I.3 Contents

II. OPERATING LIMITATIONS

II.1 Airworthiness Category

A (Aerobatics) according to LFSM.

Certification basis: Airworthiness Requirements for Sailplanes and Powered Sailplanes dated 1.11.1975.

II.2 Permitted Operations

The glider is certified for VFR flights during daytime (VFR day).

The approved operation class is indicated by a data placard on the instrument panel. Depending on the respective equipment the glider may be licensed for traffic for the following categories:

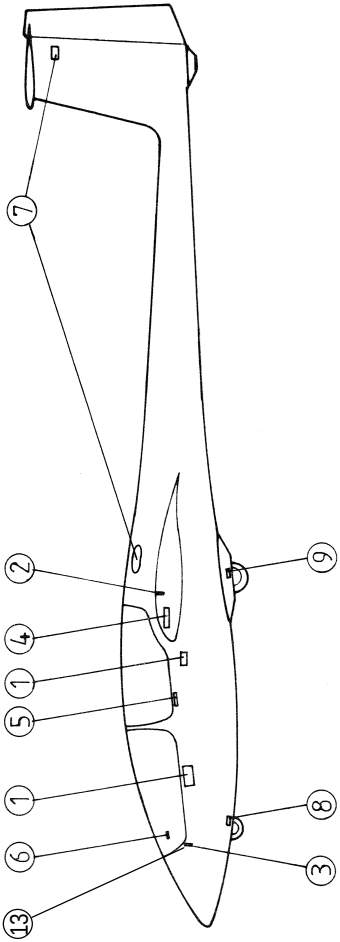
1. Airworthiness Category U (Utility), according to VFR with equipment as under 11.3 a)
2. Airworthiness Category A (aerobatics), with equipment as under 11.3 a) and 11.3 b) for the following aerobatics:

   Loop, Stall Turn, Split 'S',
   Immelmann, Slow Roll, Inverted Flights,
   Spin, Steep Climbing Turn, Lazy Eight,
   Chandelle.

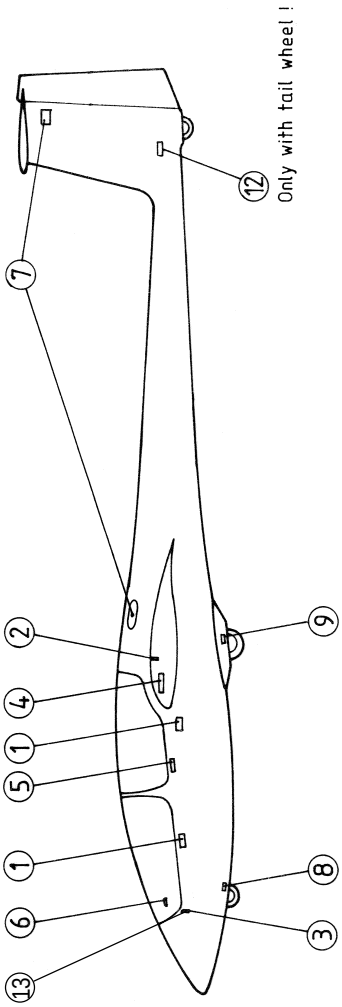
   With spin ballast attached, aerobatics are prohibited (except spinning).

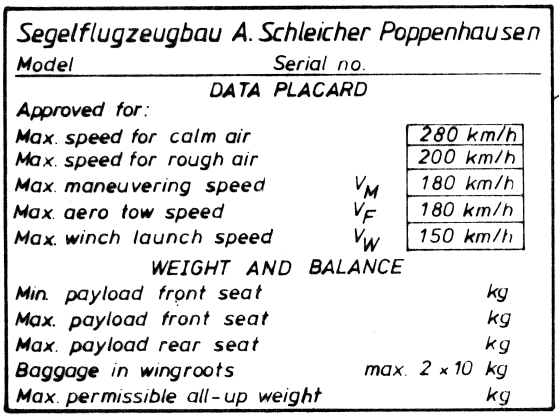
Settings of placards

II.9



Settings of placards [Only with tail wheel]





Segelflugzeugbau A. Schleicher Poppenhausen

Model Serial no.

DATA PLACARD

Approved for:

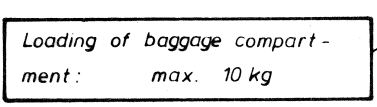
Max. speed for calm air		280 km/h
Max. speed for rough air		200 km/h
Max. maneuvering speed	V_M	180 km/h
Max. aero tow speed	V_F	180 km/h
Max. winch launch speed	V_W	150 km/h

WEIGHT AND BALANCE

Min. payload front seat	kg
Max. payload front seat	kg
Max. payload rear seat	kg
Baggage in wingroots	max. 2 × 10 kg
Max. permissible all-up weight	kg

1

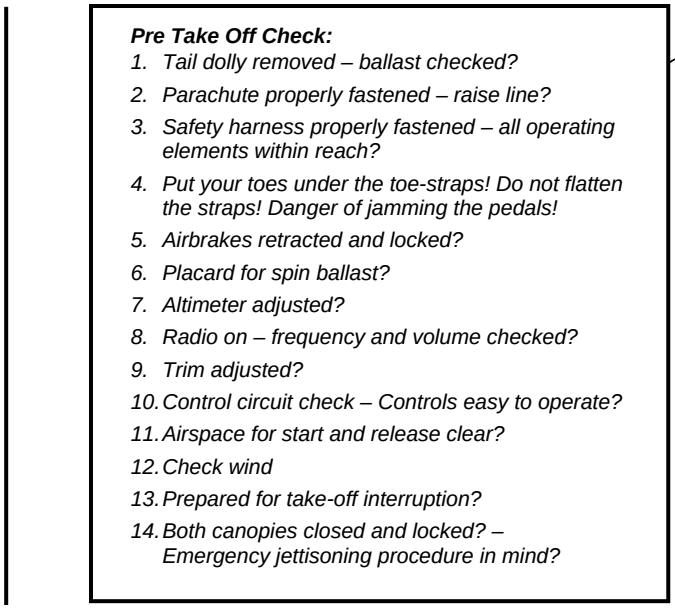
2 off



Loading of baggage compartment: max. 10 kg

4

2 off

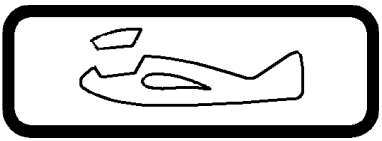


Pre Take Off Check:

1. *Tail dolly removed – ballast checked?*
2. *Parachute properly fastened – raise line?*
3. *Safety harness properly fastened – all operating elements within reach?*
4. *Put your toes under the toe-straps! Do not flatten the straps! Danger of jamming the pedals!*
5. *Airbrakes retracted and locked?*
6. *Placard for spin ballast?*
7. *Altimeter adjusted?*
8. *Radio on – frequency and volume checked?*
9. *Trim adjusted?*
10. *Control circuit check – Controls easy to operate?*
11. *Airspace for start and release clear?*
12. *Check wind*
13. *Prepared for take-off interruption?*
14. *Both canopies closed and locked? – Emergency jettisoning procedure in mind?*

6

1 off



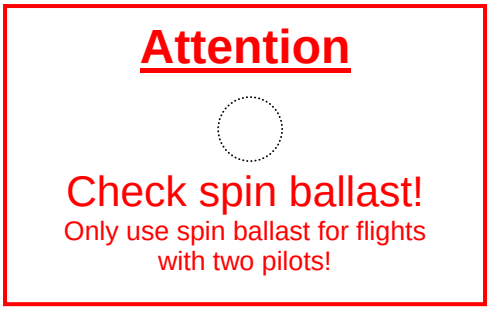
Canopy emergency jettisoning: push to the left the red flat knob above the instrument panel

Ventilation

This placard must be fitted in the front and rear cockpit in full view of the pilot.

When the plane is equipped with an attachment for spin ballast (TN4b)

Placard at the front instrument panel, informing about mounted spin ballast.



A M8-screw must be mounted through the placard from the back. The placard is visible, when spin ballast is mounted on the tail (= DANGER). When spin ballast is removed, the placard is covered by the nut that otherwise holds the spin ballast.

NOTE: *During spins the ASK 21 oscillates in pitch. From a steep nose down spin recovery according to the standard procedure is up to 1 turn, from a flat spin less than 1 turn.*

The speed at which the stall takes place depends on the payload. The following standard values are applicable:

	without airbrakes	with airbrakes
Single, all up weight 1043 lbs = 470 daN	65 km/h 35 kts IAS	68 km/h 37 kts IAS
Dual, all up weight 1320lbs = 600daN	74 km/h 40 kts IAS	77 km/h 42 kts IAS

Spinning with spin ballast

Mounting of spin ballast see pages 47a and 47b. Spinning with spin ballast is only allowed by dual flights. With spin ballast other aerobatic manoeuvres are not permissible.

Entry procedure:

The best entry speed is 2 km/h (1.1 kts) above the speed, at which the stall warning sets in. This must be checked before in flight.

Step hard on the rudder in the intended spin direction. Then, fully pull the stick. The aileron stays neutral. The rudder must stay in this position as long as the spin is supposed to continue.

WARNING: *If a spiral dive sets in, it must be stopped immediately, to prevent overstressing the structure.*

Recovery procedure:

Recovery according to the standard procedure, see chapter III.1.

Further information can be found in the appendix to the Flight Manual, titled “Spin training with the ASK 21: Summary of important information and further recommendations”.

IV.7 High Speed Flight

The sailplane shows no flutter tendency within the permissible speed range.

With airbrakes extended in a 45° dive the speed remains below V_{NE} = 280 km/h (151 kts); it goes up to 232 km/h (125 kts) at G = 600 kg (1323 lbs).

IV.8 Approach and Landing

The most favorable approach speed is 49 kts = 56 mph = 90 km/h. With turbulence it may be advisable to increase slightly the approach speed.

Even steep approaches may be slowed down efficiently with the air-brakes at the beginning of the landing final approach.

NOTE: The airbrakes increase the stalling speed by about 1,6 kts = 3km/h.

Sideslipping is also suitable as an approach control. With full rudder during the sideslip the rudder pressure decreases to zero; the rudder must be pushed back.

During sideslip the airspeed indication goes to zero reading.

Permissible indicated speeds

Inverted flight without pitot head extension:

V_{NE}:	Single	35-130kts	=	65-240km/h.
	Dual	38-130kts	=	70-240km/h.
Indicated maneuvering speed		75kts	=	140km/h
Indicated max. speed		130kts	=	240km/h.

Inverted flight with pitot head extension:

Indicated maneuvering speed	97kts	=	180km/h
Indicated max. speed	151kts	=	280km/h
Indicated stall speed	47kts	=	87km/h
	With two occupants		

ATTENTION: *never release stick and rudder pedals when flying aerobatics.*

For aerobatics instruction a reliable agreement must be made between instructor and student flyer with regard to the communication system for the mutual taking over of the controls.

Airbrakes must be extended as soon as the pilot loses the control of the glider or as the speed increases involuntarily too fast.

Exception: "Tail sliding"!!!

The trim remains in the center position for aerobatic maneuvres. Do not ever change the trim when flying aerobatics!!

With spin ballast is attached, aerobatics are prohibited (except spinning).

PROHIBITED AEROBATICS:

All abrupt aerobatic maneuvers
Loop forward
Tail sliding.

Weight and balance information with spin ballast

Without valid spin ballast-table (Flight Manual page 47b), spin ballast at the tail may not be used. The validity period is specified on each spin ballast-table. A valid spin ballast table can be obtained from the manufacturer (procedure, refer to Maintenance Manual page 36).

Before every flight with spin ballast the pilots must be weighed with the equipment worn in flight (clothes, parachute …).

When the load in the front seat is below 70kg (154lbs), compensate missing load by attaching trim ballast in the front fitting, so that the load in the front seat equals 70kg (154lbs). For this purpose, follow the instructions on page 13. During the further procedure, the front pilot and the front trim ballast count together as a pilot of 70kg (154lbs).

The amount of spin ballast is specified in the current spin ballast-table. The mass of the pilot in the front seat defines the line of the table; the mass of the pilot in the rear seat defines the column of the table. At the intersection, the number of ballast plates (1 kg = 2.2 lbs), which are to be attached, is noted.

Up to a maximum of 12 spin ballast plates are permissible. The plates have to be distributed evenly to the left and right side of the fin and have to be fixed with the provided screw.

CAUTION: *The washer and nut fixed at the cockpit placard (see below)* ***must*** *be used. After removal of the spin ballast the washer and the nut must be fixed again on the placard.*

Attention

Check spin ballast!

Only use spin ballast for flights with two pilots!

VI.3 Weighing Record

Date of weighing, carried out by							
Equipment list used for weighing (date)							
Empty weight kg (lbs)							
Empty CG behind datum mm (in)							
Empty weight momentum max							
Max pay-load kg (lbs) max							
Old spin ballast table* removed (check off)							* Flight Manual Page 47b
Signature							

The empty weight momentum is necessary to calculate the in flight cg. (load table).

Attachment 1 of TN 4b

Spin training with the ASK 21: Summary of important information and further recommendations

Introduction

This appendix puts together pieces of information, which are important for spin training, but are found on different places in the Flight Manual. Furthermore, some general recommendations were added. About 170 ASK 21 were fitted with an attachment for spin ballast according to TN 4a (winter 2013). Now, it seems advisable to supply more information and more compact.

Spin Characteristics

The ASK 21 spins in upright flight as well as in inverted flight.

WARNING: *Intentional spins are only permitted in upright flight.*

The ASK 21 spins fast, steeply, and combined with a pitch oscillation. The oscillation of the spin causes a variance in pitch attitude that can range from extremely steep to nearly flat. Thereby the nose can pitch up almost to the horizon and the cockpit noise can calm down nearly completely. The pilot may not be used to such flat phases from other gliders of plastic design. The oscillation is more pronounced with increased loading. Nevertheless, it is possible in all phases to recover from a spin within one additional turn. But there are some important points to be regarded.

WARNING: *The following important points have to be regarded during recovery (see Flight Manual page 13):*

- *Deliberately apply opposite rudder **up to the stop**, and keep it at the stop until the rotation ends.*
- *Short pause (approx. ½ turn) after applying rudder and before releasing the stick.*
- *As long as rotation has not stopped, only give in to the pressure of the stick. Do **not** push the stick.*

Disregarding these points can delay or even prevent recovery.

WARNING: *During recovery from stalls in the presence of wing drop, or from departures and spins, application of forward stick prior to opposite rudder can delay recovery up to three additional turns.*

In order to obtain a reproducible result independently of the setting of the elevator trim, look out to bring the stick into neutral position, i.e. to the middle elevator course. In no case, the stick may be pushed to full nose down position.

Familiarize yourself with the spin characteristics

WARNING: *The combination of varying cockpit noise levels, varying pitch attitudes, and varying rotation rates and airspeed indications can cause disorientation to those unfamiliar with spinning this aircraft. If this occurs, positive application of recovery controls should be initiated immediately to minimize any effects of disorientation.*

We strongly recommend even experienced gliding instructors to familiarize them with spinning the double seated ASK 21. This may happen through a fellow instructor already experienced in spin training on the ASK 21. When the spin ballast attachment is new in the gliding club, there might be opportunities through the national gliding associations or in training courses for the continuing education of instructors. Apart from that, there are also flight schools offering spin training with the ASK 21. A list of such schools can be requested from Alexander Schleicher, or looked for on their web site.

Condition of the aircraft

The condition of the glider must be identical to the condition during the last valid weighing. This condition is documented in the equipment list, on which the weighing report refers.

When the batteries in the wing root were installed during weighing, they must also be installed during flight.

CAUTION: *Control surface gaps have to be treated either according to the Maintenance Manual, Section VIII, or according to Maintenance Instruction C.*

Disregarding this item can delay spin recovery or may even prevent recovery.

The spanwise gaps of ailerons and elevator must be *air-tight*. According to the Maintenance Manual Section VIII this is achieved with a certain adhesive tape. According to Maintenance Instruction C this is achieved with a teflon sealing/slip tape under the mylar fairing strips. Mylar fairing strips without sealing tape beneath are not sufficient!

The rudder gap either stays open (Maintenance Manual Section VIII), or a zig-zag-tape is placed on the forward edge of the mylar fairing strip (a combined zig-zag-fairing tape is also possible, Maintenance Instruction C).

Usage of the Spin Ballast Table

Directly before flight the pilots have to weight themselves with the equipment worn in flight (clothes, parachute …) (see Flight Manual, page 47a). When the load in the front seat is below 70kg (154lbs), compensate missing load by attaching trim ballast in the front fitting, so that the load in the front seat equals 70kg (154lbs). For this purpose, follow the instructions on page 13. During the further procedure, the front pilot and the front trim ballast count together as a pilot of 70kg (154lbs).

According to the spin ballast table page 47b, spin ballast has to be attached. Every other trim ballast and (loose) equipment in the cockpit has to be removed.

By following the spin ballast table a c.g. of approx. 406 mm (16 inch) is set in for the flight. In any case, a maximum of 12 kg at the tail may not be exceeded. This amount of 12 pieces of ballast may not be sufficient to reach the 406mm with heavy pilots. With such a loading (larger masses on the front and tail of the glider), the glider may even be spinning at more forward c.g.-positions.

Higher masses in the cockpit and on the tail influence the rotational speed of the spin and the amplitude of the superimposed pitch oscillation. With higher masses, the average pitch attitude is approx. –40° and the pitch amplitude is about ±30°.

In all spins, the altitude loss is approximately 60 m (200 ft) per turn with a variance of 45 m (150 ft) minimum to 80 m (250 ft) maximum.

Spin Entry Procedure

The spin entry procedure is described on page 34 of the flight manual.

An aileron impulse against spin direction in due time can support spin entry.

CAUTION: *We recommend to enter spins in a generously safe altitude.*

For example it may be recommendable to enter the spin not below 1000 m (3280 ft) AGL, when you intend to spin one turn and then recover. If you want to spin three turns and then recover, do not enter the spin below 1300 m (4270 ft) AGL.

When determining your minimum altitude for entering a spin, always bear in mind, that the student may not recover correctly at first go, or other imponderability may happen. For example, recovery may be postponed by three additional turns during a wing drop or spin, when forward stick was applied before opposite rudder.

WARNING: *If a spiral dive sets in, opposite rudder, opposite aileron, and relaxed back stick pressure must be used immediately to prevent overstressing the structure.*

If cockpit noise due to outside airflow continues to increase to the point that conversation between crewmembers is difficult, or if the airspeed indicator is increasing through 110 km/h (60 kts), the aircraft is no longer spinning but is likely in a spiral.

NOTE: *We recommend not to use the airbrakes during recovery to reduce the airspeed, since the tolerable load factor with extended airbrakes is only +3,5g / -0g.*

Spin Recovery

see Flight Manual page 13, and above “Spin Characteristics“

Emergency procedures

For your own safety, the decision height for a bail out should be determined before start. It should be agreed upon, who makes the decision, and what the instruction to bail out is.

If, for whatever reason, the glider has not yet finished the spin after one turn, the following questions have to be checked:

- Is *full* rudder applied against the spin? Is back pressure upon the stick released, and aileron neutral?
- Is the glider really in a spin – and not in a spiral dive?

If both questions can be answered with „Yes“, the glider should still be given the chance, to recover from the spin (Patience!). The altitude loss in a spin is 45 m to 80 m (150 ft to 250 ft) per turn. After further three turns it propably makes sense to restart the recovery procedure.

Attachment 2 of TN 4b

Excerpt of the USAF Manual

The US Air Force flight tested the ASK 21 with spin ballast in 1989. Their results also went into the concept of Technical Note 4b (TN4b). In the report of the USAF there is also a recommendation for the Flight Manual. This text is too detailed for the average student pilot. As an offer to the flight instructor, it is attached below. Since it is older than TN4b there are some deviations from TN4b (e.g. concept of spin ballast table).

Some definitions are given at the end of the text. Remarks and omissions made by AS are indicated by square brackets [].

Schleicher ASK-21 (TG-9) Stall and Spin Evaluation

Doyle B. Janzen, Charles J. Precourt

July 1989,
Air Force Flight Test Center Edwards Air Force Base

This text may supply useful information for the pilot.
It is not part of the approved flight manual.

[..] The following discussion is the recommended writeup for SectionVI (Flight Characteristics) of the flight manual. The information is also appropriate for the manufacturer's flight manual.

[..]

DEPARTURE AND SPIN SUSCEPTIBILITY

Entry Techniques

The simplest spin entry is accomplished from wings level with the pitch attitude held constant at 10 degrees nose high until stall, while smoothly applying full rudder and full aft stick. Proper timing of aileron inputs prior to stall can generate additional yaw (adverse yaw due to aileron) to assist spin entry. This is particularly true at more forward cg when rudder and elevator alone fail to produce spin entry.

Spin entry is sensitive to entry conditions. If the entry attitude is too nose high, it results in a spiral dive. If the entry attitude is too shallow, it results in a steep-banked sideslip. The spiral or sideslip occur more frequently as the cg is moved forward. Spin entry is unlikely with the in-flight cg forward of 12.4 inches [315 mm]. In this case, entry attempts result in spirals or sideslips regardless of control input techniques.

Mass Properties Effects

Spin entry success is also sensitive to inertia loading. The ASK 21 aircraft has the unique feature of tail ballasting, meaning that it can be loaded at both ends of the fuselage. Although the tail weights were designed to control cg, they greatly effect the inertia terms that govern aircraft response to flight maneuvers. Since the tail weights significantly increase the inertia of the longitudinal axis of the aircraft, any initial yaw rotation results in more angular momentum than without tail weights. This greater momentum results in, achievable spins at cg's further forward than the low inertia case.

Flight testing has produced spins at cg's as far forward as 12.9 inches [328 mm]. With minimum inertia loadings (solo, lightweight pilot without tail ballast), incipient spins can be achieved at cg's aft of 13.0 inches [330 mm] and sustained spins aft of 15.0 inches [381 mm]. With higher inertia loadings (two pilots and tail ballast), incipient spins can occur aft of 12.5 inches [318 mm] and sustained spins aft of only 13.5 inches [343 mm]. Therefore, the tail weights cause the target cg where spins can be expected to move progressively more forward as pilot weights increase.

[..] In reference to test results [..], the best cg for spin training is 16.0 inches [406 mm]. [..] The maximum number of tail weights permitted is [12]. If pilot weights call for more than [12] tail weights [..], use [12] tail weights which will result in a cg slightly ahead of 16.0 inches [406 mm]. Due to the higher inertia of this case, the aircraft will still spin easily for training.

No Rudder Spin Entry

Spin entry without using rudder input can occur under certain conditions. A wing drop at stall can generate sufficient yaw to cause the rudder to float to the prospin position. Wing drop can occur due to adverse yaw from uncoordinated aileron inputs near stall or turbulence. In this case, if recovery is not initiated by applying rudder opposite the wing drop and then breaking the stall with forward stick, a spin can develop.

[..] If proper coordination is not exercised near stall, a departure or spin may occur with only stick inputs.

SPIN CHARACTERISTICS

Spin Modes

The ASK 21 has two spin modes, one upright and one inverted. Both are classified as fast, steep, and oscillatory, However, the oscillation of the spin causes a variance in pitch attitude that can range from extremely steep to nearly flat. The average attitude value is classified as steep. The spin modes may also appear smooth instead of oscillatory if they are only examined for three turns or less. This is because the period and frequency of the pitch oscillation vary as a function of cg and inertia loading. Variations from one oscillation per turn to one oscillation every three turns can be seen, depending on loading.

Spin-Parameters

The pitch attitude during ASK 21 upright spins averages 40 to 50 degrees nose low. The steep phase of the oscillation is as much as 70 degrees nose low and the flat phase as high as the horizon. In no case does the flat phase tend toward an unrecoverable situation. On some occasions, the spin attitude is steep enough that the AOA is momentarily less than stall, resulting in recovery as the aircraft pitches down out of the spin.

The oscillation occurs more frequently as the cg is moved aft, while increases in inertia loading result in a larger amplitude of the oscillation. For example, at a forward cg, the oscillation is seen every third turn. At the aft cg limit, the oscillation occurs every ¾ to 1 turn. At low inertia values, the pitch attitude oscillates typically ±15 degrees about 50 degrees nose low, while at high inertia the oscillation is ±30 degrees about 40 degrees nose low.

The rotation rate of the spin is as fast as 140 degrees per second, or one turn every 2.5 seconds. This rate occurs at the steep phase of a spin oscillation. During the flat phase, the rotation rate is as slow as 90 degrees per second or one turn every 4.5 seconds. The average rotation rate is fastest at forward cg 's and high inertias, where oscillations occur least frequently. Toward the aft cg limit, where oscillations to flat attitudes are more frequent, the average rotation rate is slowest.

In all spins, the altitude loss is approximately 200 feet [60 m] per turn with a variance of 150 feet [46 m] minimum to 250 feet [79 m] maximum. This indicates that in spite of the oscillatory nature of the spin mode, the descent rate remains relatively constant.

Airspeed indications during the spin oscillate along with pitch attitude. In most cases, airspeed oscillates between 30 and 40 KIAS [56 and 74 km/h] During larger oscillations in pitch attitude, higher sideslip angles are present and airspeed erroneously reads zero or less (pointer unwinds [backwards]).

Since airspeed indications can be unreliable during spins, particular attention is necessary to recognize the transition to a spiral. If cockpit noise due to outside airflow continues to increase to the point that conversation between crewmembers is difficult, or if the airspeed indicator is increasing through 60 KIAS [110 km/h], the aircraft is no longer spinning but is likely in a spiral. Opposite rudder [, opposite aileron,] and relaxed back stick pressure should be used immediately to avoid potential overspeed or overstress situations associated with high-speed spirals. Spoilers should be used as necessary to control airspeeds during all spin or spiral dive recoveries. [Remark: AS does not recommend the use of airbrakes during recoveries. Extracting the airbrakes has an unfavourable influence on the lift distribution, and the tolerable load factor reduces to +3,5g / -0g, see Flight Manual Section II.5].

[..]

Cockpit noise also varies during sustained spin oscillations. During steep phases of the spin, cockpit noise from outside airflow is loudest, while during flat phases, the cockpit is very quiet.

WARNING: *The combination of varying cockpit noise levels, varying pitch attitudes, and varying rotation rates and airspeed indications can cause disorientation to those unfamiliar with spinning this aircraft. If this occurs, positive application of recovery controls should be initiated immediately to minimize any effects of disorientation.*

Control forces during spins are light. There is a tendency for the ailerons to float into the direction of the spin, accompanied by 5 to 10 pounds [2,3 to 4,5 daN] of lateral force on the control stick. At the higher spin rates, the elevator and rudder forces at full prospin deflection drop to zero.

CONTROL EFFECTS

Flight Manual Recovery

When opposite rudder is initiated at a slow point or flat phase of the spin, the rotation stops in ¼ to ½ turn and the aircraft recovers. In the majority of cases, even at higher rotation rates, opposite rudder recovers the aircraft in ½ to ¾ of a turn from the point of input. However, with cg's of 14 to 16 inches [355 to 406 mm] and at higher inertias, recovery can take up to 1½ additional turns to recover once opposite rudder is applied. It is imperative that a slight pause occur between application of opposite rudder and forward stick or even greater delay in recovery can occur.

[Due to this statement the flight manual had been changed, adding the rule to obey a short pause between applying full rudder and relieving stick back pressure.]

A recovery of 1½ turns may take up to 5 seconds, which may seem excessively long to an inexperienced pilot. The flight manual procedure has a 100 percent success rate if given sufficient time to work.

Aileron Effect

For the ASK 21, ailerons against the spin produce a noticeable bank angle away from the spin turn direction as well as a nose down pitch rate. This sometimes results in recovery as the yaw rate decreases through inertial coupling and the nose pitches down leaving the aircraft in a steep sideslip to terminate the spin. In other cases, the aircraft remains in the spin with a bank angle away from the spin direction. Therefore, ailerons against the spin are not a reliable contributor to spin recovery.

Ailerons with the spin increase rotation rate but this effect is masked by the oscillatory characteristics of the spin. In the majority of cases, ailerons into the spin achieve a slightly higher rotation rate and a more

sustainable spin. The results of testing isolated aileron inputs indicate neutral aileron is the best position for recovery.

Elevator Effects

In some case, application of forward stick with no rudder input will result in a continued spin. During either the incipient phase of the spin or at the start of a nose up oscillation, full forward stick can produce up to three more turns before recovery.

WARNING: *During recovery from stalls in the presence of wing drop, or from departures and spins, application of forward stick prior to opposite rudder can delay recovery up to three additional turns.*

Hands Off

In the majority of cases, when the controls are released during a spin, the stick moves laterally in the direction of the spin. The stick usually reaches full aileron deflection and then starts forward toward neutral. The aircraft pitch attitude steepens and then the rudders return to neutral. At this point, the aircraft self-recovers in a steep attitude.

If the controls are released just after the pitch attitude has cycled nose low and the rotation rate is high, the stick moves abruptly into the direction of the spin and remains at full aft/full aileron deflection. Rudders also remain at full deflection, or nearly so, and the spin continues indefinitely until the pilot forces the controls to the recovery position. This is most prevalent in the 14- to 16-inch cg range [355 to 406 mm] with higher inertia loadings. Since airloads on the controls can occasionally cause them to "lock out" in a prospin position, releasing the controls is not a viable option for departure or spin recovery. The spin recovery procedure must be used to ensure successful recovery.

INVERTED SPINS

Flight testing has verified that the ASK 21 has an inverted spin mode. Testing has been conducted between 15.8 inches cg [401 mm] and the aft cg limit.

WARNING: *Intentional inverted spins are prohibited.*

Susceptibility

[..] Inverted spins become less likely to occur at cg's forward of 15.8 [401mm] inches since control positions become more critical. Overall, the ASK-21 is extremely resistant to inverted spins since only sustained inverted stalls result in spins, regardless of cg. Although testing indicates increased resistance forward of 15.8 inches cg [401 mm], this does not imply inverted spins at more forward cg's are impossible.

Characteristics

The inverted departure and spin entry are essentially a mirror image of the upright case. The nose falls to approximately 60 degrees nose low and then hesitates. Cockpit g forces build up to –2g and the nose then oscillates back up to 40 degrees nose low. The spin develops in approximately 180 degrees of rotation and is oscillatory just as the upright spin. Altitude loss is 200 to 300 feet per turn [61 to 91 m] and rotation rate is one turn every 3 to 2½ seconds. At the cg's tested, the inverted spin oscillations occur every ¾ to 1 turn. Once the spin is developed, gforces oscillate between –1 and –1.5g. Airspeed oscillates near 40 KIAS [75 km/h] and remains stalled throughout. Cockpit g forces are uncomfortable but other spin characteristics are very comparable to the upright case.

Inverted spin recovery is immediate (¼ to ½ turn) when controls are neutralized. Altitude loss from initiating recovery to level flight is 400 to 500 feet [122 to 152 m]. Since the spin includes a component of roll rate as well as yaw rate, the aircraft rolls to an upright attitude during recovery on its own, without further pilot input. Airspeeds are typically 90 to 100 KIAS maximum [167 to 185 km/h] during inverted spin dive recoveries.

Definitions

Term	Definition (see page 5 of USAF-report)
Departure	Event in poststall flight, that precipitated entry into a poststall gyration or spin. Momentary event, indicated by uncommanded, divergent aircraft motions, and synonymous with complete loss of control
Incipient spin	For the purpose of this report, an incipient spin means achieving a minimum of one turn, and the aircraft self-recovered in spite of maintaining prospin inputs.
Sustained Spin	For the purpose of this report, a sustained spin was a spin that continued at least five turns, or indefinitely, as long as prospin inputs were maintained.

VI. Weights and C.G. positions

You will find the min and max C.G. limits with regard to the glider empty weight on the diagram on page 37.

Min pilot weight front seat = 70 kg (154.3 lbs).
Max pilot weight both seats = 110 kg (242.5 lbs) each.

Pilot weight always means pilot + parachute. If the empty weight c.g. positions are within the permissible range, it is assured that also the in-flight c.g. is within the permissible range - provided that the load limitations (pilot weights) have been observed.

The max all up weight of 600 kg (1323 lbs) must not be exceeded. In the case that the empty weight comes to more than 380 kg (838 lbs), the max permissible pilot weights have to be reduced accordingly.

Weights of non-lift producing members

The weight of the non-lift producing members is composed of pilots' weights, fuselage, tail units, and equipment, - without the weight of the wings.

The weight limit of 410 kg (904 lbs) for the non-lift producing members must not be exceeded.

After repairs, repaintings or the installation of additional equipment, at the latest however every 4 years the empty weight and the c.g. positions must be re-established.

Table for spin ballast

When the plane is equipped with an attachment for spin ballast (TN4b):

After every weighing any spin ballast-table (Flight Manual page 47b) must be removed. Removing the spin ballast-table does not compromise the airworthiness of the ASK 21. But spin ballast may not be used without valid spin ballast-table.

A new table for the spin weights can be requested from the manufacturer. A copy of the weighing formula and the equipment list, signed and stamped by the inspector, must be forwarded to the manufacturer. The table is to be filed after page 47a in the Flight Manual.

VI.2 C.G. Positions at the last Weight & Balance

see also FM page 48

Date of weight & balance	Empty weight c.g. behind datum ((mm/in)	Front seat payload incl. chute (kg/lbs) min max	Rear seat payload incl. chute (kg/lbs) min max	Old spin ballast table* removed (check off)	Signature of inspector, in-spection stamp

* Flight Manual Page 47b

CAUTION: *As always, only calibrated scales may be used for weighing. The lever arms for determining the empty mass c.g. have to be determined during every new weighing.*

Weight, empty weight C.G. and payload have to be certified by an inspector on page 48 of the Flight Manual and on page 38 of the Instructions For Continued Airworthiness.

VI.3 Installation of *fixed* ballast in the tail

It may be necessary to install ballast in the tail in order to get the empty weight C.G. within the permissible range.

1. The amount of the lead ballast which is required is established either by calculation or by a weight and balance procedure.
2. Suitable cast lead plates are available with the company Schleicher.
3. Remove the rudder.
4. By use of a knife remove the tailskid very carefully. Grind off glue residues and other impurities.
5. From below drill a hole of 8mm (0,3in) diameter:
   centrically to the lead plate. The long side of the lead plate must be placed next to the vertical tail unit spar so that the plate will not turn.
6. Shorten the M8 screws, screw them on and safety with a selflocking nut. A washer must be added on each side.
7. Reglue the rubber skid with contact cement.
8. After the hardening smooth the tailskid/fuselage gap and tape it in order to prevent the peeling off or catching of long grass.
9. Refit the rudder and safety duly with castellated nut and cotter pin.

VII. Check Lists

Pre Flight Check

1. Main pins safetied?
2. Rear wing attachment pins: is the safety lock visible above the pin?
3. Horizontal tail unit pins safe tied? Is the spring retainer engaged?
4. Elevator pushrod connected? Safetied with a spring clip? Not applicable for gliders using the automatic elevator connection!
5. Aileron pushrods connected? Safetied with a spring clip? Do not forget the visible control through the access hole cover!
6. Airbrake pushrod connected? Satisfied with a spring clip? Do not forget the sight control through the access hole cover!
7. Check for foreign objects!

ATTENTION: *At all L'Hotellier quick release joints, one must be able to touch the ball pivot by feeling through the slot in the ball socket. Check the proper engagement of the safety lock by pushing it on to close!*

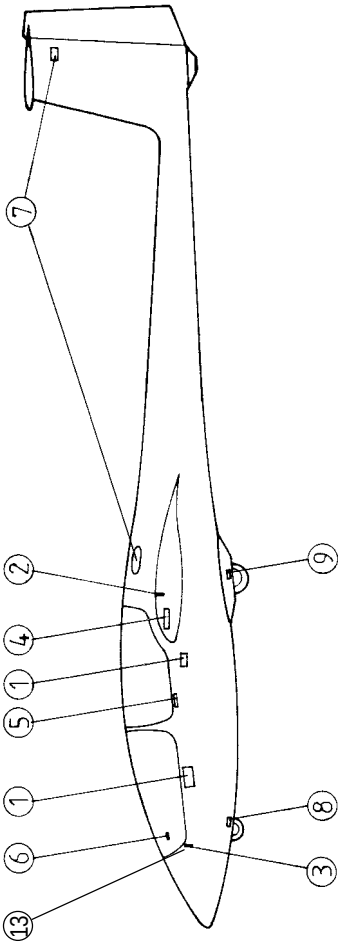
Pre take-off Check

1. Tail dolly removed – ballast checked?
2. Parachute properly fastened – raise line?
3. Safety harness properly fastened - all operating elements within reach?
4. Put your toes under the toe straps! Do not flatten the straps! Danger of jamming the pedals!
5. Airbrakes retracted and locked?
6. Placard for spin ballast?
7. Altimeter adjusted?
8. Radio on – Frequency and volume checked?
9. Trim adjusted?
10. Control circuit check – Controls easy to operate?
11. Airspace for start and release clear?
12. Check wind
13. Prepared for take-off interruption?
14. Both canopies closed and locked – Emergency jettisoning procedure in mind?

X. Placards and Markings

1. Data placard with weight & balance data;
   one placard each for the front and rear seat on the right cockpit wall.
2. Fire-proof type plate;
   on the right at the spar tunnel bottom.
3. Placard stating the approved Airworthiness Category; on the front instrument panel.
4. Max. baggage compartment loading,
   on placard each left and right on the rear cockpit wall close to the baggage compartment opening.
5. Placard on the rear instrument panel.
6. Placard for „Pre take off check“;
   on the underside of the front instrument panel cover so that the placard is visible when the canopy is open.
7. Placard on left side of top of fin.
   Note: This placard is cancelled if your glider features the automatic elevator connection. Placard in the access hole cover
8. Placard for tire pressure nose wheel: 2.0 bar (29 psi).
9. Placard for tire pressure main wheel: 2.7 bar (39 psi).
10. Airspeed indicator marking.
11. G-meter marking.
12. –
13. For gliders equipped with an attachment for spin ballast (TN4a):
    Placard for spin ballast (at the front instrument panel)
    (see XIII. Description of Symbolic Placards)

Settings of placards

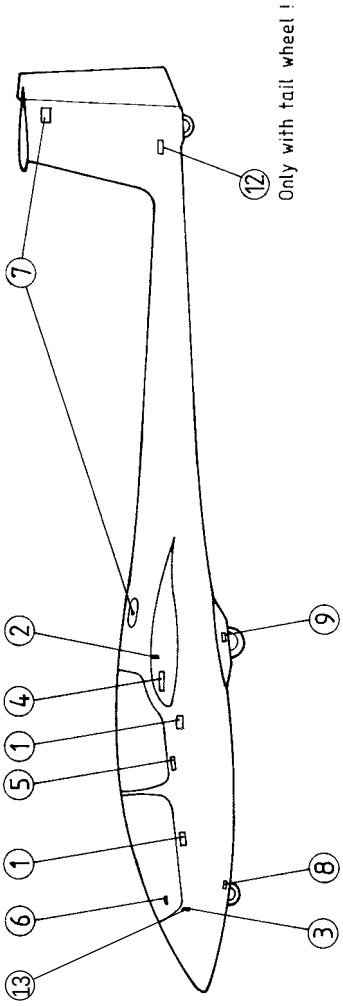


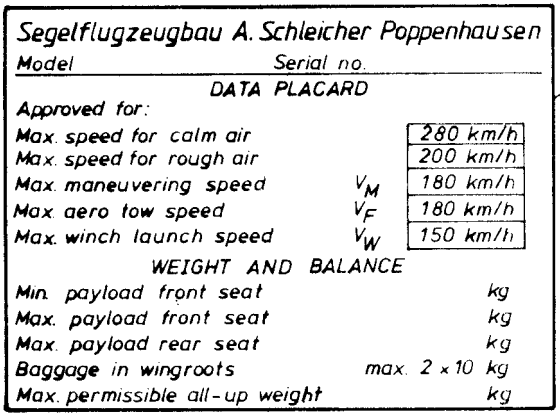
For tailwheel option only

X. Placards and Markings

1. Data placard with weight & balance data;
   one placard each for the front and rear seat on the right cockpit wall.
2. Fire-proof type plate;
   on the right at the spar tunnel bottom.
3. Placard stating the approved Airworthiness Category; on the front instrument panel.
4. Max. baggage compartment loading,
   on placard each left and right on the rear cockpit wall close to the baggage compartment opening.
5. Placard on the rear instrument panel.
6. Placard for „Pre take off check“;
   on the underside of the front instrument panel cover so that the placard is visible when the canopy is open.
7. Placard on left side of top of fin.
   Note: This placard is cancelled if your glider features the automatic elevator connection. Placard in the access hole cover
8. Placard for tire pressure nose wheel: 2.0 bar (29 psi).
9. Placard for tire pressure main wheel: 2.7 bar (39 psi).
10. Airspeed indicator marking.
11. G-meter marking.
12. Placard for tire pressure tail wheel: 2.5 bar (36 psi).
13. For gliders equipped with an attachment for spin ballast (TN4a):
    Placard for spin ballast (at the front instrument panel)
    (see XIII. Description of Symbolic Placards)

Settings of placards





Segelflugzeugbau A. Schleicher Poppenhausen

Model Serial no.

DATA PLACARD

Approved for:

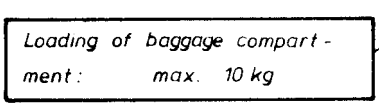
Max. speed for calm air		280 km/h
Max. speed for rough air		200 km/h
Max. maneuvering speed	V_M	180 km/h
Max. aero tow speed	V_F	180 km/h
Max. winch launch speed	V_W	150 km/h

WEIGHT AND BALANCE

Min. payload front seat	kg
Max. payload front seat	kg
Max. payload rear seat	kg
Baggage in wingroots	max. 2 x 10 kg
Max. permissible all-up weight	kg

1

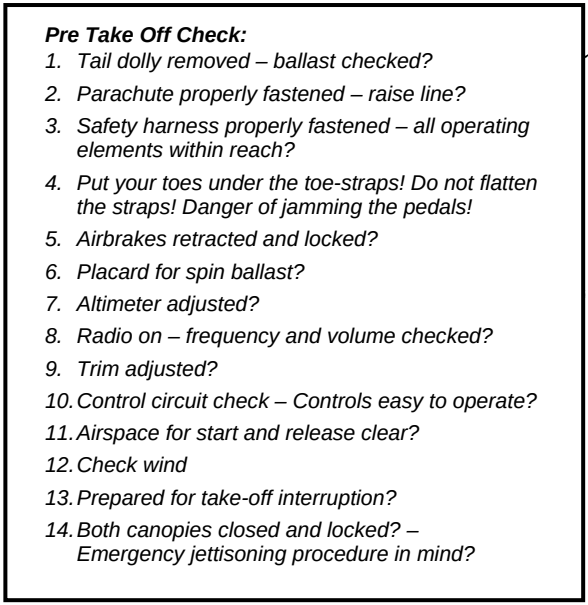
2 off



Loading of baggage compartment: max. 10 kg

4

2 off



Pre Take Off Check:

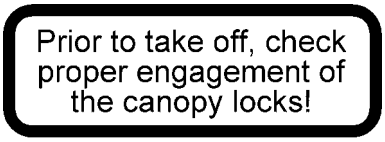
1. *Tail dolly removed – ballast checked?*
2. *Parachute properly fastened – raise line?*
3. *Safety harness properly fastened – all operating elements within reach?*
4. *Put your toes under the toe-straps! Do not flatten the straps! Danger of jamming the pedals!*
5. *Airbrakes retracted and locked?*
6. *Placard for spin ballast?*
7. *Altimeter adjusted?*
8. *Radio on – frequency and volume checked?*
9. *Trim adjusted?*
10. *Control circuit check – Controls easy to operate?*
11. *Airspace for start and release clear?*
12. *Check wind*
13. *Prepared for take-off interruption?*
14. *Both canopies closed and locked? – Emergency jettisoning procedure in mind?*

6

1 off

Canopy emergency jettisoning: push to the left the red flat knob above the instrument panel

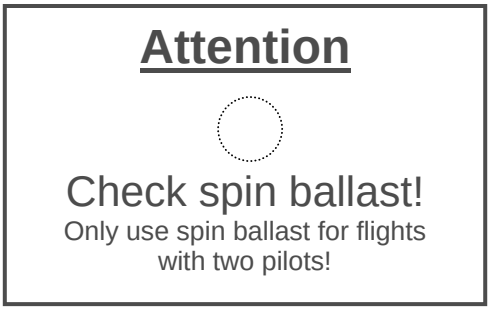
Ventilation



This placard must be fitted in the front and rear cockpit in full view of the pilot.

When the plane is equipped with an attachment for spin ballast (TN4b)

Placard at the front instrument panel, informing about mounted spin ballast.



A M8-screw must be mounted through the placard from the back. The placard is visible, when spin ballast is mounted on the tail (= DANGER). When spin ballast is removed, the placard is covered by the nut that otherwise holds the spin ballast.