Every pilot knows from his instruction time that the minimum speed goes up in steep turns or when loading the aircraft with ballast (fuel, flight instructor). In conformity to the same law as the minimum speed the speed ranges of the single flap settings do also shift by changement of the wing loading and/or the load factor.

The following table will show to you the coherencies. The data stated are based on performance measurements.

m/S [kg/m²]	Load-factor n	$V_{min.}$ [km/h] Flap L	Low-drag speed range [km/h] Flap 4	Flap 3	Flap 2	Flap 1
33	0,5	47	50 ÷ 60	60 ÷ 81	81 ÷ 117	over 117
33	1,0	66	70 ÷ 85	85 ÷ 114	114 ÷ 165	over 165
33	1,3	75	80 ÷ 97	97 ÷ 130	130 ÷ 188	over 188
33	2,0	93	99 ÷ 120	120 ÷ 161	161 ÷ 220*	over 220
43	0,5	54	57 ÷ 68	68 ÷ 92	92 ÷ 134	over 134
43	1,0	75	80 ÷ 97	97 ÷ 130	130 ÷ 188	over 188
43	1,3	86	91 ÷ 110	110 ÷ 148	148 ÷ 215	over 215
43	2,0	106	113 ÷ 137	137 ÷ 184	184 ÷ 220*	over 220

* Maximun speed for this flap setting!

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m/S [lb/sq.ft.]	Load-factor n	$V_{min.}$ [kts] FlapL	Low-drag speed range [kts] Flap 4	Flap 3	Flap 2	Flap 1
6,75	0,5	25,5	27 ÷ 32,5	32,5 ÷ 43,5	43,5 ÷ 63	over 63
6,75	1,0	35,5	38 ÷ 46	46 ÷ 61,5	61,5 ÷ 89	over 89
6,75	1,3	40,5	43 ÷ 52,5	52,5 ÷ 70	70 ÷ 101,5	over 101,5
6,75	2,0	50	53,5 ÷ 65	65 ÷ 87	87 ÷ 118,5*	over 118,5
8,8	0,5	29	31 ÷ 36,5	36,5 ÷ 50	50 ÷ 72	over 72
8,8	1,0	40,5	43 ÷ 52,5	52,5 ÷ 70	70 ÷ 101,5	over 101,5
8,8	1,3	46,5	49 ÷ 59	59 ÷ 80	80 ÷ 116	over 116
8,8	2,0	57	61 ÷ 74	74 ÷ 99	99 ÷ 118,5*	over 118,5

* Maximun speed for this flap setting!

Now these above-mentioned coherencies should not confound the ASW 20-pilot nor make him give up because it is too complicated. There is a very simple method of estimating the correct flight attitude.

The flap has been designed such that the changement of the angle of attack produced by flap deflection just compensates the difference of angle of attack which results from the new flight attitude. This means that the fuselage and tailplane remain always almost parallel to the airflow.

Since the glide angle is very flat for the whole speed range of the ASW 20, the relation of the ship to the horizon remains the same for load factor 1 (1g) provided that the flaps are used properly. A simple pitch indicator will move only in a small range, even in turns and other accelerated maneuvers, and, therefore, is a good control instrument for the low drag- angle of attack. (This is, however, not true for flap position L or for extended air brakes because in this case you are leaving intentionally the aerodynamically optimum ranges in order to produce more drag).

The table also shows the control actions for some flight maneuvers.

Principally, a flapped glider has two pitch controls : flaps and elevator. However, only one combination of both control settings results in optimum performance for a given flight attitude.

Case 1

Acceleration from thermalling to fast cruise :

According to the law that energy remains constant we can only pick up speed (kinetic energy) by giving away altitude (potential or static energy) with regard to the air around us. This is only possible by reducing our g-load (or load factor) below 1.

For thermalling our speed was 85 km/h and n = 1.3 (because of 40° bank) in flap position 4. Now we want to accelerate downwards (n = o.5) and, pursuant to our table, therefore simultaneously must reduce bank and put the lever at least into No. 2 position, but as soon as our speed exceeds 93 km/h we must even put the flap lever into position No.1. If we now do not do anything else, the static stability of the sailplane will balance out at approximately 120 to 150 km/h and load factor 1.

The stick shows only little movement during the whole maneuver which manifest itself also by the fact that the trim hardly needs to be adjusted. With a conventional rigid profile wing the whole trim range would be needed for such a maneuver.

Case 2

Pullup into a thermal from very high speed (wing loading 33 kp/m^2) :

From fast cruise of 200 km/h (1g) a pullup into a thermal shall be done. This is impossible without increasing the load factor. Since turbulence is to be expected, a mild 1.3 g - pullup should be initiated.

A glance at the table shows that at n = 1,3 and 200 km/h (108 kts) the pilot should still fly at flap setting 1.

Hence the pull up should first be started by pulling in up elevator. At about 188 km/h (101,5 kts) flap setting 2 is selected. The aircraft is now climbing so steeply that the elevator can be neutralized to produce a straight climb at n = 1; flap setting 2 is best up to approximately 114 km/h (61,5 kts), then flap setting 3 is selected. In order to end the climb, we briefly select flap setting 2 which produces n = 0,5, start the thermal turn at about 85 km/h (46 kts) and select directly flap setting 4. During this maneuver also the control stick is only required to make very minor corrective movements and the trim will need only slight adjustment.

On a flapped glider the flap control is the more active means of pitch control while the elevator is more or less a corrective control.

The flap control affects the lift of the wing directly and is, therefore, much more sensitive than the elevator control which alters the angle of incidence of the wing by rotating the aircraft and, therefore, alters the lift relatively slowly.

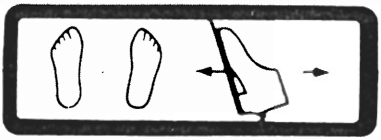
During high-speed flight above 180 km/h (97 kts) the elevator control alone is used, as the flap setting 1 covers a large angle of incidence range.

When flying close to the ground (landing approach, ridge soaring, passing the finishing line) and also when thermalling together with several aircraft, the flaps must on no account be operated, because of the resultant abrupt changes in altitude which are difficult for the pilot to judge.

1.2. Operating Handles, Placards, and Nomenclatures

Stick with wheelbrake lever and transmitter button (optional).

Rudder pedal with longitudinal adjustment.

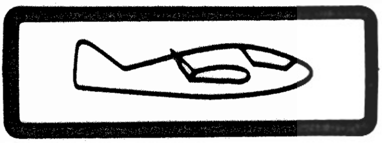


Rudder pedal adjustment : grey knob RH of control stick

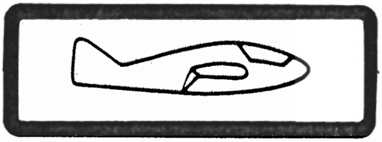
To move pedals back :
Take load off pedals and pull back. Release control knob suddenly and put slight pressure on pedals to adjust them.
To move pedals forward :
Pull knob and simultaneously push pedals forward. Release control knob suddenly and lock in place by putting slight pressure on pedals.

Flap control : Black lever on upper LH cockpit wall.

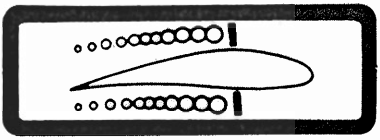
Marking of the essential flap positions by numbers 1, 2, 3, 4, and L below the flap lever.



FLap lever in high speed position



Flap lever in landing position



Air brakes (spoilers): Blue lever on LH cockpit wall. Extending of air brakes by pulling lever backwards.

Serial number and Type Plate:

A. Schleicher
6416 Poppenhausen

Muster:	AS-W20
Werk Nr:	20 XXX
Kennz:	

Made in West Germany

loading of baggage compartment:

Loading of baggage max.
campartment 15 kp [33 lb]

Data Placard and loading scheme:

Segelflugzeugbau A.Schleicher Poppenhausen

Type: ASW 20 S.No.

Data plate

Permission for:

Winch Launch	up to	
Aero tow	up to	
Max. speed	up to	
Maneuvering speed	up to	
Max. speed for flaps pos.	1	
Max. speed for flaps pos.	2	
Max. speed for flaps pos.	3	
Max. speed for flaps pos.	4	
Max. speed for flaps pos.	L	
Gear down	up to	

Weight and Balance

single	max.		min.	
dual				

Max. permissible all up weight

1.3.

Operation Values and Limitations

Maximum indicated airspeeds

(equivalent airspeeds are about 5 % higher, see page 49)

For flap position 1 (below 3000 m m.s.l. / 9000 feet m.s.l. *)	265 km /h(143 knots)
For flap position 2	200 km/h (108 knots)
For flap position 3	200 km/h (108 knots)
For flap position 4	160 km/h (86 knots)
For flap position L (landing pos.)	120 km/h (65 knots)
In rough air **	180 km/h (97 knots)
With full control deflections (maneuver speed)	175 km/h (94 knots)
For winch and auto tow	120 km/h (65 knots)
For aerotow	175 km/h (94 knots)
For extending landing gear	175 km/h (94 knots)

For this purpose the following colored calibration markings appear on the airspeed indicator :

Red line at		265 km/h	(143 knots)
Green range between		90 and 180 km/h	(48,5 and 97 knots)
Yellow range between		180 and 265 km/h	(97 and 143 knots)
White range between		85 and 200 km/h	(46 and 108 knots)
White marking	WK L at	120 km/h	(65 knots)
	WK 4 at	160 km/h	(86 knots)
	WK 2 and 3 at	200 km/h	(108 knots)

The yellow ▷ at 90 km/h shows the recommended approach speed for landing.

* Please note : The inflight flutter tests are done at about 2.500 m to 3.500 m m.s.l.
Since the airspeed indicator reads too low values

For flap position L (flaps 38° down, ailerons -8° up) minimum speed in level flight is :

66 km/h or 35,5 knots
(75 km/h or 40,5 knots).

Extending of the airbrakes (spoilers) increases minimum speeds by approx. 7 km/h or 4 knots.

In bankings the minimum speeds are increased. An increase of 10 % is valid for 30° bank, 20 % are valid for 45° bank.

About the proper use of flap settings this manual has already informed you at length in the preface page 8.

Maximum approved wing loading is not always the most favorable, the type of flight rather has to be considered.

For long distance flights ballast is not necessary, since the optimization of weak morning and evening thermals matters and not a slightly increased cruising speed.

For speed tasks the following wing loadings are proposed :

0 to 1 m/s (200 feet per min.), flying weight should be as low as possible (wing loading below 33 kg/m² or 6,75 lbs per sq.ft.)

1,5 m/s (300 feet per min.), flying weight about 360 kg or 800 lbs (wing loading 35 kg/m² or 7.2 lbs per sq.ft.)

If the rate of climb is higher than 2 m/s (400 feet per min.), the ASW 20 should fly with max. all up weight of 454 kg (1000 lbs).

Dangerous Flight Attitudes

The ASW 20 has an extremely harmless stalling flight which is indicated by large stick movements without noticeable speed change. The aileron effectivity, too, is noticeably weaker when stalling speed is reached. In all configurations approach to stall speed can be noticed by slight tail buffeting.
Even in stalled flight attitude (the vario will read 1,5 to 2 m/s sink in calm air, that is 300 to 400 feet per min.) ailerons and rudder work in the usual manner, as long as only half control deflections are applied. Full control deflections result in light wing dropping, whereas full deflected controls in opposite directions with stick pulled completely back will cause rapid wing dropping.
Initiated from turning flight wing dropping is more rapid than from level flight.
The loss in altitude for wing dropping is about 20 m (60 feet). For flap position L (landing position) loss in altitude can be 50 m until recovery, since the airflow may separate from the horizontal tail surface, if the elevator remains in full up deflected position. For recovery move stick in less pulled back position, until elevator effectivity is regained.
Only at rear C. of G. positions (near minimum cockpit load) the ASW 20 will not maintain a stationary stall with the stick hard back, but starts 'porpoising'.
Full deflections of rudder and aileron will cause wing dropping, opposite rudder and aileron deflections will lead to a spin. Wing dropping as well as spinning are terminated with the (German) standard procedure (opposite rudder and elevator neutral, see page 22).
If no corrective measures are taken, the sailplane will terminate the sideskid or spin by itself and will pass into a spiral-like side slip. This

side slip can also be terminated with opposite rudder, before the ship eventually changes to a spiraldive with the typical build-up of high speeds.
At forward C. of G. positions the ASW 20 spins very steeply and starts spiraldive after less than one turn, whereas at rear C. of G. positions the gliders pitch becomes steeper and steeper after an initial flat and slow turn (approx. 30° negative pitch) until the transition into spiraldive develops after 5 to 7 turns.
Rain drops, hoarfrost, and icing deteriorate the aerodynamic flow and will cause a change in flight characteristics. Therefore, a safety margin of 10 km/h, 5 knots or 7 mph should be added to the above speeds for level flight and circling. These speeds must be regarded as minimum speeds.
Again we point out that the ASW 20 spins easier and flater with positive (down) flap settings (4 and L) than with negative (up) flap settings (2 and 1).
Therefore, setting the flaps in negative positions is a measure to prevent wing dropping and spins. Because of the involved altitude losses (about 15 m or 50 feet) this is impossible near the ground or when thermalling in gaggles. Here only a safety margin in extra speed compared to minimum speed is good airmanship.

Landing

Lower the landing gear in time, at the latest in 100 m (300 feet) altitude, and put the flap lever in position No.4.
The approach normally should be made at about 90 km/h or 48,5 knots (yellow ▷ at airspeed indicator), this speed should be trimmed. For turbulent air a correspondingly faster speed must be flown. Only if the pilot is very sure that he can make the threshold of his airstrip, the flap lever is moved to position No. L (flaps 38° down).

Because of the enormous aerodynamic twist of this flap configuration (flap down, ailerons up) the performance of the sailplane is bad in this flap setting. By extending of the airbrakes (spoilers) the performance can be further reduced (glide ratio 5 in 1 at 85 km/h or 46 knots) so that very steep approaches are possible with headwind.

For strong headwinds flap setting No. L is not recommended because of the danger of landing short off the field.

Those pilots having no experience with flaps for landings should only use flap setting 4 for headwind landings !

Setting the flaps from position No. L back to position No.4 is not recommended near the ground because of the danger of loss in altitude. This maneuver should only be done after plenty of training at a safe altitude and in a very careful manner.
In flap position No.4 sideslipping is very effective with the ASW 20. At low bank and high yaw angles the loss in performance is great.
In flap position No. L such great yaw angles are impossible.

Because of the good landing qualities which can be achieved by flap setting L in combination with the variable effectivity of the spoilers sideslipping is restricted to extreme situations (approaches in rain, snow-showers or into the sun), since then the landing field can be observed more easily through the slide window.
Therefore, landing with sideslip should be practiced occasionally under good conditions.

Water ballast must be dumped before landing !

Control surface movements: ASW 20 B/BL / C/CL — Table dated: 07.04.83

Flap lever setting	Control stick position	STARBOARD WING Aileron MPE=79mm specified	actual	STARBOARD WING Flap MPE=148mm specified	actual	PORT WING Flap specified	actual	PORT WING Aileron specified	actual
(1) -12°	Right	- 22° ±2°		- 15° ±2°		- 9° ±2°		- 2,5° ±2°	
	Neutral	- 12° +1°		- 12° +1°		- 12° +1°		- 12° +1°	
	Left	- 2,5° ±2°		- 9° ±2°		- 15° ±2°		- 22° ±2°	
(2) -6°	Right	- 21° ±2°		- 10,5° ±2°		- 1,5° ±2°		+ 8° ±2°	
	Neutral	- 6° ±1°		- 6° ±1°		- 6° ±1°		- 6° ±1°	
	Left	+ 8° ±2°		- 1,5° ±2°		- 10,5° ±2°		- 21° ±2°	
(3) 0°	Right	- 16° ±2°		- 4,5° ±2°		+ 4,5° ±2°		+ 14° ±2°	
	Neutral	0° ±1°		0° ±1°		0° ±1°		0° ±1°	
	Left	+ 14° ±2°		+ 4,5° ±2°		- 4,5° ±2°		- 16° ±2°	
(4) +9°	Right	- 8° ±2°		+ 4,5° ±2°		+ 13,5° ±2°		+ 20° ±2°	
	Neutral	+ 7,5° ±1°		+ 9° ±1°		+ 9° ±1°		+ 7,5° ±1°	
	Left	+ 20° ±2°		+ 13,5° ±2°		+ 4,5° ±2°		- 8° ±2°	
(L) -8° Ail. +38° Flap	Right	- 21° ±3°		+ 34° ±3°		+ 42° ±3°		+ 4° ±3°	
	Neutral	- 8° ±1°		+ 38° ±2°		+ 38° ±2°		- 8° ±1°	
	Left	+ 4° ±3°		+ 42° ±3°		+ 34° ±3°		- 21° ±3°	

	MPE		specified	actual
Rudder	MPE*=310 mm	Right	30°±3°	
		Left	30°±3°	
Elevator	MPE=145 mm	up	-24°±3,5°	
		down	+20°±2°	

Datum:

Serial No:

Signature:

* MPE (Meßpunktentfernung zur Drehachse) = Distance from measuring point to pivot axis (m.m.)

Juw

Maximum permissible control surface play

The maximum permissible play can also be measured at the Measuring Points (MPE) at which the control surface deflections are measured. To do this, lock the controls in the cockpit so that they cannot move.

	MPE (mm / in)	Permissible play (mm / in)
Rudder	310 / 12,2	4,5 / 0,18
Elevator	145 / 5,71	3,0 / 0,12
Aileron	79 / 3,11	1,75 / 0,07
Camber-changing flap	148 / 5,83	2,75 / 0,11

CONTROL SURFACE WEIGHTS AND TAILHEAVY MASS BALANCE MOMENTS

	Mass (kg)*	Moment (daNcm)
Rudder	2,8 - 3,6	8,6 - 11,0
Elevator	2,1 - 2,7	6,6 - 8,4
Aileron	1,76 - 2,10	1,88 - 2,53
Camber-changing flap	3,64 - 4,46	7,07 - 9,23

(*The table in lbs and inlbs is given on page 46a.)

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The permissible control surface weights and tailheavy mass balance moments are:

	Mass (lbs)	Moment (inlbs)
Rudder	6,18 - 7,93	7,45 - 9,53
Elevator	4,63 - 5,95	5,72 - 7,28
Aileron	3,88 - 4,63	1,63 - 2,20
Camber-changing flap	8,02 - 9,83	6,14 - 8,01