ASW 28

Flight Manual

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Flight Manual

for sailplane model

ASW 28

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Pages identified by "LBA-App." are approved by the German Federal Civil Aviation Authority (LBA) as shown below:

....
Signature

Luftfahrt-Bundesamt
....
Authority

....
Stamp

10. JUL. 2001
....
Original Date of Approval

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 (GW) and Lutz-Werner Jumtow (Juw).

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 juristical 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.

This Flight Manual is FAA approved for U.S. registered gliders in accordance with the provisions of 14 CFR Section 21.29, and is required by FAA Type Certificate Data Sheet G13CE.

0.1 Record of Revisions

Any revision of the present manual, except weighing data established from time to time, must be recorded in the following table "Record Of Revisions" (pages 0.2/0.3) and in case of approved Sections endorsed by the LBA.

The new or amended text in the revised page will be indicated by a black vertical line in the margin, and the Rev. No. and the Date will be shown at the bottom of the page.

Record of Revisions

Rev. No.	Section & Pages Affected	Date of Revision	Approval	LBA-Approved on Date	Date of Insertion of Pages	Ref./ Signature

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0.2 Index of Effective Pages

Section		Page	Date
Title		----	02.07.01
0		0.1	02.07.01
		0.2	02.07.01
		0.3	02.07.01
		0.4	02.07.01
		0.5	02.07.01
		0.6	02.07.01
1		1.1	02.07.01
		1.2	02.07.01
		1.3	02.07.01
		1.4	02.07.01
		1.5	02.07.01
		1.6	02.07.01
2	LBA App.	2.1	02.07.01
	LBA App.	2.2	02.07.01
	LBA App.	2.3	02.07.01
	LBA App.	2.4	02.07.01
	LBA App.	2.5	02.07.01
	LBA App.	2.6	02.07.01
	LBA App.	2.7	02.07.01
	LBA App.	2.8	02.07.01
	LBA App.	2.9	02.07.01
3	LBA App.	3.1	02.07.01
	LBA App.	3.2	02.07.01
	LBA App.	3.3	02.07.01
	LBA App.	3.4	02.07.01
	LBA App.	3.5	02.07.01
	LBA App.	3.6	02.07.01

Section		Page	Date
4	LBA App.	4.1	02.07.01
	LBA App.	4.2	02.07.01
	LBA App.	4.3	02.07.01
	LBA App.	4.4	02.07.01
	LBA App.	4.5	02.07.01
	LBA App.	4.6	02.07.01
	LBA App.	4.7	02.07.01
	LBA App.	4.8	02.07.01
	LBA App.	4.9	02.07.01
	LBA App.	4.10	02.07.01
	LBA App.	4.11	02.07.01
	LBA App.	4.12	02.07.01
	LBA App.	4.13	02.07.01
	LBA App.	4.14	02.07.01
	LBA App.	4.15	02.07.01
	LBA App.	4.16	02.07.01
	LBA App.	4.17	02.07.01
	LBA App.	4.18	02.07.01
	LBA App.	4.19	02.07.01
	LBA App.	4.20	02.07.01
	LBA App.	4.21	02.07.01
	LBA App.	4.22	02.07.01
	LBA App.	4.23	02.07.01
	LBA App.	4.24	02.07.01
	LBA App.	4.25	02.07.01
5	LBA App.	5.1	02.07.01
	LBA App.	5.2	02.07.01
	LBA App.	5.3	02.07.01
	LBA App.	5.4	02.07.01
	LBA App.	5.5	02.07.01
		5.6	02.07.01
		5.7	02.07.01
		5.8	02.07.01
		5.9	02.07.01
		5.10	02.07.01

6	6.1	02.07.01
	6.2	02.07.01
	6.3	02.07.01
	6.4	02.07.01
	6.5	02.07.01
	6.6	02.07.01
7	7.1	02.07.01
	7.2	02.07.01
	7.3	02.07.01
	7.4	02.07.01
	7.5	02.07.01
	7.6	02.07.01
	7.7	02.07.01
	7.8	02.07.01
	7.9	02.07.01
	7.10	02.07.01
	7.11	02.07.01
	7.12	02.07.01
	7.13	02.07.01
8	8.1	02.07.01
	8.2	02.07.01
	8.3	02.07.01
	8.4	02.07.01
	8.5	02.07.01
	8.6	02.07.01
	8.7	02.07.01
	8.8	02.07.01
9	9.1	02.07.01
	9.2	02.07.01

0.3 Table of Contents

Section

Section 1

1.1 Introduction

This Sailplane Flight Manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the ASW 28 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 sailplane has been approved by European JAA (Joint Airworthiness Authorities) in co-operation with the German Federal Civil Aviation Authority (LBA) using JPL (Joint Local Procedures) in accordance with Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes JAR-22 issued 1995 (Change 5 of the original edition) including NPA 22.D-46 and NPA 22.D64.

Additionally the following requirement had to be complied with:
CRI A-02,"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 been applied for on 11 November 1998.
The document number is 423.
Application is made for Airworthiness Category "U".
U stands for Utility and refers to 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 28 is a high performance single-seat sailplane the design of which was orientated to the FAI Standard Class specification.
The ASW 28 is suitable for record breaking and competition flying. Not least, its pleasant flying characteristics make the ASW 28 suitable for use in performance-orientated clubs.

Its aerodynamic design using boundary layer control by blow-turbulators or zig-zag tape turbulators and the use of carbon, aramide (Kevlar) and polyethylene (Dyneema or Spectra) fibers represent the latest state of the art.

The ASW 28 is a shoulder wing glider with T-tail (fixed stabiliser plus elevator) and sprung, retractable landing gear with hydraulic disc brake. Detachable 0.5m high winglets are installed at the wing tips.

Technical Data:

	(metric system)
Span	15.00 m
Fuselage length	6.585 m
Height (Fin and Tail Wheel)	1.30 m
Max.Take-Off Mass	525.00 kg
Wing chord (mean aerodynamic)	0.745 m
Wing area	10.50 m^2
Wing loadings: -	
- min.	about 29.0 kg/m^2
- max.	50.0 kg/m^2

	(British and US system)
Span	49.21 ft
Fuselage length	21.60 ft
Height (Fin and Tail Wheel)	4.27 ft
Maximum Take-Off Weight (Mass)	1157.43 lbs
Wing chord (mean aerodynamic)	2.444 ft
Wing area	113.02 ft^2
Wing loading	
- minimum	about 5.94 lbs/ft^2
- maximum	10.24 lbs/ft^2

Figure 1.4-1 General View

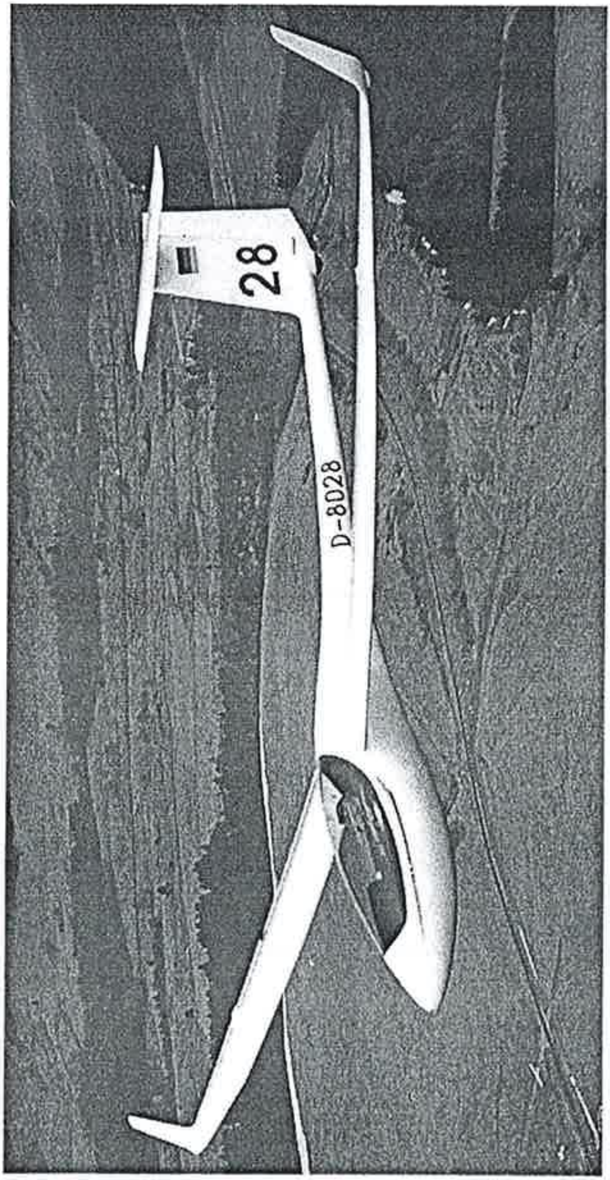
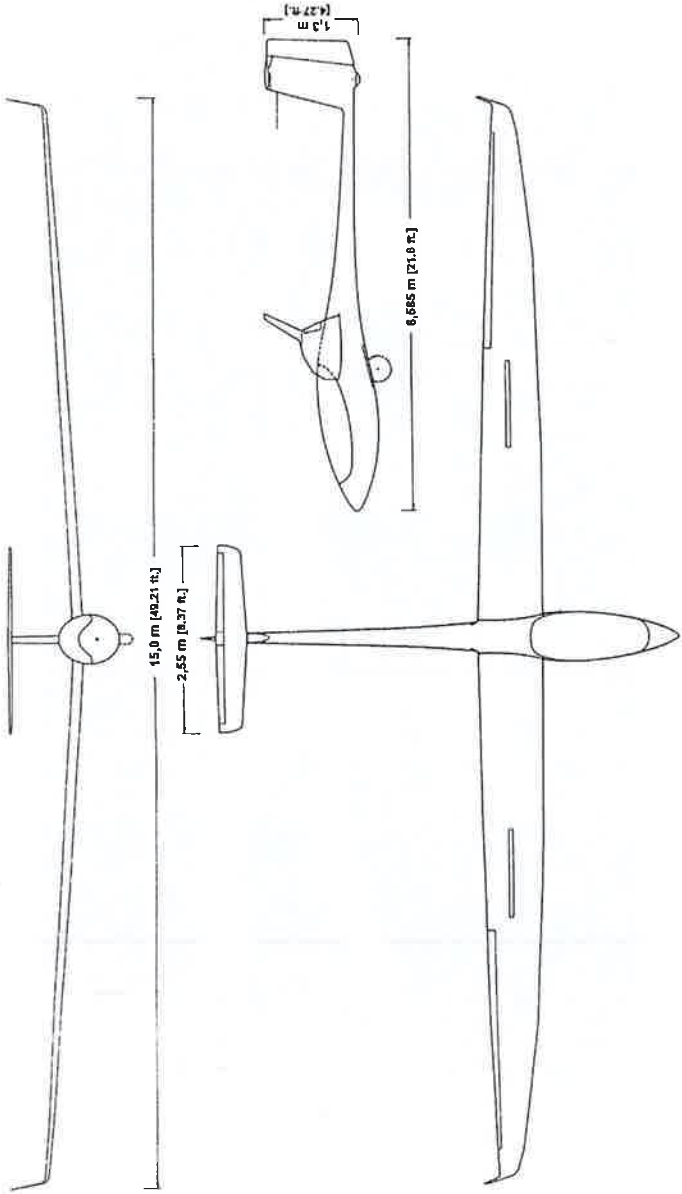


Foto: M. Münch

1.5 Three View Drawing

Fig. 1.5-1



Section 2

2.1 Introduction

Section 2 includes operating limitations, instrument markings and basic placards necessary for the safe operation of the ASW 28, its standard systems and standard equipment.

The limitations included in this Section and in Section 9 have been LBA-approved.

2.2 Air Speed

Air speed limitations and their operational significance are shown below:

	Speed	IAS	Remarks
V_{NE}	Never exceed speed	270 km/h, 145.6 kts, 167.8 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**	200 km/h, 108 kts, 124 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**	200 km/h, 108 kts, 124 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_W	Max. **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, 92 kts, 106 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.

2.3 Airspeed Indicator Markings

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

Marking	(IAS) value or range	Significance
Green arc	92 - 200 km/h, 49.6 - 108 kts, 57.2 -124 mph	Normal Operating Range
Yellow arc	200 - 270 km/h, 108 - 145.6 kts, 124 - 167.8 mph	Manoeuvres must be conducted with caution and only in smooth air.
Red line	270 km/h, 145.6 kts, 167.8 mph	Maximum speed for all operations.
Yellow triangle	95 km/h, 51.2 kts, 59 mph	Approach speed at maximum weight **without** water ballast.

2.4 Mass (Weight)

Maximum Take-Off Mass:	
-with water ballast	525 kg (1157.4 lbs)
-without water ballast	380 kg (837.7 lbs)
Maximum Landing Mass:	525 kg (1157.4 lbs)
Max. mass of all non-lifting parts	260 kg (573.2 lbs)
Max. mass in the baggage compartment:	12 kg (26.5 lbs)

2.5 Centre of Gravity

Centre of gravity range (for flight):

forward limit	0.222 m (0,72 ft) aft of RP
aft limit	0.345 m (1,13 ft) aft of RP

See also diagram in Section 5.3.4 .
"RP" stands in this context for "Reference Datum Point" which is situated at the wing leading edge at the wing root rib.
An example of the C.G. position calculation and a table of c.g. ranges at different empty weights can be found in Section 6 of the ASW 28 Maintenance Manual.

2.6 Approved Manoeuvres

This glider is approved for use in normal gliding operation (Airworthiness Category "Utility").
See also Sections 2.7, 2.9, and 2.10 .
Within this Airworthiness Category U the following aerobatic figures are approved:
Positive Loop, Lazy Eight, Chandelle, Stall Turn and Steep Turn. Further details concerning these manoeuvres will be found in Section 4.5.9 .

2.7 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:	200 km/h (108 kts, 124 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 (145,6 kts, 167,8 mph)	

2.8 Flight Crew

The crew of the ASW 28 is <u>one</u> pilot.
Pilots weighing less than 70 kg = 154,5 lbs (incl. parachute) must use additional trim ballast plates. Please refer to the 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).

2.9 Kinds of Operation

Flights may be carried out in daylight, in accordance with VFR. Cloud flying is permitted, if appropriate instrumentation is fitted (see section 2.10), without water ballast, and if regulations currently in force are complied with.

In Canada and Australia cloud flying is prohibited !

Aerobatic manoeuvres according to section 4.5.9 of this Flight Manual are only permitted <u>without</u> water ballast !

2.10 Minimum Equipment

Minimum Equipment consists of:

1 ASI indicating up to at least 300 km/h (162 kts)
1 Altimeter
1 4-part safety harness (symmetrical)

Additional minimum equipment for ASW 28 registered in **Belgium** or **France**:

1 Variometer
1 Magnetic Compass
1 Side slip indicator

For cloud flying the following additional equipment must be fitted:

1 Turn-and-Slip indicator
1 Magnetic Compass
1 Variometer

Approved equipment is listed in the Maintenance Manual in Section 12.1. A. Schleicher as the manufacturer recommends to install a yaw string on top of the canopy as well as a magnetic direction indicator (compass). As the compass is not part of the required minimum equipment, it must not be of an approved kind. Compensation however should be possible and be done.

2.11 Aerotow and Winch Launching

The maximum permissible launch speeds are:

For Aerotowing	170 km/h (92 kts, 106 mph)
For Winch Launch	140 km/h (75.5 kts, 86 mph)

For both types of launch, a weak link of 560 to 660 daN (1235 to 1455 lbs.) must be used in the launch cable or tow rope.
For Aero Tow, the tow rope must be as specified in optional regulations but additionally not less than 40 m = 130 ft or more than 60 m = 200 ft in length.

2.12 Limitations Placards

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

Segelflugzeugbau Alexander Schleicher GmbH & Co. Poppenhausen

Model: **ASW 28** Serial-No.: 28 . . .

Data and Loading Placard

Empty Mass (Weight):			kg
Max. Mass (Weight):		1154.7 lbs	525 kg
Minimum Seat Load:			kg
Maximum Seat Load:			kg
Max. Permissible Speeds:			
	Calm Air	145.6 kts	270 km/h
	Winch Launch W/T	75 kts	140 km/h
	Aerotow A/T	92 kts	170 km/h
	Extending Landing Gear	108 kts	200 km/h
	Maneuvering Speed	108 kts	200 km/h
Weak Link for Aerotow & Winch Launch			1235 bis 1455 lbs
			560 bis 660 daN
Tire Pressure:	Main Wheel		2,4 bis 2,6 bar
	Tail Wheel		2,4 bis 2,6 bar

08.11.2000

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 !

For Reduction of Minimum Cockpit Load by means of removable trim ballast discs mounted in the front part of the cockpit: - see Section 7.11 .

This placard is to be glued near the data placard.

Following aerobatic manoeuvres are aproved without waterballast !

Looping (positiv)
Lazy Eight
Chandelle
Stall Turn
Steep Turn, max.bank angle 70°

ASW 28

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

Only approved for winch- and autotow-launching !

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

Only approved for aerotowing !

Section 3

3.1 Introduction

This section 3 provides check list and amplified procedures coping with emergencies that may occur.

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

EMERGENCY PROCEDURES

[1]	**Canopy Jettison**

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

[2]	**Bailing Out**

- Push instrument panel UP
- release safety harness
- roll over cockpit side
- push off strongly
- watch wings and tail surfaces!
- pull parachute!

[3]	**Spin Recovery**

(a) apply opposite rudder and at the same time
(b) relax back pressure on stick until rotation stops
(c) put rudder in centre position and immediately pull out gently from dive !

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 28 will immediately re-gain flying speed.

When opposite aileron is applied during a fully stalled flight attitude, the ASW 28 will roll outwards a little as back pressure is relaxed.

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) put the rudder into a center position and gently pull out of the dive.

CAUTION: *Spinning is not noticeably affected by extending the air brake paddles, but it will increase the height loss when pulling-out, and is therefore inadvisable.*

3.6 Spiral Dive Recovery

Depending on the aileron position during spinning with forward C.G. positions - that is: the C.G.- range when the ASW 28 will no more sustain a steady spin - it will immediately or after a few turns develop a spiral dive, or a slipping turn similar to a spiral dive.

These conditions will both be terminated by:

(1) applying opposite rudder
(2) applying aileron opposite to direction of turn.

3.7 Other Emergencies

(1) 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 28 should be touched down with airbrakes closed as far as possible, at a shallow angle and without stalling on to the ground.

(2) 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!

(3) Emergency Landing on Water

A landing on water by a plastic glider with wheel retracted has been experimentally tried out. The experience gained on that occasion suggests that the aircraft will not skim across the water, 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 wheel lowered,** and **only** as a very last resort.

(4) Flying with Defective Water Ballast Drainage

The water ballast dump valve operation ensures that, when water ballast is jettisoned, both tanks are drained at the same time. When the optional tail water ballast tank is installed also this third tank is drained at the same time. 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 in the direction of the heavier wing.

If a drain valve is defective, 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.

Section 4

4.1 Introduction

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

4.2 Rigging and Derigging

To rig: The ASW 28 can be rigged without use of rigging aids by three people, or by two people when a fuselage cradle and a wing trestle 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. Insert right wing spar fork into fuselage and support the wing tip with a trestle, if available. While rigging, the airbrake paddles should be retracted and the ailerons slightly raised.

4. 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, and rigging completed with the aircraft standing on its wheel.

5. The winglets must be installed into their pockets in the wing tips, and safety it by a self engaging spring loaded bolt or by a screw M 5 x 14 DIN 963 and then by self adhesive tape.

   NOTE: *Regard carefully, that the ventilation opening of the water tanks at the wing tip below the winglet joint is not taped over or blocked in another way!*

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

6. Check prior to rigging of the vertical tail if a trim weight or -battery in the fin compartment is needed! 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 rigging aid AS-P/N 99.000.4657 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.

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

   NOTE: *Please take care that the venilation port of the water tanks at the wing tip below the winglet juncture remains open!*

   The fin-tailplane junctions should also be taped up. 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.

8. Now use the Check List (see the following Section 4.4) to carry out the pre-flight check. Under Point 3. "(Control gaps in flight direction must have a clearance of min. 1.5 mm = 1/16 in)", check that the ailerons have that minimum clearance from the inboard and outboard cut-out edges.

This clearance is necessary to ensure that these surfaces do not foul the wing cut-out edges when deformed under load in flight.
The gap at the aileron actuator no gap is necessary between the two aileron parts.

To de-rig: proceed in the reverse order of rigging. 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.

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.

3. Do not forget to disconnect the winglets before de-rigging the wings!

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

1- Open canopy and check canopy jettison

- Main pins home (to the handle) and secured?

- Check positive control connections - ailerons, elevator and air-brakes - in fuselage/wing mounting area.

- Check cockpit and control runs for loose objects or components.

- 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 - if installed - pitot tube (optional extra) in fuselage nose.

- Check condition and operation of towing hook(s). Release control operating freely ? Don't 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 water ballast drain openings to be clean.

3- Ailerons:
Check condition and full and free movement (control surface clearances). 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 safetied?

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 : 2.5 bar +/- 0.1 bar (= 35,6 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 that static ports in the fuselage tail boom are unobstructed.

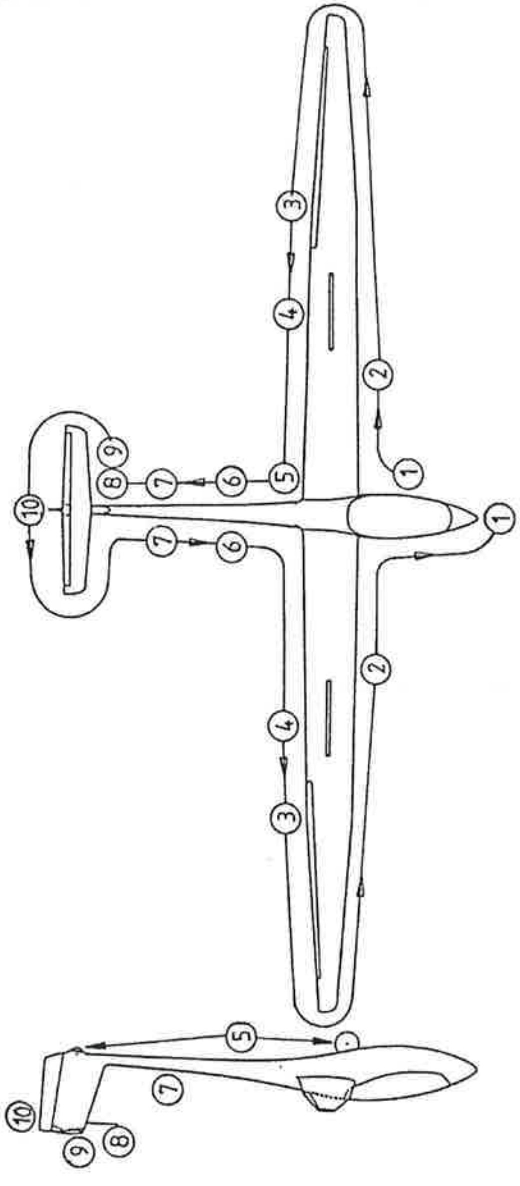
8- Check the pressure port in the fin:
Is the probe properly seated, tight and safetied by elastic tape?
Check tail water ballast tank drain hole to be clean.

9- Check that the tailplane bolt is tight and locked.
Is a trim weight or Battery installed inside the fin compartment? When yes regard elevated minimum cockpit load.

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

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

4.3.1 Tour of Inspection round the Aircraft



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-Flight Checks

1. Main pins fully home and secured?
   Tailplane bolt fitted?
2. Controls checked for positive connections and
3. Control gaps in flight direction must have a clearance of min. 1.5 mm (1/16 in) !
4. Parachute ripcord connected?
5. Check C.G. position! (Battery in fin? Trim ballast plates in fuselage nose?)
6. Comply with Loading Placard !
7. Water tank drain and vent openings, and pressure ports unobstructed?

Pre-Take-Off Checks:

1. Parachute clipped on?
2. Safety Harness secure and tight?
3. Wheel locked down?
4. Airbrakes closed and locked?
5. Trim set for Take-Off?
6. Altimeter set?
7. Tail dolly removed?
8. Check wind direction!
9. Close and lock canopy!

4.5 Normal Procedures and Recommended Speeds

4.5.1 Winch Launch

CAUTION: *The sailplane is certificated for winch- and autotow- launches when the c.g. tow release is used.*

It is recommended that the trimmer should be set at the center of the indicator for forward c.g.-positions or slightly nose-heavy (in the forward 33% of the indicator gate) for rear c.g.-positions. When these trim settings are adjusted the ASW 28 will assume a gentle climb attitude. Above a minimum safe height the climb angle should be increased by applying back pressure on the stick

A weak link of 560 to 660 daN (1235 to 1455 lbs.) must be used in the launch cable.
Maximum acceptable crosswind component is 25 km/h = 13,5 kts.

NOTE: *Rear c.g.-positions are given when the cockpit load is close to the actual minimum cockpit load, see page 6.4. Forward c.g.-positions are given when the actual minimum cockpit load is exceeded by more than 30 kg (66.15 lbs.).*

NOTE: *The wheel should **not** be retracted during the launch.*

CAUTION: *Winch launching with water ballast is not recommended at less than 20 km/h = 10.5 kts headwind component. 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!*

4.5.2 Aero Tow

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

The trim should be set nose-heavy. A tow rope of between 40 m and 60 m = 130 ft and 200 ft long, but never less than 40 m in length should be used.

At the start of the take-off run it has proved useful to open the airbrakes fully at first. This prevents over-running the tow rope as slack is taken up, and the tendency for the glider to swing due to one-sided prop wash is considerably reduced. As the ailerons become effective during the ground run, the airbrakes should be promptly closed and locked.

For the actual lift-off, the following practise has proved satisfactory:

Try to keep the tail wheel in contact with the ground until the aircraft lifts off; this increases directional stability during the ground run, and helps the glider to lift off at the earliest possible moment.

After lift-off, climb to between 1 m and 2 m = 3,5 ft and 6,5 ft in order to avoid pitch oscillations caused by ground effect and slipstream turbulence from the tug.

NOTE: *Inform tug pilot of minimum towing speed.*

T/Off Mass	Recommended Towing Speed
300 kg (661,5 lbs)	115 km/h (62,0 kts)
400 kg (882,0 lbs)	120 km/h (64,8 kts)
525 kg (1157,4 lbs)	125 km/h (67,4 kts)

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

4.5.3 Flight

In straight flight with clean wings and at a flight mass of about 340 kg = 749,7 lbs the ASW 28 will enjoy laminar flow within a speed range of 75 km/h to 160 km/h = 40,5 kts to 86 kts. At the maximum flight mass of 525 kg = 1157,4 lbs the favourable aerodynamic range lies between 90 km/h and 190 km/h = 48,5 kts and 102,5 kts. Beyond these speed ranges, flight performance will noticeably deteriorate.

When circling, remember that 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 - see also Section 5.2.2.

CAUTION: *Flights in conditions conducive to lightning strikes must be avoided as the ASW 28 is not approved for such conditions under JAR 22 requirements.*

Low Speed Flight and Stalling Behaviour

The ASW 28 behaves normally in slow and stalled flight. In all C.G. positions, reduced aileron effectivity together with flow separations at the fuselage and a gentle oscillation about the vertical axis will give warning of an impending stall. 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.

Even with rearmost C.G. position, about half of maximum aileron deflection can still be applied, with rudder centralised, to maintain the aircraft in straight stalled flight. It would, of course, be more appropriate to control the aircraft by means of rudder alone, and to leave the ailerons centred.

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

CAUTIONS: *Height loss due to incipient spin from straight or circling flight depends largely on the all-up flight mass!*

Height loss from straight flight after prompt recovery action -
~ 20 m (about 65 ft) !!

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

More specifically, the following would apply:

C.G. Position	Rudder & Aileron Co-ordinated	Rudder & Aileron Crossed
rearmost	steady spin	steady spin
middle	spin, leading to spiral dive	spin, leading to side slipping
foremost	~ half turn of spin, leading to spiral dive	side slipping

Wing drop from circling flight is not noticeably more violent than from straight flight.

4.5.4 Approach

Make the decision to land in good time and, notwithstanding the high performance, lower the wheel at not less than 150 m ~ 500 ft agl.

For the remainder of the circuit, maintain about 95 km/h = 51 kts (yellow triangle on ASI scale).

The glider should be trimmed to between 90 and 100 km/h = 48,5 and 54 kts. In turbulence, the approach speed should be appropriately increased.

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

Side slipping with the ASW 28 is very effective and may therefore also be used for controlling the glide angle.
Side slips can be performed between 90 km/h and 120 km/h IAS (49 to 65 kts) by gently applying rudder and <u>opposite</u> aileron control at the same time. With increasing speed less aileron deflection is necessary to achieve a straight flight path despite the rudder is fully deflected. The yaw angles and consequently the additional drag decrease with increasing speed. 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 controlled by pitch altitude. The upper edge of the instrument panel must not rise above a horizon position as known from thermal flight altitude.
Associated negative rudder control force gradients and rudder lock can be easily overcome by moderate pedal forces or by easing the control stick into a more neutral position

NOTE 1: *Side slipping should be practised from time to time at a safe height!*

NOTE 2: *With a partial but symmetric water ballast load side slipping is possible!*

WARNING: *When an asymmetric water ballast load is suspected or recognised, **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.
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.

4.5.6 Flight with Water Ballast

For normal European weather conditions, the wing loading of the ASW 28 is at its best even without additional water ballast.
If achieved lift is markedly greater than 2 m/s = 394 ft/min, wing loading can be increased up to a maximum of 50 kg/m² = 10,24 lb/ft² by use of water ballast.

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

Filling of Water Ballast

CAUTION: *When an optional tail water ballast is installed and tail water ballast is needed this has to be filled first!*

All water ballast valves are operated by only one actuator lever which is situated on the right hand cockpit arm rest in the landing gear gate. That all water ballast valves are operated at the same time is an important requirement of the LBA in order to avoid unintended opening of only one valve which in turn leads to uneven load. Lever forward is open!

Screw the transparent filling hose into the drain port in front of the tail wheel and fix it with some tape to the fin in front of the water level marks. Fill the required amount of ballast water into the system and close the valve (rear position). A table for the required amount of water and resulting c.g. is given in Section 6.2 .

The integrated wet surface wing water ballast tanks are then filled through the filling/ventilation openings on the upper wing surface. To do so, the water ballast actuation lever remains in the closed position. Then screw the covers in place and safety.
For filling the wings must be kept level.

With wings level, carry out a balancing test to check that the ballast loads are even. Should one wing prove to be heavier, the lighter one is filled until an even load is achieved.

The drain ports are about 0,3 m left and right of the fuselage and about 0,27 m behind the leading edge on the lower wing surface.
The ventilation opening (in flight) is at the wing tip below the winglet juncture and at such a place that local pressure is slightly more than static, which means that no water should be sucked out of the wing in symmetric flight.

WARNING: *It is expressly prohibited to use pressurised 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: *The **ASW 28 must be parked level** after the water ballast is filled in. Otherwise the wet water tank may dump slowly through the ventilation of the low wing.*

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

The maximum permissible water ballast volume can be calculated as follows:-

Maximum Take-off Weight.	525 [kg] = 1157,4 lbs
less - Empty Weight	-xxx [kg]
less - Cockpit Load	-xxx [kg]
= max. water ballast load (in kg or liters)	xxx [kg]

You will find a table with precise values in Section 6.2. !

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).
Every time any water is jettisoned, it is most important to look at the wing trailing edges to check that the water is draining at an equal rate from both valves!
We distinguish between two distinct types of circumstance in which ballast is normally released.

1. Partial reduction of wing loading:
   The mean rate of drainage amounts to 0.5 l/sec, higher if tanks are full, less if they are nearly empty. After an appropriate lapse of time the valves should be closed.

2. Rapid ballast jettison:
   The full tanks take about 7 ½ minutes - about 450 seconds - to drain. The first half of the ballast will drain in about 3 minutes, while the remainder will take about another 4 ½ minutes.

Should the 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 you do not succeed after several attempts the situation should be regarded as an emergency, and instructions in Section 3.7, (4) (Other Emergencies) should be followed.

Operation of an optional tail water ballast tank installed inside the fin (tail tank)

Foreword:

A serial ASW 28 without a tail tank can only be trimmed to a desired c.g.-position by trim weights in the front fuselage or in the tail. Only one trim ballast configuration, either "dry" or loaded with a certain amount of water ballast is possible.
After reading Section 5.3.4 of this manual, the performance minded pilot can adjust the C.G. for the "dry" sailplane to an optimum position by trimming using weights. To do so, he must use trim discs for the front fuselage or an especially prepared trim weight or battery for the upper fin compartment, which is covered and approved by the current weight and balance.
The water ballast tank inside the lower fin, which can be drained in flight, is used to compensate the nose heavy moment resulting from the wing water ballast load, which is also disposable in flight. The tail tank may be used to optimise a second c.g.-position when water ballast is carried.

However, the dump system does not synchronise the water flow from wing and tail tanks such that the desired optimum C.G. can be maintained when the water load is only partially disposed of.

Use of the tail tank:

When the ASW 28 is equipped with a tail water ballast tank inside the lower fin, it can only be used to compensate the nose heavy moment resulting from a water ballast load inside the wings. The in flight C.G. can be quite exactly adjusted, see Section 5.3.4 of this Manual.

In order to make reasonable use of the tail tank, the in flight C.G. of the (dry) sailplane without water ballast must first be adjusted to the optimum range from X = 300 mm to 310 mm using trim weights.

When the pilot weight including the parachute is between 0 and 13,5 kg higher than the placarded or approved minimum cockpit load, see the entries into page 6.4 of the Flight Manual of the sailplane in question, the c.g.-position must be adjusted by trim discs in the front fuselage according to the following table:

Pilot + parachute above min. cockpit load [kg]:	0	2,5	5	7,5	10	12,5
Trim discs of 1,11 kg each in fuselage nose:	6	5	4	3	2	1

When the approved minimum cockpit load is exceeded by more than 13,5 kg, especially prepared trim weights which were included into the valid weight and balance of the sailplane in question can be placed into the upper fin compartment. The installation of such a trim weight into the fin compartment leads to an increased minimum cockpit load of the so equipped ASW 28 in question and must therefore be carefully weighed and also be entered into the individual Flight Manual and onto the Data Placard.
The following figures may apply as a first approach for exceeding the minimum cockpit load by Y + 13,5 kg:

Y [kg] more than 13,5 kg:	0	5	10	15	20	25	30
Additional weight in the fin compartment:	0	1	2	3	4	5	6

To make sure that the instructions given above are well understood, some examples are given below:

The entries in page 6.4 of the Flight Manual show two valid weight and balance results:
Empty Weight 245 kg; Empty weight C.G. 593 mm behind datum without trim ballast in the tail compartment, pilot weight including parachute min. 70 kg, max. 115 kg.

Empty Weight 249 kg; Empty weight C.G. 653 mm behind datum including 4 kg ballast in the tail compartment, pilot weight including parachute min. 90 kg, max. 115 kg.

Example 1: The pilot weighs 80 kg including parachute. What must he do to get an optimum in flight C.G. when no water ballast is carried?
Answer: He weighs 10 kg more than minimum cockpit load without trim weights in the fin and therefore screws two trim discs weighing 1.11 kg each to the fitting in the fuselage nose.

Example 2: The pilot weighs 83.5 kg including his parachute.
Answer: He does not need any additional trim weights.

Example 3: The pilot weighs 97 kg including his parachute. What must he do to get an optimum in flight C.G. when no water ballast is carried?
Answer: He is 7 kg heavier than the minimum cockpit load when 4 kg trim weight is fitted in the fin compartment and puts another 4 trim discs weighing 1.11 kg each to the fitting in the fuselage nose.
Alternatively he could prepare a trim weight just below 2.6 kg for the fin compartment, do a weight and balance and get this weight entered into the Flight Manual.

Example 4: The pilot weighs 103.5 kg including his parachute. What must he do to get an optimum in flight C.G. when no water ballast is carried?
Answer: He is 13.5 kg heavier than the minimum cockpit load when 4 kg is fitted in the fin compartment and needs no trim discs in the fuselage nose.
Pilots who are heavier than 103.5 kg including their parachute must prepare a heavier weight than about 5 kg for this glider and must get it approved by weight and balance and entered into the Flight Manual.

CAUTION: *The tail tank of the ASW 28 must never be used to compensate a nose heavy moment resulting from pilot weight, as its water content can be jettisoned in flight. This is in violation to JAR 22.31 (c) which does not allow this. A second tail tank which cannot be drained in flight would be needed and this is not available.*

Only when the in flight C.G. (in dry configuration) is adjusted according to above given procedures can water ballast be filled into the tail water ballast tank inside the lower fin. Use the following table to select the mass of water to be filled.

Water ballast inside the wings [kg]:	0	40	80	120	160	200
Water ballast in the tail tank [kg]:	0	1	2	2,8	2	1,4

You should notice that the amount of water ballast needed in the tail tank is not proportional to the amount of water ballast inside the wings. This comes from the fact, that wing water ballast below 100 kg is placed forward of the desired optimum c.g.-position of 300 mm to 310 mm.

When more water ballast than 100 kg is filled into the wings this brings the C.G. near or behind the desired optimum c.g.-position. The effort of the designer to get along without any tail tank for the ASW 28 becomes obvious and would have been met if the optimum c.g.-position would have been near 280 mm behind datum as calculated during design stage prior to flight testing.

It may appear to the pilot, that it is unimportant for flight safety if 5 kg are filled into the tail tank or only 3 kg in the fin compartment plus 2 kg into the tail tank. This is correct from the balance point of view however not covered by JAR-22 for very good (safety) reasons. For heavy pilots there is the danger that the forward c.g.-limit could be exceeded if the tail tank leaks or the water drain actuator is opened for only a short while. Even if the c.g.-limits are not exceeded all water from the full tail tank goes quickly in about 40 seconds, whereas from the wings only about 40 kg are drained during the same time after the cockpit lever is opened. In a most unfavourable case the sailplanes C.G. can move 50 mm more forward and therefore far away from the favourable position.
This unapproved procedure is therefore not only potentially dangerous but also far away from the optimum.

4.5.7 High Altitude Flight

Flutter tests were carried out at about 2000 m (6562 ft) msl. Because the ASI under reads with increasing altitude but since flutter limits for sailplanes are determined by true airspeed, the following limitations apply to high-altitude flights:

Altitude msl.		V_{NE} Indicated Airspeed		
0 - 6000 m	0 - 19685 ft	270 km/h	146 kts	168 mph
8000 m	26247 ft	236 km/h	127 kts	147 mph
10000 m	32808 ft	209 km/h	113 kts	130 mph

If the above airspeed limits given as IAS are adhered to the true air speed will remain constant at 361 km/h (195 kts, 224 mph) above 6000 m (19685 ft) altitude.
Despite the IAS being remarkably under reading, the true airspeed TAS relative to air mass and ground is sufficient to face even strongest head winds at high altitude.

Placard for airspeed reduction at high altitude:

V_{NE} Speed Limit for high altitude	
Altitude msl.(m)	V_{NE} IAS (km/h)
< 6.000	270
< 8.000	236
< 10.000	209

V_{NE} Speed Limit for high altitude	
Altitude msl.(ft)	V_{NE} IAS (kts)
< 19.700	146
< 26.250	127
< 32.800	113

V_{NE} Speed Limit for high altitude	
Altitude msl.(ft)	V_{NE} IAS (mph)
< 19.700	168
< 26.250	147
< 32.800	130

The appropriate placard has to be installed near the ASI.

JAR 22.1541(c): 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 there dry comparatively slowly.*

This may cause the controls to become stiff to operate, or in extreme cases, jam them. 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 even if heavy icing-up of wing and tail unit leading edges occurs.
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.

4.5.8 Flight in Rain

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

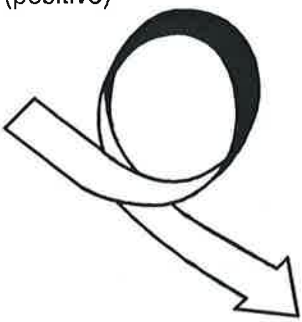
4.5.9 Aerobatics

WARNiNG: Aerobatics are only permitted without water ballast!

In accordance with JAR-22.3 some simple aerobatic manoeuvres may be permitted for the Utility Category, provided they are demonstrated by appropriate substantiation in the course of type approval tests.
As a steady spin is only possible with aft c.g.-positions, the spin is not a suitable aerobatic manoeuvre. This is because with central and forward c.g.-positions the ASW 28 cannot be held in a spin.

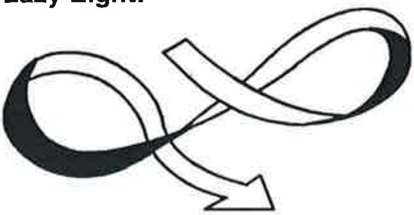
The following manoeuvres have been demonstrated and are approved:

Loop:
(positive)



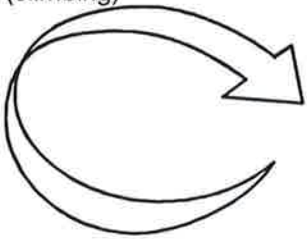
A positive loop may be flown at an entry speed at the lowest point from 180 km/h = 97 kts, but a speed of 200 km/h = 108 kts is recommended.
The required g-load is well below the permissible maximum value of 5.3 g.

Lazy Eight:



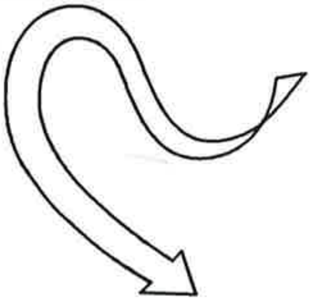
This figure may be flown at entry speeds of 150 km/h = 81 kts and more at the point of intersection. It is, however, easier to fly this manoeuvre at an entry speed of about 180 km/h = 97 kts, and it will also look better. A woollen thread on the canopy is very useful in avoiding side slipping.

Chandelle:
(climbing)



Recommended entry speed is V_A = 200 km/h = 108 kts (end of the green arc on the ASI scale), but not less than 190 km/h = 102,5 kts. Vertical climb must be reached by ~160 km/h = ~86,5 kts. At this speed and in that flight attitude it becomes necessary to start applying forward pressure on the stick and begin rolling out to get the wings level to avoid the manoeuvre ending in a stall.

Stall Turn:



For the stall turn the recommended entry speed is also V_A = 200 km/h = 108 kts. While pulling up vertically full rudder must be applied at the latest by the time the indicated air speed has reduced to 130 km/h = 70 kts to ensure a clean Stall Turn and not fall into a slipping tail slide.

Steep turns:
In a steep turn at 75° bank the minimum speed is 140 km/h = 75,5 kts and an acceleration of 4 g is imposed. It is therefore recommended that steep turns should be carried out with not more than 60 to 70° of bank at about 160 km/h = 86,5 kts to avoid flow detachment at the wing (High Speed Stall).
However, using a g-meter sustained 4-g turns can easily be achieved at an airspeed of 160 km/h= 86,5 kts.

SECTION 5

5.1 Introduction

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

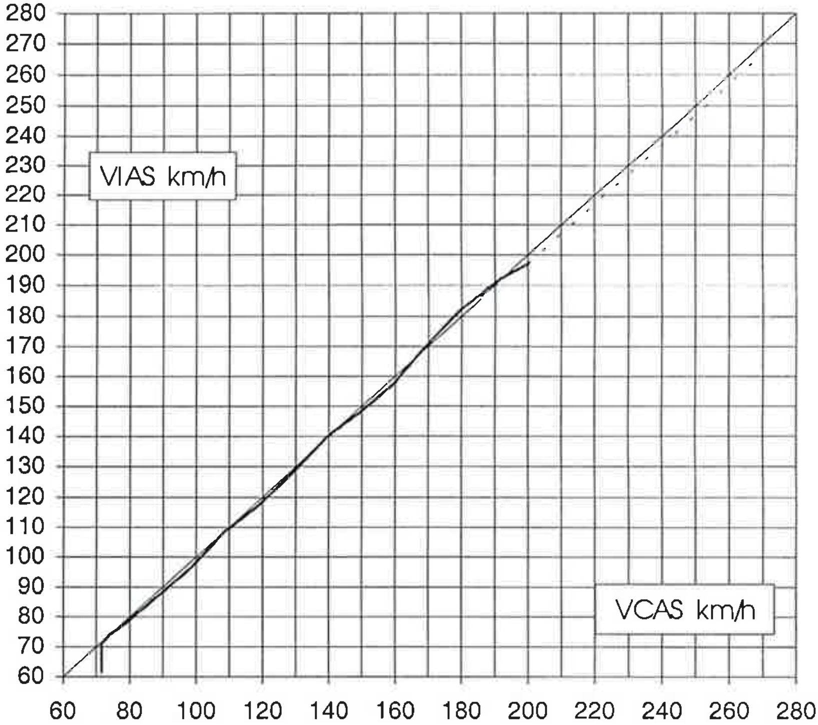
The data in the charts has been computed from actual flight tests with the sailplane in good conditions and using average piloting techniques.

5.2 LBA-Approved Data

5.2.1 Airspeed Indicator System Calibration

Upwards of an indication of 80 km/h = 43 kts (without water ballast) or of 90 km/h = 48,5 kts (at max. all-up mass) the ASI will only show a minimal indication error. The deviations are within an under-indication of about 2 to 3 km/h = 1 to 1,5 kts, mostly little low, however around 180 km/h about 95 kts also little high indication.
In stalled flight the air speed is greatly under-indicated and the pointer will fluctuate between 0 km/h and about 60 km/h = 0 and 32 kts.

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



V_{IAS} = Indicated Air-Speed

V_{CAS} = Calibrated Air-Speed

5.2.2 Stall Speeds

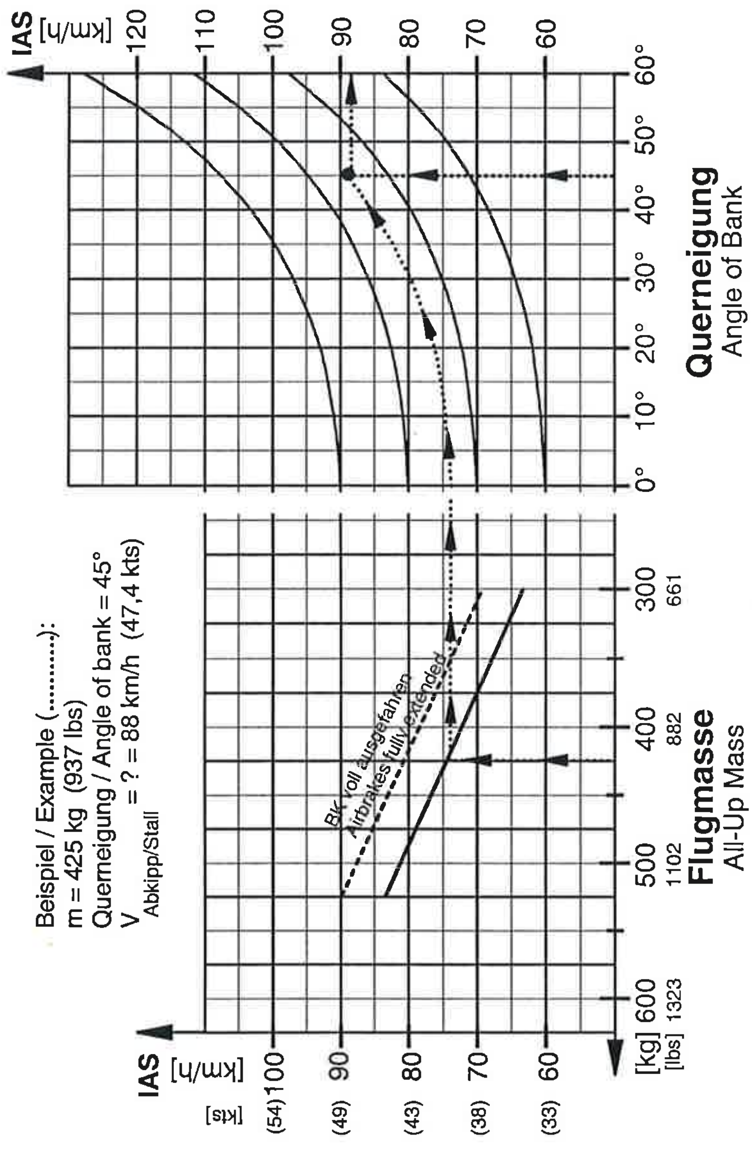
Stall Speeds in km/h (kts) Indicated Air Speed.

		All-Up Weight kg	(lbs)
Air Brake Setting	320 kg (705.5 lbs)	410 kg (904 lbs)	525 kg (1157.4 lbs)
closed	65 km/h (35 kts)	73,5 km/h (39.5 kts)	83 km/h (44.7 kts)
open *	71,5 km/h (38.5 kts)	81 km/h (43.5 kts)	90 km/h (48.5 kts)

* with landing gear extended !

1. The speeds quoted are valid for the aerodynamically clean glider.
2. Stall warning in the form of decreasing aileron effectiveness and of tail unit buffeting or gentle oscillation about the vertical axis will commence at about 6 % above the indicated stall speeds.
3. Extension of air brakes increases the indicated stall speed in straight flight by about 10 % if the landing gear is extended.
4. But if the landing gear is retracted, and with the air brakes extended, very much lower air speeds may be indicated, i.e. even of about 10 % less than shown in the top line of the table above.

Stalling Speed Diagrams



5.3 Non-Approved Further Information

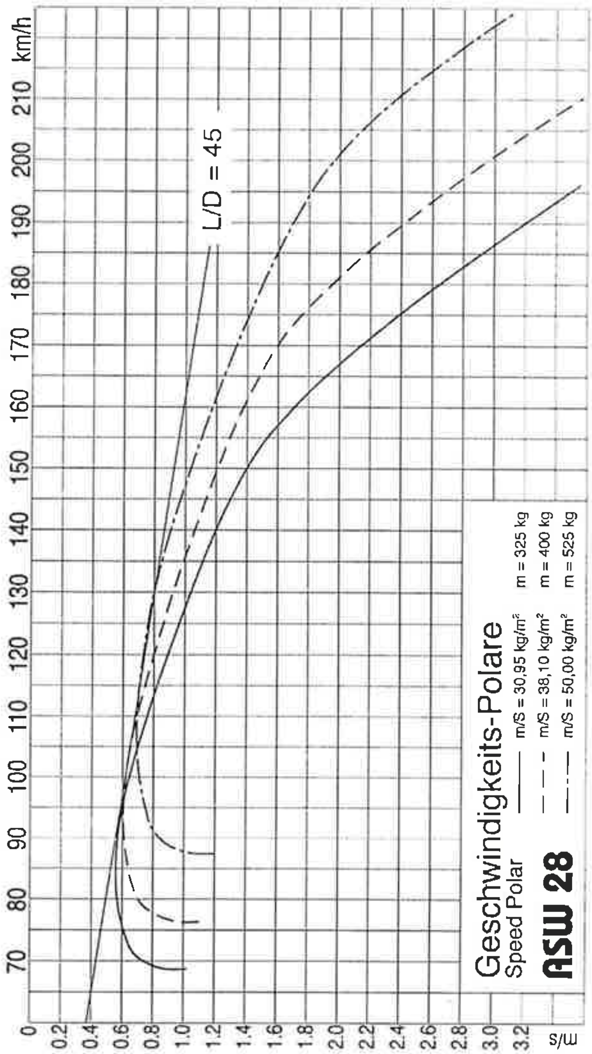
5.3.1 Demonstrated Crosswind Performance

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)

5.3.2 Flight Polar - Level Flight

The speed polar was calculated, and established in the course of preliminary comparison flights.

Figure 5.3.2-1



5.3.3 Flight Polar - Circling Flight

The following diagram has been established by calculations based on the speed polars given before.
Figure 5.3.3-1

The calculation of these polars is postponed and will be done, when measured flight performance speed polars are available!

5.3.4 Trim drag, influence of c.g.-position on flight performance

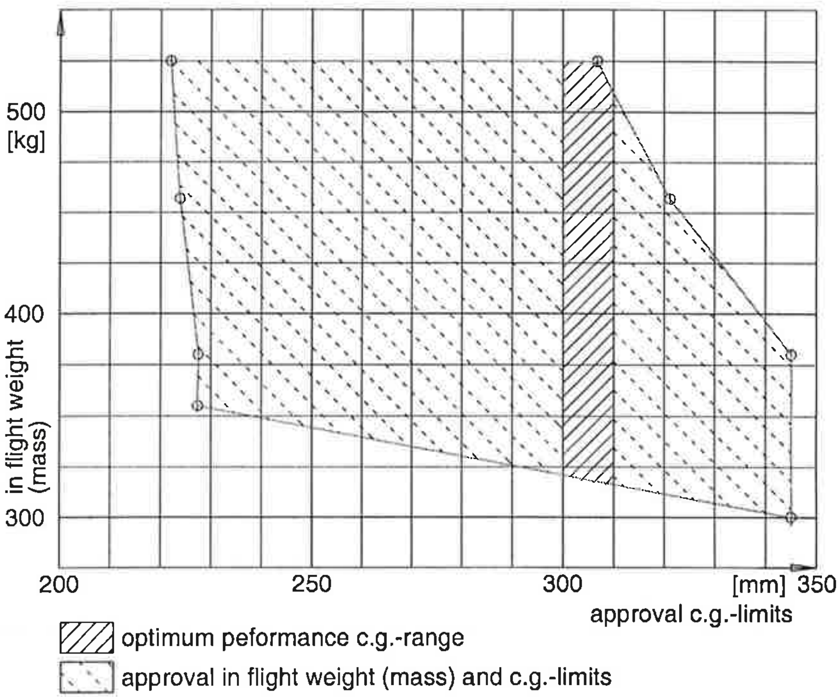
In "Technical Soaring" Vol. 16, No. 1 (Jan. 1992) Cedric O. Vernon published an article on "Trim Drag".
He confirmed earlier papers on the subject and explained in detail that the horizontal tail surface must have nearly no lift (neither up nor down) to get the optimum performance of the sailplane.

It is obvious to every pilot that it cannot be optimum that the wing produces lift whereas the horizontal tail produces a great down load.
Also it is easy to understand that 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.

So the lowest trim drag for a T-tail sailplane is given when nearly all lift is produced by the wing and only very little lift is produced by the horizontal tail surface.

For a sailplane made to match FAI Standard Class rules the camber of the wing profile determines the horizontal tail surface loads which are depending mainly from air speed. The horizontal tail surface loads however, resulting from c.g. position are independent from airspeed.
Knowing these details the designer has adjusted the c.g.-range of the ASW 28 such that the calculated optima are covered with minimum loss in performance.
At high speeds the wing produces a strong nose heavy pitching moment which must be compensated by a strong down force of the horizontal tail or a tail weight. Therefore at high speed a rear c.g.-position is favourable beyond the approved range is an optimum. By use of a larger horizontal tail this situation could be rectified, however the additional drag caused by the bigger tail surface would compensate the reduction in trim drag.
The tail surface size selected for the ASW 28 is an optimum of all drag components together.
For the best L/D range of speeds X = 310 mm is the optimum c.g.-position and for low speed and circling in thermals X = 275 mm.
The data given above are confirmed by competition pilots, who recommend X = 300 mm to 310 mm as a good compromise, see the shaded area in the diagram for approved c.g.-limits on page 5.10 .

diagram for approved c.g.-limits



Section 6

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 comprehensive list of all equipment available for this sailplane and the installed equipment during this weighing of the sailplane are contained in the applicable ASW 28 **Maintenance Manual**, Section 6.

6.2 Mass (Weight) and Balance Form

The Mass and Balance Form overleaf shows the maximum and minimum cockpit loads, and any additional load still permissible for the baggage compartment.

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 28 **Maintenance Manual**, Section 6.

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, this can be rectified by means of trim ballast plates fitted in front of the rudder pedals. See also Section 7.11.

Heavy pilots often like to ballast their aircraft for optimum performance to suit their individual weight. A housing is provided for this purpose in the upper part of the fin where trim ballast, for instance in the form of a battery, may be fitted.

If any trim ballast is mounted in the fin, the minimum cockpit load will of course 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 <u>without</u> 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 <u>WITHOUT</u> 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 Weighing	Empty mass 1)	Empty mass C.G. 2) aft of RP	Pilot mass incl. chute 1)		Load in baggage compart.* 1)	Inspector´s stamp and signature
			min.	max.		

* Permissible baggage load = 260 kg (=573.2 lbs) less empty mass of non-lifting parts less pilot mass less mass of parachute: BUT not more than 12 kg (= 26.5 lbs) !!

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

Maximum Permissible Loading with Water Ballast

Empty Mass kg [lbs]	Pilotmass + parachute + bagage kg and [lbs]					
	75 [166]	85 [188]	95 [210]	105 [232]	115 [254]	125 [276]
220 [485]	full	full	full	200 [441]	190 [419]	180 [397]
230 [507]	full	full	200 [441]	190 [419]	180 [397]	170 [375]
240 [529]	full	200 [441]	190 [419]	180 [397]	170 [375]	160 [353]
250 [551]	200 [441]	190 [419]	180 [397]	170 [375]	160 [353]	150 [331]
260 [573]	190 [419]	180 [397]	170 [375]	160 [353]	150 [331]	XXX
270 [595]	180 [397]	170 [375]	160 [353]	150 [331]	XXX	XXX

XXX: These combinations are precluded as they would cause the maximum permissible mass of non-lifting parts to be exceeded!

The integrated wet surface water ballast tanks in the ASW 28 can hold about 210 litre together.

NOTE: *One liter equivalent to 1 kg water weighs 2.2 lbs or 0,265 US-Gallons.*

CAUTION: *Fill in the tail water ballast first, when an optional tail tank is installed, then fill the wing tanks!*

Example of load / C.G. calculation:

A weighing gave the following results:
Empty Mass m_L = 245 kg (540.23 lbs)
Empty Mass C.G. x_L = 0.590 m (23.2 inches)

A second weighing with a (removable) trim ballast of 6 kg (13,23 lbs) in the fin showed:
Empty Mass m_L = 251 kg (553.46 lbs)
Empty Mass C.G. x_L = 0.676 m (26.6 inches)

The **MASS AND BALANCE FORM** in page 6.4 must be filled in according to the following example :

Date of Weighing	Empty mass 1)	Empty mass C.G. 2) aft of RP	Pilot mass incl. chute 1) Min.	max.	Load in baggage compart.* 1)	Inspector´s stamp and signature
xx.xx.xx	245 kg 540.23 lbs	0,590 m 23.2 in. without trim-ballast in the fin	70 kg 154 lbs		12 kg 26.5 lbs	
				115 kg 254 lbs	12 kg 26.5 lbs	
	251 kg 553.46 lbs	0,676 m 26.6 in. with 6 kg trim-ballast in the fin	100 kg 220 lbs		12 kg 26.5 lbs	
				115 kg 254 lbs	12 kg 26.5 lbs	+ + +

* Permissible baggage load = 260 kg (= 573,2 lbs) less empty mass of non-lifting parts less pilot mass less mass of parachute: BUT not more than 12 kg (= 26.5 lbs) !!

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

Section 7

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.

The principal purpose of this Section is to describe the controls in the cockpit, their layout and placards.

7.2 Airframe

The wing profile is equipped with boundary layer control by "blow turbulators" on the lower surface.

7.3 Flight Controls including Trim

(1) 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.

(2) Rudder

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

Pedal Adjustment:
grey knob at Right of stick.

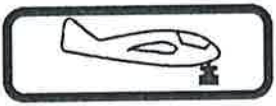
To move pedals forward: pull knob and push pedals forward with your heels. Release knob and push again to lock in position.

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

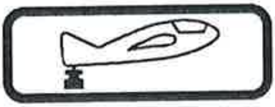
(3) Trim

To set the trim, simply 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.

When trim is unlocked by pressing the stick mounted trim release lever, the trim can also be adjusted by sliding at the same time the trim indicator knob to a desired position.



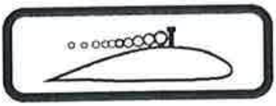
Trim nose heavy



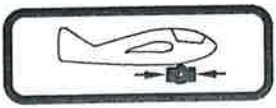
Trim tail heavy

7.4 Airbrake System

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



Pull the blue handle to extend the airbrake paddles.

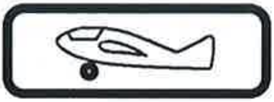


When the airbrake handle is pulled back to its fullest extent, it will also actuate the hydraulic disc brake of the main wheel.

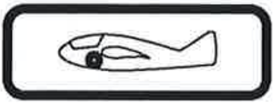
The double-paddle airbrakes extend on the upper wing surface only.

7.5 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 > Retractable landing gear*
retracted *landing gear = retracted lever.*

Tire pressures: Main wheel: 2.5 bar +/- 0.1 bar (35,6 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).

7.6 Cockpit, Canopy, Safety Harness and Instrument Panel

(1) Launch Cable / Towing Hook Release:

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

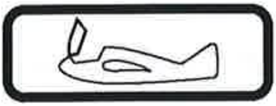
Pulling the yellow knob will open one or both of the towing hooks.
For the launch cable to be attached, pull the yellow knob back and then merely release it to allow the towing hook to snap shut and lock.

(2) Seat and Seating Positions:

The seat is designed to allow tall and medium sized pilots to sit comfortably, and improve their position by means of cushions and an appropriate choice of parachute. For tall pilots we would recommend the use of thin parachute packs of the new type. Very short pilots will have to adjust their seating position by means of a hard-foam cushion so that all controls are within comfortable reach, that their view to the outside is improved, and that they are prevented from sliding back during initial take-off (winch launch) acceleration.
Very tall pilots may fly without the seat back, but must then fit a spinal support by means of a hard foam (e.g. Styrofoam, Conticell or Rohacell)!
A head rest made from energy absorbing foam must be stripped on to the shoulder straps as a head rest!

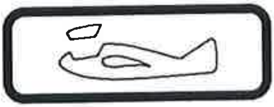
(3) Canopy Operation

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



These levers are marked by these adhesive labels.

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



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

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 it could act as a lens concentrating the sun's rays, which might ignite cockpit instruments and equipment.*

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

(4) Safety Harness:

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

- sit down in the seat;
- put pelvic belts on and fasten them as tightly as possible;
- make sure that the pelvic belts are lying on the pelvis and the buckle is in the middle of the pelvis;
- 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!
- when the belt system loosens during the flight: always refasten the pelvic belts first ant than the shoulder belts.

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

(5) Ventilation

The ventilation flap is located at the front of the canopy frame and is operated by means of the small black knob on the instrument panel. Pull to open.

This flap also serves as a de-mister.

A further air outlet nozzle is fitted at the right cockpit wall to the right of the instrument panel, which is opened and closed by twisting the rim and the direction of which can also be adjusted. This air outlet should be closed if the de-misting function of the front canopy ventilation flap needs to be made more effective.

(6) Instrument Panel

For safety reasons, only a GRP panel made in accordance with the lamination plan specified by the manufacturer may be used.
Instruments weighing more than 1 daN need further support, in addition to the fixing screws provided. This can be done by means of aluminum straps fixed to the instrument pod.
Equipment with operating controls must be fitted conveniently to hand and within reach, even when the safety harness is worn. 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) 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.

7.7 Baggage Compartment

Hard objects may not be carried in the baggage compartment in front or on top of the spar 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.

The baggage load in the compartment may not exceed 12 kg = 26.5 lbs.

BAGGAGE COMPARTMENT LOAD
max. 12kg (26.5 lbs.)

7.8 Water ballast system

The wings are equipped with integrated wet surface water ballast tanks of 200 litres (52.8 US-Gallons).
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 place cover must be safetied by tape in flight. Use elastic white tape like Fascalfolie or Tesaflex 4163, Ø 60 mm). On the cover of the wing root rib an automatic opener for the drain valve which provides adequate ventilation of the wing when the wing is de-rigged and the other ventilation opening is uncovered.

The operation of the mechanical valves are operated by the lever on the right hand cockpit arm rest in the landing gear lever gate.

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

All water ballast valves are operated by only one lever. This ensures that an un-intended opening of one valve with quickly development of an uneven load is impossible.

An optional tail water ballast tank can be installed into the fin which can only be used for fine trimming the water ballast load.

Also the optional tail water tank is operated by above mentioned lever to ensure that a dangerous tail heavy load is impossible.
By controlling all the valves with a single lever, an inadvertent opening of only one valve, which would result in an asymmetric and/or tail heavy ballast load, becomes impossible.

7.9 Electrical System

The electrical system is supplied by a 12 V battery. Each electrical consumer is protected by its own fuse. A fuse is also fitted in the cable connected to the fin-mounted battery, close to the battery.

7.10 Pitot and Static Systems

Pitot pressure is obtained from a Prandtl-tube mounted in the fin. Ensure that this Prandtl tube is fully pushed home in its seating in the fin. The inner end of the probe should from time to time be lightly lubricated with Vaseline or a similar lubricant, in order to save the O-ring gaskets from wear.

At the same time, the Prandtl tube provides very accurate static pressure which can be used for electrically compensated variometer systems.

Static pressure for the ASI is obtained from the static ports at either side of the fuselage tail boom.

7.11 Miscellaneous Equipment

(1) Removable Trim Ballast

If required, the ASW 28 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 1.11 kg (= 2.45 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 1.11 kg (=2.45 lbs) each.

Maximum 6 trim plates are allowed for installation.

(2) Trim Mass (Battery) mounted in the fin

If a trim mass (battery) is fitted in the fin, the minimum cockpit seat load will be more than 70 kg = 154,5 lbs (incl. parachute).
This **increased** minimum cockpit load must then be shown in the DATA and LOADING PLACARD in the cockpit.
Any **reduced minimum** cockpit load when no tail ballast is fitted will be quoted on page 6.4.

For further details of minimum cockpit load see Section 2.8 of this manual.

The foam buffer fitted over the battery secures it above. 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 which is allowed to be installed into the fin compartment is 6 kg = 13.2 lbs.

(3) Oxygen

A seating for the oxygen bottle is prepared for. To activate it a cut-out at the bottom right in the main bulkhead, beside the wheel box must be made and a rear adapter for the oxygen bottle must be installed to ensure that the bottle cannot slide backwards into the controls. .
A 3-liter bottle of 100 mm diameter is found to be the most suitable to fit in this opening.

A suitable bottle fixing bracket is required, and is an optional accessory with Schleichers.

When 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 !*

(4) 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 laminations screen the transmission radiation, the ELT aerial must be fitted in the area between wing spar and canopy.

Section 8

8.1 Introduction

This Section contains manufacturer`s recommended procedures for proper ground handling and servicing of the sailplane. It also identifies certain inspection and maintenance requirements which must be followed if the sailplane is to retain that new-plane performance and dependability.

It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered.

8.2 Sailplane Inspection Periods

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

Further details are given in the ASW 28 **Maintenance Manual**, Sections 4 and 7.

8.3 Sailplane Alterations or Repairs

Regarding repairs and modifications, please see ASW 28 **Maintenance Manual**, Sections 10 and 11.

It is important that the Aviation Authority concerned should be advised **before** carrying out any modification of the glider which is not yet officially approved. This would ensure that the airworthiness of the aircraft is not invalidated.

8.4 Ground Handling / Road Transport

(1) Parking

Parking of the aircraft in the open can be recommended only if foreseeable weather conditions remain suitable. It should be seriously considered whether the secure picketing, covering, and cleaning of the aircraft before the next flight may not demand more effort than de-rigging and re-rigging would have done.

For tying-down the wings, trestles (perhaps from the trailer) should be used which 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!

For longer parking periods, also inside hangars as well as during road transport of the sailplane, the winglets must be de-rigged. Because of flutter safety reasons they have to be built extremely lightweight and therefore may be easily damaged during rough ground operation.

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

(2) Road Transport

Messrs. 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.
Re-inforced points of the fuselage are the main wheel (but remember the suspension springing !), and tail wheel; also possibly the drag spar pins (make up support seatings from plastic material like Nylon!), and the area under the canopy arch.

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, or with heavy tarpaulin cover, may be considered suitable, which in any case should have light coloured surfaces and be well ventilated also while stationary so as to avoid high internal temperatures or humidity.

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

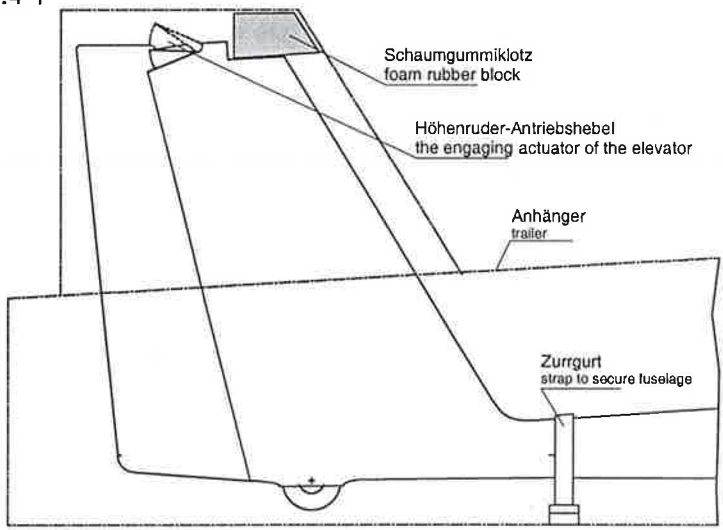
In order to protect the air brake cover plates from damage the airbrakes must be closed and locked!

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.

When, for example, a foam block applied some load to the elevator actuator, which, in turn, 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 false assumption that plastic materials are impervious to moisture and ultra-violet light we would state emphatically that even modern gliders need care and maintenance!

(1) 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 high humidity must be avoided! (As 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 or the additional frp-liner on the inside of the wet surface water ballast tanks nor the plastic or rubber skins of older 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.

(2) Sunlight - Effects on the surface finish

Sunlight - especially its UV component - embrittles the white polyester gel coat and the perspex canopy. The wax layer on the gel coat will also oxidize and discolor more quickly if the aircraft is unnecessarily exposed to strong sunlight. There is no paint finish on the market as yet which is unrestrictedly suitable for plastic gliders, and would approximate the life span of the plastic structure of the airframe without maintenance.

(3) Care of Surface Finish

As the white polyester gel coat is protected by a fairly durable wax layer, it will tolerate being washed down from time to time with cold water, with a little cleaning medium 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.

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).

Traces of Adhesive from Self Adhesive Tapes 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.*

(4) 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.

(5) 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

9.1 Introduction

This Section contains additional information designed to facilitate safe and effective operation of the glider, if equipped with various ancillary systems and equipment not included as standard equipment.

9.2 List of Inserted Supplements

(1) Oxygen system installation
(2) Emergency Location Transmitter

9.3 Supplements inserted

(1) Oxygen installation:

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.
He makers' instructions should be complied with.

(2) Emergency Location Transmitter:

See Section 7.11 of this Manual.