ALEXANDER SCHLEICHER SEGELFLUGZEUGBAU
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M A I N T E N A N C E M A N U A L

for the sailplane model

A S K 2 1

This manual belongs to the sailplane ASK 21,

serial number .....

registration number .....

This manual is the translation of the German original which is approved by the LBA (Federal Office of Civil Aeronautics of the Fed. Rep. of Germany) as maintenance manual according to para 12 (1)2 of the German 'LuftGerPO' (Aviation Equipment Test Regulations).
The translation has been done by best knowledge and judgement. In any case the original text in German language is authoritative.

Edition 1980.

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Record of Revision

Rev. No.	Title	Page	Date Signature
1	Installation of tail weel, TN-No. 2	18 S, 47 S & 48 S	26.08.80
2	Modification release cable fairlead, TN-No. 10	43 a, 43 deleted	10.10.83
3	Automatic elevator Connection, TN-No. 11 Page 47 S and 48 S deleted, there are no pages 24 und 48 !	6 a, 7 a, 11 a, 40 a & 47 . 6, 7, 11, 40 & 47 deleted	09.03.84
4	Amendment to the Manuals in English language, TN-No. 14	56 a 56 deleted	28.05.84
5	New canopy locking system, TN-No. 15	55 a & 56 b, 55 & 56 a delet.	08.06.84
6	Change / supplement to the Maintenance Manual, TN-No. 20	40 a, 43 a, 43 b & 43 c	03.11.87
7	Amendment of the Maintenance Manual, Inspection program to increase the service life, TN-No. 24	21, 25, 31, 43 c to 43 f, 58 & Appendix	01.10.92
8	Rudder actuated by means of hand lever, TN-No. 25 (optional)	13 & 15	17.06.93

I. TECHNICAL DATA

Wing

Airfoil Wortmann FX S02 196 / S02 196 / 60-126
Span b = 17.0 m
Wing area F = 17,95 m^2
Aspect ratio b^2/F = 16,1
ti = 1,5 m (inner chord)
tk = 1,0 m (chord at aileron)
ta = 0,5 m (outer chord)
Angle of incidence at root $+2^o$
Dihedral Wing center line $+4^o$
Sweep of airfoil : Inner wing leading edge level.

Fuselage

Length	8.35 m
Cockpit widht outside	0.70 m
Cockpit height outside	1.04 m
Fuselage area	app. 12.33 m^2

Vertical tail unit

Height above fuselage center line	h_s = 1,37 m
Area	F_s = 1,357 m^2
Aspect ratio	1,383
Lower chord	1,17 m
Upper chord	0,80 m

Airfoil Wortmann FX 71-L-150/30

Rudder

% of vertical tail unit chord : 31 %
F = 0,42 m^2

Horizontal tail unit

SPan	3,1 m
Area	1,92 m
Aspect ratio	5,005
Inner chord	0,8 m
Outer chord	0,4 m
Airfoil Wortmann FX 71-L-150/30	

Elevator

Area	0,576 m^2
% of horizontal tail unit chord :	30 %

Airbrakes

(Schempp-Hirth type on upper wing only)

Area (for both)	F_{BK} = 0,326 m^2
Distance from wing center line	2,9 - 4,3m

Weights

Empty weight	app. 360 kg
Payload	240 kg
Max payload front seat	110 kg
Max payload rear seat	70 kg
Max all up weight	600 kg
Payload in % all up weight	40 %
Wing loading	24 - 33,4kg/m^2
Max weight of non lift producing parts	410 kg

II. DESCRIPTION OF A/C ASSEMBLY & EQUIPMENT

II.1. CONTROL SYSTEMS

Elevator control system

Both control sticks are built as 2-armed levers and feature universal joints. The control sticks are linked together by a main steel tube torsion rod at the bottom. This torsion rod features at its front and rear end an adjustable stop for both control sticks. Another bent steel tube torsion rod leads from the rear control stick to a combined elevator/aileron rocker arm. From there a short aluminum pushrod leads to a 180° duralumin bellcrank which is linked up by a long aluminum pushrod which runs through 4 support bearings; the support bearings consist of a fiberglass bracket with 3 ball bearings. Via a 90° duralumin bellcrank, the control forces are lead upwards into the fin using a fiberglass plastic pushrod. Here connects a 180° duralumin bellcrank to a short aluminum pushrod which in turn connects to a M12.41/HOTELLIER joint which operates the elevator.

Elevator with automatic connection:

Instead of the aluminum pushrod, an actuating pushrod is installed, which is supported with a parallel rocker.

Trim

The trim is spring suspended and consists of 2 trim levers, 1 connecting pushrod and the 2 trim springs with slotted gate sheet metal. The trim levers are connected to the control sticks with a knurled nut at the control

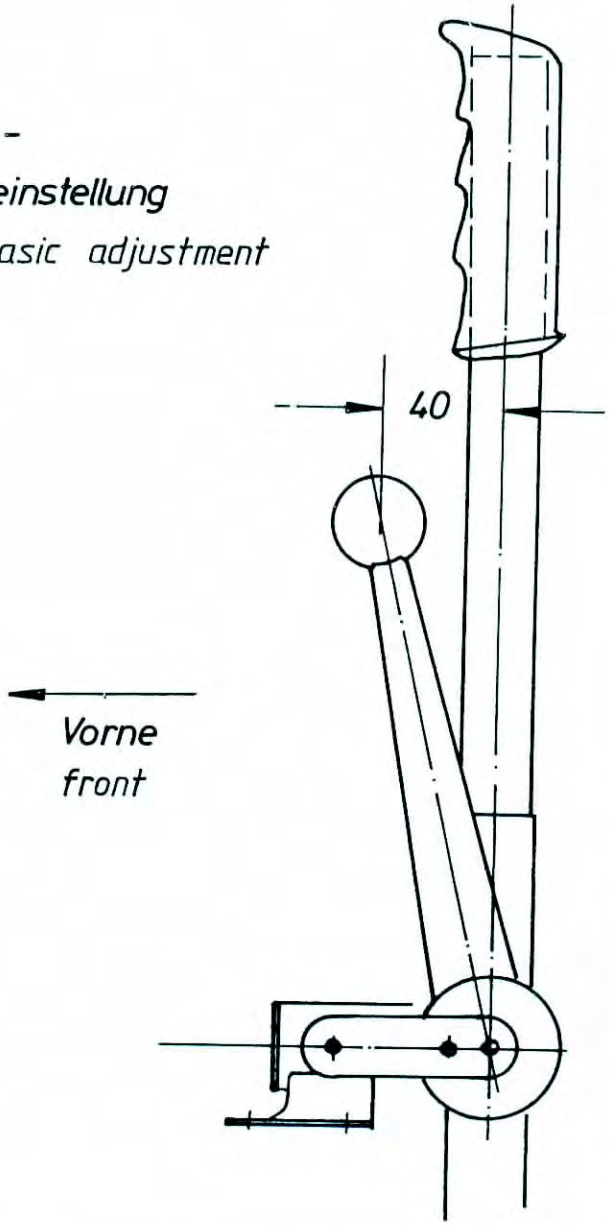
stick bearing bolt. A friction brake is tightened with this knurled nut at the control stick bearing bolt. The braking force should be distributed evenly between the front and rear brake. The brake should be tightened so strong that even with extremely opposed positions of stick and trim lever, the trim will not move. The trim connecting pushrod features a stop at its front and rear end. The springs with the adjusting plate between them, are suspended into the 2 rings of the front control shaft.
The adjusting plate itself is mounted to the bolt of the trim connecting pushrod; here the trim may be adjusted.
The trim should be adjusted such that with 1 pilot and the trim set full forward, a trimmed speed of 150-160 km/h (81-86,3 kts; 93,2-99,4 mph) is reached; then the trim lever is in a slightly forward position when the stick is free and in its center position (elevator connected).

To adjust the trim roughly to a trimmed speed of max. 160 km/h (86,3 kts; 99,4 mph):

1. Connect elevator.
   (This is inapplicable when your glider features the automatic elevator connection).

2. Adjust the trim spring such that the stick is set to the above-mentioned relative position to the trim lever. Friction must be balanced by "feeling for" the center position.

Trimm -
Grundeinstellung
Trim basic adjustment

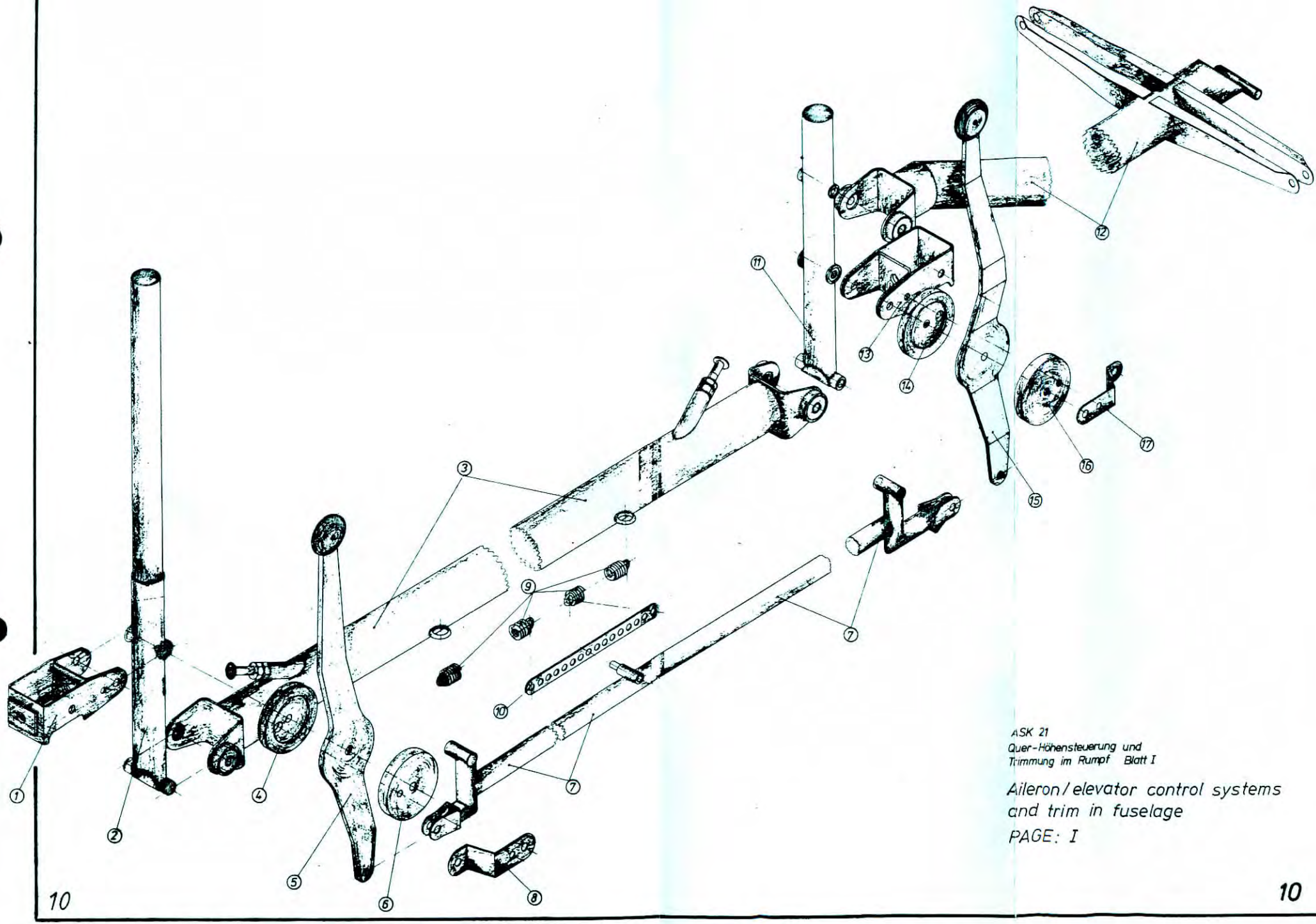


Trim indicator

In addition to the visible position of the trim lever the trim features a trim indicator. The trim indication should be in the center position when the trim lever is vertical to the glider's longitudinal axis. It can be adjusted by opening the clamp at the trim connecting pushrod and by displacing the Bowden cable. Then retighten the clamp.

Aileron control system

A short aluminum pushrod leads from the horizontal aileron control system lever at the rear elevator/aileron control system torsion rod upwards to a 90° duralumin bellcrank in the fuselage. By a Hotellier joint (M12.41) follows from here the long aluminum pushrod in the wing. This pushrod is supported altogether seven times in each three ball bearings. For the compensation of the bellcrank travels short steeltube pushrods are articulated by ballbearings (14C6) at both ends of the long pushrod. The inner short pushrod features the Hotellier connection with the adjusting screw. At the 90° duralumin bellcrank the aileron pushrod actuates the aileron through a Hirschmann-Unibal adjustable head (SMx CP6). The stops for the aileron are positioned in the pushrod box in front of the rear stick. These are two plywood blocks glued into the pushrod box and cut out such that they stop laterally the travel of the front torsion shaft.



ASK 21
Quer-Höhensteuerung und
Trimmung im Rumpf Blatt I

Aileron / elevator control systems and trim in fuselage
PAGE: I

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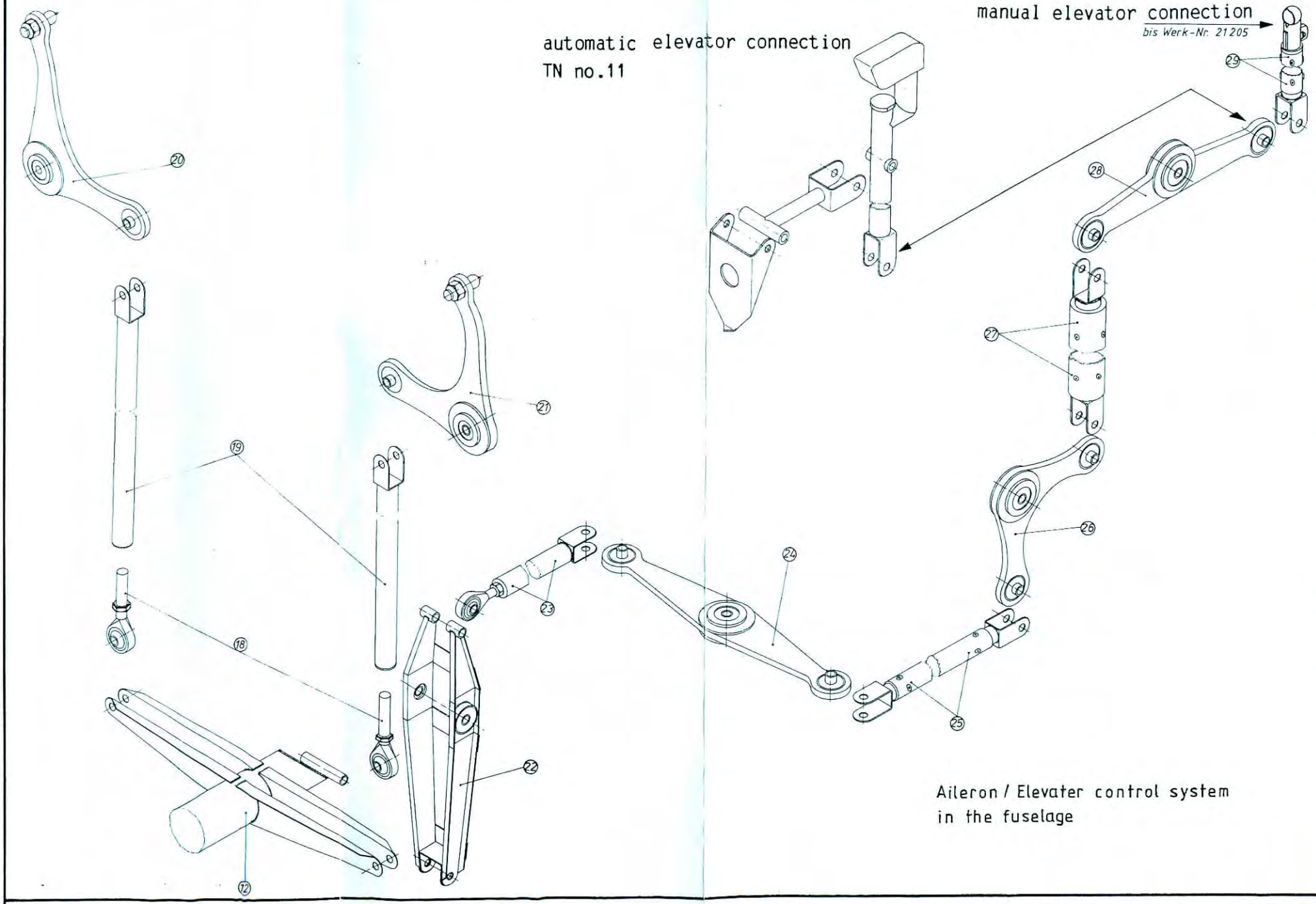
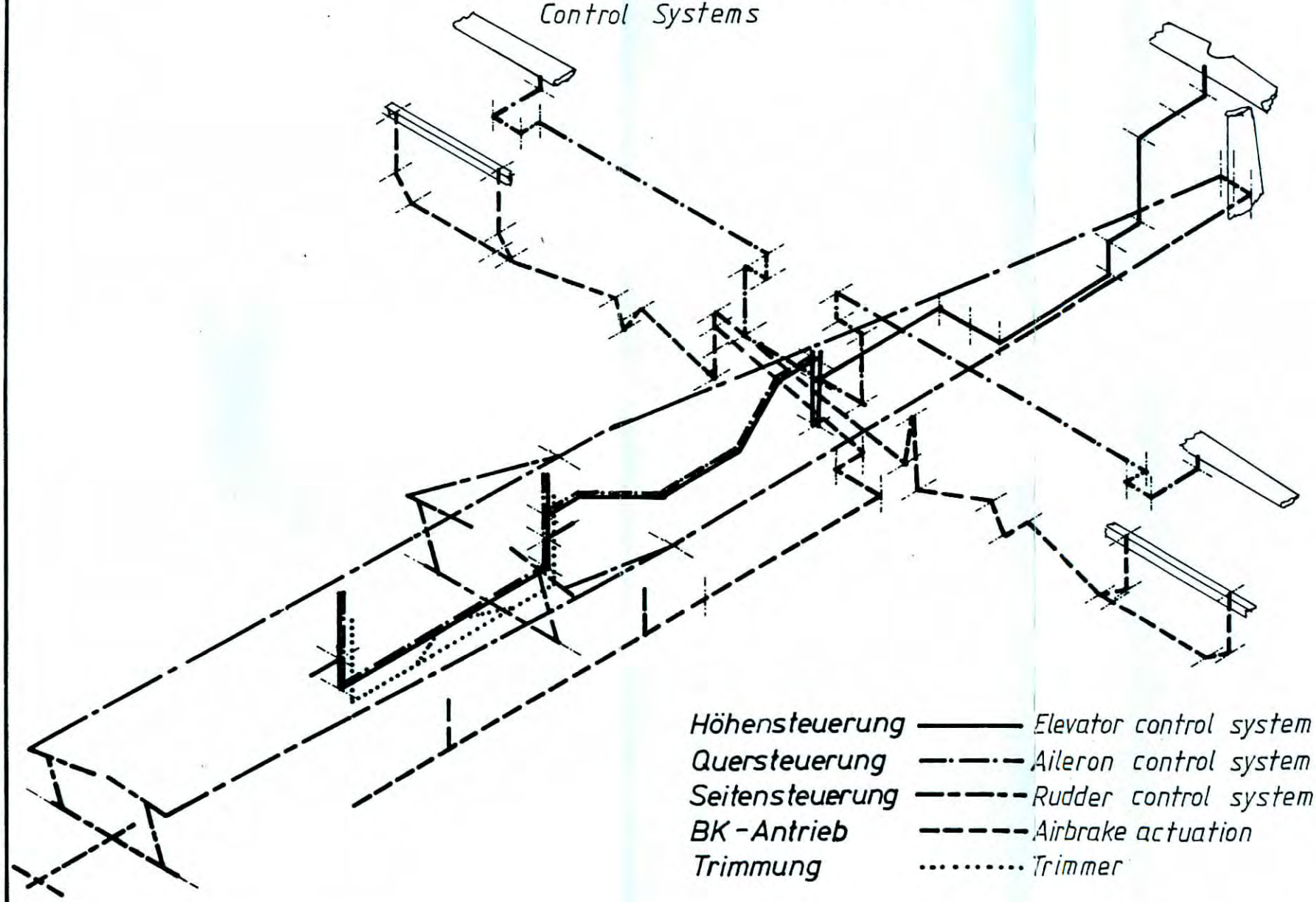
automatic elevator connection
TN no.11

manual elevator connection
bis Werk-Nr. 21205



Aileron / Elevater control system
in the fuselage

Steuerungs-System ASK 21
Control Systems



Höhensteuerung	Elevator control system
Quersteuerung	Aileron control system
Seitensteuerung	Rudder control system
BK-Antrieb	Airbrake actuation
Trimmung	Trimmer

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II.2 LANDING GEAR

The landing gear consists of the sprung main wheel 5.00-5 and the unsprung nose wheel 4.00-4. The trailing boom main wheel uses two hollow-type rubber springs (type KE 120/95 core A with mounting member, quality RTK 55).

The rim is a Cleveland wheel 4078 (B), 5.00-5 TypeIII.
Brake : Cleveland brake assy 30-9.
Mainbrake cylinder : master cylinder 10-20.
Tank for brake fluid : below the rear seat pan on the LH side.
Main wheel : tire with tube 5.00-5, 6 ply rating.
Nose wheel : tire with tube 4.00-4, 4 ply rating.

Tire pressure : main wheel 2,7 bar;
nose wheel 2,0 bar;
tail wheel 2,5 bar

To fill up the brake :

Brake fluid : ESSO UNIVIS J-13 or AEROSHELL FLUID 4.
You absolutely have to observe that only brake fluid on a mineral oil basis is used. Car brake fluid on ester basis will destroy gaskets and tubes in a very short time.

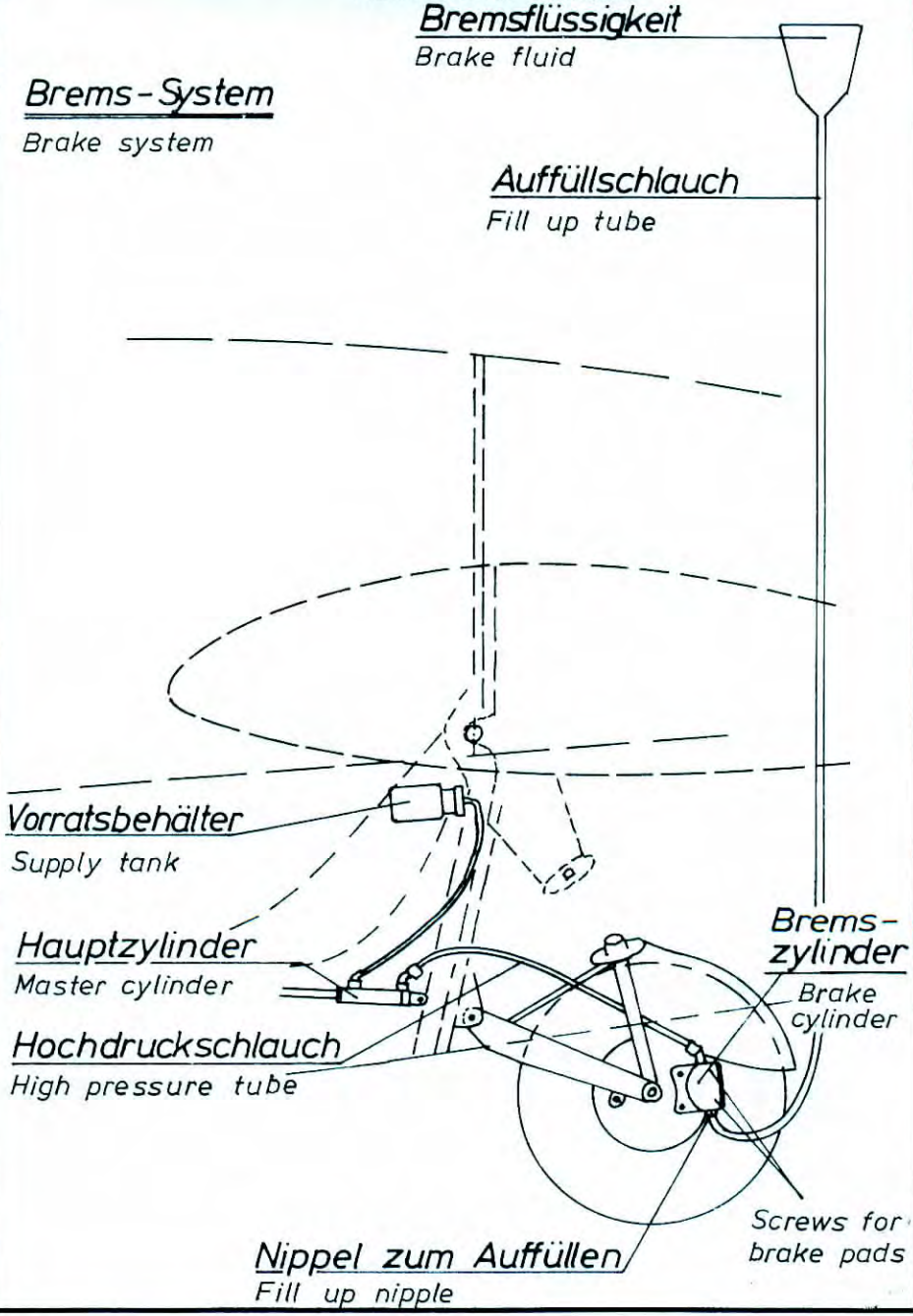
Brake fluid must be filled up from bottom to top in order to avoid air bubbles. For a simple fill up device you need instrument flexible tubing of about 2 m (6,56 ft) length and a funnel filled with approx. 1/4 ltr. of brake fluid at the upper end. The brake cylinder uses a fill up nipple at its bottom. The lower end of the cable must be slipped onto the nipple. When loosening the hexagonal head screw by one turn, a valve opens the nipple.
Hold up the funnel as high as possible so that the brake fluid may run in with pressure. You absolutely have to take care that no air bubbles get into the system. Therefore, always sufficient fluid must be also in the funnel.
Fill up until the fluid in the storage tank stands at 2/3.
Now retighten the nipple and remove the fill up device. Reattach the dust shield cap !!

For the refilling of brake fluid the small plastic tank is taken out of its support. Open it and refill brake fluid !

If the brake system has been emptied already to such an extent that air has penetrated between master cylinder and operating cylinder, filling up must be done again from bottom to top.

Air in the brake system will cause an extension of the actuating travel at the airbrake lever. In consideration of the flexibility of the flexible pipes etc. one may assume that there is no air in the system, if the flexible travel does not exceed 50mm (1,97 in) for an actuating force of 20 kg at the airbrake lever.

Brems-System
Brake system



Inspection and Replacement of Brake Linings

Minimum thickness of brake linings and brake disc:

The linings must be renewed at the minimum residual thickness of 2.54 mm = 0.10 in !

The brake disc must be renewed at the minimum residual thickness of 4.242 mm = 0.167 in !

Reference: WHEEL and BRAKE ASSEMBLIES CATALOG, Component Maintenance Manual, Appendix A, Fits and Clearances, A-1. Brake Lining Wear Limits, A-2. Brake Disc Minimum Thickness, from Messrs. Parker Hannifin Corporation, Avon, OH. USA.

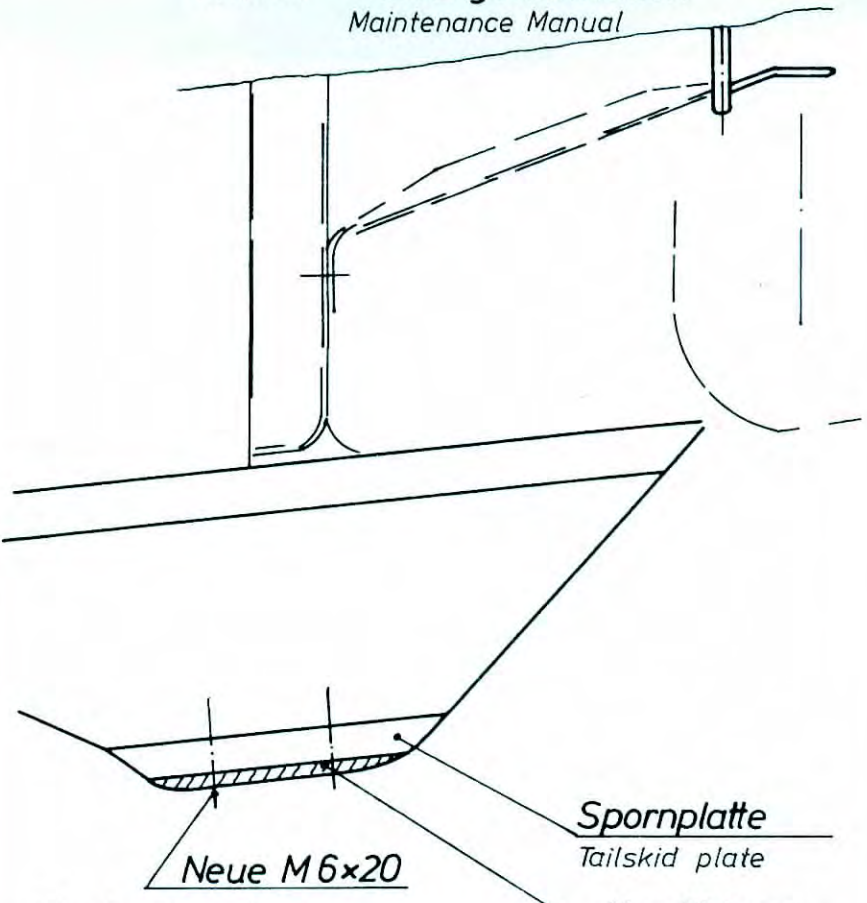
1. Remove wheel fairing.
2. Loosen the two 1/4" screws which are safetied by wire. Do not unscrew the brake line hose!
3. Take out the brake shoes with linings. The linings must be renewed before they have been worn down as far as the rivets as otherwise the brake disc will be damaged and the braking effectiveness unacceptably reduced. To rivet the new linings in place it is best to use a riveting tool designed for the purpose. Alternatively, however, a hammer, centerpunch, and round punch of not less than ϕ 6 mm at the tip may be used.
4. Now replace brake shoes and tighten the two 1/4" screws and secure them with locking wire.
5. Remount wheel fairing.

Brake linings and rivets to suit can be obtained from Messrs. Schleicher. Orders must specify brake linings suitable for the Cleveland 30-9 brake assy.

Tail Skid

Watch the wear of the tail skid metal plate and either reinforce it in time by welding on sheet metal, or replace it by a new one. Remove the tail skid plate for the welding job.

The rubber tail skid is designed so that it will shear away from the fuselage with strong lateral forces. It may be glued on again or be repaired using contact glue (Pattex). You must apply plasticised fabric adhesive tape over the gap (glue joint) between skid and fuselage in order to prevent long grass from being caught.



Verstärkung der Spornplatte

Reinforcement of the tailskid plate

II.3 RADIO EQUIPMENT

The front instrument panel is provided for the installation of the radio. For the installation the mounting accessories and cables of the radio manufacturer are to be used. For the layout of the instrument panel you have to consider that the radio must be clearly visible and easily accessible to the pilot in the flying position.

As to the clear visibility, however, priority must be given to the flight control instruments for the layout.

A suggestion for the instruments layout is given on the drawing of the instrument panels.

The BECKER radio may be installed both horizontally or vertically.

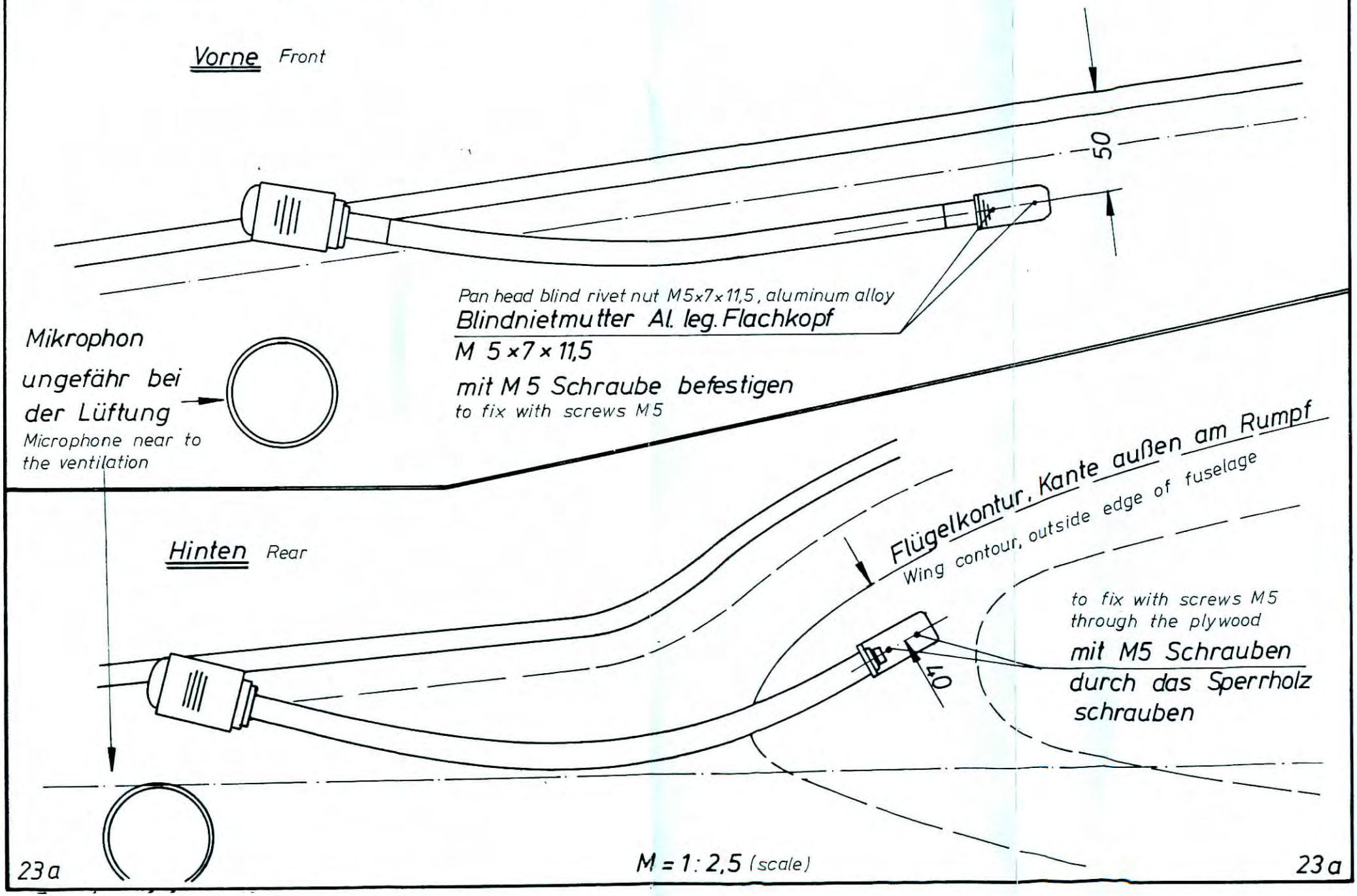
The loudspeaker may be fitted below the rear instrument panel cover on the LH side.

The boom microphone is to be fitted on the RH cockpit wall.

A support for a dryfit battery (12V, 6.5Ah) is provided in the luggage compartment of the left wingroot.

Einbau der Schwanenhalsmikrophone an der rechten Rumpfseitenwand

Installation of boom microphones on the RH cockpit wall



M = 1 : 2,5 (scale)

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II.4 Oxygen Equipment

Suitable bottle fixing brackets for two 4 liter oxygen bottles of dia. 100 mm are available as an optional accessory from Messrs.SCHLEICHER.

When fitting the oxygen bottle(s), ensure that it is properly installed and securely anchored.

NOTE: Fitting of oxygen equipment causes only a minimal change in the empty--mass C.G. position ! However, it is necessary to re-weigh the glider and redetermine the empty mass C.G.

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

II.5 PRESSURE PORTS AND CONNECTIONS FOR THE INSTRUMENTS

(see drawing on page 27)

1 Airspeed indicator : total pressure.

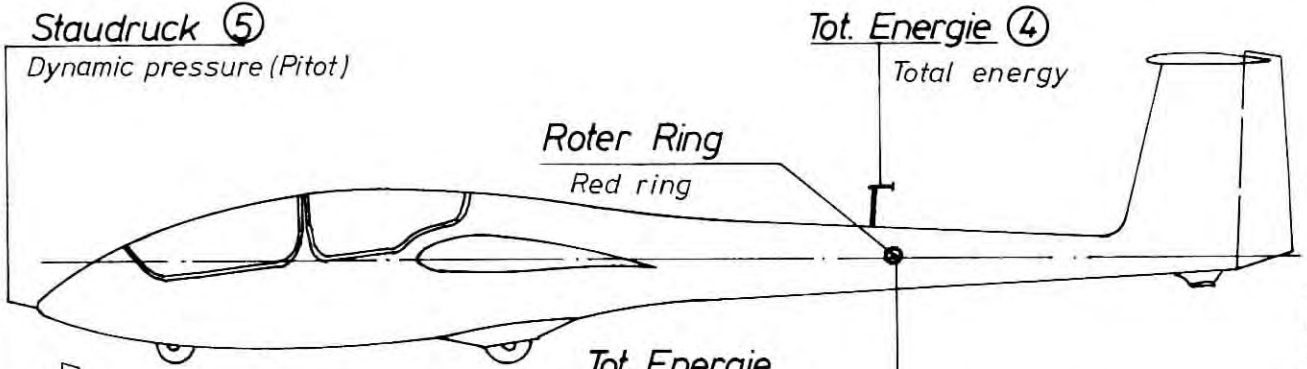
2 Altimeter : static pressure or without any connection.

3 Variometer

4 Total energy probe

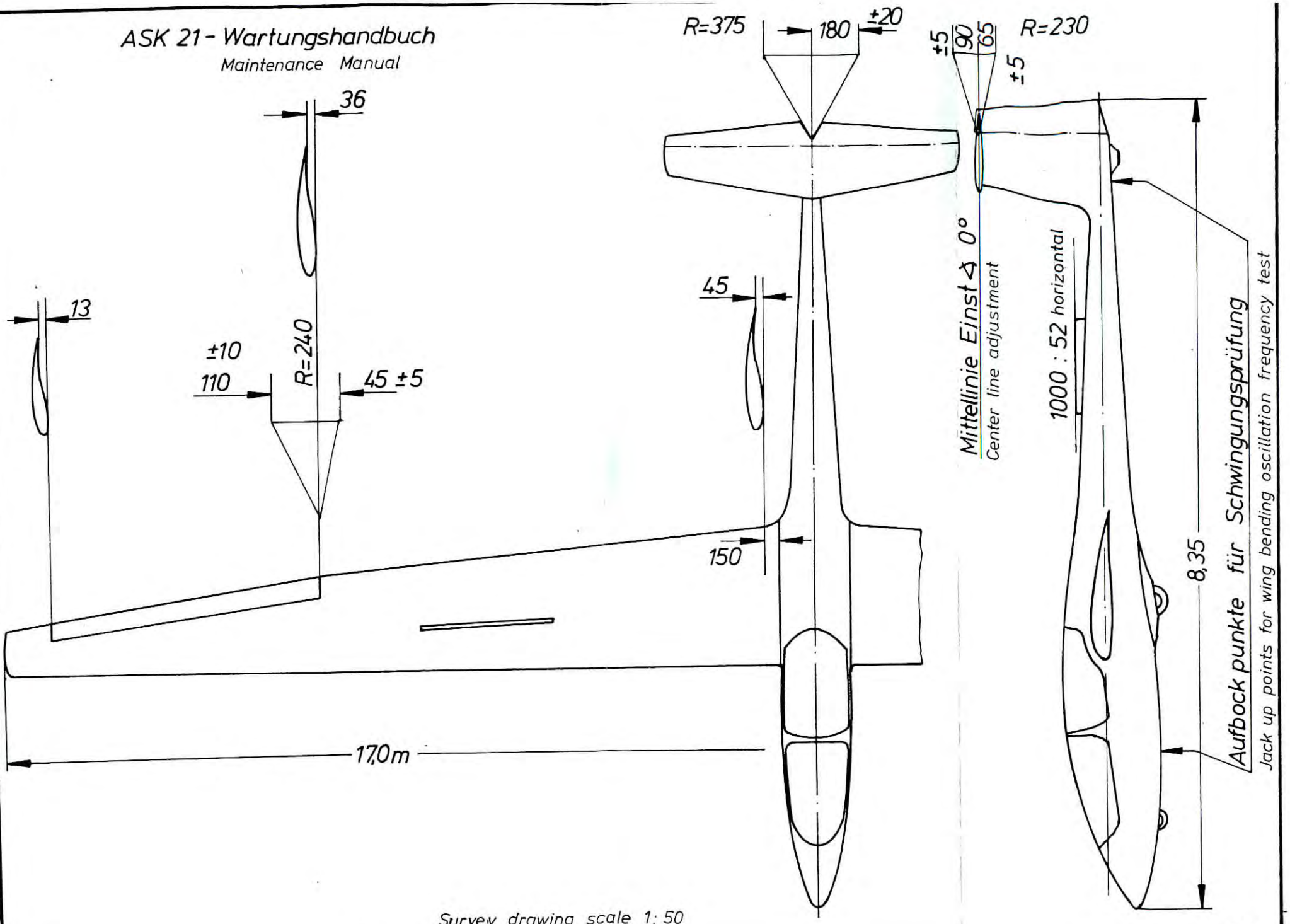
5 Dynamic pressure (pitot tube)

6 Static pressure


Staudruck ⑤
Dynamic pressure (Pitot)
Tot. Energie ④
Total energy
Roter Ring
Red ring
Tot. Energie
Total energy Red
Stat. Druck ⑥
Static pressure
Dynamic pressure
Staudruck
Grün Green
③
Variometer
③
Druckleitungen und Anschlüsse
für die Instrumente
Pressure Ports And Connections For The Instruments
①
Fahrtm. ① Airspeed indicator
Stat. Druck Static pressure
Farblos Transparent

Color of flexible tubing

1. Pitot pressure : green.
2. Static pressure: transparent
3. Capacity bottle: blue
4. Total energy probe : red.



Survey drawing scale 1: 50

ASK 21 Übersicht M=1:50

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ADJUSTMENT

Basic adjustment :	Wedge on fuselage aft section 1000 : 52 horizontal	
Wing angle of incidence :	Distance from center line	Trailing edge higher than horizontal line applied from below.
	y = 0,52 m (1.7 ft)	50 ± 5
	y = 5,20 m (17.06 ft)	37 ± 5
	y = 8,00 m (26.25 ft)	16 ± 5
Wing dihedral :	Angle between upper wing center section and horizontal line	3,6°
Sweep of airfoil :	Wing center section leading edge	level
Stabilizer adjustment :	Airfoil center line	0°

Control deflections :	Upwards	Downwards	Measurement distance from center of rotation
Aileron	110 mm ± 10 (4,33 in ± 0,39)	45 mm ± 5 (1,77 in ± 0,2)	240 mm (9,45 in)
Elevator	90 mm ± 5 (3,54 in ± 0,2)	65 mm ± 5 (2,56 in ± 0,2)	230 mm (9,06 in)
Rudder	180 mm ± 20 (7,09 in ± 0,79)		375 mm (14,76 in)

Tow release : Release force max 12kg (for both tow releases together)

Airbrake gap between airbrake and wing 25 - 35 mm (1 - 1,3 inches)

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IV. Equipment With Limited Operation Hours

Tow Release Couplings

The Tost tow release couplings, factory fitted, i.e. the C.G. Safety Tow Release "Europa G 72", or "G 73", or "G 88" respectively, and the front Nose Tow Release "E 72", or "E 75", or "E 85" respectively, have a limited service life (TBO) and must be returned to TOST for re-inspection in regular intervals. The service life is stated in the appertaining Manufacturer's Authorized Release Certificate. The instructions given in the TOST "Operating Manual" or in the "Operating and Maintenance Instructions" for the tow release couplings must be observed!

Instruments

The flight monitoring instruments are not normally subject to service life limitations. As a general rule, the makers' instructions should be complied with.

Oxygen Equipment

For oxygen systems fitted, the relevant section of the appertaining Manufacturer's Inspection Release Certificate states the overhaul time limit. Over and beyond this, the oxygen bottles must be re-inspected by a technical inspection institute every five years in accordance with pressure vessel regulations.

Special Servicing Procedures

At regular intervals of 6 years the brake line hose of the hydraulic wheel brake must be replaced. Should this hose be found to be in good condition, it need not be replaced, on condition that its condition is checked at least every 100 flying hours.

V WEIGHTS AND C.G. POSITIONS

V.1 On the WEIGHT AND BALANCE SHEET (see page 33) the min and max c.g. limits with regard to the glider empty weight are noted.

Min pilot weight for front seat = 70kg.
Max pilot weight for both seats = 110kg each.

Pilot weight 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 600kg must not be exceeded. In the case that the empty weight comes to more than 380kg, the max permissible pilot weights have to be reduced accordingly.

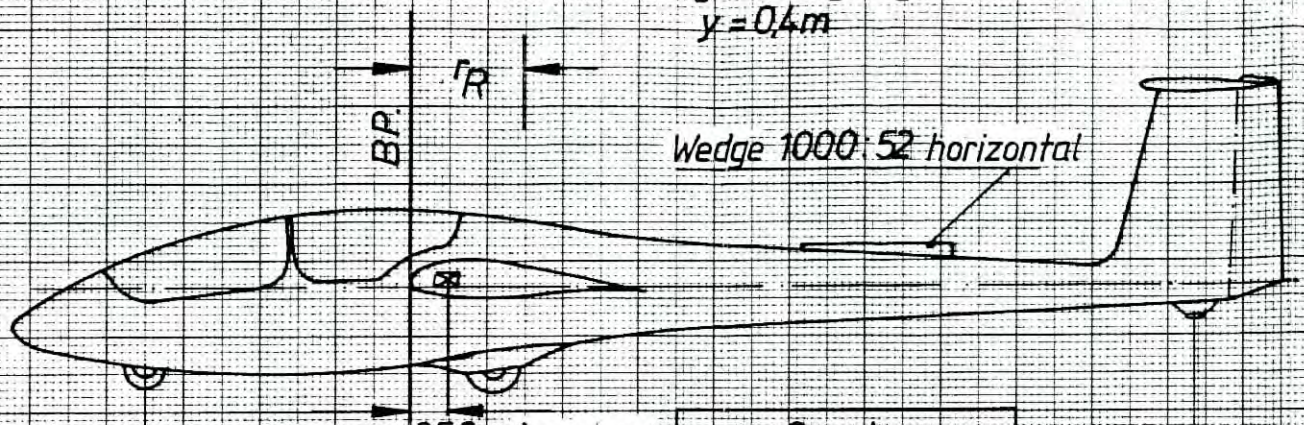
V.2 WEIGHTS OF NON-LIFT PRODUCING MEMBERS

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 of 410kg for the non-lift producing members must not be exceeded.

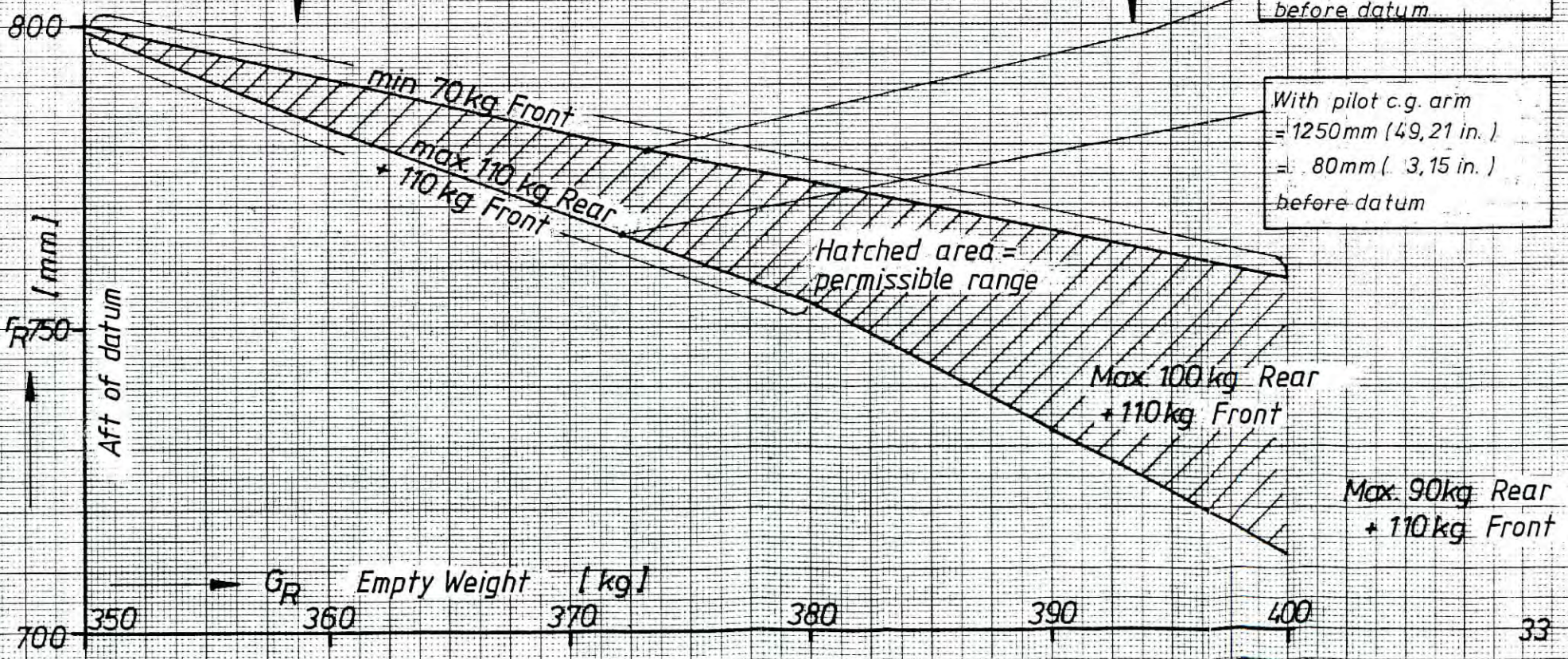
After repairs, repaintings or the installation of additional equipment, at the latest however every 4 years the empty weight and the c.g. positions must be reestablished.

ASK 21 - Wägeblatt
Weight and Balance Sheet

Issue April 1980



$$r_R = \frac{G_2 \cdot L_1}{G_1 + G_2} - L_2$$



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C.G. POSITIONS AT THE LAST WEIGHT AND BALANCE

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

Weight, empty weight c.g. and payload have to be certified by an inspector on page 11 of the Flight Manual and on page 34 of the Maintenance Manual.

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

Installation of ballast in the tail

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 (o,3 in) in 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;

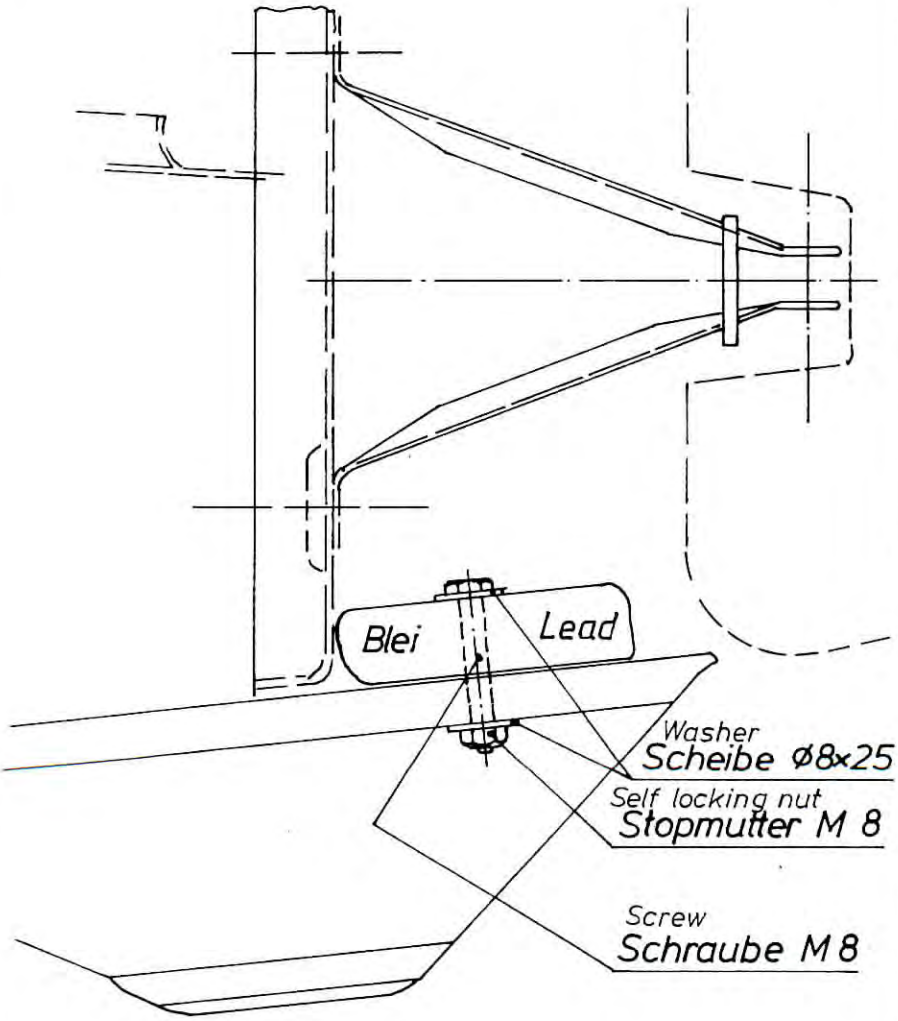
6. Shorten the M8 screws, screw them on and safety with a selflocking nut. A washer must be added on each side.

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.

Anbringen von Ballast im Rumpfheck
Installation of ballast in the tail



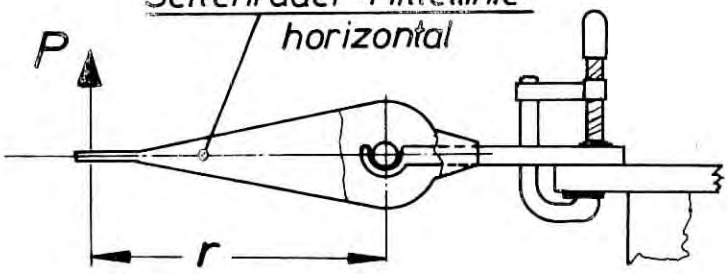
VI WEIGHTS AND TAILHEAVY STATIC BALANCE OF CONTROL SURFACES

After repairs or repaintings the weight of the control surfaces and their tailheavy static balance must be checked. For this job the control surfaces have to be removed. For the determination of the tailheavy static balance $M = P \cdot r$ the control surfaces must be seated in the fulcrum with as little friction as possible. If necessary suspend them in their bearings with thread. To measure P at the trailing edge it is best to use a spring balance of 1kg scale to which a small piece of tape is attached. If necessary, a letter balance will do, too.

If weights or tailheavy static balance moments are not within the approved tolerances, you should contact the company Schleicher.

Tolerances in weight and tailheavy static balance of control surfaces and tolerances in play (backlash) of control systems (controls fixed):

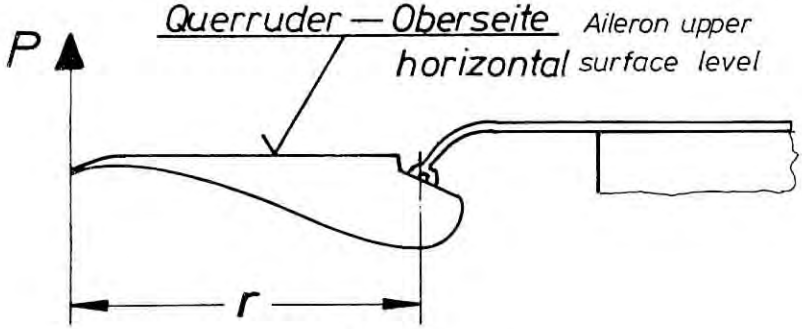
	Weight tolerance kg / lbs	Tailheavy static balance tolerance cm*kp / in*lbs	Tolerance in play (backlash) Degree / mm / in
Rudder	1.75 - 2.59 / 3.86 - 5.71	17.1 - 22.3 / 14.84 - 19.35	0.672° / 3.88 / 0.15
Elevator	3.15 - 4.1 / 6.95 - 9.04	13.9 - 18.4 / 12.06 - 15.96	0.92° / 2.84 / 0.11
Aileron	2.85 - 3.75 / 6.28 - 8.27	17.4 - 22.9 / 15.10 - 19.87	0.864° / 3.01 / 0.12

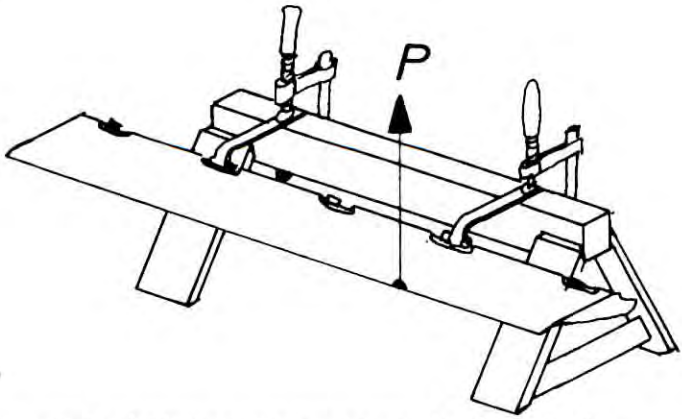


$M = P \cdot r \quad (kp \cdot cm)$

Messung von P mit Brief-oder Federwaage

Determination of 'P' by use of a spring balance or a letter balance





Tailheavy static balance measurement of controls

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 safetied ? Is the spring retainer engaged ?
4. Elevator pushrod connected ? Safetied with a spring clip ? This is not applicable for gliders which use the automatic elevator connection !
5. Aileron pushrods connected ? Safetied with a spring clip ? Do not forget the sight control through the access hole cover !
6. Airbrake pushrods connected ? Safetied with a spring clip ? Do not forget the sight control through the access hole cover !
7. Check for foreign objects !

Attention !

With all 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. Parachute connected to harness ?
2. Safety harness fastened ?
3. Airbrakes locked ?
4. Trim neutral ?
5. Altimeter correctly set ?
6. Canopies closed and locked ? Rear Canopy !!
7. For flights with only one occupant remove the rear back rest !!
8. Leave your toes under the pedal toe-straps ! Never flatten the straps ! Danger of jamming the pedals !

3. Special checks

After rough landings :

Check the landing gear suspension mount at the front main bulkhead !!
Check the wheel fork for deformation; gear box !!
Check the control shaft above the wheel for deformation !!
Make sure that the rubber buffers have not come over the support discs !!
Check spar tongue and fork for white areas !!
Check the wing connections at the fuselage !!
Check the cross tube at the front main bulkhead for compression deformations !!
Determine wing bending oscillation frequency and compare with the value of the last inspection report. In case of differences by more than 5 % contact the Schleicher factory. (See survey drawing on page 29 of the Maintenance Manual for jack up points !).

After ground loops :

Inspect the fuselage tail cone at the transition to the fin and also the attachment of the horizontal tail unit to the fin !!
Check wing connections at the fuselage !!
Inspect horizontal shear web in the fuselage (between front and rear main bulkhead).

VIII PERIODICAL INSPECTIONS

The following maintenance checks have to be carried out periodically, however, imperatively at the latest annually :-

1. Check the whole glider - outside and inside where accessible - for cracks, holes, dents and white spots in the fiberglass.

2. The attachment hinges and pins must be checked for corrosion, tool marks and play. If the front shear pins of the wing-fuselage junction show too much lateral play due to ground loopings, thin metal washers must be added on these pins.
The spar pins must show some play, otherwise the wings possibly cannot be rigged at all with different temperatures. Besides here the bearing pressure is so low that there is no danger of wear-out.
On the other hand the rear pins of the wing-fuselage junction require more attention. In the case of play (backlash) at these pins they have to be replaced in time against oversize pins. The play (backlash) at these pins should be within the tolerances H7/g6.
Good preventive maintenance will increase considerably the service life of all pins and fittings. Always clean and relubricate the pins prior to every rigging. Do not misalign the pins !!

3. Check all metal parts for corrosion and, if necessary, repaint them. As priming a zinc-chromate prime has to be used.

4. Check that there is no play in the fuselage/wing and fuselage/tailplane connections (see also above Point 2.).
5. The condition of all accessible bearings, fittings, joints, stops in the control linkages, and especially the control cables and towing hook cables, must be checked.
   The plastic tubes inside the S-shaped rudder pedals tubes must be checked for proper and tight fit !
6. The controls, including the airbrakes, must be subjected to an operational test, and their control deflections measured.
7. If any control is not free-moving over its entire range of movement, then the cause is to be established and eliminated.
8. The condition of the main landing gear and tailskid (foam skid with wear plate or pneumatic tailwheel respectively) including tire, brake linings, and rubber shock absorber must be checked. See also that there is sufficient brake fluid in the tank.
9. The towing hooks must be inspected according to the manufacturer's "operations and maintenance instructions".
10. The pressure openings (pitot and static pressure ports) on the fuselage, including their flexible lines, are to be checked for blockages and leaks.
11. Condition and function - if applicable, maximum permissible operational time - of all instruments, VHF-transceiver unit, and other equipment are to be checked !
12. The wing bending frequency is to be measured and compared with the stated value in the latest inspection report. For this test the fuselage must be rigidly supported on two supports, in order to obtain comparable values; for the position of the supports see the Survey Drawing on page 29.
13. Check that the equipment and instrumentation are in accordance with the Equipment Inventory.
14. After repairs or alterations to the equipment the new empty weight and the C.G. position are to be found by calculation or weighing, and are to be recorded in a summary of weights.

Checking and securing the L'HOTELLIER quick-release connectors in the control linkages

1. **Securing**

Past experience showed that the quick-release connectors in the airbrake, aileron and particularly in the elevator control linkages were incorrectly assembled or that their assembly was even completely forgotten (as of serial no. 21206 the aircraft was then supplied with an automatic elevator connection). A sticker (Fig.1) fixed to the fin and the access hole cover, serve to remind the pilot of the correct assembly. All quick-release connectors must be secured in addition by means of a spring clip (Fig.2). With the older type of connectors the check hole must be drilled to approx. 1,2 mm ⌀ for this purpose.

Fig. 1

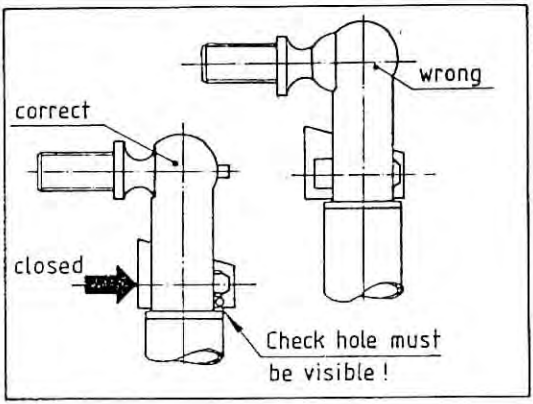
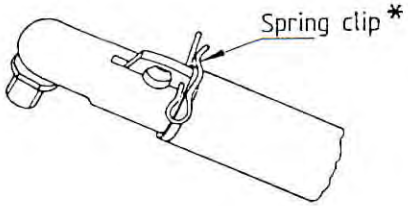


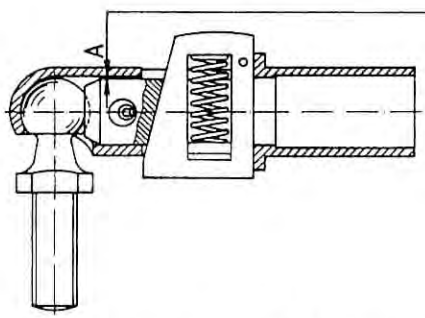
Fig. 2



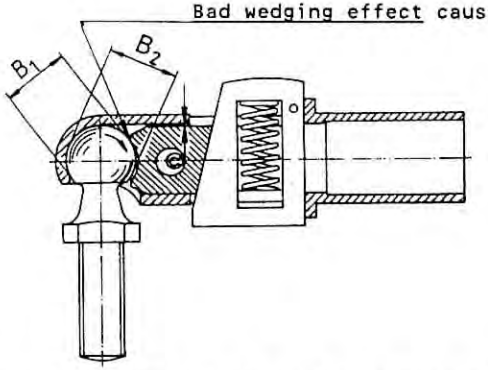
* Spring clip no.50030771 can be ordered from Alexander Schleicher or from the company A.Würth, P.O.Box 1261, D-7118 Künzelsau. (This part is also identical with the FORD brake securing spring clip).

2. Inspection

As experience accumulated in Australia has shown, the condition of the L'HOTELLIER quick-release connectors must be checked on every annual inspection of the aircraft, especially when it has been operated frequently and from sandy airfields.



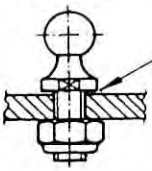
Clearance A must not exceed 0,15 mm (0,006 in); check this by using a wire of the above diameter!



Bad wedging effect causing wear of the ball.

The greatest and smallest diameters B to be found must not differ by more than 0,1 mm (0,004 in).

The tight seat of the ball ends inside the fittings must be checked as loose ball ends are likely to break under bending loads in the thread area.



Gap generated by an unscrewed and incorrectly refitted ball end or owing to overloading /wear out of the lever part.

NOTE: The Technical Note "Technical Data No. IM.10.01A, Issue B 01/89", by the manufacturer HOTELLIER must be observed!

Inspecting the taping of the control surface gaps

For aerodynamic reasons the control surface gaps between wing and aileron and between stabilizer and elevator respectively are taped where the control surface hinges are located.

Should this adhesive tape come off or be damaged, this may lead to flutter! Therefore the sealing adhesive tape must be inspected in regular intervals and where necessary replaced.

If the adhesive tape needs to be removed for maintenance, or repair purposes, or because of aging please observe the following: as a replacement you must use only the Tesa tape no.46451, white, 25 or 38 mm wide, made by Beiersdorf AG, Hamburg.

Where other types of adhesive tape have been used, flutter cases have been repeatedly reported!

Where a plastic fairing tape (elastic lipseal) has been fixed at the control surface gaps, you have to observe MAINTENANCE INSTRUCTION C.

VIII.1 Inspection Program to extend Service Life

Introduction

Fatigue tests on GRP/CFRP wings and GRP/CFRP wing spars have shown that a service life expectancy of at least 18000 hours may be achieved for these components. However, as this test program did not examine an entire aircraft made of CFRP and GRP, this service life of 18000 hours can be achieved only if the long-term airworthiness of each individual glider is demonstrated in a special multi-stage inspection program (over and above the mandatory annual C of A inspections).

Time Limits

1st Stage:
When the sailplane has reached a service life of 3000 and 6000 hours respectively, tests must be carried out in accordance with the Inspection Program for the ASK 21, Issue 2 dated 28.04.92, as laid down by Messrs. Schleicher.

If the results of these tests are positive, or if any defects discovered have been correctly repaired, the service life of the sailplane will be increased after the 6000 hours-inspection by 3000 hours, i.e. to a total of 9000 hours.

2nd Stage:
When a service life of 9000 flight hours has been reached the above Inspection Program must be repeated. If the results are again positive, or any defects found have been correctly repaired, the service life may be increased to a total of 12000 flying hours.

3rd Stage:
Before reaching a service life of 12000 flight hours an inspection in accordance with TN no.29 must be accomplished. Depending on the results of this inspection, as well as on the history of the aircraft and the evidence of the percentage of aerobatics being below 12.5 % as compared to the total flight time, Messrs. Schleicher will decide on a release to service for up to 15000 hours.
The Inspection Program must then again be repeated and on the condition that the results are again positive, or any defects found have been correctly repaired, the aircraft may be approved for increase of service life up to 18000 hours.
It will be decided at a later date whether an extension of service life beyond 18000 hours may become possible. A research program which is intended to clear the preconditions of this aim, has already been started with the BMVBW (Federal Ministry of Transport).

Inspection Program
Please contact SCHLEICHER in order to obtain the Inspection Program for the ASK 21, Issue 2 dated 28.04.92, or any later issue effective.

The inspections must be carried out only by the manufacturer, or by an appropriately licensed aircraft repairer.

The results of the inspections must be entered into the Inspection Program which is at the same time the report of findings, where each item must be annotated with a comprehensive comment, as laid down.
If the inspections were carried out by a licensed aircraft repairer, a copy of the filled in Inspection Program (report of findings) which must be signed by the inspector, must be returned to SCHLEICHER for the purpose of evaluation.
On receipt and examination of such Inspection Program Report SCHLEICHER will issue an "Acknowledgement of Receipt" and send this back to the operator of the sailplane. Only on receipt of this "Acknowledgement" the inspector may certify the extension of the service life as laid down in the Inspection Program, into the logbook and the relevant sailplane's inspections papers.
The need for annual Certificate of Airworthiness inspections and overhauls (for German registered gliders § 27 (1) LuftGerPO applies*) is not affected by this rule.
*) LuftGerPO = Aeronautical Products Examination Order

IX LUBRICATION SCHEME

Ball bearings :

The slotted-sealed ball bearings are filled with a longlasting grease and capped off. So it is unnecessary to regrease this bearing.
The 14C6 self-aligning bearings in the pushrods and in the duralumin rocker arms are also greased and covered with felt seals so that they likewise do not need any regreasing for a long period of time.
The same applies to the ball bearings of the pushrod guides.
The grease nipples at the control stick and at the landing gear rocker arm should be lubricated at least annually.
The grease nipples of the control systems are accessible from the top when the seat cushions are removed.
The rear seat has to be removed in order to reach the grease nipples of the landing gear rocker arm.

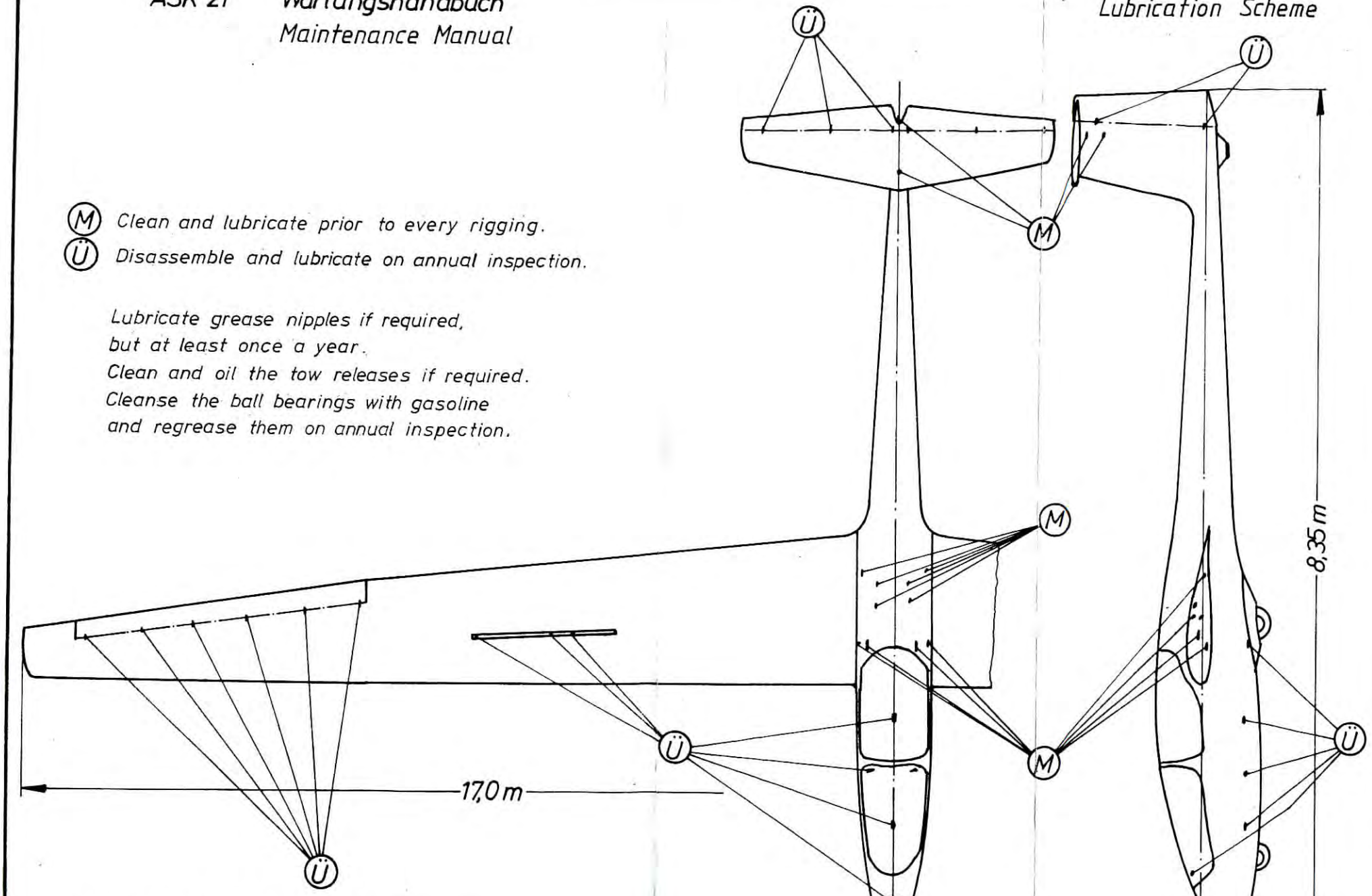
The canopy locks, and especially the emergency jettisoning device in the front cockpit, have to be kept well lubricated.

Dirty tow releases are cleaned best with compressed air, brush and through movement of the kinematics. Then regrease them with a spray oil or some similar agent.

Lubrication Scheme

(M) Clean and lubricate prior to every rigging.
(Ü) Disassemble and lubricate on annual inspection.

Lubricate grease nipples if required,
but at least once a year.
Clean and oil the tow releases if required.
Cleanse the ball bearings with gasoline
and regrease them on annual inspection.



LUBRICANTS: multi purpose grease.
OIL : machine oil or car engine oil.

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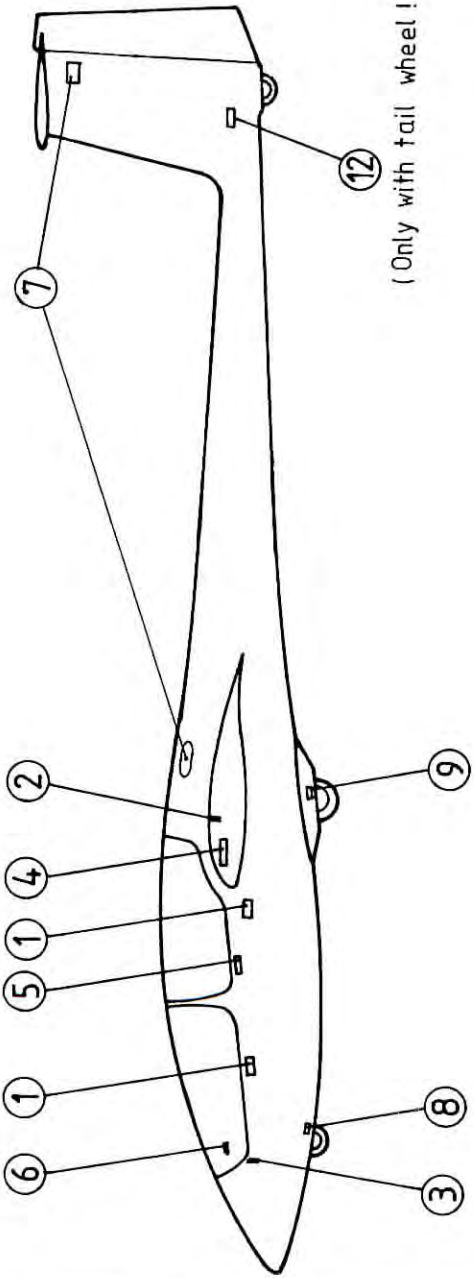
X. PLACARDS AND MARKINGS

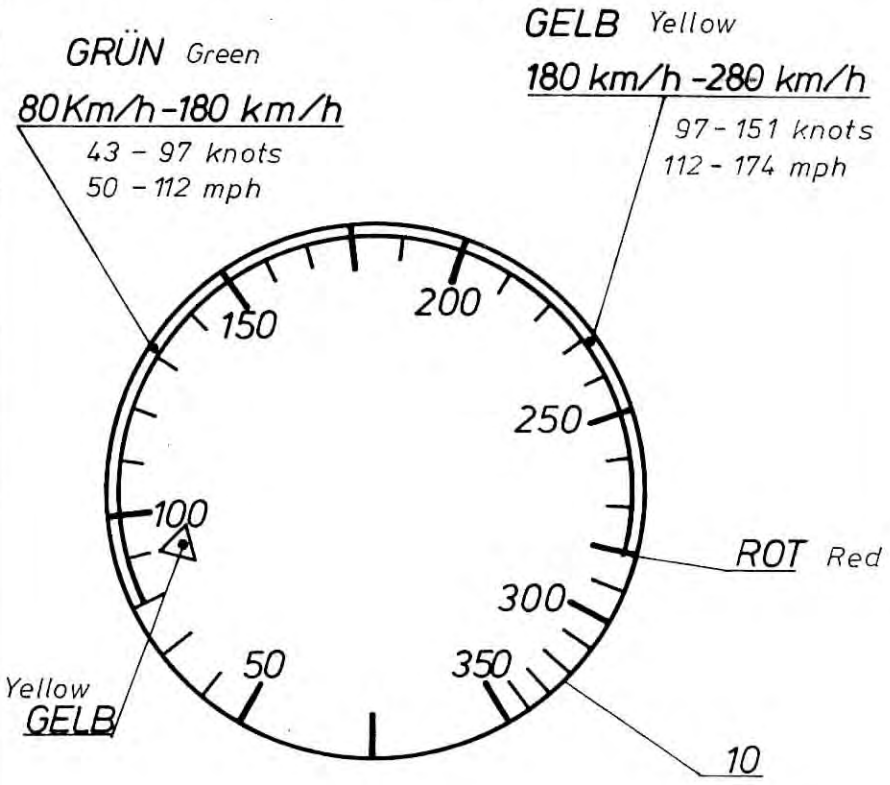
1. Data placard with weight & balance data;
   one placard each for the front and rear seat on the right cockpit wall.
2. Fire-proof type plate;
   right at the spar tunnel bottom.
3. Placard stating the approved Airworthiness Category;
   on the front instrument panel.
4. Max. baggage compartment loading;
   one 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 !
9. Placard for tire pressure main wheel:
   2,7 bar !
10. Airspeed indicator marking.
11. G-meter marking.

For gliders with pneumatic tailwheel only

12. Placard for tire pressure tail wheel (only when the pneumatic tailwheel is installed):
    2,5 bar !



Setting of placards



GRUND MATTSCHWARZ Ground mat-black

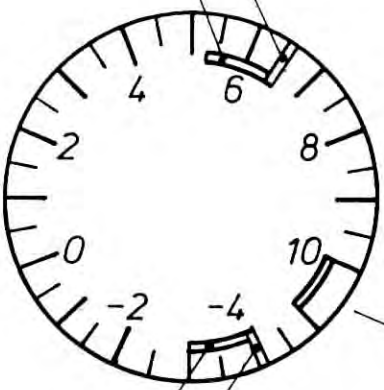
MARKIERUNG UND SCHRIFT LEUCHTFARBE Color codes and letters in luminous paint.

Airspeed indicator color codes
Fahrtmesser Markierung

Positive range
a.) positiver Bereich

Yellow arc from +5,3 to 6,5

Red radial line at +6,5



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Negative range
b.) negativer Bereich

Yellow arc from -3 to -4

Red radial line at -4

G-meter color codes
G-Messer Markierung

XI REPAIRS

On principle repairs must only be made by the manufacturer or by a certified (licensed) technical aviation facility.

For exceptions see repair manual. In case of doubt contact the manufacturer !

XII MODIFICATIONS

Minor modification :

A modification to the aircraft,which has no influence on its airworthiness and is feasable by using standard working methods, may be done without prior notification to the Civil Aviation Authority if it is done in accordance with a technical note issued by the Civil Aviation Authority.

Major modification :

A modification to the aircraft, which has an influence on its airworthiness or requires a change of the operation instructions or of the operation limitations or is not feasable by using standard working methods, must only be done by a certified (licensed) technical aviation facility. The major modification must only be done in accordance with technical documentations which were subject of a supplementary type-approval under the test regulations for aircraft.

A supplementary type-approval is not necessary, if the major modification is restricted to only some single units. Prior to the carrying-out of the major modification the proof of the airworthiness must be furnished in accordance with the test regulations for aircraft.

(5) 1 off Rear

Attention! Emergency bailout!

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

(2)

A. Schleicher
6416 Poppenhausen

Model : ASK 21
Serial no: 21 XXX
Registration letters :
Made in West Germany

(3) 1 off

Aerobatics prohibited!
Equipment as under airworthiness category "U" (Utility)

For equipment without g-meter and bottom strap.

(3) 1 off

Aerobatics as per Flight Manual
Equipment as under airworthiness category "A" (Acrobatic)

For epuipment with g-meter and bottom strap.

Segelflugzeugbau A. Schleicher Poppenhausen

Model Serial no.

DATA PLACARD

(1) 2 off

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

(4) 2 off

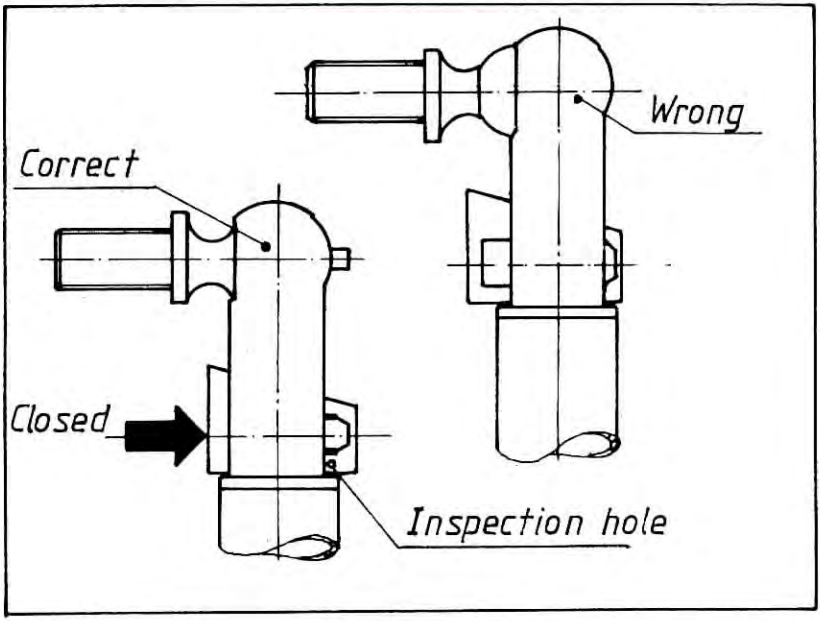
Loading of baggage compartment: max. 10 kg

(6) 1 off

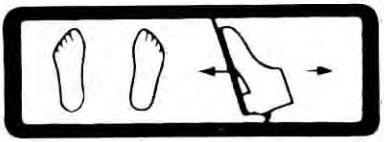
Pre Take Off Check:

1. Controls easy to operate ?
2. Airbrakes locked ?
3. Trim in the center position ?
4. Parachute and safety harness fastened ?
5. Altimeter adjusted to field height or to zero ?
6. Radio "ON" and adjusted to proper frequency ?
7. Both canopies locked ?

Placard no. 7



XIII DESCRIPTION OF SYMBOLIC PLACARDS

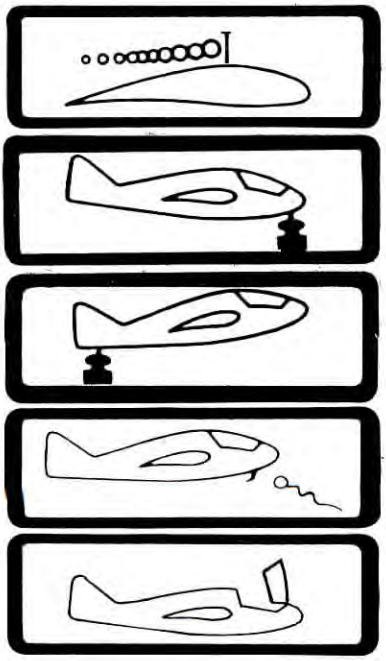


Rudder pedals adjustment:

grey knob on the RH side of the console.

To adjust pedals backwards:
Take your feet off the pedals and pull pedals backwards. Then let go the grey knob and load the pedals in order to lock them.

To adjust pedals forwards:
Pull grey knob and push pedals forwards with your heels. Then let go the grey knob and load the pedals in order to lock them.



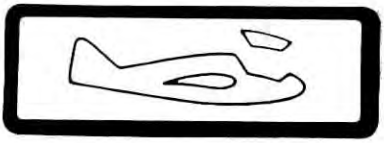
Airbrakes:
blue lever in the LH arm rest. Pull to extend airbrakes.

Trim : noseheavy

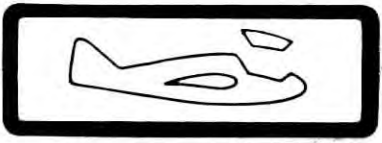
Trim : tailheavy

Tow release :
Yellow knob LH below canopy frame

OPEN front canopy :
Move white levers LH and RH on canopy frame backwards.



EMERGENCY JETTISONING of front canopy:
Push lever with red flat knob to the left.



OPEN rear canopy and/or EMERGENCY JETTISONING:
Move red levers LH and RH on canopy frame backwards.

Ventilation

Prior to take off check the proper engagement of the canopy locks! forward=locked

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

XIV APPENDIX

XIV.1 Equipment List

Minimum equipment

1. Airspeed indicator

a. Winter	GW 6005	50 to 350 km/h
b. PZL	PS 08	50 to 350 km/h
c. Winter	6 FMS 4	50 to 300 km/h
d. Winter	6 FMS 421	0 to 300 km/h
e. Winter	6 FMS 5	50 to 300 km/h
f. Winter	7 FMS 4	50 to 300 km/h
g. Winter	7 FMS 5	50 to 300 km/h

2. Altimeter

a. Winter	4 HM 6
b. Winter	4 FGH 10
b. PZL	W-12 s
d. Winter	4 FGH 20

3. Safety harness

a. Gadringer
Bagu V-B/1
Schugu II-C/V
Bogu I-B/V vorne
Bogu I-A/V hinten

b. Schroth

Additional minimum equipment for aerobatics

a. G-meter	BM 770 L
b. G-meter	AM 10
c. G-meter	BM 470 - 2
d. G-meter	BJ 10 - 2
e. G-Meter	G 510
f. G-Meter	GM 510 - 2

Additional minimum equipment for cloud flying

Turn & bank indicator Apparatebau Gauting WZ - 402/31

Compass	Ludolph	FK 5
	Ludolph	FK 16
	PZL	BS-1
	PZL	B 13 / KJ

VHF - transceiver

a. Dittel	FSG 15/25
b. Dittel	FSG 16/25
c. Dittel	FSG 40 S
d. Becker	AR 2008/25
e. Becker	AR 2009/25
f. Avionik Dittel	ATR 720
g. Dittel	FSG 71 M

XIV.2 Maintenance Instructions

The following Maintenance Instructions are established from time to time as required, in accordance with experience accumulated in operating the ASK 21. The Maintenance Manual is to be supplemented in case of new issues of Maintenance Instructions.

The general **"Maintenance Instruction ALL FRP GLIDER MODELS dated June 19, 1986"** describes the removing of play between the sockets (= bushings) and bolts (= pins) of the wing-to-fuselage transition.

The general **Maintenance Instruction "PAINT CRACKS"** dated June 26, 1989, describes how to inspect, preserve, and repair the paint surface.

The **Maintenance Instruction A** for the ASK 21 (dated March 23, 1987) describes how to readjust the airbrakes.

The **Maintenance Instruction B** for the ASK 21 (dated July 4, 1990) describes how to install oversize drag pins (rear).

The **Maintenance Instruction C** for the ASK 21 (dated May 7, 1992) describes how to fix for the first time or how to replace the plastic fairing tape (elastic lipseal) at the control surface gaps.

Sheet: 1 of 1	All FRP glider models Maintenance Instruction dated 19.06.86	Alexander Schleicher Segelflugzeugbau 6416 Poppenhausen

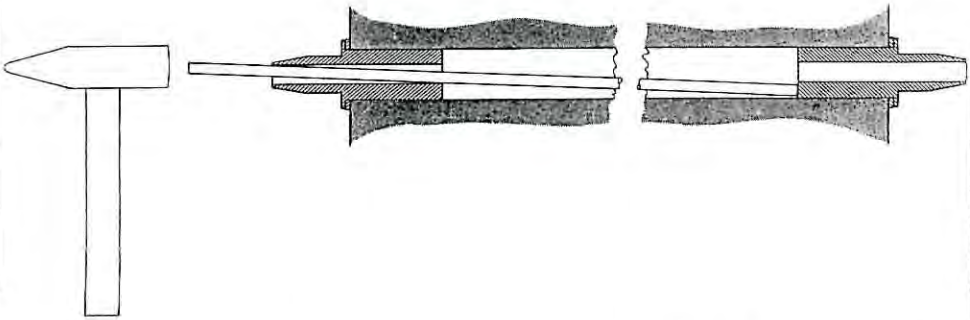
Removing play between the sockets and bolts of the wing-fuselage transition

1. Longitudinal play between the four sockets in the wings and the bolts on the fuselage (Note: for the ASK 21, only the socket/bolt connection front in the wing nose/fuselage transition) leads to disturbing click-click noises when the rudder is operated, and can result in unpleasant tail oscillations at high speeds.

2. The play is eliminated by fitting metal washers of Ø22,5/32-thickness according to the extent of the play. By testing, the play must be reduced such that the wings can be assembled still properly - this applies to a normal temperature of 20 °C. Depending on the extent of the play, the metal washers can be fitted under one or more bolts.

3. The bolts are slid out of the fuselage cross tubes by fitting a steel rod through the hole in the opposite bolt, and driving the bolt out from the inside with a hammer (see sketch below).

4. After fitting the metal washer(s), it should be possible to drive the bolt back in place, using only a 500 g (~ 1 lb) hammer and a few blows. If it returns too easily, then knurl the seating area slightly until a tight fit is obtained again.



Poppenhausen, June 19, 1986

ALEXANDER SCHLEICHER
GmbH & Co.

L.-W. Jumtow

Maintenance Instruction
PAINT CRACKS

Alexander Schleicher
GmbH & Co.
Segelflugzeugbau
D-6416 Poppenhausen

Subject: Paint cracks on fiber composite gliders.

Types affected: ASW 12, ASW 15, ASW 17, ASW 19, ASW 20, ASK 21, ASW 22, ASK 23, ASW 24, ASH 25; ALL variants and all serial no.s.

Compliance:

1. If **deep cracks** which go down to the fiber composite structure, are found on the glider, the glider must be presented each year to the manufacturer or any other licensed aviation station, who upon examination of the glider decides whether the glider can be continued in service for 1 year more or whether the repair must be done at once (see point "Action A.").
2. If **hairline cracks** which run only in the paint surface, are found on the glider, the glider shall be presented at the latest after three years annually to the manufacturer or any other licensed aviation station, who upon examination of the glider decides whether the glider can be continued in service for 1 year more or whether the repair must be done at once (see point "Action B."). The 3 years extension applies only on the condition that the maintenance and care of the aircraft is no longer neglected during this period of time and that the gliders are no longer stored outside;

Reason:

The Flight and Maintenance Manuals for SCHLEICHER-gliders contain insistent notes concerning the detrimental influence of moisture and sun radiation on the aerodynamic paint surface quality standard. Herewith we point out emphatically once again that every owner is obliged to observe the flight and maintenance or operations manuals of his glider in all points, and this refers also to the relevant notes on the care and maintenance of the glider.

If these notes are contravened, the result will be sooner or later - depending on the climate - damage to the paint surface quality.

Influence of the two factors
moisture and UV-radiation:

To begin with, generally an enlargement of the waviness of the finish develops - mainly on the wing and tail unit skins - caused by penetration of moisture. On the occasion of performance measurements (accomplished by P.Bickle, R.Johnson and the German DFVLR/Idaflieg) it has been demonstrated repeatedly that the larger waviness leads already to considerable performance loss which is all distinctly noticed in competitions. A competition

pilot will always be anxious to preserve or restore the performance of his glider to its full extent, but unfortunately owners of training and instruction gliders are generally of the opinion that they may accept such a performance loss with those gliders. This is regrettable in the view of the manufacturer because he makes all efforts to build and supply also these gliders with a clean aerodynamic surface. The valuable production time used to this end is then possibly uselessly provided.

Owing to the UV-radiation the gel coat of the paint surfaces grows brittle and shrinks; at the same time the UV-light destroys paint ingredients. So moisture (rain, dew) working in on long term will wash the decomposed paint ingredients out off the paint. The paint starts chalking and gets hairline cracks owing to the concurrence of embrittlement and shrinkage. Furthermore, these hairline cracks gather dirt which through its aggressive effect and its stronger heating-up from sun radiation further precipitates the degradation of the paint. Owing to this the intended protective effect for the fiber composite structure against moisture and UV-radiation is no longer granted.
Certainly a good care with hard wax can slow down the above process distinctly, but it cannot be stopped completely. For this reason a repainting of the aircraft will always become necessary at some point of time.

However, we point out explicitly that paint cracks - even deep cracks - do not represent damages to the aircraft structure if as of their first appearance immediate correct maintenance and care is given furthermore to the aircraft.
As all the outside skin of the aircraft is dimensioned for stiffness, there are no critical mechanical strength problems, even if some cracks have gone down into the fiber composite structure and have already attacked the resin matrix base.
The unknown ageing effects caused by the influence of moisture and UV on the unprotected fiber composite structure are more dangerous.

Those paint cracks as reported from customers in USA and Australia do not appear here in Europe or they develop so much more slowly that a paint crack repair has never yet been carried out here at our works. Accordingly we have no experience of our own with such repairs.
In this connexion we point out expressly that for the mentioned cases in the USA or Australia an absolute "zero" care of the gliders in question added to the "climate" factor; besides these gliders were exposed to the weather almost continuously and without any particular protection - very often day and night.

Maintenance Instruction
PAINT CRACKS

Alexander Schleicher
GmbH & Co.
Segelflugzeugbau
D-6416 Poppenhausen

Action:

To repair the paint cracks, these have to be removed generally by sanding them down to their ground. But in doing so, the fiber composite structure lieing under the gel coat should not be sanded on. Thus the sanding job is difficult and, therefore, relatively expensive.

A. If **deep cracks** are concerned which go down to or into the fiber composite structure (it is assumed that they result from large and rapid temperature changes as found e.g. with wave flights !), and if a repair is decided to be necessary, the paint material has to be sanded down to the fiber composite structure carefully and the area affected must be repaired.
In case that the resin matrix base of the fiber composite structure is already damaged, one should consider peeling off and replacing the damaged fiber composite layer. This work is possibly easier than the careful sanding job.

B. If **hairline cracks** are concerned which run only in the paint surface (and which presumably result from bad maintenance together with continuous UV-radiation - i.e. gliders left outside without any protection for a long period of time), we recommend to remove the paint material from all areas attacked by sanding on them down their end and to repaint these areas. The sooner this measure is taken, the less the work expenditure.

On the subject of rebuilding the paint system with materials available in the USA as well as on the subject of how to rebuild the profile (which is a must for high performance gliders which are to be flown in competitions) R.H.Johnson, Dallas Soaring Association, has written several articles published in SOARING magazine. We advise to consider in any case the repair experience accumulated in the USA.
For Europe we suggest to spray the sanded surfaces first with polyester fillers, to sand them again, and to respray them finally thinly with a white paint system on a Polyurethane basis which should be aircraft-approved.

Material & drawings:

See above point "Action".

Mass and C.G.:

It is necessary to redetermine the mass and C.G. data after repaintings.
After repainting of control surfaces and flaps special attention must be paid to their tailheavy balance

moments; these data are given in the respective Maintenance (or Operations) Manuals of the gliders.
If in the case of older glider models such data are not contained in the manuals, then the mass of the control surfaces and their tailheavy static balance moment must be determined prior to the paint job and must be re-adjusted after the repainting by ± 5 %.

Notes:

1. The action as per this Maintenance Instruction must only by accomplished by the manufacturer or by a technical aviation service station holding an appropriate license.
2. The present Maintenance Instruction PAINT CRACKS dated June 26, 1989, supersedes the previous Maintenance Instruction dated 15.07.87.

Poppenhausen, den 26.06.89

ALEXANDER SCHLEICHER
GmbH & Co.

Gerhard Waibel.

The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

ASK 21
Maintenance Instruction A

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Subject: Re-adjusting the airbrakes.

Affecting: All ASK 21 serial no.s.

Compliance: As required.

Reason: It is important to check in regular intervals the locking of the airbrakes. Each airbrake has its own toggle in the wing. For this reason it must be checked that both airbrakes lock simultaneously and securely.

Action:

1. This is checked by connecting the brakes individually and marking the point on the operating lever gate in the cockpit at which the linkage's dead center occurs. Both dead points should be within 5 mm (0.2 in) of each other and, in the locked state, the individual brakes should still have 10 mm of free movement of the front lever forwards in the gate.

2. If you observe that the airbrakes do not have an even over-center lock, the toggle over dead center must be readjusted. This must be done with the airbrake pushrod disconnected from the HOTELLIER ball quick-disconnect.
   As shown in Fig.1 the short pushrod (1) is to be disconnected from the toggle crank (2); back off the lock-nut (3) and screw out the pushrod (1) by 1/2 to 1 turn. Re-connect in the reverse order and check again as described under point 1.).

3. if the airbrakes still do not have sufficient dead lock force, peel a little off the toggle stop block (4). Using a punch carefully remove some layers from the stop block (4); then again readjust the airbrakes as described under points 1.) and 2.).

Material: New safety nut NM 6, DIN 980-6, if needed.

Poppenhausen, March 23, 1987

ALEXANDER SCHLEICHER
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L.W. Jumtow.

The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

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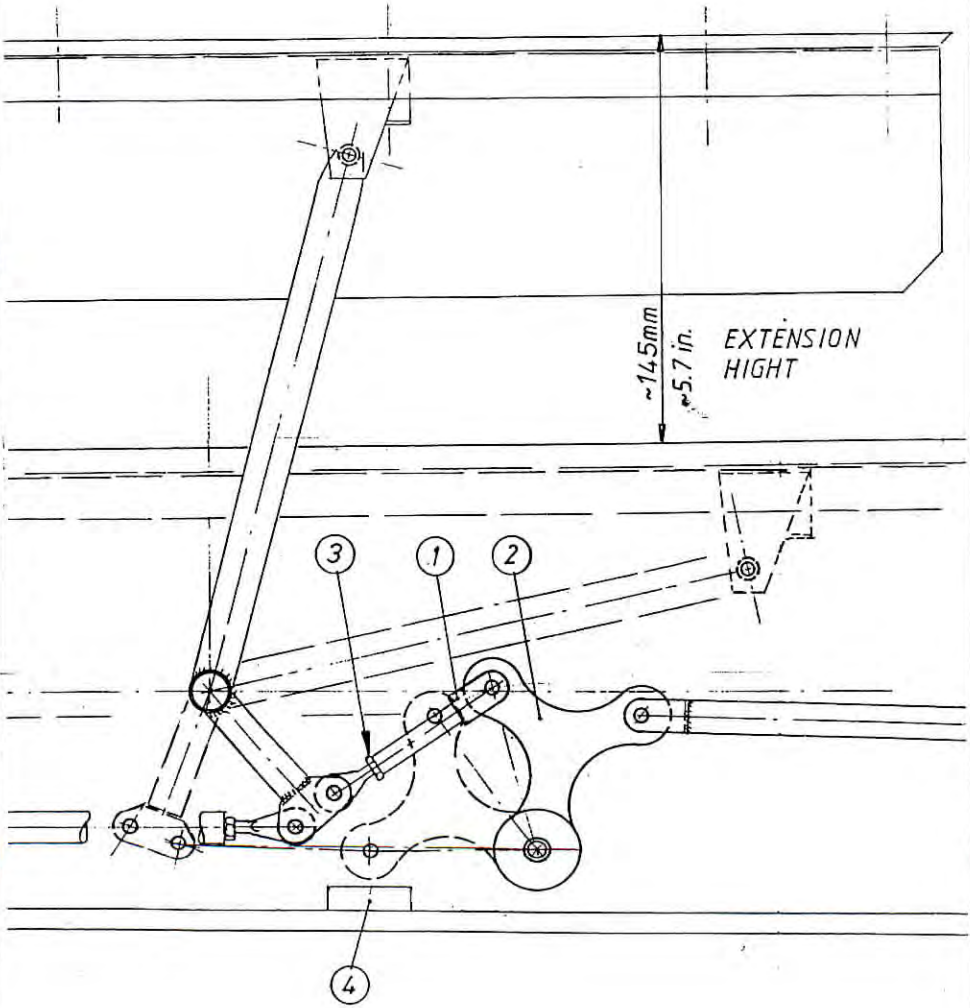
Fig.1



ASK 21
Maintenance Instruction B
Issue I

Alexander Schleicher
GmbH & Co.
Segelflugzeugbau
D-6416 Poppenhausen

Subject: Installation of oversize drag pins

Affecting: All serial no.s ASK 21.

Action:

1. Derig the glider.
2. To be able to safely ream the new holes the safety clips have to be removed at the root ribs
3. Then rig the glider as usual and support the wings by use of wing stands or equivalent (saw horses, trailer dollies) such that the drag pins can be easily removed and inserted.
4. Take one drag pin out, ream the oversize hole and insert new drag pin.
5. Do the same on the other side.
6. Derig the glider.
7. Fix the safety clips again at the new drag pins.

Note: The following pin diameters are available:
11.95 mm, 12.0 mm, 12.1 mm, 12.2 mm and 12.3 mm.

Poppenhausen, July 4, 1990

ALEXANDER SCHLEICHER
GmbH & Co.
Gerhard Waibel
Gerhard Waibel.

The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

Alexander Schleicher
GmbH & Co.
Segelflugzeugbau
D - 6416 Poppenhausen

Subject: Fixing for the first time or replacing the plastic fairing tape (elastic lipseal) at the control surface gaps of aileron, and horizontal and vertical tail.

Affecting: All ASK 21, Data Sheet no. L-339, as of serial no.21001, optional.

Reason: Performance measurements with various gliders have shown that drag can be considerably reduced by a continuous transition between wing and aileron and between stabilizer and elevator respectively.

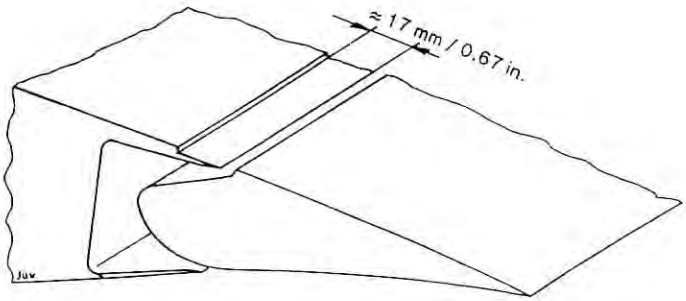
This continuous transition is achieved by means of an elastic lipseal which is applied to the wing, the stabilizer and the fin respectively in order to bridge the actual gap between wing & aileron, stabilizer & elevator, and fin & rudder, due to its curvature into which it is pre-formed to ensure tight seating on the control surfaces.
It is important to ensure that the seal underneath this bridging lipseal is 100 % airtight. The control surface gaps are sealed in addition by means of a Teflon sealing/slip tape, which at the same time serves to reduce the friction of the elastic lipseal on the aileron and elevator surfaces.
Should the elastic lipseal come off or be damaged, this may lead to flutter!

The additional aileron, elevator & rudder control friction generated is minimal and acceptable.

Action:

1. If the elastic lipseal was not fitted before to your glider, a step must first be rebated in the upper wing surface as illustrated in Fig.1.
   NOTE:
   Only the finish layer is carefully removed down as far as the outer FRP lamination without damaging the glass layer.

Fig.1 Upper Wing Surface



2. If the elastic lipseal needs to be removed only for maintenance or repair purposes, please observe the following:

   For disassembly of elevator or aileron:
   The elastic lipseal and the sealing/slip tape need to be removed only on the upper surface (where the control surface hinges are located).

   For disassembly of the rudder:
   Here it is not necessary to remove the elastic lipseal at the fin.

2.1 The elastic lipseal must be removed very carefully so as to avoid any delaminations of the layers in this area. Remove any adhesive residue by means of synthetic resin thinners.

2.2 Accomplish any required inspection, maintenance or repair work at the control surfaces themselves and / or their hinges.

3. Fixing for the first time or replacing the plastic fairing tape (elastic lipseal)

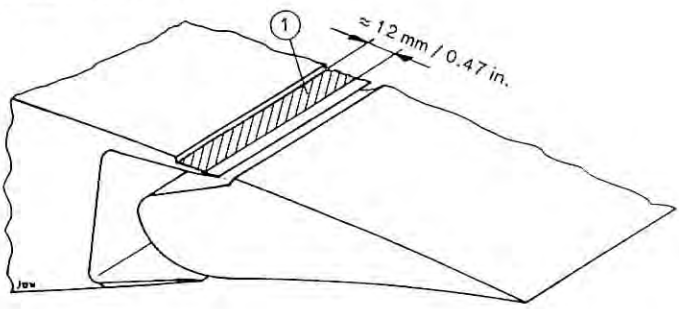
   Notes:
   All surfaces must be completely clean, dry and free from dust and grease!
   This can best be tested by sticking a self adhesive tape to the cleaned surface and then pulling it off again to check that no further dust particles adhere to it.

   Cut the new elastic plastic fairing tape and the sealing/slip tape into appropriate lengths (refer to the table under point "Material").

3.1 Upper Wing Surface

   Apply a 12 mm wide temporary positioning tape (1) [e.g: 12 mm Tesafilm 104] abutting the front edge of the approx. 17 mm wide recessed step [Fig. 2].

Fig.2 Upper Wing Surface



Now apply the sealing/slip tape (2) [3M Scotch Teflon Tape 30 mm wide] abutting the rear edge of the temporary positioning tape (1) . Be careful that the sealing/slip tape lies slack over the gap.
Set the aileron to maximum positive deflection, so that later the Teflon sealing/slip tape is not stretched during normal full control deflections!
Apply full aileron several times so that the sealing/slip tape fits well into the gap.
Then the Teflon sealing/slip tape (2) must be firmly rubbed down on to the surface.

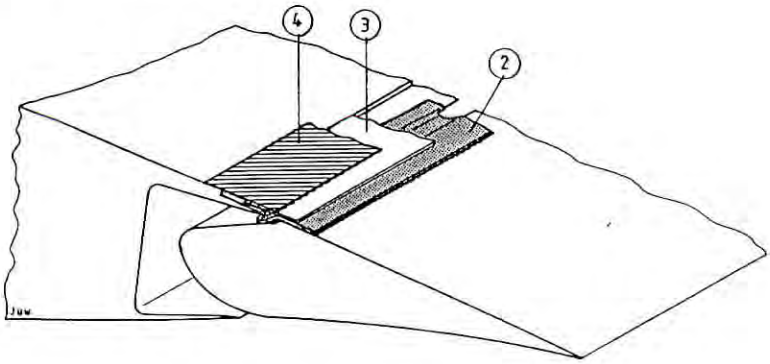
Then remove the temporary positioning tape (1) first applied.

Peel the protective backing from the plastic fairing strip (3) [Mylar foil, 30-15mm wide] and firmly stick it on abutting the front edge of the recessed step in the wing by means of its adhesive film layer [Fig.3].

Press the adhesive zones of the plastic fairing strip firmly down on the surface using a soft wooden block (e.g: Balsa) or a hard rubber roller.

Finally, a protective adhesive tape (4) is applied over the abutment of the front edge of the plastic fairing strip (3) and the step in the wing [Fig.3]. This tape should be as thin and moisture-proof as possible; an example of a suitable tape would be white Tesa film No.104, 25 mm wide.
This protective tape serves to prevent the detachment of the front edge of the plastic fairing strip (elastic lipseal) which might result in dangerous flight characteristics.

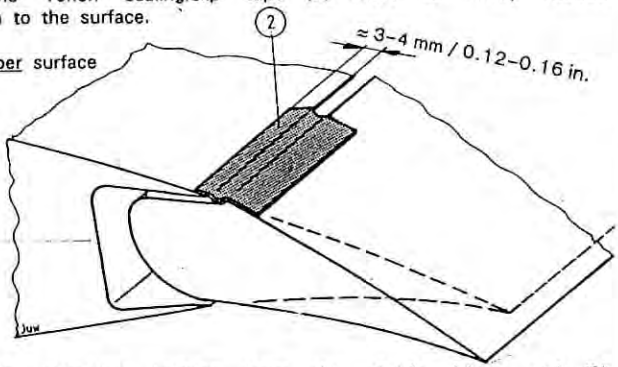
Fig.3 Upper Wing Surface



3.2 Horizont tail upper surface:

There is no recessed step at the stabilizer. As shown in Fig.4 the sealing/slip tape (2) [3M Scotch Teflon Tape 30 mm wide] is stuck on over the stabilizer-to-elevator gap. At the same time the elevator must be set to maximum positive deflection, so that later the Teflon sealing/slip tape is not stretched during normal full control deflections!
Be careful that the sealing/slip tape lies slack over the gap. Apply full elevator several times so that the sealing/slip tape fits well into the gap.
Then the Teflon sealing/slip tape (2) must be firmly rubbed down on to the surface.

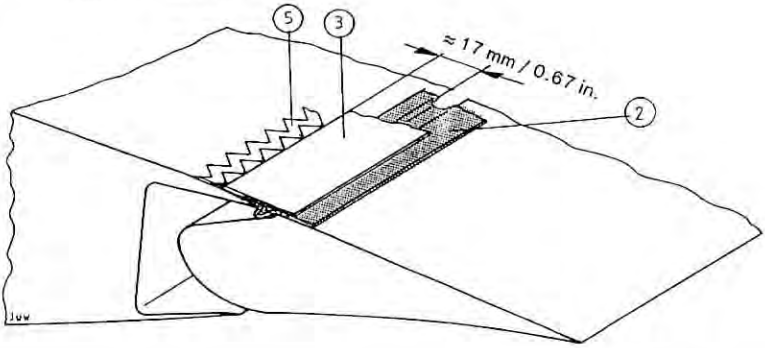
Fig.4 Horizont tail upper surface



Peel the protective backing from the plastic fairing strip (3) [Mylar foil, 30-15mm wide] and firmly stick it on to the stabilizer by means of its adhesive film layer [Fig.5].
Press the adhesive zones of the plastic fairing strip firmly down on the surface using a soft wooden block (e.g: Balsa) or a hard rubber roller.

The zig-zag-tape (5) is stuck on abutting the edge of the plastic fairing strip (3).
NOTE: The front teeth (in the direction of the flight) must not be flattened by pressing them too far down into the glue film, otherwise their turbulator effect will be reduced!

Fig.5 Horizont tail upper surface



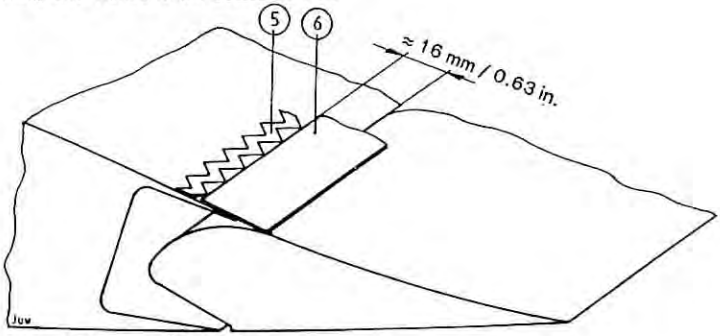
3.3 Wing and horizont tail lower surface:

Remove protective backing from plastic fairing strip (6) [Mylar foil 22-15 mm wide] and stick it on to the wing and horizontal tail lower surfaces, by means of its adhesive film layer [Fig.6].

Press the adhesive zones of the plastic fairing strip firmly down on the surface using a soft wooden block (e.g: Balsa), or a hard rubber roller!

Then the zig-zag-tape (5) is stuck on abutting the edge of the plastic fairing strip (6). [See the NOTE under point 3.2].

Fig.6 Wing and horizont tail lower surface

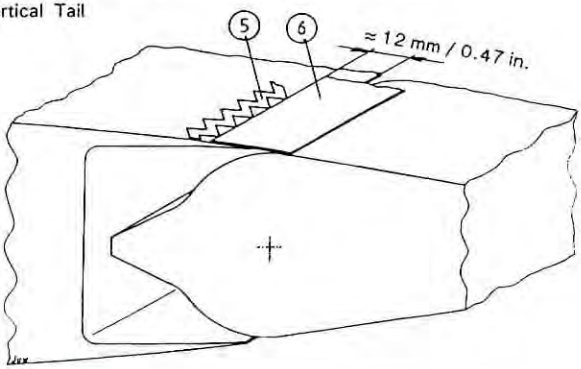


3.4 Vertical tail:

There are no recessed steps at the fin. As shown in Fig.7 the plastic fairing strip (6) [Mylar foil, 22-15 mm wide] is stuck on over the rudder-fin transition at the left and right side (with its adhesive film layer on the fin), then pressed firmly down on the surface.

Then the zig-zag-tape (5) is stuck on abutting the edge of the plastic fairing strip.

Fig.7 Vertical Tail



Material:

	Wing Surfaces Upper	Wing Surfaces Lower	Horizontal Tail Sfce.s Upper	Horizontal Tail Sfce.s Lower	Vertical Tail Sfce.s L & R *
(1) Temporary positioning tape Tesafilm No. 104, 12 mm wide	2x 2.85 m				
(2) Sealing/slip tape 3M Scotch Teflon Tape, 30 mm wide	2x 2.85 m		1x 3.10 m		
(3) Plastic fairing tape Mylar foil, 30-15 mm wide	2x 2.85 m		1x 3.10 m		
(4) Protective adhesive tape Tesafilm No.104, white, 25 mm wide	2x 2.85 m				
(5) Zig-zag tape Mylar foil, 0.5mm thick;12 mm wide		2x 2.85 m	1x 3.10 m	2x 1.50 m	2x 1.25 m
(6) Plastic fairing tape Mylar foil, 22-15 mm wide		2x 2.85 m		2x 1.50 m	2x 1.25 m

Optional in the place of (5) and (6):

(7) Combi-Zig-zag/plastic fairing tape Mylar foil, 38-20 mm wide		2x 2.85 m		2x 1.50 m	2x 1.25 m

* = left and right

The materials required can be obtained from Messrs. Schleicher.

Notes:

1. This action can be accomplished by a competent person.
2. In the place of the plastic fairing tape (6) and the zig-zag-tape (5) optionally a combi-Zig-zag/plastic fairing tape (7) may be glued on.
3. Ensure that the elastic lipseal is in tight contact with the surfaces of the controls even when they are fully deflected.
   The secure and firm adhesion of the elastic lip must be checked.

Poppenhausen, May 7, 1992

ALEXANDER SCHLEICHER
GmbH & Co.
Lutz-W. Jumtow
(Lutz-W. Jumtow)

The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

INSTRUCTIONS FOR THE MAINTENANCE L'HOTELLIER BALL AND SWIVEL JOINTS

HISTORIQUE DU DOCUMENT

REV.	DATE	OBJET DE LA MISE A JOUR	RED.	QUAL.	RESP.
A	11/85	Creation of document	BE	MJD	JMB
B	02/86	Representation of 1 swivel	BE	MJD	JMB
C	01/89	Adjunction of Fig.1 and Fig.2	BE	MJD	JMB
D	07/92	Updating of function of CR147	BE	MJD	JMB
E	03/94	Updating following DEI229-EM	BE	MJD	JMB

LISTE DES DESTINATAIRES

B.E. B.C. Q.C. B.C. Q.C. C.B.	OR. +1 EX. 1 EX. 1 EX.	PRODUCTION	1 EX.

Louis L'HOTELLIER S.A.
93, avenue Charles De Gaulle - 92270 BOIS COLOMBES
Tél.(1)42.42.13.94 Télex 611153F LHOTAIR Télécopie (1)47.60.07.07

RED. : BE DATE : 03/94
PAGE : TIT IND. : E

DOCUMENT IMA N° : 10.01	INSTRUCTIONS FOR THE MAINTENANCE L'HOTELLIER BALL AND SWIVEL JOINTS	E08-A

COMPOSITION DU DOCUMENT

PAGE	IND.	PAGE	IND.	PAGE	IND.	PAGE	IND.	PAGE	IND.
TIT	E	SOM	E	1	E	2	E		

SUMMARY

Louis L'HOTELLIER S.A.
93, avenue Charles De Gaulle - 92270 BOIS COLOMBES
Tél.(1)42.42.13.94 Télex 611153F LHOTAIR Télécopie (1)47.60.07.07

1 - PREVENTIVE AND SAFETY MAINTENANCE INSTRUCTIONS

The rotation of the swivel around the ball must be done with resisting strengh, due to minimum frictions. Consequently it is mandatory to lubricate the swivel/ball assy. This lubrification must be done after cleaning and before assembly, with a non cold coagulating grease.

Eg : ESSO purpose (general use) :
Spray containing oils enriched with silicone (recommended for assemblies exposed to sand or other abrasive materials).

It is mandatory to verify, after each assembly, the correct location of the ball in the swivel. To do so, a location hole is drilled in the locker. When the assembly is good, the hole must be visible and must enable to insert the pin "B" réf. L'H 140-31, or other devices, linked to the locker only.

2 - PERIODICAL CHECK

During the annual visit or no later than every 500 flight hours, it is necessary to verify balls and swivels as follows :

2.1. FREE MOVEMENT OF THE BALL INTO THE HOUSING

- Check that the ball move free of friction point.
- Check the angular displacement.
- Check that there is no crack at the base of the ball

2.2. BALL SPHERICITY MEASUREMENT (See fig. 2)

The variation between several measures of the ball diameter must not exceed 0,1 mm.
This check aim is to detect an abnormal ball wear.

2.3. BALL THREAD CHECK

No thread damage is acceptable. During reassembly the collar must be perfectly set on its base. It is mandatory to fix the ball in position with an adequate locking device.

2.4. SWIVEL VISUAL CHECK

No deformation or penning in ball location or in the locking device seat is acceptable.

2.5. MEASUREMENT OF THE LOCKER LOWER PART PROJECTION AFTER ASSEMBLY OF THE SWIVEL ON THE BALL (see fig. 1)

This projection must be higher than 2 mm.
The aim of this requirement is to verify the efficiency of the automatic take up clearance

2.6. CHECK OF THE LINK BETWEEN DRIVE ROD AND SWIVEL

In the case of an adjustable swivel, verify that the link between swivel and drive rod is tight and properly secured by an adequate locking device.

2.7. SWIVEL ASSY OPERATION CHECK

Seat or locker : no clamping, due to oxydation or other reason, is acceptable.

If after these verifications, one of the above check is out of tolerance, it is mandatory to replace both ball and swivel.
nevertheless it is recommended to replace this assembly every 10 years or every 3000 flight hours.

IMPORTANT NOTE

Any defection parts may be returned to Ets Louis L'HOTELLIER for technical investigation.

FIG. 1

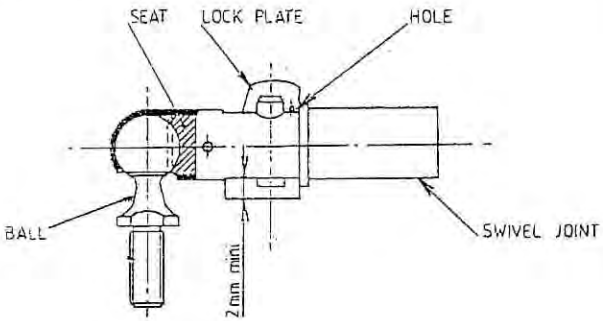
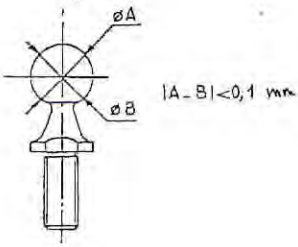


FIG. 2



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REPAIR MANUAL

REPAIR MANUAL

Issue February 1983

Amended and corrected	:	January 1994
Amended	:	July 1994
Amended	:	July 1998
Amended	:	April 1999

Published by the author ALEXANDER SCHLEICHER with the assistance of Martin Heide.

Translation into English has been done by best knowledge and judgement. In any case of doubt the original text in German language is controlling.

2. General Directions

Any material to be used for a repair must be suitable for the intended repair purpose, must fullfill the acceptance requirements of the competent Civil or Military Acceptance Authority, and must be stored according to the makers' prescriptions.
To ensure that these conditions are met, it is advisable to obtain a stock of fiber cloth, resin and hardener, as well as the manufacturer's main layer scheme drawings, already before the beginning of competitions and to store the materials (even the cloth) in airtight packs at about 20 °C. It is also advisable to make yourself familiar with the literature relevant to the subject on fiber composite repair methods.

We recommend -

in German: "Vorläufige Richtlinien für die Reparatur von GFK-Teilen (i.e. Provisional Guidelines for the Repair of GRP Components"); may be obtained from: DLR, Lilienthalplatz 7, 38108 BRAUNSCHWEIG.
or in English: MIL-HDBK-23 Part 1; may be obtained from: Government Printing Office, Washington 25 D.C., USA.

Abrupt change in thickness of laminate should be avoided in order to prevent stress concentration areas, and wherever possible the areas cut out should be oval and circular instead of rectangular. The transition between repair and undamaged area should be as gradual and smooth as possible.
The scarf or taper angles for fiber composite materials should be between 1 : 50 and to 1 : 100. Thin laminate layers cannot be scarfed; here the joints must overlap. In case of bi-directional cloth (equal number of fibers in warp and weft) the overlap lengths should be about 10 mm per 100 g/m^2 of cloth weight. With predominantly uni-directional cloth (reinforced warp) the overlap lengths of the warp should be ≈ 20 mm per 100 g/m^2. The weft fibers need not overlap. For exact values see diagram "Overlap Lengths".

Fiber composite materials are susceptible to water. Therefore, wet sanding of repaired areas must be avoided. For the same reason it is also important that all repaired areas be preserved by paint finish after the inspection - wherever necessary by a licensed inspector.

3. Repair Methods & Classification

The methods described hereafter apply only to smaller repairs. Major repairs must only be carried out by the manufacturer of the relevant part, or by an appropriately licensed aviation repair station; major repairs also require a new release inspection. Many references given hereafter apply to the repair of sandwich areas because they are particularly tricky for repair due to their structure. These described methods are analogously applicable to any simple fiber composite skin repair.

Repair Classification

Sometimes it may be necessary to do a temporary repair while the permanent repair over a larger area will then be carried out later by the manufacturer. Such provisional repairs are usually done mostly only superficially and are not the subject of these repair instructions.

Repairs are divided into the following classes, according to the extent to which the damage affects the airworthiness of the entire aircraft.

CLASS 1: Large area destructions requiring partial replacement of the component or a repair over a large area, i.e. damage to highly stressed components which impair the airworthiness, must only be repaired by the manufacturer of the relevant component, or by an appropriately licensed aviation repair station.

CLASS 2: Holes and fractures which e.g. run through a sandwich structure destroying both laminate skins, but only over a smaller area.

CLASS 3: Small holes and fractures in the outer skin which have not resulted in any internal damage, neither to the core material (foam, Balsa, tubus) nor to the inner laminate skin.

CLASS 4: Abrasions, scratches and grooves which do not involve a fracture or break.

4. Repair materials and useful aids

For all repairs it is important to know the number of layers, the cloth weight per m^2, and the fiber direction of the laminated cloth. This information is detailed in the layer scheme drawing of the component in question or can be inquired of the manufacturer. In an emergency, it is possible to establish the composition of a laminate by burning out the resin (gas welding torch) on a broken piece from the area needing repair.

The glass cloth used must be treated with Volan A finish, or I-550, and be stored in dry conditions. If in doubt, the glass cloth should be dried briefly with a fan heater before being used.
For GRP repair work the resin mixture to be used should be 100 parts (by weight) of Epikote 162 and 38 parts by weight of Laromin C 260 (Epikure 113).
Clean containers and thorough mixing (approx. 2 min.) are a basic pre-requisite to success. The pot life of a 100 g resin mixture is about 25 min. at 23 °C. When the mixture has gelled, i.e. has become noticeably more viscous, it must no longer be used, as it cannot wet out the cloth sufficiently any more. We point out distinctly that the original strength of a component cannot be achieved without final heat treatment (curing for 12 hours at 60 °C).
But temperatures above 80 °C must be avoided.

5. Preparing the parts for repair

Wherever possible all damaged components should be removed from the aircraft prior to their repair. They should then be cleaned with soap-suds and thoroughly dried. Now use a solvent (tri-chlor-ethylene, carbon tetra-chloride) to remove any wax and grease residues from the repair area. Finally the area is sanded using glass paper of grade 60 to 80. The surrounding areas are covered with stout paper or plastic foil to protect them from being soiled by resin drops.

6. Repair Classes

Class 4 Repair

Surface abrasions, scratches and grooves (provided the fiber glass laminate has not been damaged) usually ony require a new protective coat. Polyester paint is ideal for this (mixture of 100 parts UP gelcoat, white 03-69469, with 3 parts hardener 07-20500). To fill dee+er grooves, the paint can be allowed to gel slightly (about 30 min.). If the reinforcement layers have been damaged, the areas must be cleaned and, if necessary, smoothed down lightly with glass paper. Then one layer of fine glass cloth is applied over the area and covered with plastic foil. When the resin has hardened, use filler and re-paint.

Class 3 Repair

The damaged outer laminate skin is cut out over a sufficiently large area in rounded shapes. Be careful to remove any detached laminate layers from the core material. Then the edges of the damaged outer skin must be sanded down to a very flat taper. The laminate layers which become visible like contour lines, provide a good guide for the evenness of the taper. If the supporting core material has also been damaged, it must be removed, where necessary, right down to the inner laminate. Please note that the core material is repaired using Balsa wood of the specific weight 0.15 - 0.19 kg/dm^3. Scarf ratio is 1 : 5 in the direction of the fiber.

No scarf is made at right angles to the fiber direction. The foam core material - Conticell or Rohacell - is not scarfed (see Fig. 3a and 3b).
The cloth for the new outer laminate skin is now cut to size; where the largest cut piece should just cover the entire sanded area and the smallest cut piece should be the size of the removed core material area. All remaining layers should be graded in equal steps between these two extreme sizes.
A suitable technique is: a suitably larger piece of cloth is laid on a plastic foil and impregnated with resin, using a paint brush or a rubber smoother, then it is covered with a second plastic foil and all air bubbles and excess resin is squeezed out. Together with these foils the laminates are then cut to size.
Now first the new core material piece is impregnated and inserted in its place. Then the laminates are laid in, starting with the largest cut piece. To do this the bottom foil is torn off, the laminate inserted, and then the upper foil is peeled off, etc. All further repair steps are similar to those described under Class 4. For unsupported skin laminates proceed analogously. Perhaps it needs in this case first a piece of foam to be glued to the bottom surface to prevent the wet cloth laminate from sagging down (Fig.1.).

Class 2 Repairs

Damage which has penetrated both laminate skins, can be repaired as follows: all damaged areas in the skins and in the core material are cut out; the skins here again being cut in either oval or round shape. GRP laminate skins are sanded to a very flat taper (1 :50 up to 1 : 100) and the Balsa wood is scarfed in along the fiber direction (1 : 5). When the new core material has been inserted, the laminates are glued in as described under Class 3 repairs. First on one side only, and then after the first skin has cured completely, the laminate on the other side is glued on (Fig.2).

If there is no or only very difficult access to the inner skin of the sandwich, the repair area should be prepared as shown in Fig.3. Because the inner skins of the sandwiches (wing; tailplane) are very thin throughout, they cannot be scarfed, but only overlapped. However, this fact simplifies the repair somewhat as the lower laminate skin need not be scarfed.

The cloth layers of the upper laminate skin are prepared as described for Class 3 repairs. The lower skin layers are laminated onto the underside of the core material and then allowed to gel for 2 to 3 hours at 20 to 23 °C. Now fresh resin-hardener mixture is applied to the glue joints and the core piece with the lower laminate skin already glued on, is inserted and glued into place under light pressure. The upper laminate skin can then be repaired as described for Class 3 repairs.

If there is the risk (especially in the case of larger holes) that this thin, unsupported inner laminate skin will be displaced when the core material is glued in place, then it should be supported from the inside by some foam pieces beforehand. Styro-foam used with Uhu-por glue has proved useful here. If the inside area is inaccessible, the foam pieces can remain in these repaired areas permanently.

Class 1 Repairs

Such repairs should be reserved to the manufacturer or to an appropriately licensed aviation repair station. In any case the manufacturer and the competent Civil Aviation Authority must be contacted.

7. Summing up.

the following points are particulary important for successful repairs:

1. A bright, warm (20 °C), and dry room (50 % relative humidity).
2. Grease-free, cleanly sanded glue surfaces (watch hand sweat!).

3. Use of original materials; resin and hardener must not be older than 2 years.
4. Glass cloth treated with Volan A finish or I 550 finish, stored in dry condition. Observing pot life and curing time. A well mixed resin/hardener mixture (crystallized hardener can be regenerated by warming it up to 30 °C).

8. New Materials Carbon & Aramid

There are now in addition to the so far used standard glass fibers the late-technology carbon and aramid fibers (aramid is also known as Kevlar or PRD) which have alredy been used for main components in the series construction of the ASW 22. In composite with a resin system these materials are known as CFRP (Carbon Fiber Reinforced Plastics) and SFRP (S standing for the aramid fiber including Synthetic Fiber).

Components in various SCHLEICHER sailplanes are built from these new fibers, e.g. -

- Wing spar flanges	Carbon fiber rovings (ASW 22).
- Wing shells	CFRP-Conticell sandwich (ASW22)
- Fuselage tail boom	CFRP fabric strips (ASW 22)
- Control surfaces & flaps	SFRP and SFRP-Rohacell-sandwich (ASW 20 B/C and ASW 22)

The general repair instructions given here before for GRP fibers, are also applicable to the above new materials. Any differences for repairs with carbon and kevlar fibers are described hereafter.

Special Notes

Resin

When repairing CFRP and SFRP components it must be observed that these fibers require a different type of resin-hardener system than GRP repairs. In order to get the maximum use of the strength of carbon and kevlar fibers at higher temperatures, an epoxy resin must be used which provides still sufficient strength at 54 °C temperature.

For this reason the usual Epikote 162 cannot be used. SCHLEICHER uses for these components the resin L 160 with hardener 163 (100 parts resin : 28 parts hardener). The components must be cured at least 15 hours at above 55 °C.

Carbon fibers

Broken CFRP parts splinter badly so that there is increased risk of injury; gloves should always be worn when working on such fractures. A major disadvantage for such repairs is that the delaminations do not show distinctly by visible white areas - as in the case of glass repairs. To detect the extent of the damage, therefore, the areas surrounding a damaged region must be examined with the greatest care for hardly visible cracks, e.g. by loading or pressing them.

Even when only the paint appears to be damaged, you will find sometimes damage in a CFRP laminate where a GRP laminate would have been still undamaged underneath.

Basically cloth or rovings from carbon fibers can be worked up in the same way as glass fibers. If you have to repair laminates where the carbon fibers run into one direction only while glass fibers run in the other direction (e.g. Interglas 02902), such layers are treated as uni-directional or warp-reinforced layers and the glass need not be scarfed.

Overlap lengths of the different cloth weaves or rovings (mats) are given in the diagram. Note that the scarf length must only be half as long as the overlaps.

When wetting them with resin you will notice that the wetting through of the cloth is not visible. The solution here is to weigh the cut carbon piece which is to be used for the repair, and to work on it with the corresponding calculated resin-hardener amount. For a

CFRP laminate applied by hand the correct proportion of fiber weight is about 35 %; this means that the proportion of the resin used must be 65 % (exception: this does not apply to roving spars).

Aramid fibers

You will come across the first difficulty in working with Aramid right at the point when attempting to cut the cloth. This material can only be cleanly cut when using really sharp cutting tools (serrated cutters).

When sanding it, you will quickly realize that it is virtually impossible to obtain a sanded surface free from fiber fluff. It helps to rub it down wet with wet-and-dry paper. Of course. the sanded area must at once be dried thoroughly, using a fan heater, before further work is continued.

As the Kevlar fiber absorbs moisture, by which it will be deteriorated, it must be stored always in dry conditions or at least dried out before use.

Kevlar must be protected from UV light, both in its unprocessed and processed condition. A Kevlar repair area therefore must immediately be painted, using a paint with a UV-filter. The UP paints (former designation was PE paint) used by SCHLEICHER do contain this UV protection (titanium dioxide as white pigment).

Thin Kevlar skins as e.g. in the control surfaces and flaps of the ASW 22 cannot be scarfed and should be repaired by simple overlap. The resulting disalignment in height is corrected with filler and smoothed down. In view of aerodynamics this has no longer any influence for flaps or ailerons.

When repairing mass-balanced control surfaces their tailheavy moment must be checked in any case after the repair is done.

It may be useful to determine the tailheavy moment already *prior* to the repair. Thus it is possible to estimate whether it will at all be feasible to stay within the limits after a repair.
In case of large damage to these parts a replacement by new parts makes more sense anyhow.
Overlap lengths are given in the relevant diagram for Aramid. Scarf lengths are half as long as overlap lengths.

Dressings

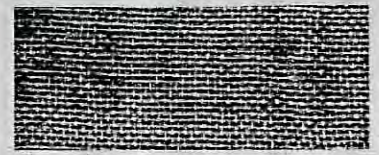
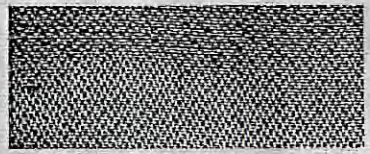
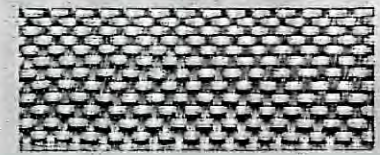
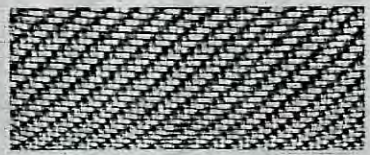
Carbon and Aramid fibers are treated with a dressing to make it possible to weave cloths from the fibers. For carbon fiber cloths this dressing also provides for better working qualities. It is an Epoxy resin which is used as dressing for carbon fiber.
The Aramid fibers are even dressed with a substance (poly vinyl alcohol) which is also used as a release agent. For this reason it is absolutely essential to wash out the Aramid cloth very thoroughly (dressing residue < 0.05 %).

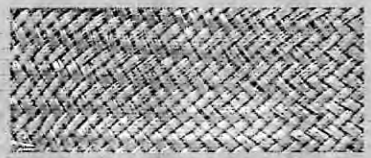
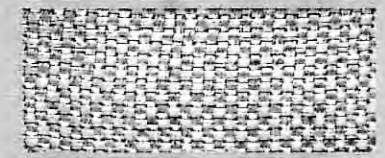
WARNING: Only such Aramid cloth qualities must be used where the manufacturer states explicitly that the dressing has been washed out.

Latest service life fatigue tests with carbon laminates have demonstrated that the type of Epoxy resin used as dressing must match the resin with which the laminate has been made.
Therefore, it is important to use only the original materials stated.

9. Tables and Diagrams

6 Tables, 3 Figures, 3 Diagrams.

Muster / sample	weight g/m²	Gewebe - Bezeichnung (code) f. Glasfasern (glassfibre) Interglas	LN 9169	remarks
	63	90070	8.4505.6	1610* * US-Spezifikation
	106	91110	8.4545.6	
	163	92100		
	163	92110	8.4548.6	

Muster / sample	weight g/m²	Gewebe - Bezeichnung (code) f. Glasfasern (glassfibre) Interglas	LN 9169	remarks
	280	92115		1510* * US-Spezifikation
	280	92125	8.4551.6	
	395	92130		
	395	92140	8.4554.6	

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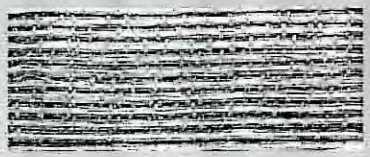
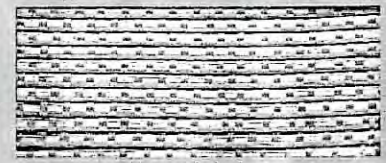
	220	92145	8.4520.6	
	430	92146	8.4525.6	

Rev.No./Date. Sig.

Author

Date July 1994

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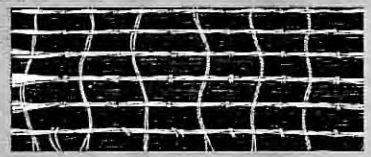
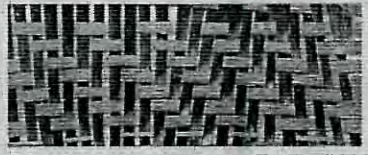
Muster / sample	weight g/m²	Gewebe - Bezeichnung (code) f. Kohlefasern (carbonfibre) producer	LN	remarks
	125	Rigilor AXT 125 Carbotex CX 12		DEUTSCHE CARBONE AG AEROTEX GMBH
	250	Rigilor AXT 250 Carbotex CX 25		DEUTSCHE CARBONE AG AEROTEX GMBH
	293	Sigratex KDU - 1001		SIGRI ELEKTRO-GRAPHIT GMBH
	293	Sigratex KDU - 1009		SIGRI ELEKTRO-GRAPHIT GMBH

Muster / sample	weight g/m²	Gewebe - Bezeichnung (code) f. Kohlefasern (carbonfibre) producer	LN	remarks
	318	Sigratex KDU - 1012		SIGRI ELEKTRO-GRAPHIT GMBH
	190	02902		INTERGLAS
	200	03040		INTERGLAS
	245	03056		INTERGLAS

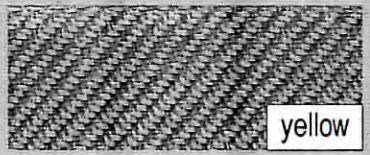
Muster / sample	weight g/m²	Gewebe - Bezeichnung (code) f. Aramid-Fasern (-fibre) Interglas	DIN 65 427	remarks
 yellow	63	98605	5.2230.3	120* * Mil-y 83370 A
 yellow	120	98608	5.2231.3	
 yellow	170	98612	5.2234.3	
 yellow	225	98631	5.2235.3	

Fig.1 REPARATUR DER KLASSE 3 / REPAIR CLASS 3

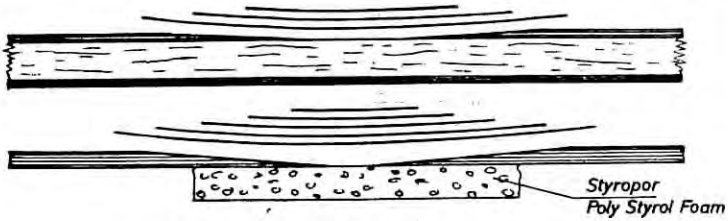


Fig.2 REPARATUR DER KLASSE 2/ REPAIR CLASS 2
(Innenseite zugänglich)/ (inside skin accessible)

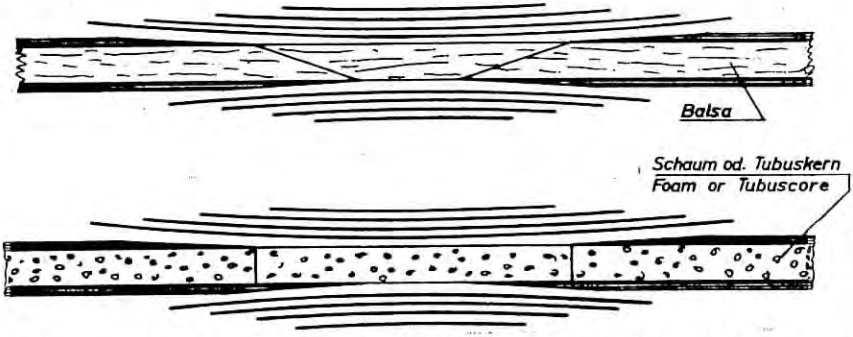
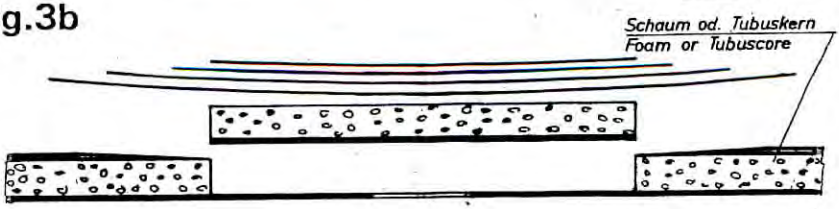


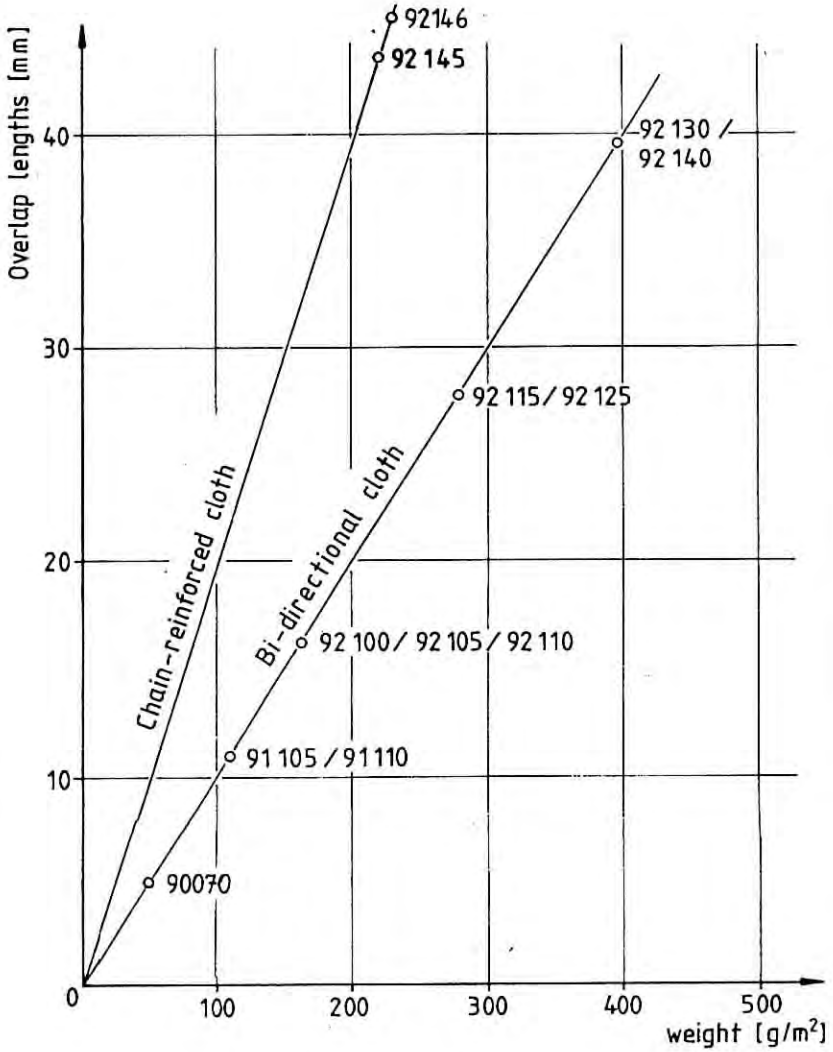
Fig.3a REPARATUR DER KLASSE 2 / REPAIR CLASS 2
(Innenseite unzugänglich)/ (inside skin inaccessible)
Vorbereitung der Reparaturstelle /Preparing the repair area

Fig.3b



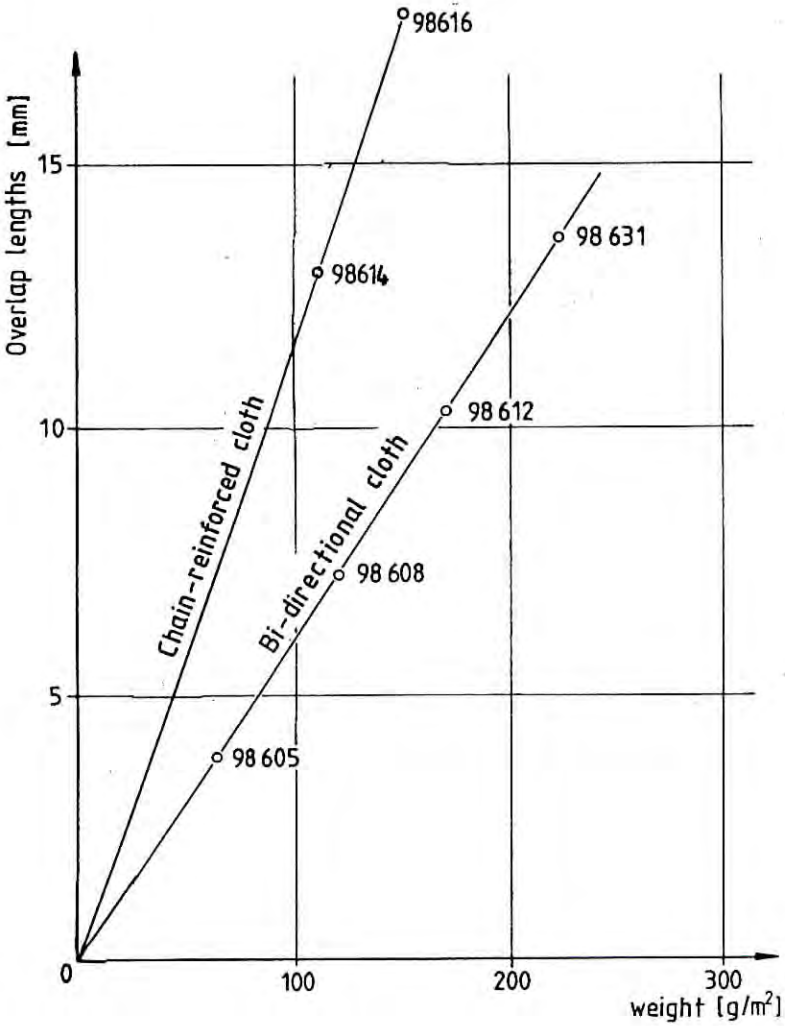
The taper of all scarf joints is shown greatly exaggerated.

Diagram: overlap length for glass fiber



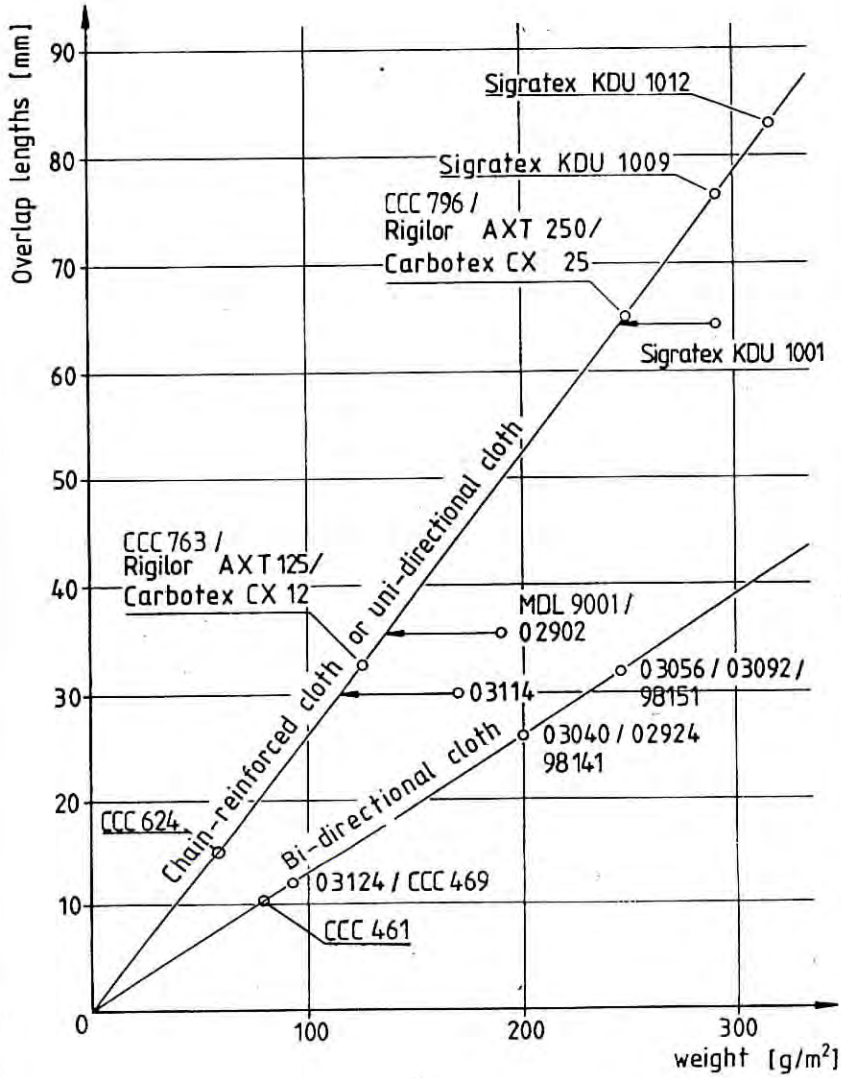
Scarf lengths are half as long as overlaps.

Diagram: overlap length for Aramid fiber



Scarf lengths are half as long as overlaps.

Diagram: overlap length for Carbon fiber



Scarf lengths are half as long as overlaps.

Materials used and supply reference: As per: 14.01.94

Any of the materials hereafter may be obtained by Messrs.ALEXANDER SCHLEICHER.

		formerly:	
Resin	Glycidäther 162	Epikote 162	Araldit LY 1525 BD
Hardener	Epikure 113	Laromin C 260	HY 2954
Manufacturer:		Manufacturer:	
Deutsche Shell Chemie GmbH		Ciba-Geigy AG	
Kölner Straße 6			
65760 Eschborn		Frankfurt/Main	

Resin	L 285	L 160
Hardener	H 285/286/287	H 163
Manufacturer:	Martin G. Scheufler Am Ostkai 21/22 70327 Stuttgart-Obertürkheim	

Glass fiber cloth from E-Glass with Finish Volan-A or I 550	Carbon and Kevlar cloth
Manufacturer: CS-INTERGLAS AG Benzstraße 14 89155 Erbach	C. Cramer GmbH & Co. KG Weberstr. 21 48619 Heek-Nienborg

CARBON FIBER MATS

Carbotex CST 125, CST 250 / Rigilor AXT 125, AXT 250 with dressing for Epoxy resins.
To be supplied: from Messrs.ALEXANDER SCHLEICHER.

ROVINGS,

E-Glass: EC 9-756 K 43 (68) Manufacturer:
Vetrotex Deutschland GmbH
Bicherouxstraße 61
52134 Herzogenrath

Carbon fiber: KC 20 SDY LN 29 964 and CF-fabric strips (KDU)
Manufacturer: Sigri GmbH
Werner-von-Siemens-Straße 18
86405 Meitingen

FOAM MATERIALS — As per: 14.01.94

PVC hard foam 5.1360.2 according to DIN 29 898

	formerly:
Divinycell H 60	Conticell 60
Manufacturer:	Manufacturer:
Divinycell International GmbH	Continental AG
Max-von-Laue-Str. 7	
30966 Hemmingen	Hannover

PMI hard foam 5.1460.2 according to DIN 29 898 (Rohacell A71)
Manufacturer: Röhm GmbH
Chemische Fabrik
Kirschenallee 45
64293 Darmstadt

RESIN FILLERS:

Aerosil — Manufacturer: A+E Fischer
Postfach 13 02 45
65090 Wiesbaden

Cotton flocks, Type FB 1/035 (formerly Type FL 1f)
Manufacturer: Schwarzwälder Textilwerke
Postfach 4
77771 Schenkenzell

Micro balloon, white — Manufacturer: OMYA GmbH
Postfach 51 08 40
50944 Köln 51

PAINT

	formerly:
UP-gelcoat T 35 white	UP-gelcoat white 03-69 469
UP-hardener SF 2 / SF 10	UP-hardener No. 07-20 500
Thinner SF	Thinner No. 06-10 170
Manufacturer:	Manufacturer:
Martin G. Scheufler	AKZO Coatings GmbH
Am Ostkai 21/22	
70327 Stuttgart-Obertürkheim	Stuttgart

REPAIR INSTRUCTION
for all Fiber Composite Aircraft
Annex to the Repair Manual

Alexander Schleicher
GmbH & Co.
Segelflugzeugbau
D-6416 Poppenhausen
XXXX

new Post Code: D-36163

Subject: Repairs on fiber composite construction aircraft for which the original resin systems are no longer available in the market.

Serial number applicability: All serial no.s of SCHLEICHER aircraft made from fiber composite materials.

Reason: The first fiber composite aircraft types have been built almost 30 years ago and it becomes more and more difficult to obtain the original resin systems.
This repair instruction states which resin types can be used for which aircraft types on repairs.

Action: The following aircraft types made from glass fibers -

ASW 12 (all model variants and serial numbers)
ASW 15 (all model variants and serial numbers)
ASW 17 (all model variants and serial numbers; except for such fuselage built as per TN no.4, i.e. with carbon fiber)
ASW 19 (all model variants and serial numbers)
ASW 20 (all model variants and serial numbers; except for the control surfaces & flaps of ASW 20 B, BL and ASW 20 C, CL variants)
ASK 21 (all model variants and serial numbers)
ASK 23 (all model variants and serial numbers)

have been or are still built with the resin systems:
Epoxin 162 with hardener Laromin C260, subsequently renamed as:
Epikote 162 with hardener Epikure 113, subsequently renamed as:
Glycidether 162 with hardener Epikure 113.

In case that these original materials are no longer available, the following resin system can be used for the repair :
Scheufler L 285 with hardeners H 285 (rapid), or H 286 (medium) or H 287 (slow).

Primary structure components which have been built with the Scheufler resin system L 285, CANNOT be repaired with Epikote 162 / Epikure 113!

The carbon fiber reinforced ASW 17 fuselages as per TN no.4a were built with the resin system: Bakelite L 20 & hardener SL.

The ASW 22 (all model variants and serial numbers) was built with the resin system: CIBA XB 3052A & hardener XB 3052B; subsequently renamed as: LY 5053 & hardener HY 5052;
and with Scheufler resin L 160 and hardener H 161, H 162, H 162B or H 163, which was replaced after 1985 by the Scheufler resin L 285 with hardeners H 285, H 286 or H 287.

new Post Code: D-36163

The same resin systems as on the ASW 22 were also used for the control surfaces & flaps of ASW 20 B, BL and ASW 20 C, CL variants.

The aircraft types ASW 24, ASH 25 and ASH 26 E (all model variants and serial numbers respectively) were built only with the resin system: Scheufler L 285 with hardeners H 285, H 286 or H 287 - except for such heat-resistant engine parts which require explicitly other material.

For all before-mentioned aircraft types repairs can be done using either the original resin systems or Scheufler L 285 with hardeners H 285, H 286 or H 287 (depending on the desired pot life and curing conditions).

Any repair using Scheufler resin L 285 requires a post curing for about 12 hours at 58 - 62°C!

Notes:

Fuel Tanks:
ASK 14 and ASK 16 fuel tanks were built using the resin system: Epikote 162/Laromin C260.

Since the use of low-grade-benzole fuels (MOGAS-Eurosuper and Super Plus) these tanks have become blind and soft.

The fuel tanks for ASW 22 M, ASW 22 BE, ASW 24 E, ASH 25 E, and ASH 26 E, as well as new built tanks for ASK 14 and ASK 16 were built with: Bakelite L 20 & hardener H 91.

They must be repaired only with said Bakelite L 20 & H 91.

Poppenhausen, July 4, 1994

ALEXANDER SCHLEICHER
GmbH & Co.

Gerhard Waibel

The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

Sheet 1 of 1	REPAIR INSTRUCTION CARBON FIBER CLOTH FOR ALL FIBER COMPOSITE AIRCRAFT Annex to the Repair Manual	**Alexander Schleicher** GmbH & Co. Segelflugzeugbau D - 36163 Poppenhausen

Subject: Repair and production of fiber composite aircraft for which the types of fabrics or roving layers as stated in the layer scheme drawings are no longer used.

Applicability: All AS aircraft, sailplanes and powered sailplanes, made from fiber composite reinforced plastics (FRP).

Reason: The designations of fabrics or roving layers have changed in the course of the years or are no longer in use and /or have been replaced by other types. This repair instruction states which types of fabrics or roving layers may be used as substitute.

Action: The materials Carbotex CX 12 or CST 125 (fabric weight 125 g/m², C-fiber percentage 120 g/m²) and Carbotex CX 25 or CST 250 (fabric weight 250 g/m², C-fiber percentage 240 g/m²) are no longer used.
For repair and production of FRP aircraft or FRP structural components the following substitute fabrics or layer styles may be used and the layer scheme drawings amended correspondingly.

Substitute for Carbotex CX 12 and CST 125, respectively:

Designation	Fabric weight	C-fiber percentage	Supplier	
ITG 98320 (03 340)	132 g/m²	121 g/m²	Interglas	
MDL 9001	140 g/m²	120 g/m²	Sigri	
CCC - Style 763	140 g/m²	120 g/m²	Kramer	X)

Substitute for Carbotex CX 25 and CST 250, respectively:

Designation	Fabric weight	C- fiber percentage	Supplier	
Sigratex KDU - 1001 (75 mm wide)	293 g/m²	248.4 g/m²	Sigri	
Sigratex KDU - 1009 (75 mm wide)	293 g/m²	282.4 g/m²	Sigri	X)
Sigratex KDU - 1012 (150 mm wide)	319 g/m²	300.4 g/m²	Sigri	X)
2 layers ITG 98320	132 g/m²	121 g/m²	Interglas	
2 layers CCC - Style 763	140 g/m²	120 g/m²	Kramer	
CCC - Style 796	280 g/m²	247 g/m²	Kramer	X)

X) Currently available ex stock from SCHLEICHER!

This Repair Instruction must be inserted as Annex into the Repair Manual !

Notes: All fabric or roving layer materials can be ordered from

Alexander Schleicher GmbH & Co.
PO Box 60
D-36161 Poppenhausen
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Poppenhausen, July 7, 1998

Alexander Schleicher
GmbH & Co.

By order (Lutz-W. Jumtow)

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Sheet 1 of 1	**Technical Note No. 01-99** for all aircraft types of Glass Fiber & Fiber Composite Construction	**Alexander Schleicher** GmbH & Co. Segelflugzeugbau D - 36163 Poppenhausen

Subject: New resin system for laminating glass, carbon, and Aramid fiber cloth

Applicability: All AS aircraft - sailplane and powered sailplane types - for which resin laminating systems are used.

Compliance: None.

Reason: The resin manufacturer Martin G. Scheufler has developed a laminating resin L 335 with the hardeners H 335, H 335 - 340 and H 340 which can be used instead of the resin system Epikote 162 with hardeners Epikure 113 or Laromin C 260 respectively. Production of the resin system Epikote / Epikure will be discontinued.

This laminating resin system is qualified by the tests as prescribed by the Luftfahrt-Bundesamt (LBA) in the Guidelines for Resin Fiber Composite Structures (German: RHV) and has been certified by the LBA for the aviation industry.

Action: For all fiber composite components which were built using the resin system Epikote 162 with hardeners Epikure 113 or Laromin C 260 respectively, now the laminating resin L 335 with the hardeners H 335, H 335 - 340 and H 340 can be used when the components are new built or repaired.

Spars **must not** be repaired nor new built with the laminating resin L 335 and the hardeners H 335, H 335 - 340 and H 340. In case of doubt it is required to contact the company Alexander Schleicher.

Components which have been repaired or new built with the resin L 335 must be cured for 15 h at a temperature of 55 - 60 C°.

This TN must be inserted as annex into the AS Repair Manual.

Notes: The resin system L 335 can be obtained from :
Alexander Schleicher GmbH & Co.
P.O. Box 60
D-36161 Poppenhausen/Wasserkuppe
Tel 06658 - 890 or Fax 06658 - 8940 or email AS-sailplanes@Fulda.net

Poppenhausen, March 12, 1999

Alexander Schleicher
GmbH & Co.

by order Lutz-W. Jumtow

(Lutz-W. Jumtow)

The German original of this Technical Note has been approved by the LBA under the date of March 16, 1999, (signature: JUNG). The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

Sheet 1 of 1	**Technical Note No. 02-99** for all aircraft types of Glass Fiber & Fiber Composite Construction	**Alexander Schleicher** GmbH & Co. Segelflugzeugbau D - 36163 Poppenhausen

Subject: New finish for glass fiber cloth

Applicability: All AS aircraft - sailplane and powered sailplane types - which use glass fiber cloth for their construction.

Compliance: None.

Reason: CS-INTERGLAS AG, the manufacturer of glass fibers, has developed a new finish for Polyester resin (UP), Vinyl ester resin (VE), Epoxy resin (EP), and Polyamid systems (PA); this new finish replaces the previous finish types.

The new finish FK 800 made on the basis of Amino-Silan, offers the following advantages:
- lower Chloride values
- faster wetting of the cloth
- improved adhesion between cloth and resin system
- Chrome contents 0%
- excellent mechanical properties.

This finish is qualified by the tests as prescribed by the Luftfahrt-Bundesamt (LBA) in the Guidelines for Resin Fiber Composite Structures (German: RHV) and has been certified by the LBA for the aviation industry.

Action: Glass fiber cloth with the new finish FK 800 can be used for all fiber composite components, either for new built parts or for repairs, instead of the previously used glass cloth types.

This TN must be inserted as annex into the AS Repair Manual.

Poppenhausen, March 15, 1999

Alexander Schleicher
GmbH & Co.

by order Lutz-W. Jumtow

(Lutz-W. Jumtow)

The German original of this Technical Note has been approved by the LBA under the date of April 6, 1999, (signature: JUNG). The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.

Sheet 1 of 1	**Technical Note No. 03-99** for all aircraft of the production series ASH, ASK & ASW	**Alexander Schleicher** GmbH & Co. Segelflugzeugbau D - 36163 Poppenhausen

Subject: New material specifications for copper-zinc alloys (formerly brass).

Applicability: All AS aircraft - sailplane and powered sailplane types - currently in production as well as manufacture of spare parts for those formerly in production.

Compliance: None.

Reason: DIN 17 660 and 17 661 standards contain partly changed specifications, material abridged signs or numbers respectively, for copper-zinc alloys (formerly brass). The brass as originally stated in the drawings is no longer available in economical quantities.

Action: This TN supersedes the material specifications for copper-zinc alloys (formerly brass) on the respective existing drawings and must be inserted as annex into the AS Repair Manual.

Material: Instead of the brass material specifications which were so far stated in the drawings now the following material abridged signs and numbers can be used as substitute:

Material Abridged Sign	Material Number	Tensile Strength N/mm²	DIN
Cu Zn39 Pb2, hard F43 H120 (Ms 58)	2.0380.26	min. 430	17 660 / 17 670
Cu Zn39 Pb3, hard F43 H120 (Ms 58)	2.0401.26	min. 430	17 660 / 17 661
Cu Zn40 Pb2, hard F44 H125 (Ms 58)	2.0402.26	min. 440	17 660 / 17 661
Cu Zn37, hard F44 H140 (Ms 63)	2.0321.30	min. 440	17 660 / 17 661
Cu Zn37, hard F54 H170 (Ms 63)	2.0321.32	min. 540	17 660 / 17 661
Cu Zn37, hard F61 H200 (Ms 63)	2.0321.34	min. 610	17 660 / 17 661
Cu Zn40 Al2 *) (So MS 58 Al2)	WL 2.0564.0+8	min. 550	17 661

*) To be used as first choice, where possible!
Former abridged sign in brackets! (Ms = brass)

Drawings: The brass material specifications which were so far stated in the drawings are herewith replaced by the material abridged signs and numbers respectively in this TN. The respective drawings need not be changed.

Poppenhausen, March 26, 1999

Alexander Schleicher
GmbH & Co.

by order Lutz-W. Jumtow
(Lutz-W. Jumtow)

The German original of this Technical Note has been approved by the LBA under the date of April 6, 1999, (signature: JUNG). The translation into English has been done by best knowledge and judgement; in any case of doubt the German original is controlling.