

ASK 21 - Flight Manual

I.1 Amendments Record

No.	Title	PAGE	Date, signature
1	Weak link in towrope (TN no.6)	12	15.04.80 <i>[Signature]</i>

April 1980

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I.3 DESCRIPTION

The ASK 21 is a two-seater sailplane with T-tail, fixed nose wheel and dive brakes on upper wing. The main landing gear is sprung.

The sailplane is built in FRP-sandwich-monocoque construction. It may be used for school and high performance flights as well as for aerobatics of the Airworthiness Category 'A'.

Technical Data

Span	17.00 m	(55,74 ft)
Length	8,35 m	(27,38 ft)
Height	1,55 m	(5,08 ft)
Wing area	17,95 m ²	(192,95 sq.ft)
Aspect ratio	16,1	
Max all-up weight	600 kg	(1320 lbs)
Max wing loading	33,4kg/M ²	(6,84 lbs/sq.ft)

II. OPERATING LIMITATIONS

II.1 AIRWORTHINESS CATEGORY

Basis of the type-approval are the Airworthiness Requirements for Sailplanes and Powered Sailplanes (LFSM), issue Oct. 23, 1975, with the Airworthiness Category 'A' (Acrobatic).

II.2 OPERATION RANGE CLASSES

The operation range classes approved for the particular sailplane are indicated by a data placard on the instrument panel (see Maintenance Manual page). Depending on the respective equipment the sailplane may be licensed for traffic for the following operation range classes :

1. Airworthiness Category 'U' (UTILITY)
 - a. According to VFR (during daylight) - with equipment as per II.3 a.
 - b. Cloud flights - with equipment as per II.3 a and II.3 c.

2. Airworthiness Category 'A' (Acrobatic)
- with equipment as per II.3 a and II.3 b or II.3 a, II.3 b and II.3 c -
for the following aerobatics :

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

II.3 EQUIPMENT

a. Min. equipment

1. Airspeed indicator up to 300 km/h
2. Altimeter
3. Four-piece safety harness for front and rear seat
4. Seat cushions, at least 10cm thick when loaded, or parachutes (automatic or manual)
5. Weight and balance data placard (front and rear seat)
6. Data plate
7. Flight Manual

b. Equipment for aerobatics

For aerobatics the above min. equipment must be supplemented as follows :

1. Additional bottom strap for the safety harness
2. G-meter for front seat
3. Foot loops on rudder pedals
4. Parachute (automatic or manual)

c. Equipment for cloud flying

For cloud flying the above min. equipment must be supplemented as follows :

1. Variometer
2. Turn and bank indicator
3. Magnetic compass (compensated)
4. VHF transceiver radio

II.4 SPEEDS

Max speed calm air	$V_{NE} = ^*)280$ km/h (151 kts)
Max speed rough air	$V_B = 200$ km/h (108 kts)
Max maneuvering speed	$V_M = 180$ km/h (97 kts)
Max speed aerotow	$V_T = 180$ km/h (97 kts)
Max speed winch tow	$V_W = 150$ km/h (81 kts)

Rough air means turbulence found in wave-rotors, clouds, dust devils or when skimming mountain crests.

Maneuvering speed V_M is the highest speed at which full control deflections still may be applied.

With max speed V_{NE} only one third of the max possible deflections may be applied. One must also take into account that with increasing altitude the true airspeed is higher than the reading of the A.S.I. because of the decreasing air density.

True airspeed (TAS) is, however, relevant for safety against flutter.

*) The max indicated V_{NE} is reduced as follows according to altitude :

Altitude (M)	0-2000	3000	4000	5000	6000
V_{NE} indicated (km/h)	280	267	255	239	226

Altitude (ft)	5000	10000	15000	20000
V_{NE} indicated (kts)	151	144	132	121

The airspeed indicator must show the following color codes :

Green arc	80-180 km/h	(43- 97 kts)
Yellow arc	180-280 km/h	(97-151 kts)
Red radial line	at 280 km/h	(at 151 kts)
Yellow triangle	at 90 km/h	(at 48,5 kts)

II.5 LOAD FACTORS

The following load factors must not be exceeded :

at maneuvering speed V_M	+6,5	-4,0
at max speed V_{NE}	+5,3	-3,0
with airbrakes extended	+3,5	<u>±</u> 0

G-meter markings :

- a. positive range
 - yellow arc +5,3 to +6,5
 - red radial line at +6,5
- b. negative range
 - yellow arc -3,0 to -4,0
 - red radial line at -4,0

II.6 WEIGHTS

Empty weight	approx. 360kg	(792 lbs)
Max all-up weight	600kg	(1320 lbs)
Max weight of non lift producing members	410kg	(904 lbs)

II.7 IN FLIGHT C.G.

The in flight c.g. range is from 234mm to 469mm behind datum (9,21" to 18,46"); correspondingly 20,2 % up to 41,1 % of the mean aerodynamic chord,

$t_m = 1,121m$ (3'68") with $a = 8mm$ (0,32") behind wing leading edge; inner wing = datum point.

II.8 WEIGHT AND BALANCE INFORMATION

Min payload front seat	70kg	(154 lbs)
Max payload front seat	110kg	(242 lbs)
Max payload rear seat	110kg	(242 lbs)
Baggage in wingroots max	2 x 10kg	(2 x 22 lbs)

Neither the all up weight of 600kg (1320 lbs) nor the max weight of non-lift producing members + occupants & baggage of 410kg (904 lbs) must be exceeded.

The weight limitations on the basis of the last weighing are to be found on page 11 !

With this loading the in flight c.g. is in the permissible range.

Low weight in the front seat must be compensated by fixed ballast.

To II.8 WEIGHT AND BALANCE INFORMATION

With trim weights installed in the nose
please note the following :-

<u>Number of discs</u>	<u>Min. payload front seat (kg)</u>
1	68,5
2	67,0
3	66,0
4	64,5
5	63,0
6	61,5
7	60,0
8	59,0
9	57,5
10	56,0

Date of weight & balance	Empty weight c.g. (mm/in. behind datum)	Front seat kg/lbs payload incl. chute min max	Rear seat kg/lbs payload incl. chute min max	Signature of inspector, inspection stamp
29/11-01	322.1 kg @ 750.8 mm	110 kg	110 kg	

II.9 TOW RELEASES

For aerotow : nose release E 75

For winch tow : safety release Europa G 73

II.10 WEAK LINK IN TOW ROPE

Aerotow max. 600 ± 60 daN

Winch tow max. 850 ± 85 daN

II.11 TIRE PRESSURE

Main wheel 5.00-5 : 2,7 bar

Nose wheel 4.00-4 : 2,0 bar

II.12 CROSSWIND

The permissible crosswind component is about 15 km/h
(8 knots).

III. EMERGENCY PROCEDURES

III.1 RECOVERY FROM SPIN

According to the standard procedure spinning is terminated as follows :

1. Apply opposite rudder (i.e. apply rudder against the direction of rotation of the spin).
2. Short pause.
3. Release stick (i.e. give in to the pressure of the stick) until the rotation stops and sound airflow is established again.
4. Centralise rudder and allow sailplane to dive out.

The altitude loss from the beginning of the recovery until the normal flight attitude is about 80 meter (260 feet).

III.2 CANOPY JETTISONING AND EMERGENCY BAIL OUT

- Front canopy :
- a. Move lever with red knob above the instrument panel to the left and push canopy upwards.
 - b. Open safety harness.
 - c. Get up and bail out.
 - d. With manual chute seize release grip and pull out entirely after 1-3 seconds.

- Rear canopy :
- a. Pull back both canopy side locks and push canopy upwards.
 - b. Open safety harness.
 - c. Get up and bail out.
 - d. With manual chute seize release grip and pull out entirely after 1-3 seconds.

If circumstances allow, the front pilot should allow the rear pilot to bail out first.

III.3 FLIGHTS IN THE RAIN

With wet or slightly iced wings or insect accumulation there will be no deterioration in flight characteristics.

However, one has to reckon with a rather considerable deterioration in flight performance. This must be taken into account especially on landing final approach !!

Add a safety margin of 10 km/h (5,4 knots) for approach speed !!

III.4 WING DROPPING

The sailplane is extremely harmless. Nevertheless, one always has to face the possibility of wing dropping because of turbulence. In that case push stick forward immediately and apply opposite rudder until normal flight attitude is regained.

III.5 GROUND LOOPING

For normal conditions, smooth runway, short grass, one may take off with the wing on the ground without having to fear a change in direction.

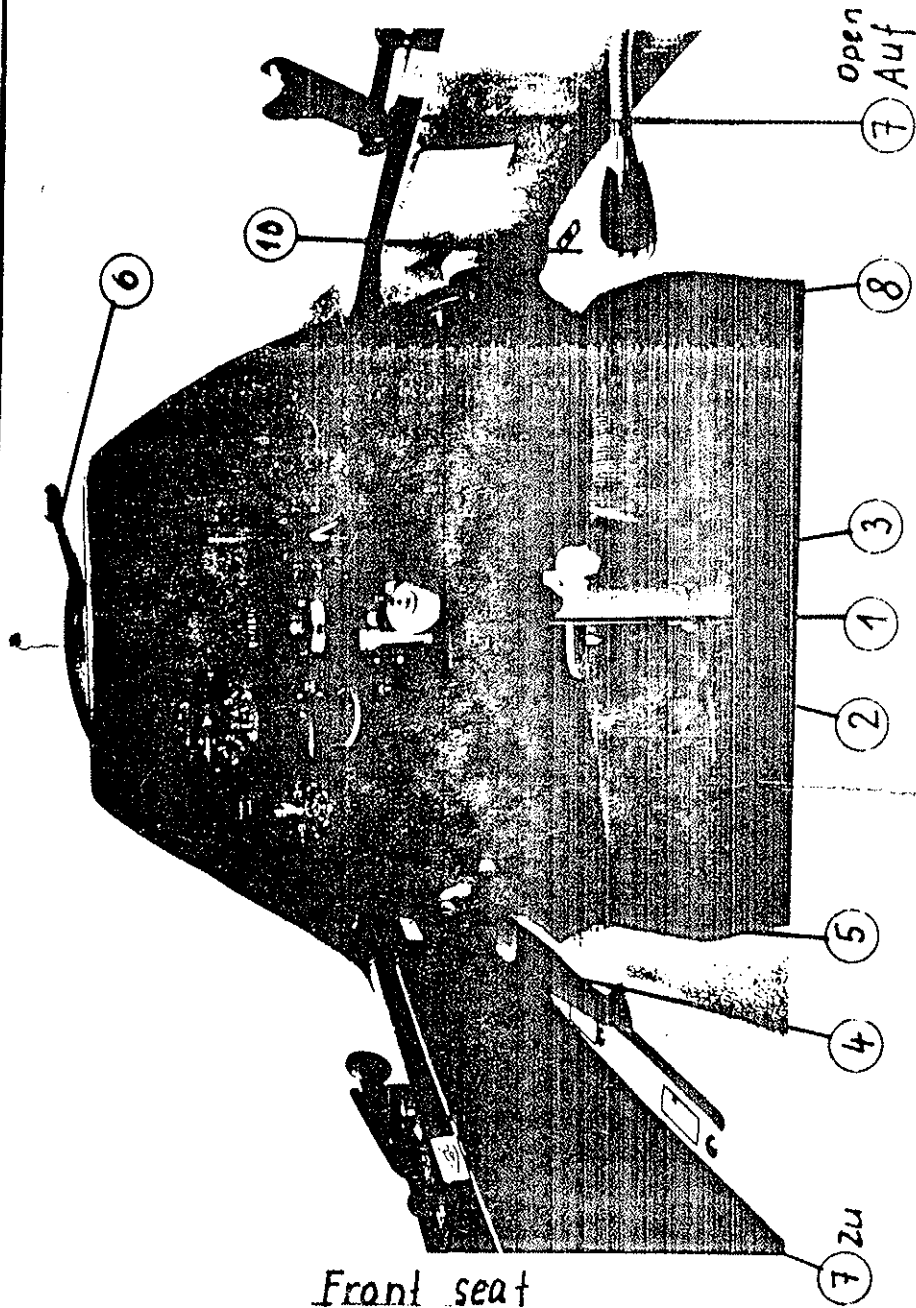
High grass and rough ground, however, may cause ground looping. In that case release tow rope immediately.

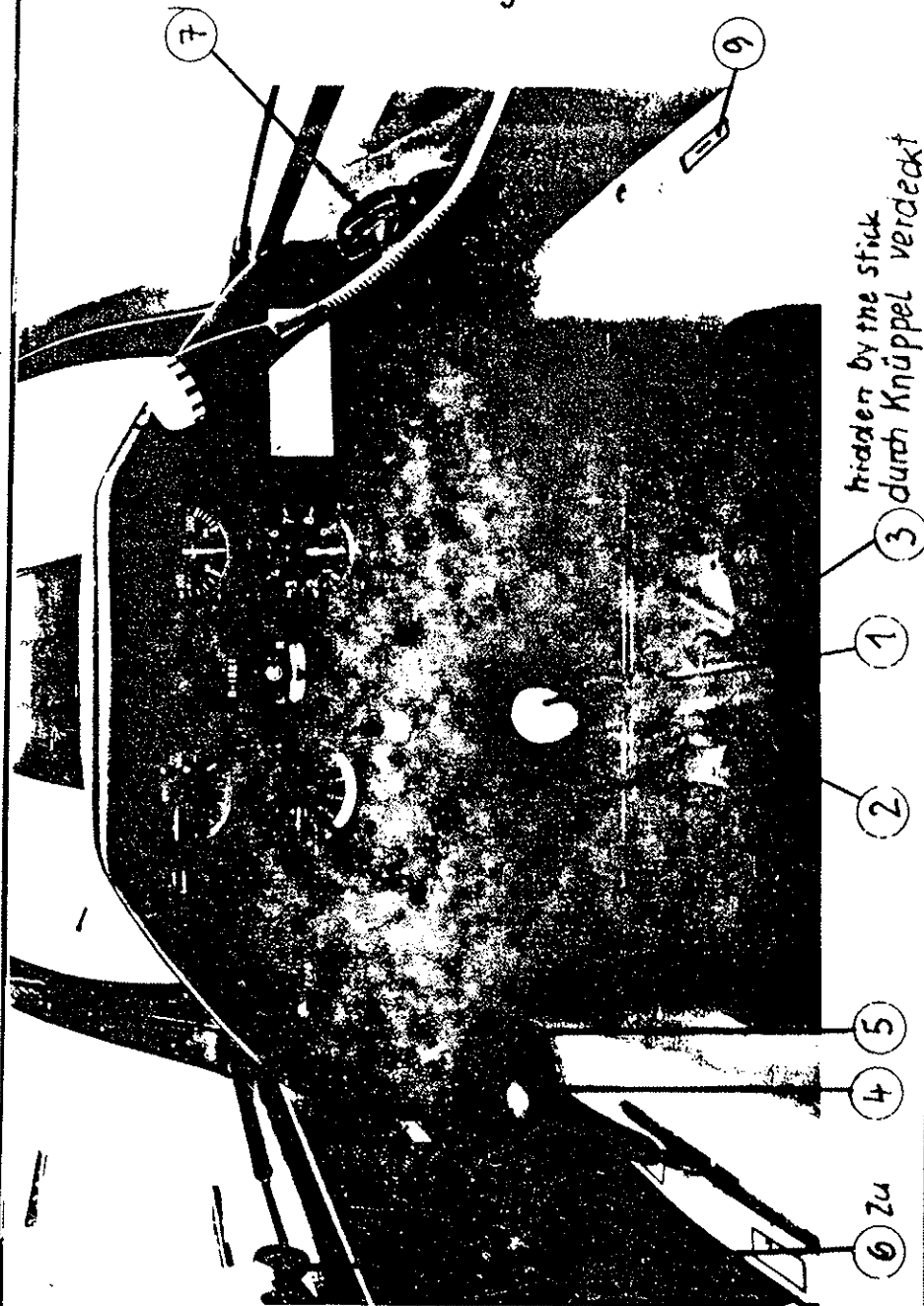
IV. NORMAL OPERATION PROCEDURES

IV.1 COCKPIT AND OPERATING LEVERS

Front seat :

- no. 1: Stick.
- no. 2: Trim; flat lever with green knob LH of stick.
- no. 3: Rudder pedal adjustment; grey knob at the console.
- no. 4: Airbrakes with wheelbrake; blue lever in the LH arm rest.
- no. 5: Release device; LH below canopy frame, yellow knob.
- no. 6: Canopy emergency jettisoning; horizontal lever with red, flat knob above instrument panel cover; to the left = OPEN.
- no. 7: Canopy locking; tilting lever LH and RH of canopy frame, white knob --
forwards for LOCKED
backwards for OPEN.
- no. 8: Ventilation nozzle; RH below canopy frame, pivoted and may be shut.
- no. 9: Back rest; the back rest may be adjusted by tilting the bottom upwards and forwards, see sketch page 20.
In its normal position the back rest cannot shift.
Very tall pilots may fly without back rest.
- no.10: Trim indicator; in the right arm rest behind the ventilation nozzle.



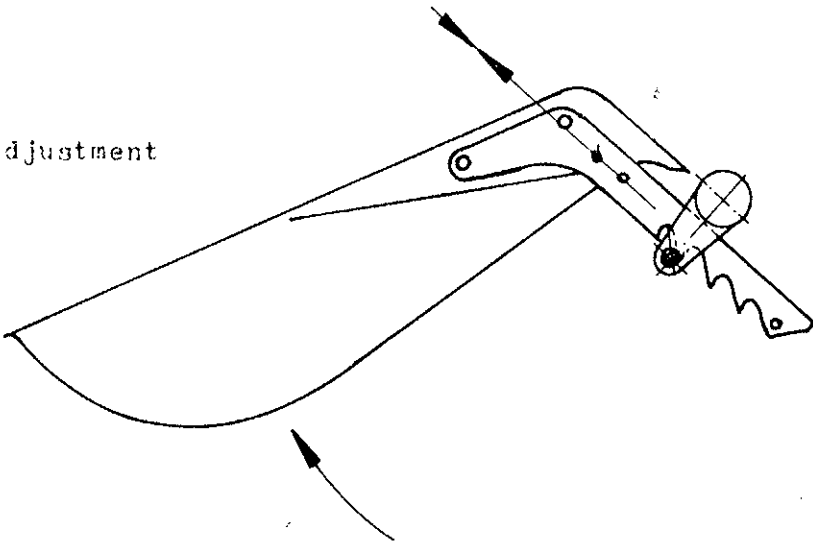


hidden by the stick
durch Knüppel verdeckt

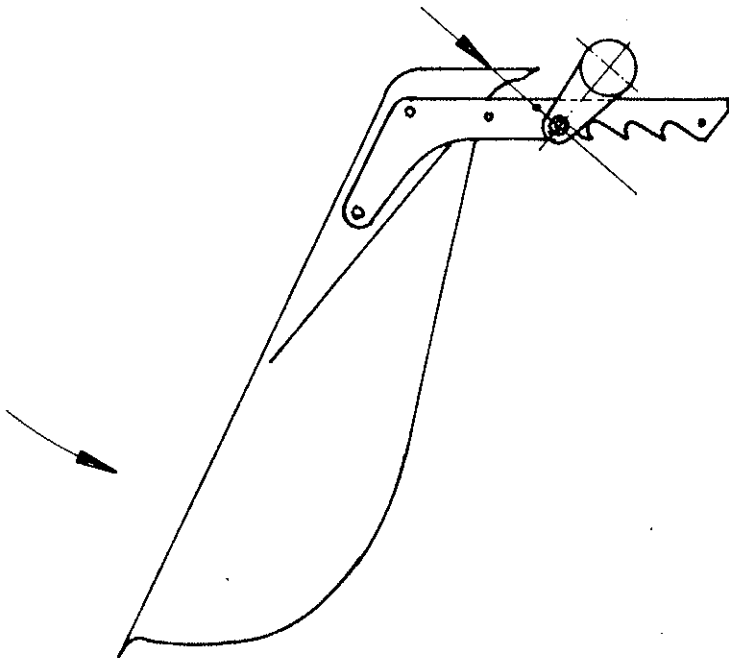
Rear seat

BACK REST ADJUSTMENT

Adjustment

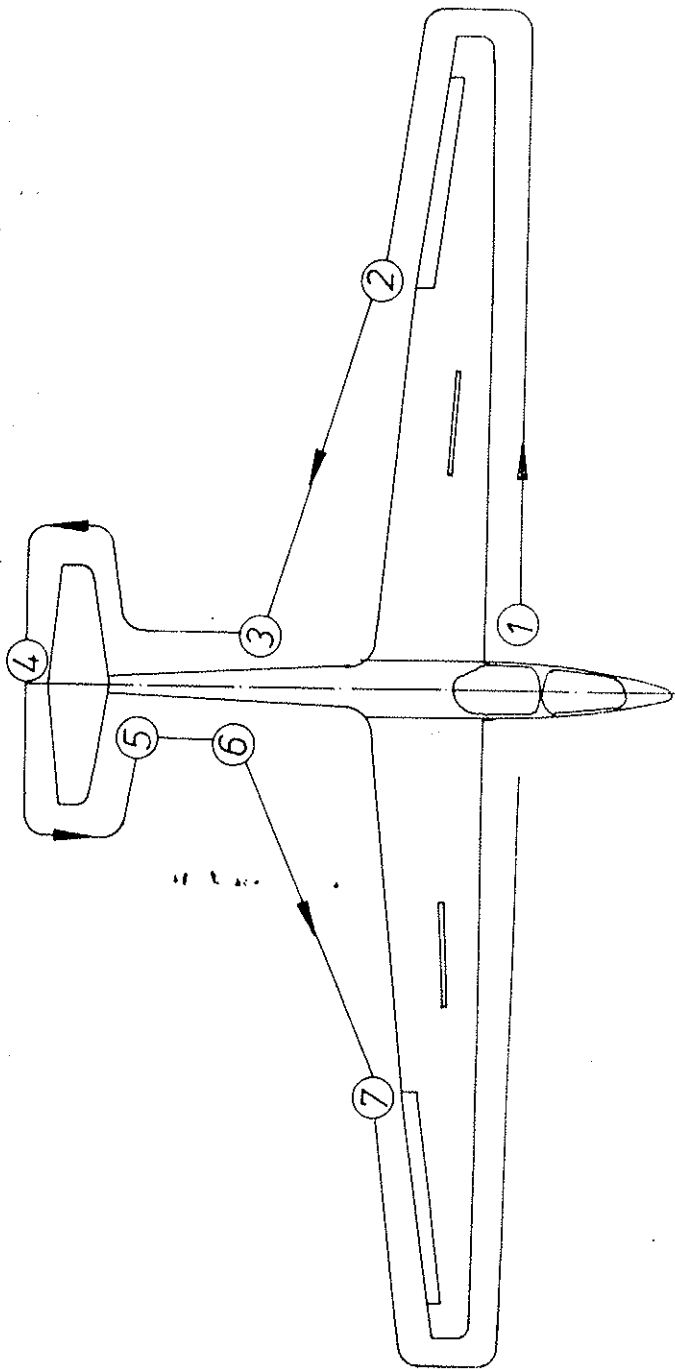


Engaged



IV.2 DAILY CHECKS

- 1.a. Open canopy ! Check whether the lock catches of the main pins are properly engaged.
- b. Check aileron and airbrake connections in the fuselage through the access hole on the LH side above the wing.
- c. Check for foreign objects !
- d. Check control circuits force and for full deflections. Apply full deflections and load the control circuits with fixed controls and airbrakes.
- e. Check tire pressure !
Nose wheel 2,0 bar
Main wheel 2,7 bar.
- f. Check condition and operation of tow release. Operate release : does it snap back freely? Engage and disengage the ring pair. Check the automatic release of the c.g. release with the ring pair which must release automatically backwards.
- g. Check wheelbrake : pull airbrake lever; at the end of its travel an elastic resistance must be felt.
- 2.a. Check upper and lower wing surface for damages !
- b. Aileron : check its condition, full deflection and ease of operation. Check pushrod connection !
- c. Airbrake : check its condition, its fit and its locking !
3. Check fuselage for damages, especially the bottom !
4. Check tail unit for correct assembly and locking. Check pushrod connection !



DAILY CHECKS (see IV.2)

5. Check condition of tailskid, pitot tube and venturi tube !
6. Check static vents for cleanness !
7. See 2.

After rough landings or excessive flight stress the whole sailplane must be checked with the wings and tail unit removed. If any damage is found, a technical inspector must be called in. On no account one must take off again before the damage has been repaired.

See also Maintenance Manual !!

IV.3 PRE TAKE OFF CHECK

1. Controls easy to operate ?? (Control circuits check done ??)
2. Airbrakes locked ??
3. Trim neutral ??
4. Canopy locked ?? Pay especially attention to the rear canopy !
5. Safety harness and parachute fastened ?? (Parachute static line engaged with automatic parachute ??)
6. Altimeter adjusted to field height or to zero ??
7. Radio "on" and adjusted to proper frequency ??

IV.4 TAKE OFF

Winch tow :

Trim neutral.

Max tow speed : 150 km/h (81 kts).

The sailplane features a tow release for winch tow in front of the main wheel.

The most favorable tow speed is 90 - 110 km/h (49 - 60 kts).

There is little pitch up tendency during the initial tow. In the upper third of the tow additional altitude may be gained by slight back pressure.

Tow release : pull the release knob to the stop several times.

Aero tow :

Aero tows only with the nose release in front of the nose wheel.

Recommended tow rope length : 30-60 m (98-197 ft); textile rope.

Trim neutral.

Max tow speed : 180 km/h (97 kts).

The most favorable tow speed during climb is 90 - km/h (49 - 76 kts).

Take off may be done with the wingtip on the ground. Getting the wings level is no problem. However, the pilot is advised to be careful with high grass and very rough ground.

Take off takes place at about 75 km/h (40 kts).

IV.5 FREE FLIGHT

The sailplane may be flown up to $V_{NE} = 280$ km/h (151 kts), see also page 8.

Up to maneuvering speed of 180 km/h (97 kts) full control deflections can be applied. At higher speeds the controls must be applied more carefully.

At V_{NE} only one third of the max possible deflections must be applied.

IV.6 LOW SPEED FLIGHT AND WING DROPPING

With the stick back a distinct tail buffet is felt.

The sailplane is very harmless in low speed flight. By use of normal aileron deflections the wings may be kept level up to min speed, even with aft c.g. positions.

With normal rudder deflections no wing dropping is found. Yaw angles of up to 5° have no significant influence on the wing dropping attitude.

Also rapid pulling up into 30° pitch does not cause wing dropping, but only a gentle nose drop. The same applies for stalling out of a 45° turn.

But one has to point out that even the most harmless sailplane needs speed in order to be controllable.

In turbulence this is especially important.

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

Single

All up weight 470kg (1034 lbs) :

without airbrakes	65 km/h	(35 kts)	IAS
with airbrakes	68 km/h	(37 kts)	IAS

Dual

All up weight 600kg (1320 lbs) :

without airbrakes	74 km/h	(40 kts)	IAS
with airbrakes	77 km/h	(42 kts)	IAS

IV.7 HIGH SPEED FLIGHT

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

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

IV.8 CLOUD FLYING

Min equipment for could flying according to paras II.3 a and II.3 c.

According to past experiences the airspeed indicator system is not exposed to the danger of icing-up. However, with very strong icing-up the pilot must always take into account the possible failure of the airspeed indicator. When planning cloud flying, he must take this point into consideration.

Excessive speeds during cloud flying must be avoided in any case. The pilot should try to keep an average speed of about 100 km/h (54 kts) and with increasing speed above 130 km/h (70 kts) he should use the airbrakes in order to control the speed.

Attention !!

Cloud flying must only be done by pilots having the necessary licence. The legal regulations with regard to airspace and the requirements for instruments have to be met.

IV.9 AEROBATICS

Attention aerobatic flyers !!

Even a sailplane which is approved for full aerobatics does not have infinite strength capacities. Most hazardous are aerobatics which get out of control or are badly executed, as they result in the high loads.

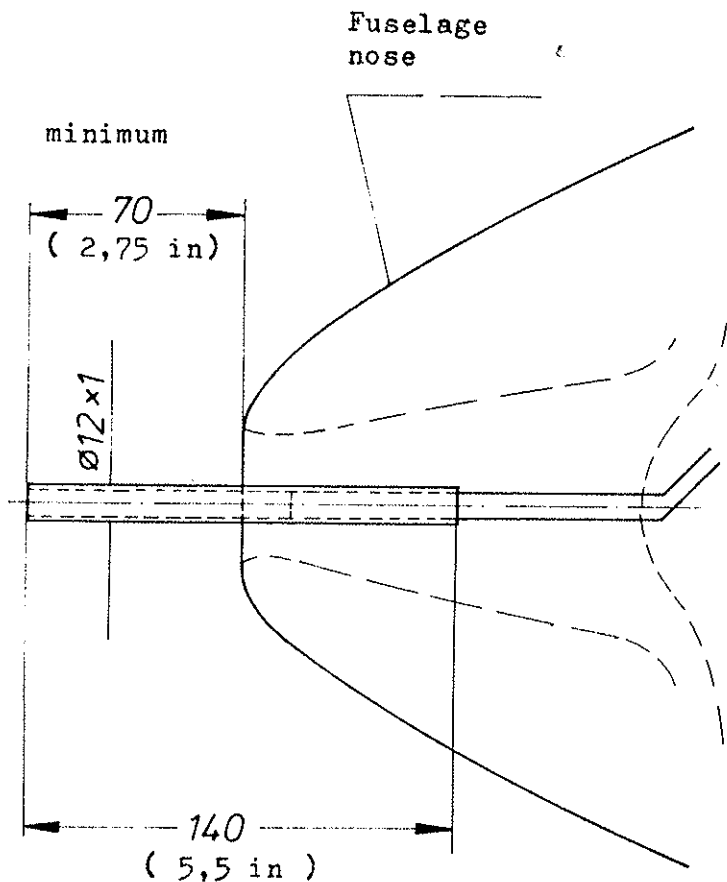
Therefore, it is urgently recommended to have oneself guided by an experienced flight instructor. The ASK 21 being an approved two-seater for full aerobatics offers this possibility.

Such guidance is even prescribed according to §69 (4) of the German 'LuftPersPO' (Aviation Personnel Test Regulations) dated January 9, 1976. Following §96 (3) of the said 'LuftPersPO' an adequate experience is required from flight instructors.

Note !!

The normal airspeed indicator system shows a large pressure error in inverted flight during which the airspeed indicator reads 40 km/h (22 kts) too low. When extending the pitot head by attaching a brass tube - 120 x 1; 140mm (5,5 in) in length - this error disappears. The tube must project in the front at least 70mm (2,75 in). For normal flights this is not necessary. In order to avoid damage when parking the sailplane in the hangar, this tube should not be left on any longer than necessary.

ASK 21 - FLIGHT MANUAL



Extension tube for total pressure head with inverted flight. Brass tube 140 mm (5,5 in) in length (12 \varnothing x 1).

One may also use a suitable plastic tube provided that it is sufficiently stiff and straight.

ASK 21 - Flight Manual

For the aerobatics hereafter mentioned the following entrance speeds are recommended :

	Indicated Entrance speed	Max Acceleration
Loop upward	single : 155km/h (84 kts)	2 - 3 g
	dual : 170km/h (92 kts)	
Stall Turn	single : 165km/h (89 kts)	3 g
	dual : 180km/h (97 kts)	
Split 'S'	single : 170km/h (92 kts)	2 - 3 g
	dual : 180km/h (97 kts)	
Immelmann	single : 165km/h (89 kts)	2,5 - 3,5g
	dual : 180km/h (97 kts)	
Slow Roll	single : 150km/h (81 kts)	
	dual : 165km/h (89 kts)	
Steep Climbing)		
Turns and Lazy)	single : 140km/h (76 kts)	
	dual : 150km/h (81 kts)	
Eight		
Chandelle	single : 160km/h (86 kts)	
	dual : 175km/h (95 kts)	

Permissible Indicated Speeds

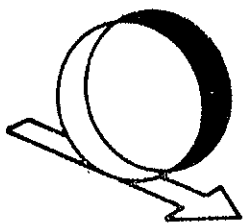
Inverted flight without pitot head extension :

V_{NE}	single	65-240 km/h	(35-130 kts)
	dual	70-240 km/h	(38-130 kts)

Indicated maneuvering speed	V_M	= 140 km/h (76 kts)
Indicated max speed	V_{NE}	= 240 km/h (130 kts)

Inverted flight with pitot head extension :

Indicated maneuvering speed	V_M	= 180 km/h (97 kts)
Indicated max speed	V_{NE}	= 280 km/h (151 kts)
Indicated stall speed		= 87 km/h (47 kts)
		with two occupants



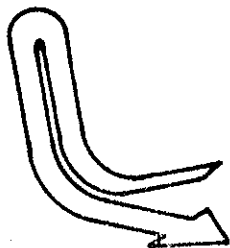
LOOP

Entrance speed :

single : 155 km/h

dual : 170 km/h

max. g = 2 - 3



STALL TURN

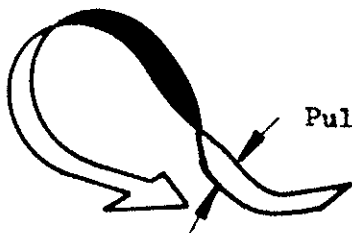
Entrance speed :

single : 165 km/h

dual : 180 km/h

max g = 3

SPLIT 'S'



Pull-up at least 30° !

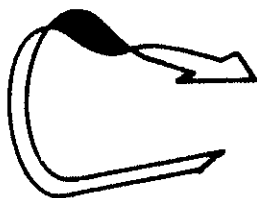
Altitude loss approx. 100 meter

Entrance speed :

single : 170 km/h

dual : 180 km/h

max. g = 2 - 3



IMMELMANN

Entrance speed :

single : 165 km/h

dual : 180 km/h

max. g = 2,5 - 3,5

SLOW ROLL



Entrance speed :

single : 150 km/h

dual : 165 km/h

INVERTED FLIGHT



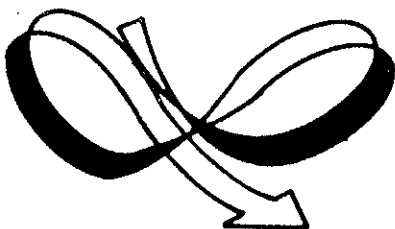
HALF LOOP

HALF ROLL

Note : with the inverted flight the fuselage nose will be unexpectedly high above the horizon.



SPIN

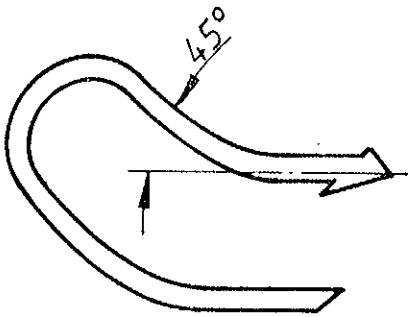


LAZY EIGHT

Entrance speed :

single : 140 km/h

dual : 150 km/h



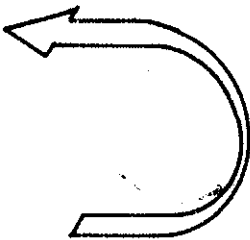
STEEP CLIMBING TURN

Entrance speed :

single : 140 km/h

dual : 150 km/h

CHANDELLE



Entrance speed :

single : 160 km/h

dual : 175 km/h

Attention !!

Never release stick and rudder pedals when flying aerobatics.

With 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 sailplane or as the speed increases unvoluntarily too rapidly.

Exception : "Tail sliding" !!

The trim remains in the center position for aerobatic maneuvers. Don't ever change the trim when flying aerobatics !!

PROHIBITED AEROBATICS :

All abrupt aerobatic maneuvers.

Loop forward.

Tail sliding.

IV.10 APPROACH AND LANDING

The most favorable approach speed is about 90 km/h (49 kts). With turbulence it may be advisable to increase the approach speed slightly. Even steep approaches may be slowed down efficiently with the airbrakes. It is advisable to unlock the airbrakes at the beginning of the landing final approach.

Note : The airbrakes increase the stalling speed by about 3 km/h (1,6 knots).

Sideslipping is also suitable as an approach control.

With full rudder during sideslipping the rudder pressure decreases to zero; the rudder must be pushed back.

V. RIGGING AND DERIGGING

V.1 RIGGING

Rigging may be done by 4 persons without any auxiliary device. If a fuselage trestle or a wing stand is available, the rigging may be done with three persons.

Prior to rigging all pins, pinholes and safeties must be cleaned and lubricated.

1. Set up the fuselage and keep it horizontal.
2. Insert left wing with 2-prong spar end into the tunnel. If available, put stand under wingtip.
3. Insert right wing.
4. Insert the two main pins and safety them with the safety hook at the spar tunnel. Never insert the rear wing pins prior to the main pins!
5. Insert rear attachment pins. Unscrew T-grip and check whether the safety lock is engaged.
6. Connect aileron ball fittings behind the spar tunnel. You must be able to touch the ball pivot by feeling through the slot in the socket. Press the safety lock.
7. Connect airbrake ball fittings behind the spar tunnel.
8. Insert horizontal tail from the front. Screw in the Allen bolt from above and tighten it with some pressure. The safety clip must be lying in one of the longitudinal slots of the Allen bolt.
9. Connect elevator.
10. Carry out pre flight check in accordance with check list.

11. Check operation of control circuits.
12. Check operation of wheelbrake and the tire pressure; see also IV.2 (Daily Checks).

V.2 DERIGGING

Derigging is done in reverse order of rigging. One must notice that the rear wing attachments pins have to be removed prior to the main pins.

V.3 PARKING

When parking the sailplane the canopies have to be locked.

V.4 ROAD TRANSPORT

The design of a sailplane trailer is a detailed subject and cannot be discussed in all details here. Of course, a closed trailer is preferable, but an open trailer may also serve its purpose. An open trailer is generally simpler and lighter. It is important that the individual components are well fixed and that they have a large support surface.

chleichers will supply general drawings of structural components for the building of a trailer on request.

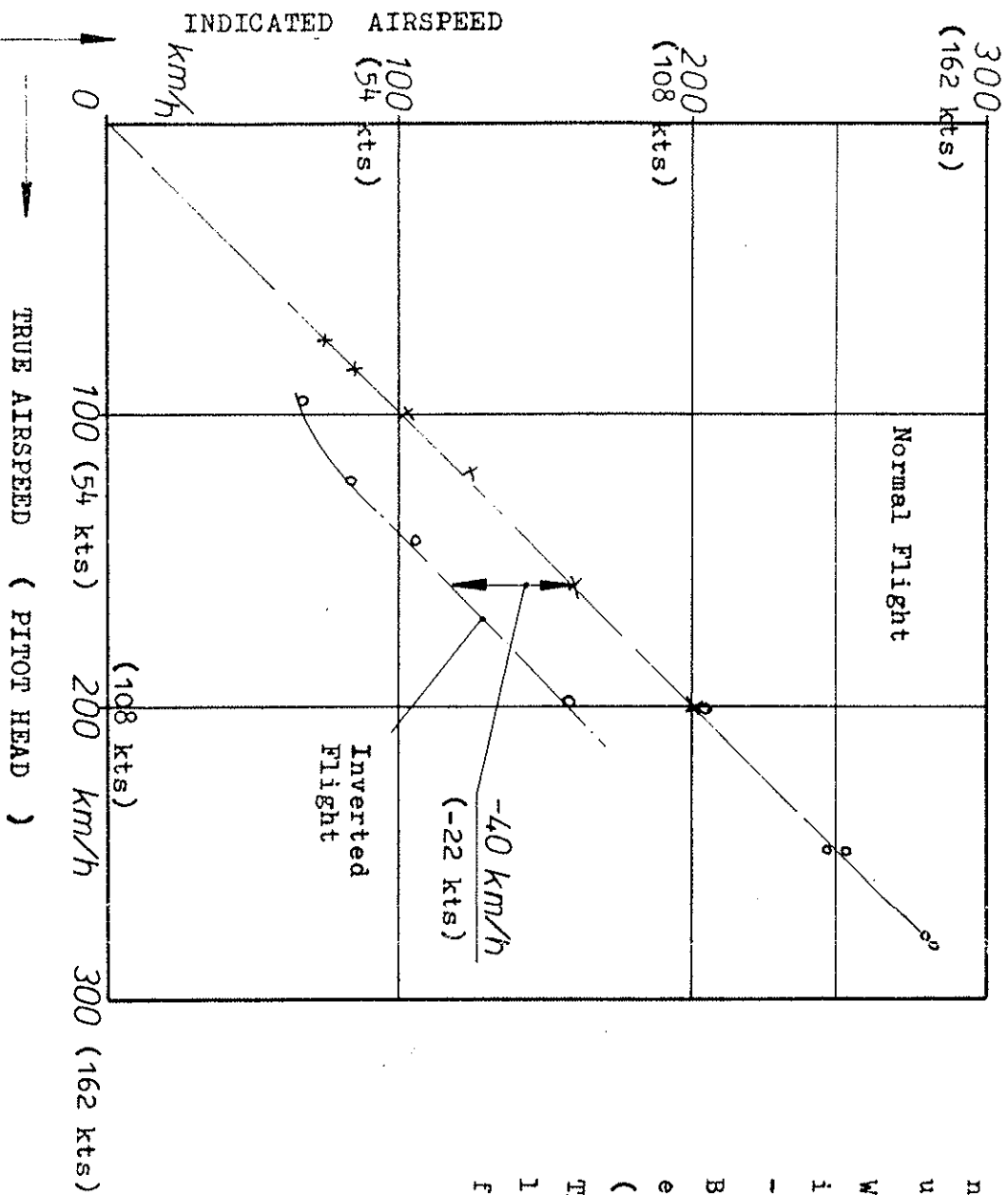
V.5 PREVENTIVE MAINTENANCE

The whole surface of the sailplane is painted with a weather resisting, white polyester polish paint. Impurities may be washed off with a mild cleansing agent. Heavy impurities may be removed with a polish.

For the paint maintenance only silicone-free agents are to be used (e.g. 1 Z-special cleansing agent-D2 from the company W.Sauer & Co., 5060 Bensberg, W. Germany, or the cleansing polish from the company Lesonal). Though the sailplane is rather insensitive, it should be protected as much as possible against moisture and humidity. If water has soaked into any components, these have to be stored in a dry room and must be turned over frequently.

The canopy is best cleaned with a special plexi-glass cleansing agent, in an emergency lukewarm water will do. Rewipe only with pure, soft leather or with glove cloth. Never wipe on dry plexiglass.

The safety harnesses must be regularly checked for damage and tears. The metal parts of the harnesses must be checked for corrosion.



POSITION ERROR

With normal flights the position error of the airspeed indicator is negligible within the whole range up to 280 km/h (151 kts).

With inverted flights the airspeed indicator reads too low, i.e. up to -40 km/h (22 kts).

By attaching an extension tube this error may be eliminated. (see also pages 27/28).

The extension tube must project at least 70 mm (2,75 in) past the fuselage nose.