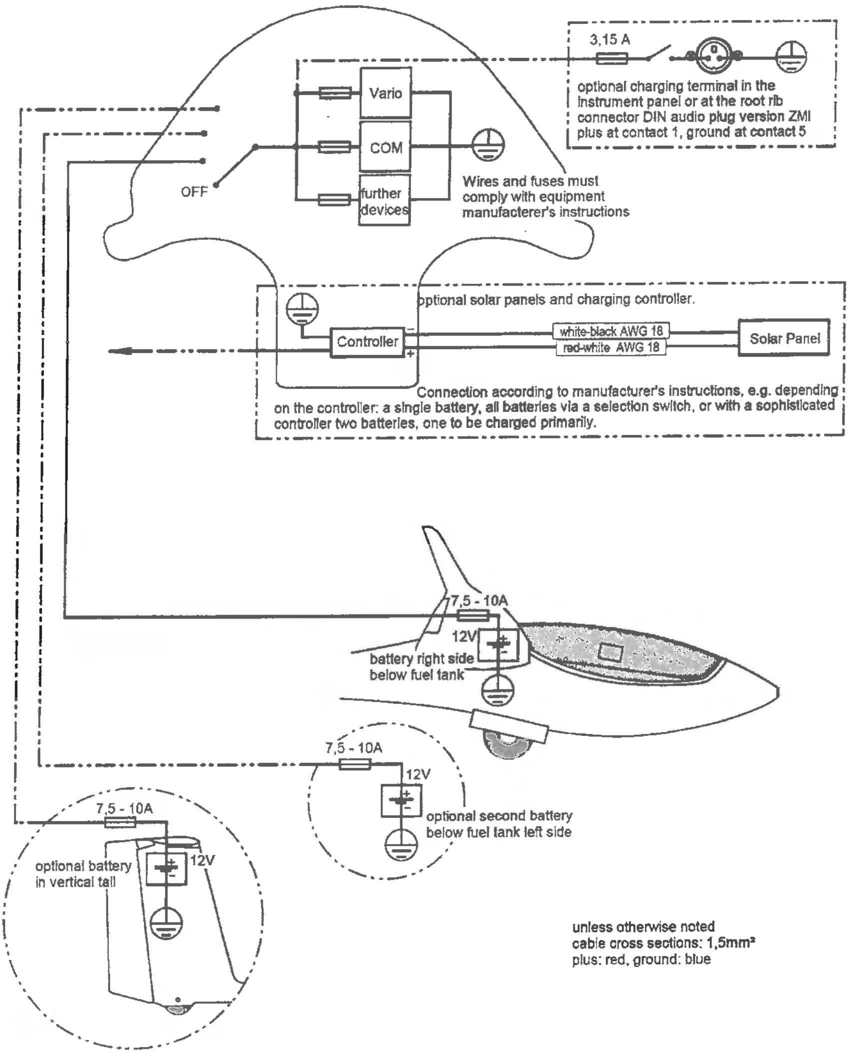
7.10 Electrical System of the Instrumentation

The electrical system is powered by 12V batteries. Battery compartments are provided in the area in front of the spar stubs, at the top of the vertical fin and optionally in the seat pan below the instrument panel. Close to each battery, the circuit is protected with a fuse between 7,5A and 10A, depending on the need of the electric consumers. The battery selector switch in the instrument panel also serves as main switch.

Each electrical consumer is protected by its own fuse.

If solar cells are installed different variants are possible, depending on the charging controller: e.g. always charging a specific battery; primarily charging one battery and than another, or a switch to select which battery to be charged.

Fig. 7.10-1 Circuit Diagram



7.11 Miscellaneous Equipment

Removable Trim Ballast

If required, the ASW 27-18E can be equipped with a fitting for lead trim ballast plates which can be bolted into place in front of the rudder pedals.

For this location, a 1.15 kg (2.54 lbs) lead trim plate equals an additional pilot weight of 2.5 kg (5.5 lbs).

Thus, a pilot weighing 10 kg (22 lbs) less than the minimum cockpit load must fit four trim plates weighing 1.15 kg (=2.54 lbs) each.

Maximum 6 trim plates are allowed for installation.

Trim Mass (Battery) mounted in the fin

Fitting a trim mass (or battery) in the fin increases the minimum cockpit seat load. Only use trim masses that were prepared for the individual glider and were considered in the latest entry of the mass-and balance form. Then the minimum cockpit seat load with or without trim mass in the tail can be looked up in section 6.2 (Mass & Balance Form). Only the highest value for the minimum cockpit seat load may be registered on the cockpit placards.

The foam buffer fitted over the mass or battery secures it upwards. This plastic foam pad must not be forgotten when changing or replacing batteries.
You should also ensure that there is adequate plastic foam seating under the battery to protect it from hard knocks!

The maximum weight allowed to be installed in the fin compartment is 6 kg (13.2 lbs).

Oxygen

A seating for an oxygen bottle is optional, but can be retrofitted any time with few expenses (see maintenance manual, section 2.7). The position of the bottle is behind the pilot's right elbow, beside the wheel-box. The bottle must be immovably attached between a rear FRP support and a clamping ring. Depending on support and clamping ring, one German 3-litre oxygen bottle, 100 mm dia. or one US bottle of 4.25" dia, 16.5" long or a US-bottle 4.3/16" dia., 17" long can be accommodated.

Fitting the oxygen bottle, ensure that it is properly installed and securely anchored.

WARNING: *When the oxygen bottle is removed the cover for the hole in the bulkhead must be installed as otherwise loose objects may get from the cockpit rearward into the control circuits.*

NOTE: *Fitting of oxygen equipment only causes a minimal change in the empty-mass c.g. position !*

When flying at greater heights while using the oxygen installation, it should be borne in mind that any particular system may only be suitable for a limited altitude range. The makers' instructions should be complied with.

Emergency Location Transmitter

The location least vulnerable to damage in case of accident is the area between the two drag spar pins at either side of the fuselage.
Therefore, the emergency location transmitter (ELT) should be fitted to the fuselage wall in the baggage compartment area, in an appropriate mounting.
Since the whole of the air frame except for the fin and a small area above the baggage space contains CRP layers, and carbon fiber laminathe area between wing spar and canopy.

7.12 Power-plant

When retracted the power-plant is accommodated in the engine bay in the fuselage behind the wing. It is extended and retracted by means of an electric jack.

The following control elements are provided for the power-plant:

- the control console on the pilot's left hand side with the main switch, engine switch and manual fuel valve button
- the power plant instrument fitted in the instrument panel
- the rear view mirror.

The Control Console

The control console is placed at the pilot's left hand side underneath the yellow cable release knob. The engine switch is the single control to be operated to start and stop the power plant.

The pilot controls the following functions with the engine switch:

① Extension and retraction of the power plant

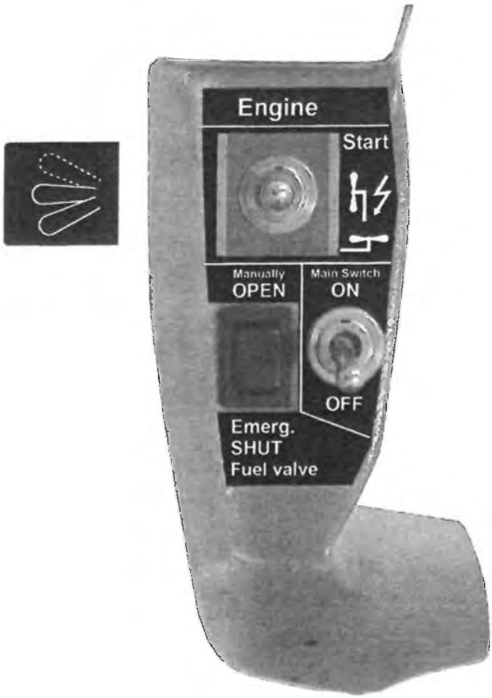
② Switching the ignition

③ Engaging the starter

In addition some functions are automatically executed depending on the engine switch position and the engine status:

④ Opening and closing of the fuel valve, braking and vertical aligning of the propeller as well as engaging of the decompression valves

Fig. 7.12-1 *View of the control console*



Element	**Position**	**Effect**
Main Switch	- OFF ON	electric power off electric power on
Engine Switch	- "OFF" - "ON" - Start (spring-loaded)	brakes and aligns propeller, retracts engine extends engine, ready for operation / engine running engage starter; if not extended the same as position"ON"
Manual Fuel Valve	- manual OPEN - emergency SHUT	opens fuel valve closes fuel valve

CAUTION: *The fuel valve is operated automatically. Only in case of an emergency it has to be operated manually. If the fuel valve is manually switched, the power-plant instrument gives a warning. After a manual fuel valve actuation the engine main switch has to be turned off to reactivate the automatic operation.*
The manual fuel valve is operated independently from other switches or logics.

CAUTION: *The engine switch directly switches the ignition - independent from other switches or logics. In the positions "ON" and Start the ignition is on.*

CAUTION: *If the propeller is turned while the system is powered off (e.g. pre flight check), he has to be aligned vertically before switching on again and retracting. The retracting is not started until the security query* "PROP.Pos RETRACT?" *of the power-plant instrument is confirmed.*
If the propeller is turned at least one full rotation while the system is on (e.g. windmilling), it knows its vertical position and aligns automatically. In this case no security query is shown before retracting.

Power-Plant Main Switch

The main switch is located in the power-plant control console and is labeled "Main Switch".

Power-Plant Instrument

The power-plant instrument of the ASW 27-18E fits in a Ø52mm housing in the instrument panel. It has several control, monitoring and display functions:

① It controls the electric jackshaft, starting and stopping of the engine, fuel valve and fuel pump depending on the position of the engine switch and the state of the power-plant.

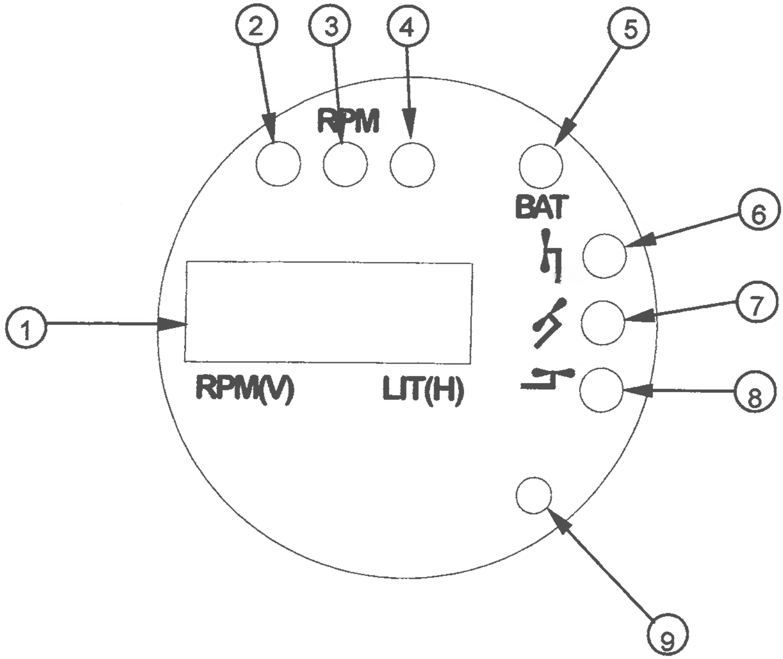
② It influences the ignition. Independently from the engine switch it shuts down the ignition, whenever the engine is not completely extended or the rotational speed exceeds the maximum permissible RPM.

③ It displays the state of the power-plant (retracted or extended, rotational speed, fuel quantity, voltage, elapsed time) and supplies warnings in case of limit exceedance or maloperation.

For few seconds after power on, the instrument switches all LEDs and the alarm sound on.

CAUTION: *Continuous alarms (=Caution) resound if limits are exceeded or undershot (rotational speed, fuel quantity, voltage, jackscrew runtime, fuse).*
Pulsing alarms resound in connection with handling advices.
See LCD display for explanation (see page 7.25).

Front-display of the power-plant instrument:



1 LCD Display
2 LED green, for green rotational speed range
3 LED yellow, for yellow rotational speed range
4 LED red, for maximum rotational speed
5 LED red, for low voltage
6 LED green, for fully extended power-plant
7 LED red, for error messages
8 LED green, for fully retracted power-plant
9 Button for display selection

Numbers in brackets in the text refer to the numbers of this figure.

Control of electric jackscrew

To extend or retract the power-plant, bring the engine switch in the corresponding position (see fig 7.12-1).

The green light (6) indicates, that the power-plant is fully extended. The green light (8) indicates the power-plant is completely retracted.

If the power-plant instrument does not receive a signal from the end-switch for an unusual long time, it stops the jackscrew. The red light (7) flashes, an alarm sound sets in, and the LCD (1) displays SWITCH R respectively SWITCH E. The possible fault may be either a faulty end-switch, a jammed engine mount or low voltage. The alarm can be acknowledged with button (9), restarting the jackscrew again. As long as there is no signal from the end-switch saying "fully extended", the ignition is blocked. (see section 3.7)

Concerning the message FUSE, see section 7.14.

Influence on ignition

The power-plant instrument features own relays to block ignition independently from the pilot's ignition switch. It blocks ignition as long as the power-plant is not fully extended and as soon as the maximum rotational speed is exceeded.

CAUTION: *If the current supply of the power-plant instrument is interrupted, it cannot block the ignition.*

Control of the electric fuel pump

To support the pneumatic fuel pump for the start, the power-plant instrument activates the electric fuel pump under the following condition:

- The engine switch is on position "ON" or Start and the rotational speed is below 2000rpm.

To save energy during non-use the electric fuel pump is turned off after 30sec. If then the engine is started, the fuel pump is switched on again.

Display of power-plant status

Section 2.5 describes the modes of the LCD-Display (1).

The sensor system of the starter motor measures the rotational speed. It is displayed in the permanent display at the left side. When the engine runs with its target speed the green LED (2) lights. The yellow LED (3) warns of approaching the maximum RPM. When reaching the maximum rotational speed, the ignition is switched off and the red LED (4) beams.

The red LED (5) lights, whenever the battery voltage falls below 11,5V.

Fuel monitoring

A sensor monitores the content of the fuselage tank. The display is calibrated for flight attitude. Therefore, on ground, it deviates from the actual fuel quantity. Also in flight the angle of attack varies, thus a calibration more accurate than for half a liter (0.13 US Gal.) is not reasonable. The scale on the fuselage itself is calibrated for ground attitude.

When the fuel quantity of the fuselage tank sinks below 2,5Ltrs (0.66 US Gal) for over 5s, an alarm resounds and the display starts to blink. The alarm can be turned down with button (9) for four minutes.

The calibration of the fuel sensor was done with fuel-oil mixture based on AVGAS 100LL. Mixtures based on other fuel qualities may lead to deviating indications. Thereby the deviation is largest with full tank and zero with empty tank.

The power-plant instrument can be set to other qualities. The fuel tank must be filled full and the power-plant retracted. Press button (9) nine times until `Calibr.?` appears at the display. Then keep button (9) pressed for five seconds to perform the calibration.

After the calibration, the power-plant instrument assumes that the signal from the fuel sensor corresponds a full tank. With a full tank, the difference between flight and ground attitude is small.

Display- and warning-ranges of the power-plant instrument:

Type	Display-range	Optical	Acoustic
Rotational speed	400 – 9990 rpm	See section 2.5	> 5400 rpm permanent alarm
Fuel quantity	0 – 10,5Ltrs	< 2,5Ltrs LCD blinks	< 2,5Ltrs permanent alarm
Engine battery voltage	10 – 15V	< 11,5V LED (5) blinks	< 11,5V permanent alarm
Starter battery voltage	0 – 63,75V	< 11,0V LED (7) blinks	< 11,0V permanent alarm
Starter motor current	0 – 255A	> 220A LED (7) blinks	> 220A permanent alarm
Starter motor temperature	0 – 255°C	> 100°C LED (7) blinks	> 100°C permanent alarm
Starter controller temperature	0 – 255°C	> 110°C LED (7) blinks	> 110°C permanent alarm
Propeller posi-tion	0 – 125		
Elapsed time counter	Counts above 2000 rpm		

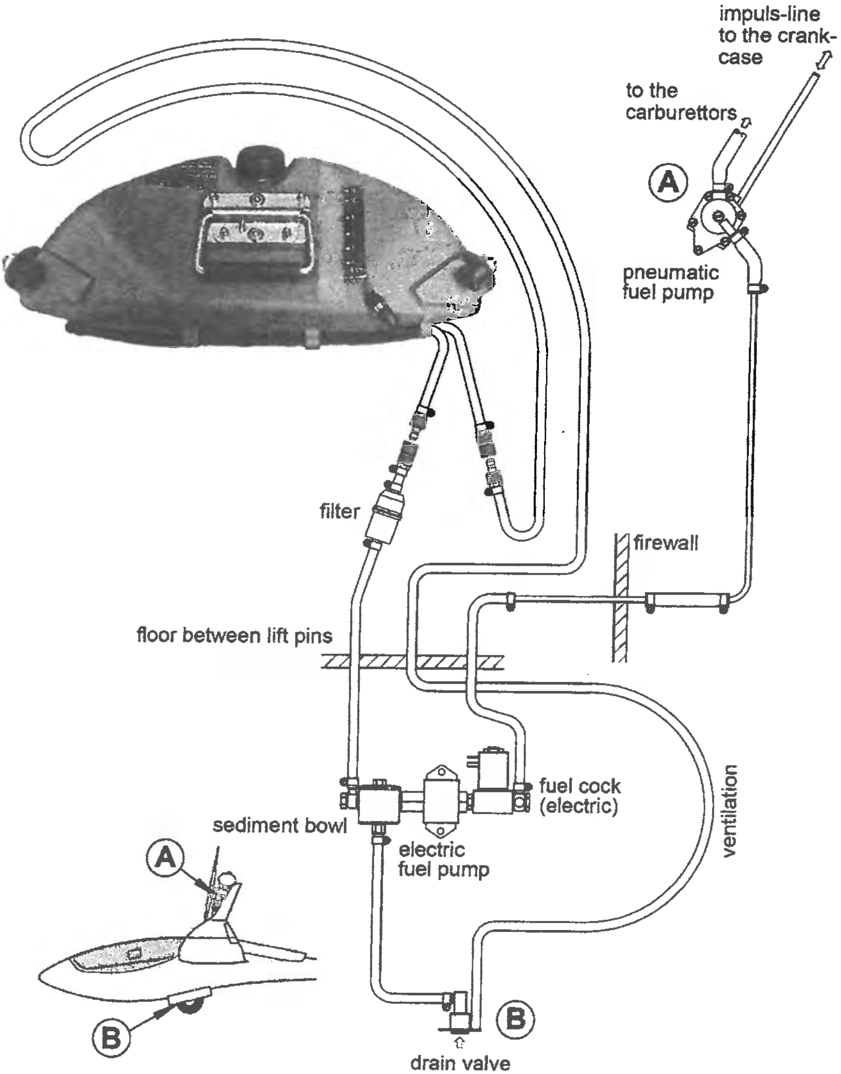
Type	Display-range	Optical	Acoustic
Running time of jackscrew	LCD displays: "SWITCH R" or "SWITCH E"	> 20s LED (7) blinks	> 20s Permanent alarm
Both endswitches closed	LCD displays: "SWITCH 2"	LED (7) blinks	Permanent alarm
Circuit breaker of jackscrew disengaged	LCD displays: "FUSE"	LED (7) blinks	Permanent alarm
Missing signal of fuel sensor	LCD displays: "INS_TANK"	LED (7) blinks	Permanent alarm
Starter motor blocked	LCD displays: "MOT·LOCK"	LED (7) blinks	Permanent alarm
No CAN-Bus-connection to starter controller	LCD displays: "ERROR CAN_MISS"	LED (7) blinks	Permanent alarm
No signal of the starter sensors	LCD displays: "ERROR SENSOR"	LED (7) blinks	Permanent alarm
Manual fuel valve operation	LCD displays: "MANUALLY FUELCOCK"	LED (7) blinks	Permanent alarm

Rear-view mirror

A rear-view mirror in the cockpit is necessary to check the correct position of the propeller before retracting the power-plant.

7.13 Fuel System

Fig. 7.13-1 Overview of the fuel system:



The fuel system consists of a fuselage tank for 10,5Ltrs (2,77 US Gal.), lasting for approximately 1 hour of powered flight. The fuel tank is located between headrest and spar stubs and can be removed for rigging and refuelling.

In the left fuselage side there are a sediment bowl, the electric fuel pump, and the fuel cock. The sediment bowl is connected to the drainer below the left landing gear door. The tank ventilation also ends there. The electric fuel pump runs automatically, when the engine is extended or started and stops when the engine is running. If the engine is extended but not started, the electric fuel pump stops after 30 sec to save the engine battery.

Removing the Fuel Tank

Behind the backrest, there is a clamp at the sidewall, where the hose couplings are affixed. Free the hoses from this clamp. Pull both locking pins, which secure the fuel tank and pull the tank so that the pins do not snap back any more. Grab the fuel tank at its handle and pull it out.

The hoses are long enough, so that it can be laid onto the seat pan or can be hooked to the canopy frame.

Reintegrating the Fuel Tank

Place the tank onto the plane in the centre of the tank compartment. Grab the heads of the locking pins, pull them and push the tank into its position.
Do not forget to reconnect the hoses again, if they were separated. Take care that there are no kinks in the lines.

Refuelling

With a funnel, the glider can be refuelled without removing the fuel tank. The tank can also be hooked to the canopy frame and be filled with a funnel. But it is also possible to disconnect the fuel and ventilation hose and take the tank to the fuel station.
The couplings automatically close when they are separated. The hoses are long enough, so that single drops can comfortably be caught with a piece of cloth.

7.14 Electrical System of the Power-plant

The electrical system of the power-plant is fed by a 12V-battery located below the seat-pan between aero-towing-hook and control-column. A 25A fuse is located immediately at the battery. This battery supplies the power-plant system (via the main switch).

The supply of the jackscrew branches off directly from the power-plant battery. The electric line and the jackscrew are protected by an automatic circuit breaker. This circuit breaker is located at the relays under the seatpan, and it is remote controlled by the power-plant instrument.

In case the circuit breaker disconnects, the red light (7) blinks, an alarm sound sets in and the word "FUSE" appears on the display (1). The alarm can be acknowledged with button (9). If the power-plant instrument tries to extend or retract the engine (depending on the engine switch and system state),it will then also try to reset the circuit breaker and to restart the jackscrew. (see also section 3.7)

The starter motor is powered by an own starter battery, which is located in the front of the engine bay between the engine mount. The starter battery is connected via a relay directly with the controller of the starter (black box located in the left wall of the engine bay). During normal use this relay is controlled by the power-plant instrument. If in case of an emergency the power-plant main switch is toggled off, the relay switches independently from the instrument also off.

CAUTION: *If the starter battery is faulty or not mounted or if the power electronics of the starter is not connected, the system is inoperable and will neither extend nor retract.*

NOTE: *If the power-plant is extended, disassembling of the starter battery is very cumbersome. It is much easier, if the power-plant is retracted. The starter battery can be charged via the port in the instrument panel alternative to disassemble it.*

Section 8

8. Sailplane Handling, Care and Maintenance

8.1 Introduction

8.2 Sailplane Inspection Periods

8.3 Sailplane Alterations or Repairs

8.4 Ground Handling / Road Transport

8.5 Cleaning and Care

8.1 Introduction

This Section contains manufacturer`s recommended procedures for proper ground handling and servicing of the sailplane. It also identifies certain inspection and maintenance requirements to 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 Sailplane Inspection Periods

A complete inspection must be carried out annually for sailplanes registered in Germany. For other countries the appropriate procedures apply.

Further details are given in the ASW 27-18E **Maintenance Manual**, Sections 4 and 7.

8.3 Sailplane Alterations or Repairs

It is essential that the responsible airworthiness Authority be contacted **prior** to any alterations on the sailplane to ensure that the airworthiness of the sailplane is not compromised.

For repairs and modifications refer to the applicable Maintenance Manual ASW 27-18E **Maintenance Manual**, Sections 10 and 11.

8.4 Ground Handling / Road Transport

Parking

Parking the ASW 27-18E, the controls and flaps should be set neutral, since the glider is equipped with elastic tape to seal the gaps at the control surfaces,

Parking the aircraft in the open can only be recommended when the predicted weather conditions are suitable. It should be seriously considered whether securing, covering, and cleaning the aircraft before the next flight may demand more effort than derigging and rigging.

For tying-down the wings, trestles (perhaps from the trailer) should be used to ensure that the ailerons cannot be stressed by the picketing ropes.

NOTE: *Parking in the open without protection against weather or light will reduce the life of the surface finish. Even after only a few weeks without intensive care the polyester paint finish can become brittle and develop cracks.*

If the aircraft is parked in the hangar for protracted periods, it is recommended to cover only the perspex® canopy with a dust cover, as dust covers retain moisture in wet weather for long periods. Moisture can impair the dimensional stability and even the strength of all fibre reinforced composites.

For this reason, protracted periods of parking with water ballast on board are also inadmissible! The filling and ventilation openings on the upper wing surface and the drain valves must both be opened!

When parking, carefully remove any remnants of food (chocolate, sweets, etc.) because experience shows these attract vermin which can cause damage to the aircraft.

Road Transport

Alexander Schleicher GmbH & Co. can supply dimensioned drawings of the glider which will provide all the measurements needed for building a closed trailer.
We can also supply the names and addresses of reputable trailer manufacturers. Regulation for trailer dimensions vary from country to country so be sure to provide us with correct data.

Above all, it is important to ensure that the wings are supported in properly shaped and fitted wing cradles, or at the very least, that the spar ends are securely supported as closely as possible to the root ribs.
Reinforced points of the fuselage are the main wheel (remember the suspension springing!), and tail wheel; also, the drag pins (make up support bushings from plastic material like Nylon!), and the area under the canopy arch between the c.g.hook and the lap-strap area.

For an aircraft of this quality and value, an open trailer, even with tarpaulin, cannot be recommended. Only a closed trailer of plastic or metal construction, may be considered suitable. The trailer should have light-colored surfaces and be well ventilated both while moving and while stationary so as to avoid high internal temperatures or humidity.

CAUTION: *Road transport with water ballast on board is **not** admissible !*

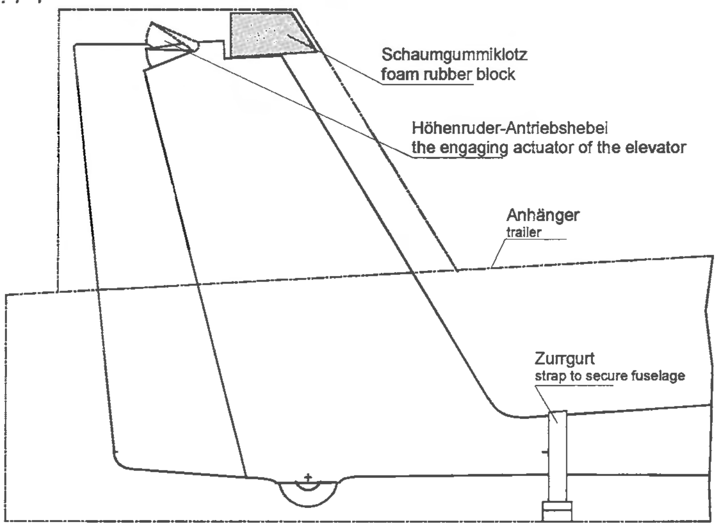
CAUTION: *In order to protect the air brake cover plates from damage the airbrakes must be closed and locked!*

WARNING: *Under **no** circumstances should the elevator actuator on top of the vertical fin be loaded or fixed in any way, even by soft foam cushions*
When designing or adapting the trailer, free movement and side clearance for the elevator actuator must be provided.

If for example a foam block applied some load to the elevator actuator, and restricted its free movement, fatigue cracks were found after long road transports. **Remedy is urgently needed!**

The following sketch shows, how a foam-rubber block must be trimmed and glued in position. It is also important to have a strap over the fuselage tail boom near the fin, which is connected to the trailer floor. In any case, it is necessary to guarantee the free movement of the elevator actuator. This must be so even if the stick is pulled fully back and the elevator is fully deflected upward.

Fig. 8.4-1



8.5 Cleaning and Care

Contrary to the popular belief that composite materials are impervious to moisture and ultra-violet light, even modern gliders need care and maintenance!

Moisture-Effects on the structure of the fiber-reinforced plastics and on the surface finish.

In the long run, moisture will also damage fiber re-inforced composites, as it will penetrate into the expoxy resin base and cause it to swell, which will partially burst the tight cohesion of the plastic molecules.

In particular, a combination of high temperature and humidity must be avoided! (e.g. poorly ventilated trailer becoming damp inside, which is then heated by the sun).

Neither the best quality of paint protection on the surfaces nor the internal protection of the water ballast tanks can fundamentally prevent water vapour diffusion; they can only retard the process. If water has entered the airframe and cannot be removed by means of sponge or chamois leather, the aircraft should be de-rigged and dried out, while periodically turning the affected part, in a room which should be as dry as possible, but not too hot.

Sunlight-Effects on the surface finish

Sunlight, especially its ultraviolet (UV) component, makes the white polyester gelcoat and the canopy plastic brittle. The wax layer on the gelcoat also oxidizes and discolors more quickly if the aircraft is unnecessarily exposed to strong sunlight. There is no paint finish on the market which is suitable for plastic gliders, and would approximate the life span of the composite structure of the airframe without maintenance.

Care of Surface Finish

Because the white polyester gelcoat is protected by a fairly durable wax layer, it will tolerate washing occasionally with cold water, with a little cleaning solution added. In normal use, the wax coating need only be renewed annually with a rotary mop. In moderate European conditions it will suffice if on two occasions a paint preservative is used in addition. In areas subject to long and stronger sun exposure this should be done more often.

CAUTION: *The use of alcaline cleaning agents (e.g. "Meister Proper") may affect the paint surface and even penetrate as far as into the foam of the sandwich structure and damage it. In single cases the acrylic foam in the control surface sandwich structure was destroyed by the use of unsuitable cleaning agents. Heavy dirt should therefore be removed using a cleaning polish.*

For the care of the paint finish, only silicone-free preparations may be used (e.g.: 1 Z-Special Cleaner-D 2 by Messrs. Werner Sauer GmbH & Co., D-51429 Bergisch Gladbach, or Car Lack 68, Car-Lack GFT + H mbH, D-78464 Konstanz).

<u>Traces of Adhesive from Self Adhesive Tapes</u> are best removed by means of benzene (petrol is toxic!) or paint thinners. After cleaning, renew the wax coating.

NOTE: *The signal and decorative markings are built up from nitric or acrylic paint; therefore no thinners must be used and even benzene should not be allowed to act on them for prolonged periods.*

Canopy

The Acrylic Canopy (Plexiglas or Perspex) should only be cleaned by means of a special cleaner (e.g.: Plexiklar) or with lots of clean water. On no account should a dry cloth be used for dusting or cleaning.

Safety Harness

The safety harness straps should be regularly inspected for tears, compressed folds or wear, and corrosion of metal parts and buckles. The reliable operation of the release mechanism - even under simulated load - should be tested occasionally.

Section 9

9. Supplements

9.1 Introduction

9.2 List of Inserted Supplements

9.3 Supplements Inserted

9.1 Introduction

This Section contains the appropriate supplements necessary to safety and efficiently operate the sailplane when equipped with various optional systems and equipment not provided with the standard sailplane.

Some widespread, optional installations are handled in Section 7.11 of this manual:

Oxygen system installation

Emergency Location Transmitter

9.2 List of Inserted Supplements

Date of Insertion	Doc. No.	Title of inserted supplement