SCHEMPP-HIRTH GmbH & Co KG, KIRCHHEIM-TECK
Federal Republic of Germany

FLIGHT and SERVICE MANUAL

for the Sailplane

Mini-Nimbus C

Translation of the German Manual

Issue: September 1978

This Manual should always be carried in the Sailplane

It belongs to the Sailplane
Mini-Nimbus C

Registration Number : .....

Serial Number : .....

Schempp-Hirth
Flugzeugbau GmbH
D-7312 Kirchheim unter Teck

Manufacturer : .....

Owner : .....

The pages 5 - 38 are approved
by the Luftfahrt-Bundesamt

Mini-Nimbus C FLIGHT MANUAL

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Mini-Nimbus C

Maintenance and Service Manual

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Amendments

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1 GENERAL

The Mini-Nimbus C is a single seat 15 m flapped sailplane in all fiber-glass construction.

W i n g

The cantilever two-piece wing has a double trapezoidal shape. It is built as a FRP-foam-sandwich shell with spar caps of parallel glass fibers and shear webs of FRP-foam-sandwich.
The trailing edge air brakes are a combination of spoilers and flaps.
The ailerons have internal drive.
Two integral water tanks have a total capacity of 190 liters.

F u s e l a g e

The fuselage is necked behind the wing.
The one-piece canopy is faired into the fuselage and hinged at the right hand side.
The fuselage shell is built in a pure glass-fiber lay-up and therefore has a high energy absorption. The fuselage shell is stiffened by FRP-foam-sandwich bulkheads.
The pilot is seated in a semi-reclined position.
The landing gear wheel is retractable.
A towing hook is installed as standard just in front of the landing wheel.

Horizontal Tail Plane

The horizontal tail plane is of a T-type with stabilizer and elevator. The elevator is trimmed by a spring loaded click-stop device on the flap operating rod in the cockpit. The stabilizer is built in a FRP-foam-sandwich, the elevator in pure FRP.

Vertical Tail Plane

Fin and rudder are built in a FRP-foam-sandwich construction. The rudder has an internal drive.

2 OPERATING LIMITS

2.1 Airspeed limits (IAS)

		km/h	knots	mph
Maximum speed Flap pos. -4, -7	V_{NE}	250	135	155
Maximum speed Flap pos. 0, +8	V_{FE}	180	97	112
In strong turbulence	V_B	200	108	124
Maneuvering speed	V_A	200	108	124
Airplane tow	V_{AT}	180	97	112
Auto winch tow	V_{WT}	150	81	93

Note

At increasing altitudes the true airspeed (TAS) is higher than the airspeed indicated on the ASI (IAS). This has no influence on the strength and loading capacity of the sailplane. For reasons of flutter safety however the following indicated airspeeds should not be exceeded.

Height m	IAS km/h	IAS knots	IAS mph
0	250	135	155
1000	250	135	155
2000	250	135	155
3000	250	135	155
4000	250	135	155
5000	240	130	149
6000	226	122	140
7000	214	115	133
8000	202	109	125
9000	191	103	119
10 000	179	97	111
12 000	159	86	99

Pressure error (at MSL)

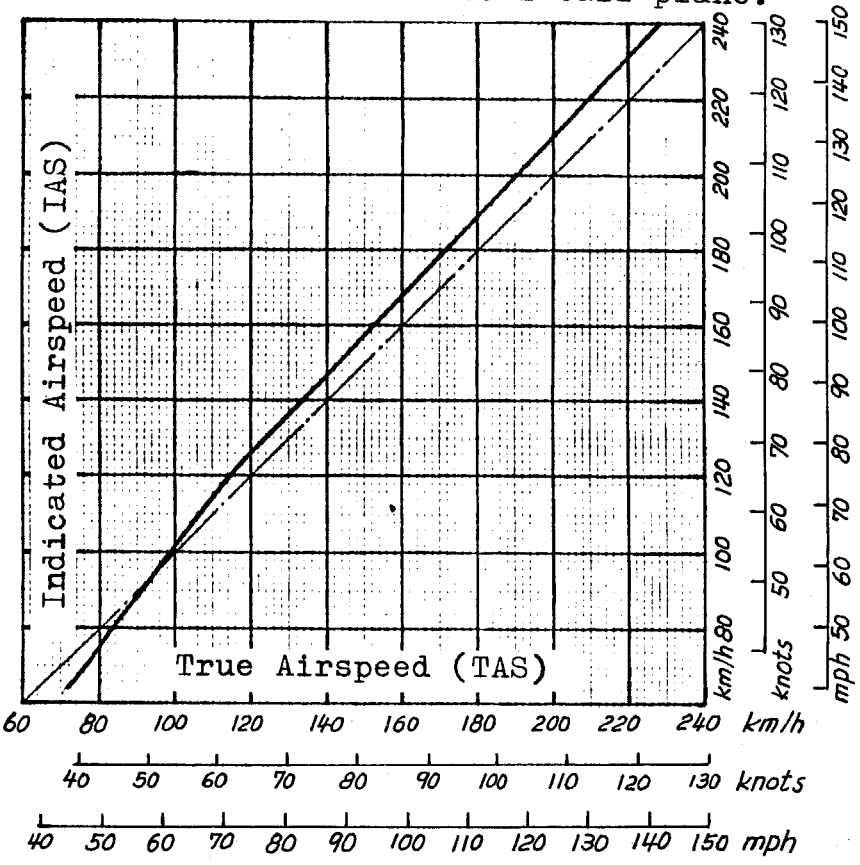
Dynamic pressure intake

Pitot tube in the nose of the fuselage.

Static pressure intake

Airspeed Indicator: 15 cm under the rear edge of the spar cut-out.

Variometer: In the area of the instr. panel and at the rear portion of the fuselage about 0.9 m in front of the vertical tail plane.



Note: All speeds stated in this Manual are indicated airspeeds (IAS).

2.2 Airworthiness Category

U (Utility) according to the ~~LFMS~~ LFSM

Based on the Airworthiness Requirements LFSM full control movements can be applied up to the maneuvering speed V_A.

At higher speeds it is possible to overstress the sailplane, therefore full control movements are not allowed at speeds exceeding 200 km/h, 108 knots or 124 mph.

At the maximum airspeed V_{NE} = 250 km/h, 135 knots or 155 mph a maximum of one third of the full control movement is permitted.

The elevator control movement at V_{NE} must be even less which depends on the permitted maneuvering load factor.

Under normal weather conditions this sailplane can be safely flown at high speeds up to V_{NE} = 250 km/h, 135 knots or 155 mph.

In strong turbulence, i.e. in wave rotors, thunder clouds, visible up-currents, or when flying over mountain ridges, the airspeed V_B = 200 km/h, 108 knots or 124 mph must not be exceeded.

2.3 Load Factors

The following load factors should not be exceeded:

+ 5.3 / - 2.65 at speeds of 200 km/h, 108 knots, 124 mph
+ 4.0 / - 1.5 at speeds of 250 km/h, 135 knots, 155 mph

} air brakes closed

+ 3.5 air brakes extended

The safety factor then is j = 1.5

2.4 Weights

Maximum takeoff weight	500 kg, 1102 lb.
Max. weight of non-lifting parts	220 kg, 485 lb.

Max. weight of water ballast (kg or liters) see page 9.

2.5 Loading instructions

Cockpit load (pilot and parachute)

Max. 110 kg, 243 lb.

Min. 70 kg, 154 lb.

The maximum takeoff weight must not be exceeded.

Less weight than 70 kg, 154 lb. must be compensated with ballast (lead or sand cushion) on the seat, safely attached, e.g. onto the suspension of the seat belt.

C.G. arm of the pilot

incl. parachute or back cushion

550 mm, 21.65 inches ahead of datum.

Water ballast

Maximum takeoff weight with water ballast 500 kg, 1102 lb.

Max. water ballast at different empty weights and cockpit loads:

Cockpit load kg	70	80	90	100	110
Empty weight kg	kg or lit.	kg or lit.	kg or lit.	kg or lit.	kg or lit.
220	190	190	190	180	170
230	190	190	180	170	160
240	190	180	170	160	150
250	180	170	160	150	140
260	170	160	150	140	130
Cockpit load lb.	154	180	200	220	243
Empty weight lb.	lb.	lb.	lb.	lb.	lb.
480	419	419	419	402	379
500	419	419	402	382	359
520	419	402	382	362	339
540	408	382	362	342	319
560	388	362	342	322	299

At high cockpit loads care is to be taken not to exceed the max. permitted weight of non-load carrying structure.

The baggage compartment can be loaded with a weight of max. 15 kg, 33 lb. of which only 5 kg, 11 lb. are allowed to be removed.

The weight of objects which do not belong to the originally installed equipment must be considered when determining the maximum permitted water ballast.

2.6 C.G. Range

a) C.G. range in flight (gross weight C.G.)

+220 mm (+ 8.66 in.) to +380 mm (+14.96 in.)
at all weights.

Datum

Wing leading edge at root rib.

Leveling means

Slope of rear top surface of fuselage: 100 to 5.1 tail down, i.e. main landing gear wheel on the ground and tail skid jacked up about 49 cm (19.3 in.).

Be cautious not to exceed the permitted aft C.G. position. When a minimum cockpit load (pilot and parachute) of 70 kg (154 lb.) is observed, it is certain to be within the limits.
Less weight is to be compensated with ballast on the seat (see page 8).

b) Empty weight C.G. range

After repair work, installation of additional equipment, new painting etc. the empty weight C.G. position must be checked. If it should not be within the limits, compensating weight must be added. If the limits of the empty weight C.G. are followed, it is certain that the gross weight C.G. is also within the permitted range.

To facilitate the checking of the empty weight C.G. position the following table shows besides of the C.G. range for different empty weights also the max. permitted tail weight, calculated for the corresponding aft empty weight C.G. position.

If the determined tail weight does not exceed these values, the empty weight C.G. position is within the limits.

Empty weight kg	C.G. range aft of datum mm	Tail weight kg
200	644 - 693	28.7
205	633 - 685	29.0
210	623 - 678	29.3
215	614 - 671	29.6
220	605 - 664	29.9
225	596 - 658	30.3
230	588 - 652	30.6
235	581 - 646	30.9
240	573 - 641	31.2
245	566 - 635	31.5
250	559 - 630	31.9
255	552 - 625	32.2
260	546 - 620	32.5
lb.	**inches**	**lb.**
440	25.40 - 27.29	63.11
450	25.03 - 27.01	63.73
460	24.67 - 26.75	64.37
470	24.33 - 26.50	65.01
480	24.00 - 26.26	65.65
490	23.69 - 26.03	66.29
500	23.39 - 25.81	66.93
510	23.10 - 25.59	67.55
520	22.82 - 25.39	68.20
530	22.56 - 25.19	68.83
540	22.30 - 25.00	69.46
550	22.05 - 24.82	70.11
560	21.81 - 24.64	70.73
570	21.58 - 24.47	71.37

Forward empty weight C.G. calculated for a max. cockpit load of 110 kg (243 lb.).
Aft empty weight C.G. calculated for a min. cockpit load of 70 kg (154 lb.) and a baggage compartment load of 5 kg (11 lb.

2.7 Weak links for towing

Winch and Airplane tow

max. 600 ± 30 kg (1320 ± 66 lb.)

2.8 Mimimum Equipment

Airspeed Indicator with a range of
min. 50 km/h to min. 270 km/h
min. 27 knots to min. 146 knots
min. 31 mph to min. 168 mph
marked as follows:

	km/h	knots	mph
White Arc flaps 0, +8	78-180	42-97	48-112
Green Arc normal range	86-200	46-108	53-124
Yellow Arc warning range	200-250	108-135	124-155
Red Radial max. speed	250	135	155
Yellow Arrow approach	90	49	56

Altimeter

Four-piece safety belt

Manual or automatic parachute or back cushion, compressed 10 cm (4 in.) thick.

Placards (see pages 23 - 25)

Flight and Service Manual

For Cloud Flying

(additional to the minimum equipment)

Magnetic Compass, Variometer, Turn & Bank.

The installed ASI system was found to be suitable for cloud flying.

2.9 Acrobatics

The Mini-Nimbus C is approved for the following acrobatic maneuvers:

Inside loops,

Spins,

Turns,

Lazy eight.

It is recommended to install a recording accelerometer in addition to the equipment listed under 2.8.

Acrobatic maneuvers are permitted only without water ballast.

Loose objects are to be removed.

2.10 Wing and Tail Setting

Reference: Rear fuselage center line.

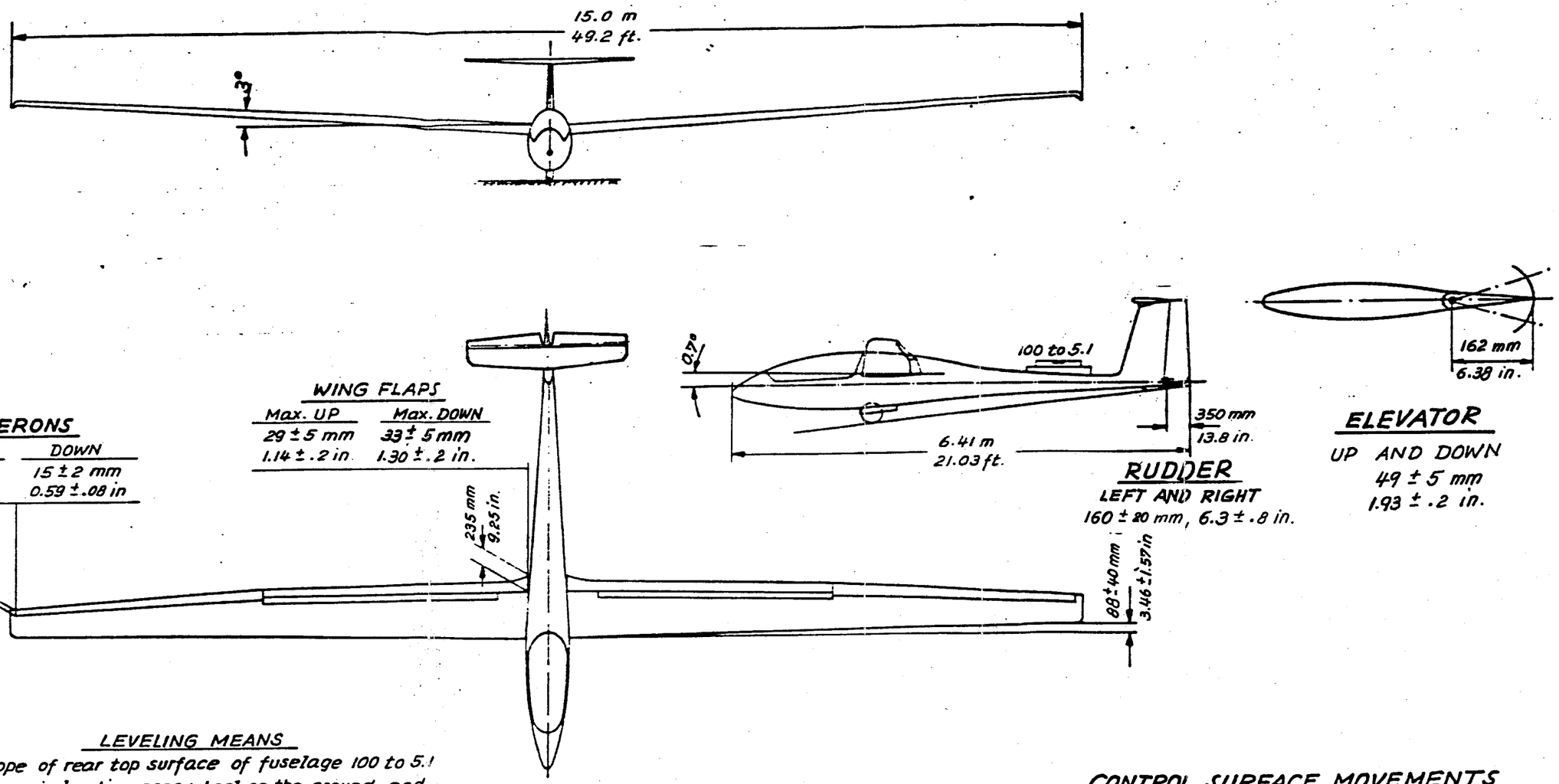
Angle of wing setting 0.7°

Angle of tail setting 0°

Control surface movements

See page 14.

Pay attention to the tolerances if repair work should be necessary.



AILERONS

UP	DOWN
31 ± 3 mm	15 ± 2 mm
1.22 ± .12 in.	0.59 ± .08 in

WING FLAPS

Max. UP	Max. DOWN
29 ± 5 mm	33 ± 5 mm
1.14 ± .2 in.	1.30 ± .2 in.

RUDDER

LEFT AND RIGHT

160 ± 80 mm, 6.3 ± .8 in.

ELEVATOR

UP AND DOWN

49 ± 5 mm

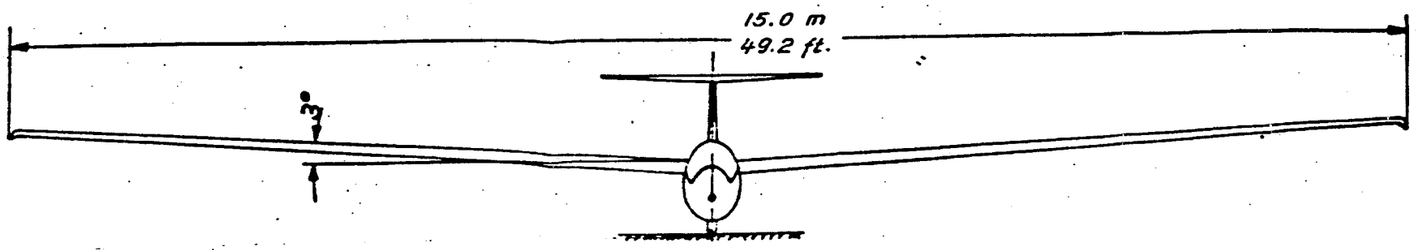
1.93 ± .2 in.

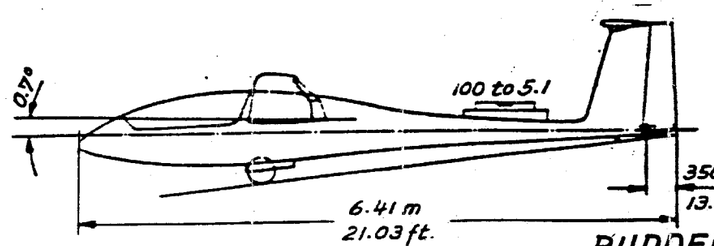
LEVELING MEANS

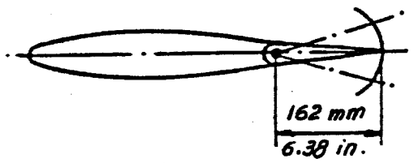
Slope of rear top surface of fuselage 100 to 5.1
i.e. main landing gear wheel on the ground and tail skid jacked up about 49 cm (19.3 inches)

CONTROL SURFACE MOVEMENTS

Mini-Nimbus C







ELEVATOR

UP AND DOWN
49 ± 5 mm
1.93 ± .2 in.

RUDDER

LEFT AND RIGHT
160 ± 20 mm, 6.3 ± .8 in.

AILERONS

UP	DOWN
31 ± 3 mm	15 ± 2 mm
1.22 ± .12 in.	0.59 ± .08 in

WING FLAPS

Max. UP	Max. DOWN
29 ± 5 mm	33 ± 5 mm
1.14 ± .2 in.	1.30 ± .2 in.

LEVELING MEANS

Slope of rear top surface of fuselage 100 to 5.1
i.e. main landing gear wheel on the ground and
tail skid jacked up about 49 cm (19.3 inches)

CONTROL SURFACE MOVEMENTS

Mini-Nimbus C

3 EMERGENCIES

3.1 Recovery from a Spin

If the sailplane with the C.G. in medium or aft positions enters unintentionally into a spin ease the control stick forward immediately and apply opposite rudder until rotation ceases.
It is very important to ease the control stick forward in order to avoid a rotation to the opposite direction when applying opposite rudder.

3.2 Malfunction

Takeoffs by winch or airplane tow on uncutted grass fields should not be conducted. If a wing is caught in the grass release immediately to avoid a ground loop and therewith damage.

To prevent the sailplane from unintentional and unnoticeable stall in an emergency release in low altitude a speed of 85 to 95 km/h, 46 to 51 knots or 53 to 59 mph (depending on the wing loading and flap position) should be maintained in a straight flight.
In a turning flight the speed is to be increased corresponding to the angle of bank.

If slight oscillations are observed or if the controls become spongy the sailplane is stalled though the ASI indicates 65 to 85 km/h, 35 to 46 knots or 40 to 53 mph (dependent on the wing loading and flap position).
The control stick then is to be released forward immediately.

3.3 Emergency Exit

The roomy and well faired cockpit warrants a quick and safe bailing out in emergency.

Jettisoning of the Canopy

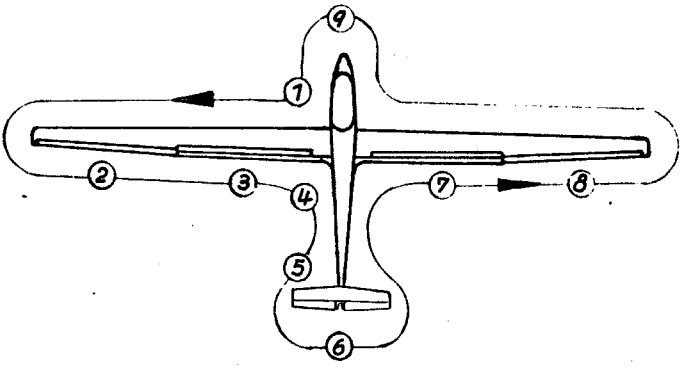
1. PULL BACK the red ball knob at the left-hand side of the canopy frame.
2. PULL BACK the red ball knob at the right-hand side of the cockpit just below of the side fairing.
3. Throw off the canopy.

The cord which holds the opened canopy in place is attached such to rip immediately when throwing off the canopy.

The canopy frame on the fuselage is built of strong glass fibers without sharp edges and is well suited as a support for the pilot to jump off.

4 Normal Operating Conditions

4.1 Daily Inspection



When going around the sailplane for inspection, check all external surfaces for tears, blisters, or dents. In case of doubt ask a FRP-expert.

(1) a) Open the canopy and check if the main bolt is installed and secured.

b) Check the cockpit controls by visual inspection.

c) Remove foreign particles.

d) Check tire pressure of the main wheel (3.5 Atm. (50 psi).

e) Check condition and function of the towing hook.

(2) Check ailerons for free and full movement.

(3) a) Check air brakes for close fit and proper operation.

b) Check trailing edges of flaps and ailerons for damage. Check flaps and ailerons for excessive backlash of attachments by rocking slightly at the

trailing edge.

c) Check the function of the gas spring with flaps in position -7. Push the flaps down at the inner root into neutral position and then release. The flaps must return to the initial position -7.

d) Check hinges for damage.

e) Check if the holes for static pressure intake under the wing are open.

④ a) Check if the holes for static pressure intake in the rear fuselage shell are open.

b) If available install the venturi and check the tubing by blowing into the venturi (the connected variometer must indicate "Climb").

⑤ Check if the attachment of the horizontal tail plane is locked.

⑥ Check elevator and rudder for free and full movement,
trailing edges for damage,
attachments for excessive backlash by rocking slightly at the trailing edge.

⑦ See ③

⑧ See ②

⑨ Check the pitot tube for contamination. When blowing into the tube the ASI must work.

After heavy landings or excessive acceleration the frequency of flexural wing vibration should be checked (about 160 /min.). Carbon wing
134/min. Glass wing

Disassemble the sailplane and check surfaces of fuselage, wing, and horizontal tail plane. If damages should be observed, e.g.
tears in the painting of the rear fuselage and of the horizontal tail plane,
white spots at the spar stubs or at the root ribs in the area of bearings and attachment bolts,
deformation of the main bolt and of the elevator control fittings etc.

The sailplane is unserviceable until the damages are properly repaired.

4.2 Cockpit Layout

1. Instrument panel

With canopy opened the instruments are well accessible. The instrument compartment cover is fastened by four screws. The instrument panel is attached onto the fuselage canopy frame and is easy to remove.

2. Control stick

The main landing wheel brake lever is mounted on the control stick.

3. Tow release

The yellow handle at the left-hand side of the control stick operates the towing hook.

4. Air brakes

Extension: Pull back the blue handle at the left-hand side of the cockpit.

Retraction: Push the handle forward.

5. Wing flaps

Tilt the grey handle at the left-hand side of the seat inward and choose the desired position.

High speed: Push the handle forward and catch it.

Low speed: Pull back the handle and catch it.

6. Trimming control

The spring loaded trimming control (green knob) is mounted onto the flap control rod at the left-hand side of the cockpit. It is gradually adjustable. Tilt the knob slightly inward, choose the position and lock.

Nose heavy : Push forward.

Tail heavy : Pull back.

7. Canopy

The one-piece plexiglass hood is attached by flush hinges at the right-hand side of the fuselage.

It is opened at the left-hand side of the cockpit. PULL BACK the red ball knob of the locking device on the canopy frame and lift the canopy.
Take care that the cord which holds the opened canopy in place is attached.

The jettisoning device is mounted at the right-hand side of the cockpit, just under the side fairing.

For jettisoning open the canopy as described before, then PULL BACK the red ball knob.

8. Landing gear

RETRACTION : Unlock the black handle at the right-hand side of the seat, pull it back and lock.

EXTENSION : Push the handle forward and lock.

9. Water ballast

Black knob at the right-hand side of the cockpit, just under the side fairing.

Knob in aft position: Dump valve closed.

Knob in front position and locked: Dump valve open.

10. Pedal adjustment

The adjustment device is operated by a Bowden cable with a plastic T-handle at the right-hand side of the control stick.

Adjustment backward: Pull the cable and move the pedals into the desired backward position. Give the pedals a slight forward push with the heels, not with the toes, until the locking pin engages self-acting with a clear clicking noise.

Adjustment forward: Pull the cable slightly back to unlock the mechanism and push the pedals with the heels into the desired forward position and lock as before.

11. Parachute support

A molded glass fiber support, serving as a stowage recess for automatic back-type parachutes, is attached onto the rear

part of the seat by means of four screws.
When using a manual long back-pack parachute it is advisable to take it off.

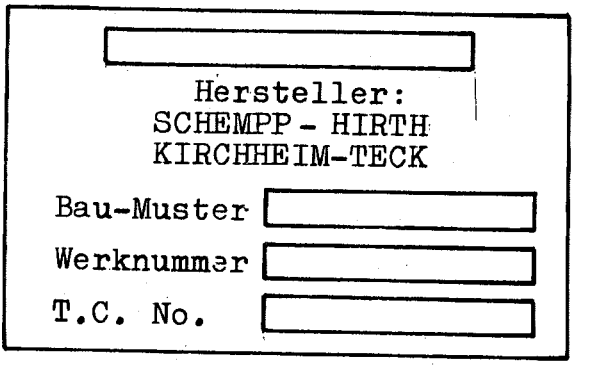
12. Cockpit ventilation

The ventilator is closed by pulling the small black knob at the right-hand side of the instrument panel.

In addition the sliding window of the canopy or its air scoop can be opened.

13. Cockpit Placards

Identification plate (fire-proof)



Operating limits

Max. take-off weight 500 kg, 1102 lb.			
Maximum permitted speeds (I.A.S.)	km/h	knots	mph
Flaps:			
Positions -4 or -7	250	135	155
Positions 0 or +8	180	97	112
In strong turbulence	200	108	124
Maneuvering speed	200	108	124
Airplane tow	180	97	112
Auto and winch tow	150	81	93

Weak links for towing
600 ± 30 kg, 1320 ± 66 lb.
Landing wheel tire pressure
3.5 Atm., 50 psi

Cockpit load

Payload (pilot and parachute)

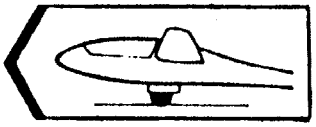
The maximum weight must not be exceeded.

Minimum payload: 70 kg, 154 lb.

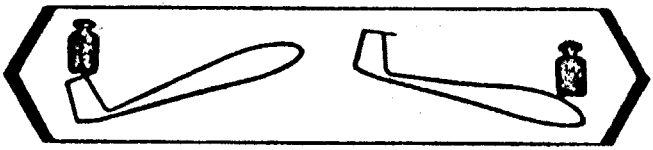
Less weight must be compensated with ballast on the seat.

Check List before take-off

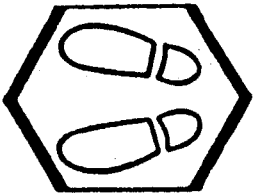
- o Parachute put on properly ?
- o Strapped in safely ?
- o Back rest and rudder pedals in comfortable position ?
- o Operating handles and instruments well accessible ?
- o Air brakes locked after having checked the function ?
- o Movement of control surfaces checked ?
- o Flight controls unrestricted ?
- o Trim adjusted properly ?
- o Wing flaps in take-off position ?
- o Canopy closed and locked ?



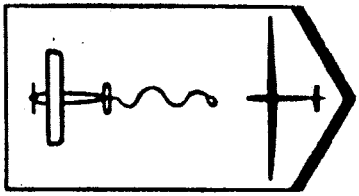
Extended Landing gear Retracted



Trimming (GREEN knob)

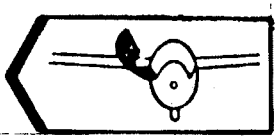


Pedal adjustment

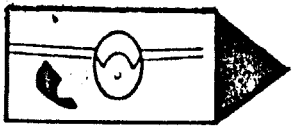


Tow release
(YELLOW T-handle)

Air brakes (BLUE handle)



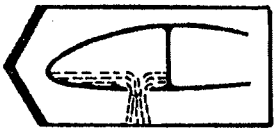
OPENING



JETTISONING

Canopy (RED ball knobs)

Ventilation



Water ballast

4.3 Check before take-off

See cockpit placard on page 24.

4.4 Take-off

Airplane tow.

Maximum towing speed (flaps -4^{o})
V_{AT} = 180 km/h, 97 knots, 112 mph.

For airplane tow Perlon tow ropes of 40 to 60 m length were tested.

When beginning the ground run put slightly on the brake to avoid rolling over the rope.

Before take-off adjust the trim,
NORMAL with the C.G. in forward to medium positions,
NOSE HEAVY with the C.G. in medium to aft positions.

Normally the take-off is conducted with flaps in position +8. With the C.G. in aft positions, high take-off weight or strong cross wind the ground run should be made with flaps in position -4 until the ailerons become sufficiently effective. The flaps then can be taken back to the normal position +8.

With the C.G. in aft positions it is advisable to hold the control stick in forward position during the ground run until the skid has ground clearance.

After lifting off at about 70 to 75 km/h, 38 to 40 knots, 43 to 47 mph the trim can be adjusted so that almost no stick force is perceptible.

The normal towing speed is 100 to 120 km/h 54 to 65 knots, 62 to 75 mph with flaps i position 0^{o}. At speeds from 120 km/h, 65 k or 75 mph it is advisable to set the flap into position -4^{o}.

With water ballast the normal towing spee should be increased about 20 %.

The landing gear can be retracted during the tow, however not in low altitude, for gripping the control stick while actuating the landing gear may change the attitude behind the towing airplane.

For release pull the release handle at the left-hand side of the stick fully through, pull several times and make sure that the rope is released before turning off.

Winch tow.

Maximum towing speed:

V_{WT} = 150 km/h, 81 knots, 93 mph.

Before take-off adjust the trim,
NORMAL with the C.G. in forward to medium positions,
NOSE HEAVY with the C.G. in medium to aft positions.

The normal take-off flap position is +8.

Put slightly on the brake when beginning the ground run to avoid rolling over the rope.

The sailplane has a normal behaviour during the ground run and lifts off without tendency to enter an excessively steep climb.

Depending on the trim adjustment the control stick should be held in slight forward position during the take-off with the C.G. in aft positions, and slightly pulled with the C.G. in forward positions.

When a safety height of about 50 m, 164 ft. is reached the sailplane can be brought into a steeper climb by pulling the stick.

If pitching oscillations are observed during the last stage of the tow ease the control stick slightly forward.

Avoid climbing take-offs and low towing speed.

With normal cockpit load and without water ballast the towing speed should not be less than 90 km/h, 49 knots, 56 mph, with water ballast not less than 100 km/h, 54 knots, 62 mph.

When using low-powered winches or engines with limitation of RPMs, when towing with the wind, in calm air or with filled water ballast tanks make sure that the winch has enough power reserve to maintain the required minimum towing speed.

Normal towing speed	km/h	knots	mph
without water ballast	100	54	62
with water ballast	115	62	71

When reaching the maximum towing height the tow rope is released automatically, nevertheless pull the release handle several times.

4.5 Free Flight

Test the effectiveness of the air brakes in safe altitude, observe the loss of height at different speeds and get familiar with the operation of the wing flaps.

Since the trim is combined with the flaps it is to be adjusted for zero stick force in straight flight at 110 to 120 km/h, 59 to 65 knots or 68 to 75 mph with flaps in position 0^{o}. The sailplane then is trimmed for all other flap positions over the optimum speed range (except of high speeds).

The sailplane has well balanced flight characteristics and controls.

With flaps in position 0^{o} and at a speed of 1.4 V_{stall} the time taken to roll from a 45 degrees banked turn through an angle of 90 degrees is 3 seconds.

Flight performances

(W/S = 33 kg/m^2, 6.76 lb./sq.ft.)

Stall speed (flap position +8)
61 km/h, 33 knots, 38 mph

Minimum sink (flap position +8)
0.57 m/sec, 1.87 ft./sec. at 80 km/h, 43 knots, 50 mph

Best gliding ratio Max. L/D (flap position 0) 1 : 41 at 95 km/h, 51 knots, 59 mph

Wing flaps

The flaps have the purpose to adapt the laminar bucket of the wing airfoil to the respective airspeed in the best way. Since the laminar buckets of the applied airfoil are covering eachother widely, the following flap positions can be accepted:

Normal flight - three positions
Landing - one position
High speed flight - one position

Application	Flaps	Airspeed km/h	knots	mph
Approach	+8	see page 37		
Thermal flight	+8	70-90	38-49	43-56
Best glide	0	80-120	43-65	50-75
Flight between thermals	- 4	110-170	59-92	68-106
High speed	- 7	160-250	86-135	99-155

With water ballast the speeds increase about 20 %.

4.6 Low Speed and Stall

To get familiar with the sailplane stalls should first be carried out in high altitude from straight and turning flight, with about 45° bank, with different flap positions. The following stall speeds were measured:

Take-off weight	335 kg (739 lb.)			500 kg (1102 lb.		
C.G.position	380 mm (15 in.)			320 mm(12.6in.)		
Stall speed	km/h	knots	mph	km/h	knots	mph
air brakes retracted flap positions						
+ 8	62	33	38	78	42	48
0	67	36	42	84	45	52
- 7	77	42	48	92	49	57
air brakes extended flap position + 8	58	31	36	70	38	43

Shortly before reaching the stall speed stall warning occurs with air brakes retracted at speeds of 62 to 92 km/h, 33 to 49 knots, 38 to 57 mph (depending on the wing loading and flap position) by slight vibration of the horizontal tail plane, ailerons become spongy.
With air brakes extended the sailplane vibrates considerably already 5 km/h, 2.7 knots, 3.1 mph before reaching the stall speed.
When pulling the stick gently back the ASI indicates again higher speeds until

(with the C.G. in aft positions) control is lost by wing dropping or (with the C.G. in forward positions) the sailplane pancakes when the control stick reaches the limit of backward travel.
The control stick then is to be eased forward.
With air brakes extended the loss of height during recovery to normal flight is about 50 m, 164 ft.
With the C.G. in aft positions full rudder in a stall brings the sailplane into a spin. It recovers safely from the spin by the standard method which is defined as:

a) apply opposite rudder (i.e. against the direction of rotation of the spin);

b) pause;

c) ease the control stick forward until the rotation ceases and the sailplane becomes unstalled;

d) neutralize the rudder and allow the sailplane to dive out.

4.7 High Speed Flight

When flying at high speed observe the maximum limiting speeds for the respective flap positions as marked on the ASI by corresponding colors.
Full control movements are permitted at speeds up to V_A = 200 km/h, 108 knots, 124 mph only.
At a speed of V_{NE} = 250 km/h, 135 knots, 155 mph only one third of the full control movements is allowed. Avoid sharp elevator control movement in any case.
In strong turbulence, e.g. in wave rotors, thunder clouds, visible vertical whirlwind or when flying over mountain ridges

the speed must not exceed V_B = 200 km/h, 108 knots, 124 mph.

With the C.G. in aft positions the required stick travel at all speeds up to V_{NE} is relatively small, the change of speed however is clearly noticed by a change of the stick force.

The air brakes can be extended at speeds up to V_{NE} = 250 km/h, 135 knots, 155 mph. Since sudden deceleration of about 2 g can occur, the air brakes should be used only in emergencies or when exceeding unintentionally the maximum permitted speeds (see page 5).

Take care that the safety belt and the shoulder harness have a tight fit.
Do not push inadvertently the control stick when extending the air brakes.
Avoid loose objects in the cockpit.

With air brakes extended do not pull-out too rapidly but gently (see load factors page 7).

Due to the steep flight attitude the air brakes should not be retracted at speeds exceeding 140 km/h, 76 knots, 87 mph.

The terminal velocity in a dive with an inclination of the flight path of 45° is about 190 km/h, 102 knots, 118 mph with air brakes and landing gear extended and at maximum weight.

4.8 Flight with water ballast

When an average climbing speed of less than 1.5 m/sec., 3 knots or 5 ft./sec. is expected or when flying in narrow thermals where highly banked circling is required the use of water ballast is not worthwhile.

Before filling water into the wing tanks the maximum permitted water ballast is to be determined following the instructions on page 9.

The wing tanks have a total capacity of about 190 liter water.

With wings held level the tanks are filled through a hole in the upper surface next to the station of the inboard aileron root.

Do not fill under high pressure, e.g. directly from the water main. Both tanks must be filled with the same water quantity. Due to the installed baffles no noticeable shifting of the water is observed.

The filling holes are closed by a cap which has a small 5 mm dia hole for pulling it out by means of the provided pin. The hole in the cap serves also as a vent hole and therefore must be kept open. The tanks have an additional vent by means of plastic tubing leading through the wing with outlet at the outboard aileron root.

The water is drained off through a hole in the lower wing surface next to the root rib. With the dump valve operating knob at the right-hand side of the cockpit pushed back (dump valve closed) the connection of the water ballast system of the wing to the fuselage is made automatically when attaching wings.

Pushing the knob forward opens the dump valve in the wings, moving the knob down locks it in that position.

When flying at temperatures lower than 0 degr. C (32 degr. F) the water must be drained off to avoid icing.

Drain off the water before landing to reduce the approach speed and therewith the landing run.

Full water tanks are drained off within about 4 minutes.

In the improbable case that the water tanks should be unequally drained off or only one-sided, stalls are to be avoided and an adequate margin of safety in the lower speed range should be observed. When the glider with the C.G. in aft positions comes to stall yet and enters unintended a spin, set the flaps on negative position immediately, apply opposite rudder and ease the control stic forward. Dive out gently when rotation has ceased.
During the landing run care is to be taken of the tendency for the glider to ground loop due to the earlier ground contact of the heavier wing.

Never park the sailplane with filled water tanks, Drain off the water, open the caps and let the tanks dry.
If the dump valves with filled water tanks should leak, coat the closing caps slightly with grease before the next filling; pull the cap down by means of a M6 mm bolt screwed into the threaded hole in the center of the cap.

4.9 Cloud flying

The sailplane has sufficient strength and stability for cloud flying. It is easy to control and has stable circling qualities.
Nevertheless observe the following instructions:

Do avoid extreme airspeeds in any case.

To prevent the sailplane from a spiral dive do not execute spins as a rescue action.

It is recommended to extend fully the air brakes already at an indicated speed of 130 km/h, 70 knots, 81 mph or at a load factor exceeding 2 g.

At speeds exceeding 140 km/h, 76 knots, 87 mph the air brakes should not be retracted again, due to its steep attitude the sailplane then could exceed the maximum permitted speed.

Take care that the required equipment for cloud flying is installed in the sailplane (see page 12).

4.10 Flight below freezing point

At temperatures below 0 degr. C (32 degr. F) as in wave flights or during winter it is possible that the flight controls cannot be operated with sufficient ease and smoothness, therefore all controls should be free from moisture to avoid icing.

This, in particular, applies to the AIR BRAKES.
Experiences have shown that it is very advantageous to coat the full span of the top covers on the air brakes with Vaseline to avoid jamming by icing.
Flaps and control surfaces are to be moved frequently.
When flying with water ballast observe the instructions on page 33.

4.11 Acrobatics (without water ballast only)

Inside loops, flaps in position -7°

The maneuver should be entered at speeds not less than 180 km/h, 97 knots, 112 mph. A speed of 200 km/h, 108 knots, 124 mph is recommended.
The speed during recovery is 180 km/h, 97 knots, 112 mph.

Spins, flaps in position $+8^{\circ}$ or 0°

Steady spins are possible only with the C.G. in the aftmost position. With the C.G. in forward positions the sailplane goes into a spiral dive.
Recovery then must be initiated immediately by neutralizing all controls and diving out.
Entry to the spin is initiated from dynamic stall by applying rudder in the direction of rotation just before stalling out.(Ailerons neutral).
Speed during entry to the spin:
60 km/h, 32 knots, 37 mph.

Speed during recovery from the spin:
120 - 150 km/h, 65 - 81 knots, 75 - 93 mph.

Action for recovery from the spin is initiated by applying opposite rudder and easing the control stick forward.

Turns, flaps in position -7°

Entry to the turn at speeds not less than 180 km/h, 97 knots, 112 mph.
A speed of 200 km/h, 108 knots, 124 mph is recommended.
After entry to the turn apply rudder in the vertical climb at a speed of 130 km/h, 70 knots, 81 mph.
Speed during recovery from the turn: 180-200 km/h, 97-108 knots, 112-124 mph.

Lazy Eight

Entry to the maneuver at a speed of 180 km/h, 97 knots, 112 mph, followed by a climb of about 30 to 45 degrees from which a turn is initiated at a speed of 120 km/h, 65 knots, 75 mph.
Speed during recovery:
180 km/h, 97 knots, 112 mph.

Dependent on the load factor and the angle of bank the speed in steep turns should not be less than the values given in the following table:

Load factor	Angle of bank	Speed km/h	knots	mph
+ 2.0	60°	110	59	68
+ 2.5	65°	125	67	78
+ 3.0	70°	135	73	84
+ 3.5	73°	150	81	93

Acrobatics are permitted only when flying without water ballast.

4.12 Approach and Landing

The very effective air brakes are a combination of spoilers and flaps and allow steep and slow approaches. They do not notably increase or decrease the lift.

The normal flap position during the landing is +8.

Pulling back the air brake handle until a clear resistance is observed means extending only the spoilers by which the sailplane can be controlled during the approach.
When pulling the handle further back the spoilers and flaps are cooperating.

The normal approach speed is about 75 - 80 km/h, 40 - 43 knots, 47 - 50 mph with flaps in position +8, air brakes and landing gear extended.

With water ballast the speeds increase up to about 20 %.

The gliding angle is about 1 : 4.5.

In the approach pull-out arc or shortly before landing at speeds less than 70 km/h, 38 knots, 43 mph the air brakes must not be slowly retracted but rapidly and fully, otherwise only the flaps are taken back into normal position (loss of lift) while the spoilers with their full drag and decrease of lif are still fully extended.
Rapid and full retraction of the air brakes does not considerably change the lift and longitudinal inclination of the sailplane; the sinking speed resp. the gliding angle however promptly improve.

With semi-retracted air brakes the Mini-Nimbus pancakes.

Landings always should be carried out with fully extended air brakes, for this configuration ensures the lowest touch down speed.

Steep approaches (e.g. in strong ground turbulence or over high obstacles) should be made with fully extended air brakes while the gliding angle is corrected with elevator control only.

Excessive height can be reduced without gaining much speed by easing the control stick forward.

The sailplane touches down on the landing wheel and the tail skid simultaneously.

The wheel brake (drum brake) is sufficiently effective. The brake lever is mounted onto the control stick.

To avoid a long landing run it is advisable to touch down at a minimum speed of 60 - 65 km/h, 32 - 35 knots, 37 - 40 mph.

Touching down at 90 km/h, 49 knots, 56 mph instead means doubling the the energy of the sailplane and considerably increases the running distance.

When off-field landings are inevitable always extend the landing gear.

Flying in rain or with iced-up wings means a loss of performance and aerodynamic qualities.

Therefore be cautious when landing!

Come in at a speed of about 95 - 100 km/h, 51 - 54 knots, 59 - 62 mph.

5 Storage, Transport, Assembly

5.1 Storage, Parking, Ground towing

The sailplane should be stored or parked in well ventilated rooms.
Closed weatherproof trailers should be equipped with sufficiently large vent holes.
Store or park always with fully drained off water tanks.
Take care to keep the sailplane free from any strain, especially at high temperatures
The wings must be supported very carefully in the trailer either by their spar stubs or by the wing root leading edge in section-true supports. The outer wing panel is to be supported by the leading edge in section-true supports in the area of the aileron about 2.4 m from the tip.
The fuselage should be supported on a wide cradle just in front of the C.G. towing hook and on the tail skid.
Dependent on the make of the trailer the tailplane can be supported either vertically by the leading edge on two section-true cradles with a distance of 1.5 to 2.0 m or horizontally in section-true supports which are attached onto the ceiling of the hinged cover as on the "Komet" trailer.
In trailers the tailplane must not be supported at the attachment fittings.
Sailplanes which are kept assembled for longer periods must be maintained so to avoid corrosion of all main attachments.
The use of dust covers should be taken for granted.
When towing the sailplane by car always use a tail dolly to avoid excessive stress and therewith wear of the tailplane attachments due to vibration.

When towing off by hand do not push at the wing tips but at the wing root area.

5.2 Assembly

Wings.

1) Clean and lubricate the attachment bolts and bearings.

2) Adjust the flap control lever in the cockpit on "high speed" position -7°, the air brake control lever and the dump valve operating lever on position "CLOSED".

3) Put the left wing (fork spar root) with the flap in position -7° and lifting it slightly into the cut-out of the fuselage up to a distance from the fuselage of about 1 cm, unlock the air brake control lever, push the wing fully in and insert the main bolt into the front fork spar bushing only .
Be cautious that the bell cranks on the root rib are safely engaged into the funnel-type fittings on the fuselage and that the flap control is catching properly the torsion drive tube.
The wing then can be laid down on a support (e.g. on the tail plane support).
Lock the flap control lever in position 0° and extend fully the air brake.

4) Put in the right wing (tongue spar root) up to a distance from the fuselage of about 10 cm. Open fully the air brake. Push in the wing with aileron in neutral position while moving the wing tip slightly back and forth and lifting the trailing edge a little to avoid a tilting of the attachment bearings on the fuselage. When a distance of 1 to 2 cm between wing root rib and fuselage is reached remove the main bolt.

Take the provided assembly tool, push it through the main bolt spar bushings and pull the wings together.
Take care of the proper connection of the controls as described by the instructions No. 3.

5) Push the main bolt through the aligned spar bushings and secure its handle onto the fuselage shell by means of a cowling safety pin.

6) Horizontal tail plane

Screw the ring bolt (mounting aid provided in the side pocket of the cockpit) into the front attachment bolt on the fin.

Put the horizontal tail plane onto the two control connection bolts, pull the spring-loaded front bolt by means of the ring and insert the bolt into the bearing of the attachment fitting on the lower surface of the stabilizer.
Remove the ring bolt.

Check if the two control connection bolts are properly inserted into their bearings by moving the elevator.

7) After assembly

Check the function of all controls.

Seal the joints of the wing and fuselage with an adhesive tape.
Seal also the hole in the fin for the front attachment bolt and the joint of stabilizer and fin.

The sealing is very important to ensure good fight qualities.

5.3 Disassembly

1) Horizontal tail plane.

Pull the front attachment bolt using the ring bolt.
Lift slightly the leading edge of the stabilizer and take off the tail plane in forward direction.

2) Wings.

With air brakes unlocked and flaps in position 0^{o} load the wings and pull out the main bolt.
Disconnect the wing attachment by pulling thoroughly at the wing tips and take off the wings.

6 Maintenance

6.1 Periodic Inspections

Rudder control cables

After every 200 flight hours and at every annual inspection the rudder control cables are to be checked in the area of the S-shaped tubular guide on the pedals with pedals in front and aft position.

The control cables should be replaced if injured, worn or corroded. A wear of single outer strands up to 25 % is permissible.

If a replacement of the cables should be necessary cables 3.2 mm (1/8") LN 9374 made of zinked carbon steel strands are to be used.

The thimble eye-splices are made with Nicopress Oval Sleeves No. 18-3-M or No. 28-3-M using a tool No. 51-M-850 and following the special instructions for making and checking the sleeves.

Gas springs

After removal of the upper fiber-glass fairing on the front steel tube frame the gas springs are accessible behind the front wing attachment tube.

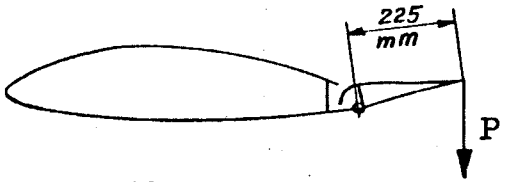
The piston rods must be clean and without any damage.

If a leakage of the piston rod oil seal should be observed the gas spring must be replaced.

The expansion force of the gas spring is to be checked on the assembled sailplane with flaps in position -7°.

It must be possible to hold the flap in this position without moving down when applying a moment of 16 to 19 Nm resp. 1.6 to 1.9 mkg or 11.6 to 13.7 ft.lb.

The required moment is obtained by pulling the trailing edge of the flap in the area of its root using a spring balance or by attaching weights.



The force or the weight should be

P = 7.0 to 8.5 kg or 15.4 to 18.7 lb.

Towing hook

Inspections are to be carried out in accord with the Operating and Maintenance Instructions for Special Towing Hooks "S 72 and SH 72", dated May 1975, LBA-approved.

Instruments

Follow the instructions of the respective manufacturers.

Suppliers

Schempp-Hirth GmbH & Co KG
Krebenstr. 25, D - 7312 Kirchheim-Teck
(Cables, Sleeves, Gas springs, Main landing wheel)

R. Lindemann
Osterrade 12, D - 2050 Hamburg 80
(Nicopress sleeves, Tools)

TOST Flugzeuggerätebau
Thalkirchnerstr. 62, D-8000 München 2
(Towing hook)

6.2 Annual Inspections

Maintenance schedule

(See control system views on pages 58, 59, 60).

Accessibilty of controls for inspection:

- o Wing controls

  Aileron drive accessible through cut-outs in the rear wing spar with air brake opened and aileron dismounted.

  Air brake drive accessible through cut-outs in the rear wing spar with air brake opened.

- o Fuselage controls

  Drives in the fuselage accessible after removal of the seat panel and the fairing on the front steel tube frame.

- o Elevator control

  Accessible after disassembly of the horizontal tail plane.

- o Rudder control

  Accessible through the cut-out in the nose with rudder deflected to the right.

After having cleaned the sailplane proceed as follows:

- o Check all external surfaces for holes, tears, scratches, dents, and detached laminates. If the outer laminate of a sandwich shell is damaged also the inner glass cloth layer is to be inspected. It is advisable to ask an expert's advice.

- o Check all accessible metal parts for damage. As known from experience no damage occurs when operating the sailplane properly.

If any repair should be necessary ask the advice of the manufacturer.

- o Check all accessible metal parts for corrosion. If necessary remove the rust and protect the surface again by a new painting. Corroded fittings, push rods, and levers should be thoroughly cleaned and consequently primed and painted, using a special primer and Nitro paint (primer and paint can be supplied by Schempp-Hirth
- o If the controls cannot be operated with sufficient ease and smoothness, clean and lubricate the corresponding hinges or bearings.
- o Replace bearings which have an excessive radial clearance.
  The automatic connections of ailerons and air brakes between wing and fuselage can be adjusted free from backlash by correcting screws on the funnel-type levers of the fuselage.
  The backlash of controls and air brake drive is to be checked in accord with paragraph 6.3.
- o All fittings attached onto glass-fiber structure are to be checked for a tight fit. Check the glass-fiber structure for tears, white spots, and broken glass cloth laminate.
- o If a loss of the braking effect of the landing wheel is observed, clean the brake drum, inspect the brake lining, replace the lining if worn. Check the brake Bowden cable and the brake lever, adjust if necessary. Check the wheel hub for lateral clearance. Follow the instructions of the manufacturer TOST.
  Check the wheel axle and landing gear struts for deformation and the attachment fittings for damage.

Check the tire pressure of the main landing wheel (3.5 Atm. or 50 psi).

- o Inspect the static and dynamic pressure intakes, the tubing, and couplings for free air pass and tightness.
  Check instruments for loose glasses.
- o Assemble the sailplane and check the control surface movements and all control for easy and smooth operation.
  The gap between flap, air brake and aileron should be at least 2 mm, 0.08 in.
  Check the wings and control surfaces for excessive backlash of controls and attachments (see paragraphs 6.3 and 6.4).
  Check the function of the tow release mechanism.

6.3 Backlash of the controls

With controls held fixed the backlash of the control surfaces must not exceed the following values:

Control surface	Backlash		Measuring point aft of hinge axis	
	mm	in.	mm	in.
Elevator	± 3	± 0.12	162	6.38
Rudder	± 5	± 0.2	350	13.8
Flaps	± 5	± 0.2	235	9.3
Ailerons	± 4	± 0.16	136	5.4
*Air brakes	± 2	± 0.08	* 120	* 4.7

* measured above hinge axis at fully opened air brake.

6.4 Backlash of the attachments

Wings

Tangential backlash (movement forth and back) can occur, due to the wear of the washers which are pressed onto the wing attachment bolts. If the movement at the wing tips exceeds 30 mm (1 3/16") additional washers of an inner diameter of 13.95 mm about 0.3 to 0.5 mm thick should be pressed onto the bolts until the backlash is eliminated.

6.5 Damages

Before every take-off, especially after a longer period of storage, a ground inspection should be carried out (see Flight Manual, page 17).

Pay attention to damages as tears in the paint, holes, white spots in glass-fiber laminate etc.

In case of doubt about the seriousness of the damage ask the advice of a FRP-expert.

Smaller damages which do not impair the airworthiness of the sailplane can be repaired by the owner himself.

(See Appendix: "Repair Instructions").

6.6 Tow release hook

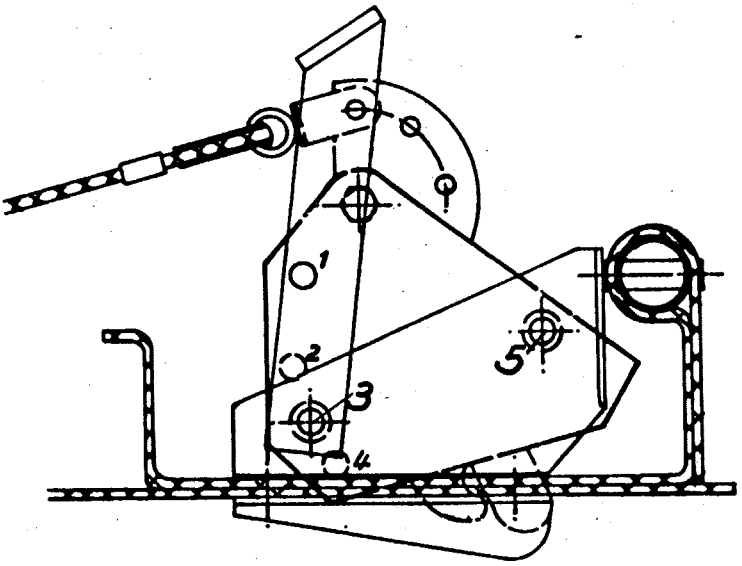
The tow release hook, mounted on the bottom of the fuselage just in front of the landing wheel, is much exposed to dirt and must be checked quite often for damages. Keep it clean and lubricated.

It is easy to take off the tow release hook for inspection or repair.
Remove the seat panel, disconnect the release cable and unscrew the two attachment bolts.

In case of belly landings the towing hook is protected by two angular fittings which are bolted onto the attachment brackets of the hook. If these fittings show an abrasion up to the heads of the attachment bolts, they must be replaced.

When mounting the towing hook again take care to attach it onto the bracket as shown on sketch, page 50.

Attachment of the tow release hook in front of the landing wheel



Towing hook to be attached onto the bracket by the bolt holes 3 and 5.

6.7 Weights and hinge moments of the control surfaces

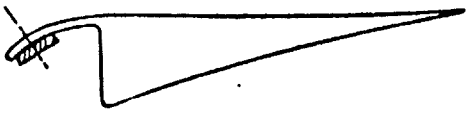
After repair or a new painting the weight and hinge moment of the control surfaces must not exceed the following values :

Control surface	Weight		Hinge moment	
	kg	lb.	mkg	ft.lb.
Flap	3.8±12%	8.4±12%	0.158±12%	1.14±12%
Aileron	3.7±12%	8.2±12%	0.065±12%	0.47±12%
Elevator	1.0	2.2	0.060	0.43
Rudder	4.9-12%	10.8-12%	$0.037^{+44\%}_{-12\%}$	$0.27^{+44\%}_{-12\%}$

If these values are exceeded a mass balance must be installed in front of the hinge axis.

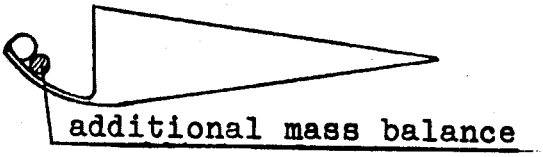
Mass balance on flaps and ailerons

A flat bar of lead or of similar heavy material is to be attached onto the inside of the nose strip between the first and second hinge fitting respectively by means of 4 mm or 5/32" counter sunk screws in a distance of 100 to 150 mm or 4 to 6 in. each.



Mass balance on the rudder

Parallel to the already installed round bar a square or a round bar of the required weight is to be glued onto the inside of the nose strip and covered with a glass cloth layer.

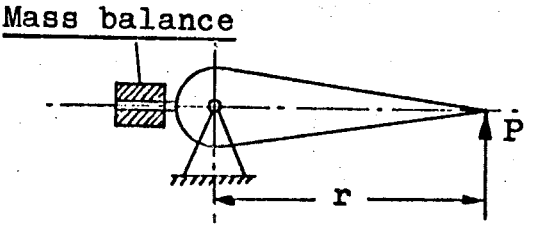


Mass balance on the elevator

On the elevator the mass balance is to be attached span-wise onto the nose joint strip.

The hinge moments must be determined on the disassembled control surfaces.

$$M = P \cdot r$$



The control surface should be supported at its hinge axis.

The force P is to be measured by means of letter or spring balance.

After the installation of an additional mass balance the control surface movements are to be checked for their unrestricted travel.

6.8 Maintenance of the surface finish

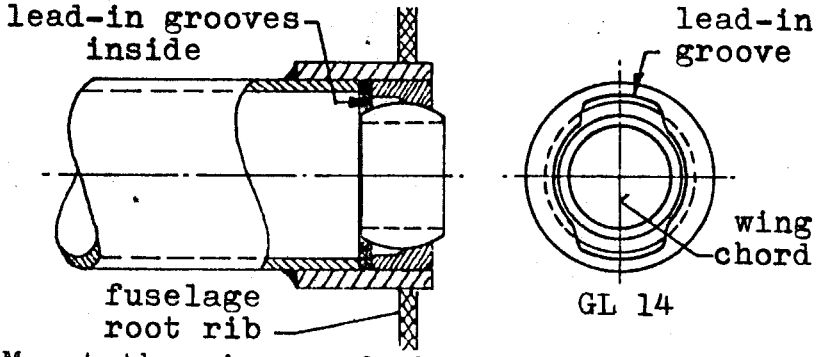
- Wash the surfaces with clean warm water using a soft sponge and wipe dry with a soft clean chamois.
- Never use gasoline, alcohol or thinner for cleaning.
- Do not addwashing agents to the water too often and don't use agents which are containing Silicone.
- Clean the plexiglass hood with a special cleaning agent for plexiglass, or in needs, with lukewarm water.
  Use only soft clean chamois for wiping dry.
  Never try to clean with a dry cloth.
- The sailplane should be protected from moisture.
  If water should be soaked into inner compartments, disassemble the sailplane and let the components dry while turning them over frequently.
- Do not expose the sailplane to extreme sunlight and avoid unnecessary permanent strain.
- Take care that all external portions of the sailplane which are exposed to sunlight are painted white.
  Other colors than white would excessively heat the FRP-structure which may impair the strength qualities of the sailplane.

6.9 Replacement of the ball bearings for wing attachment bolts on the fuselage

Four ball bearings (GL 14) are installed at the ends of the wing attachment tubes of the fuselage steel tube frame. These bearings are to be checked for cracks after heavy landings.

If a replacement of the bearings should be necessary, the repair is to be done as follows:

Turn the inner ball about 90° across and hammer the bearing out of its seat from the opposite side using a bar of about 12 to 14 mm diameter.
Insert a new ball bearing (GL 14) with the lead-in grooves to the inside in the direction of the wing chord.
Peen over or punch the outer bearing race at three spots.



Mount the wings and check the clearance of the wing attachments. If the backlash is exceeding the permitted tolerance, i.e. if the movement at the wing tips is exceeding 30 mm, follow the instructions on page 48.

6.10 Safety belts

A four-piece safety belt is required. Following makes and models are approved:

Seat belt

Gadringer - Bagu IV-D or IV-E

Autoflug - Bagu FAG - 7F/O

Attachment:
Brackets on the fuselage shell and accessible through cut-outs in the seat panel.

Shoulder harness

Gadringer - Schugu II-C

Autoflug - Schugu FAG - 7H/O

Attachment:
Front wing attachment tube accessible through cut-outs in the upper FRP-fairing.

6.11 Instruments

The original certification of the Mini-Nimbus B was carried out using the following instruments:

Airspeed Indicator 30 - 300 km/h
marked in accord with 2.8, page 12
Winter 6FMS 4-2

Altimeter 10-1000-10000 m
Winter 4 FGH 10

Magnetic Compass, Ludolph FK 16

Variometer, Winter St V 5

Radio, Dittel FSG 40 S

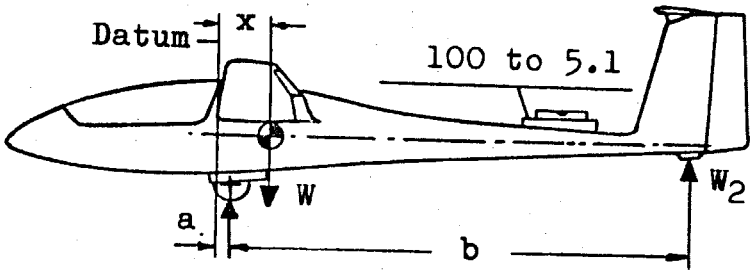
For the basic equipment or for cloud flying any approved instruments can be used, if they meet the requirements of 2.8, page 12.

7 Determination of the empty weight C.G.

For the determination of the empty weight C.G. position the sailplane is to be assembled with closed canopy, with the permanent equipment installed and without water ballast.
With main landing wheel on the ground the tail skid is to be jacked up on a balance about 49 cm (19.3 in.) from the ground, i.e. slope of rear top surface of fuselage 100 to 5.1 tail down or rear fuselage center line horizontal.
Then the weight at the tail skid is to be determined with wings held level.
The distances a and b are measured using a plumb or gathered from the last weight and balance report.

The distances a and b measured at the original weighing by the manufacturer are:

a = 129 mm (5.1 in.)
b = 3930 mm (154.7 in.)



Datum : Wing leading edge at root rib.

Leveling means : Slope of rear top surface of fuselage 100 to 5.1 tail down.

Empty weight C.G. position:

$$x = \frac{W_2 \cdot b}{W} + a$$

The empty weight C.G. position must be within the limits given in the Table on page 11 of the FLIGHT MANUAL.

A determination of the empty weight C.G. position is required after the installation of additional equipment, after repair or modifications which are changing the weight of the sailplane.

Changes of weight and C.G. position are to be entered into the log book and confirmed by a designated inspector.

Gross weight C.G. position

Before conducting performance flights it is recommended to determine the true gross weight C.G. position in order to check if it is within the optimum range for high performance.

Optimum gross weight C.G. range:

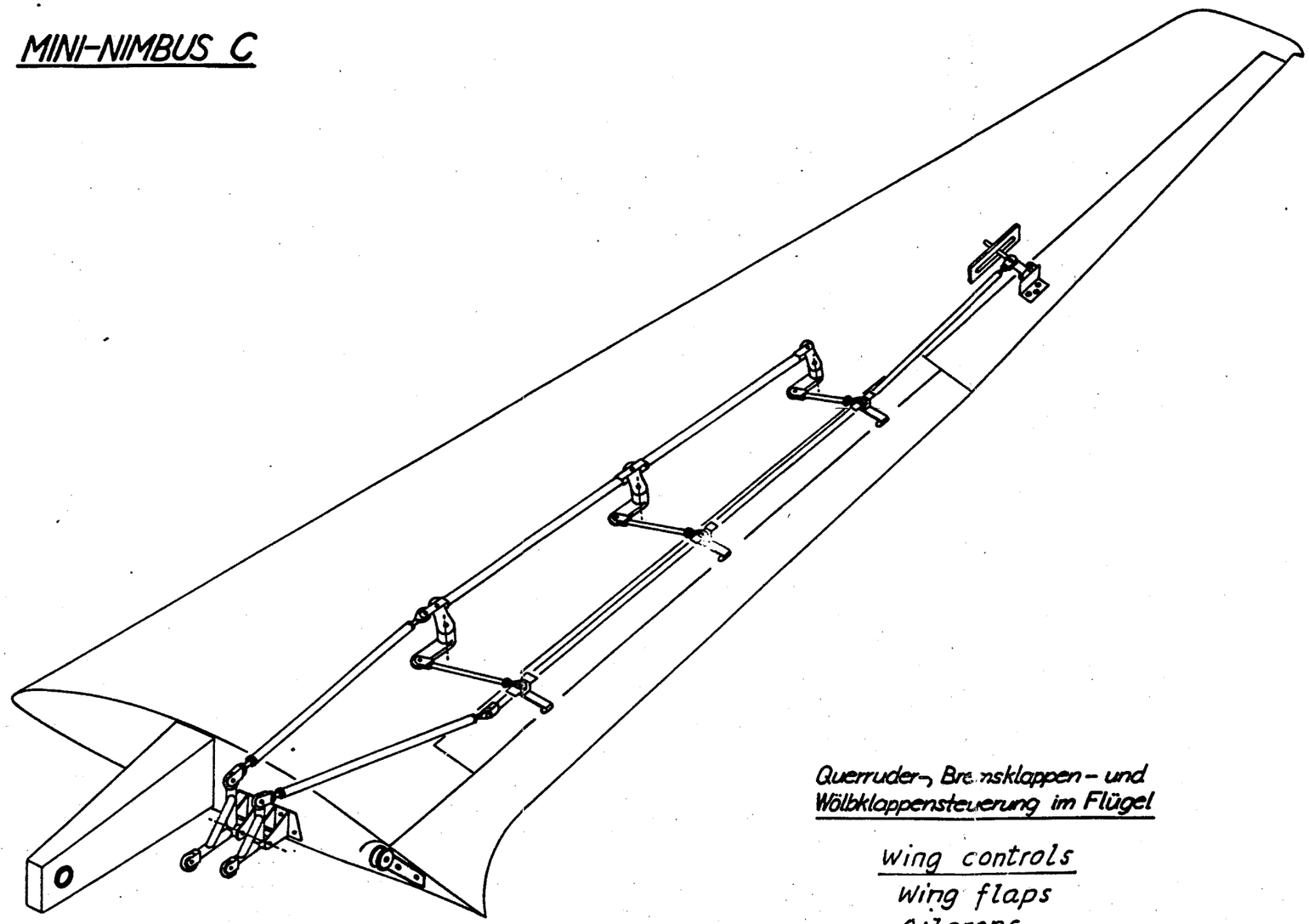
300 mm to 350 mm (11.8 in. to 13.8 in.) aft of datum.

The sailplane is to be weighed as described on page 56 with pilot and parachute and additional equipment as seat cushion, barograph, cameras etc.

Take care that the rudder pedals and back rest have the proper position.

$$x_{(Flight)} = \frac{W_{2(Flight)} \cdot b}{W + W_{(Payload)}} + a$$

MINI-NIMBUS C

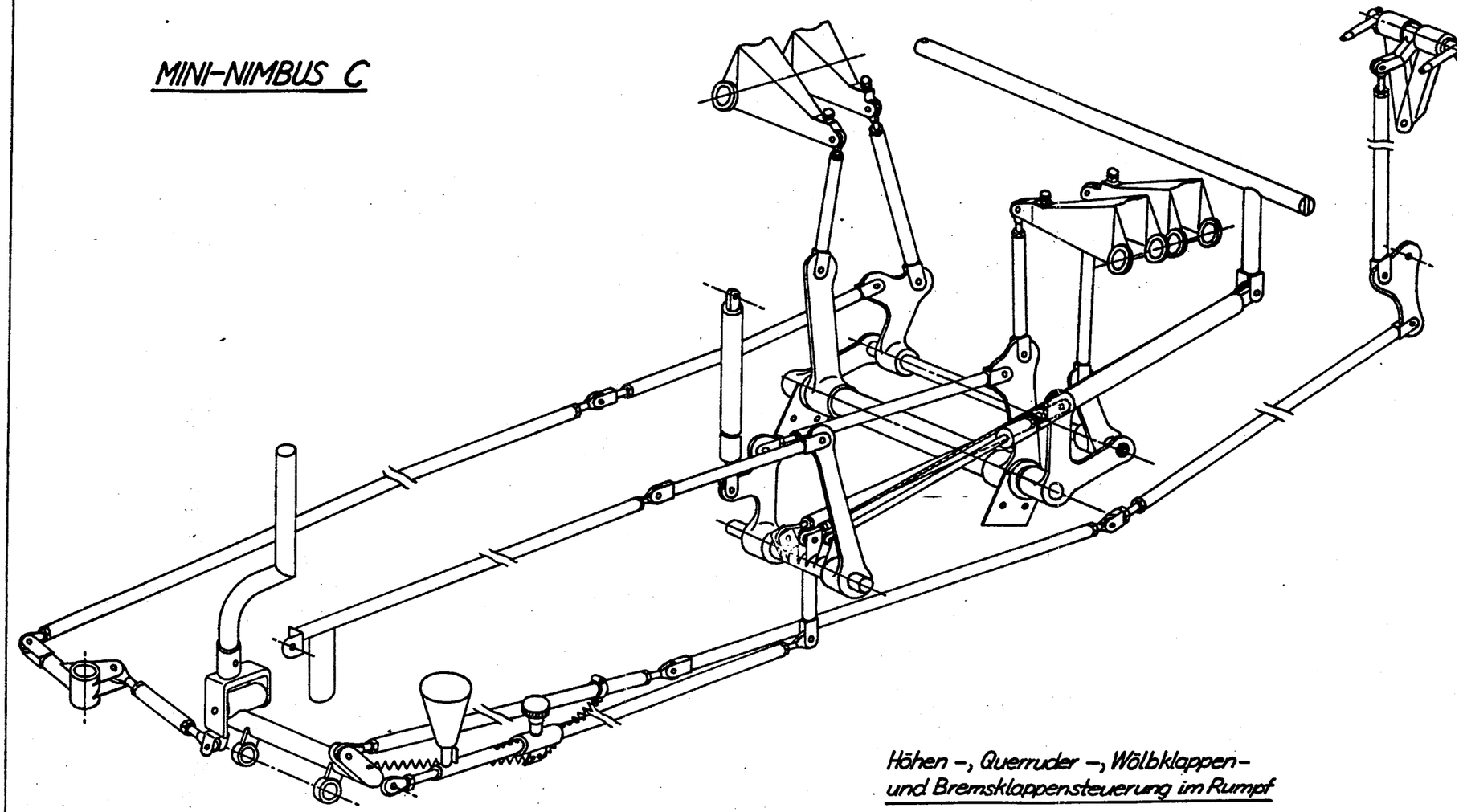


Querruder-, Bremsklappen- und Wölbklappensteuerung im Flügel

wing controls

Wing flaps
Ailerons
Air brakes

MINI-NIMBUS C

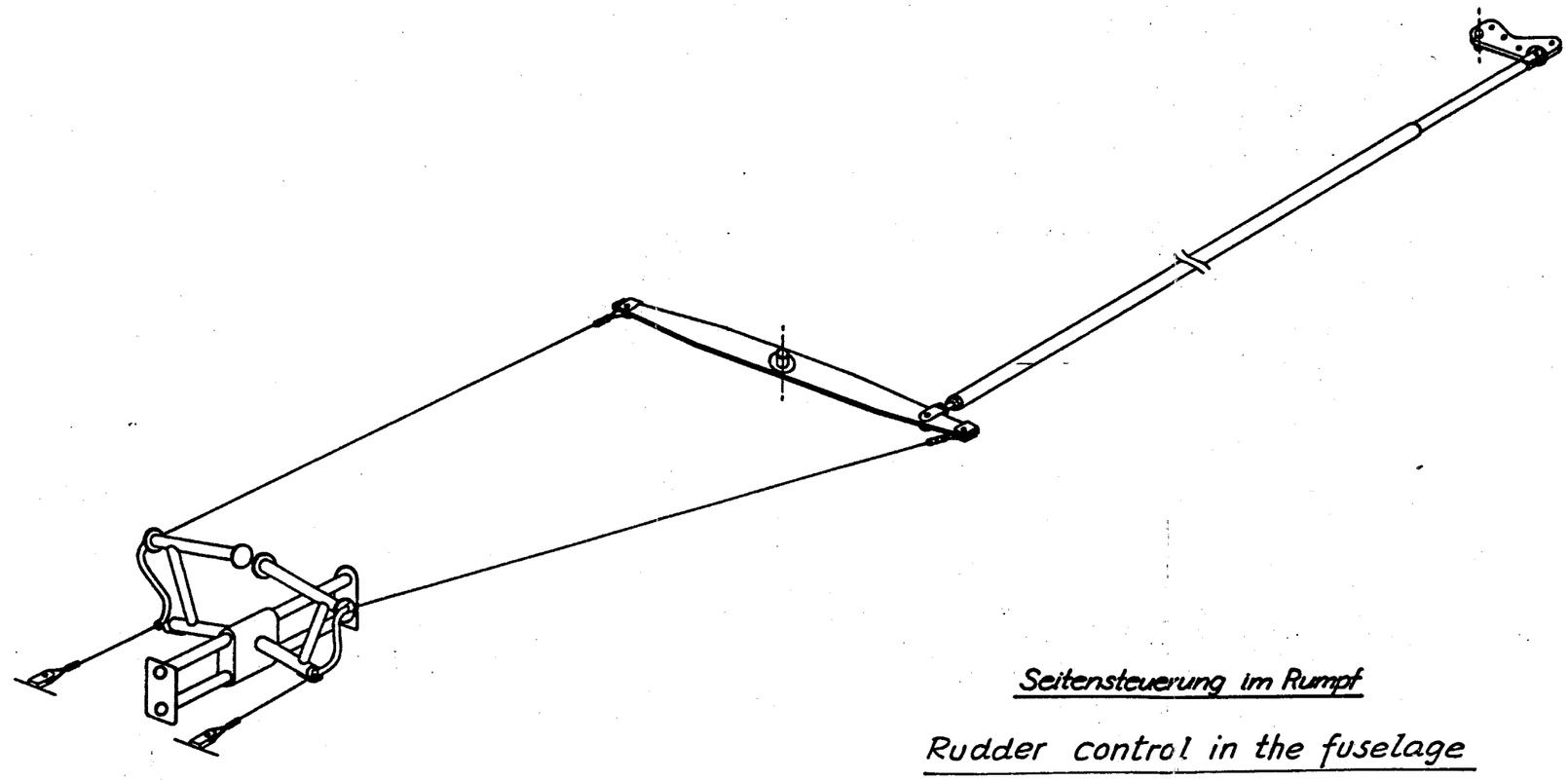


Höhen –, Querruder –, Wölbklappen- und Bremsklappensteuerung im Rumpf

Fuselage Controls

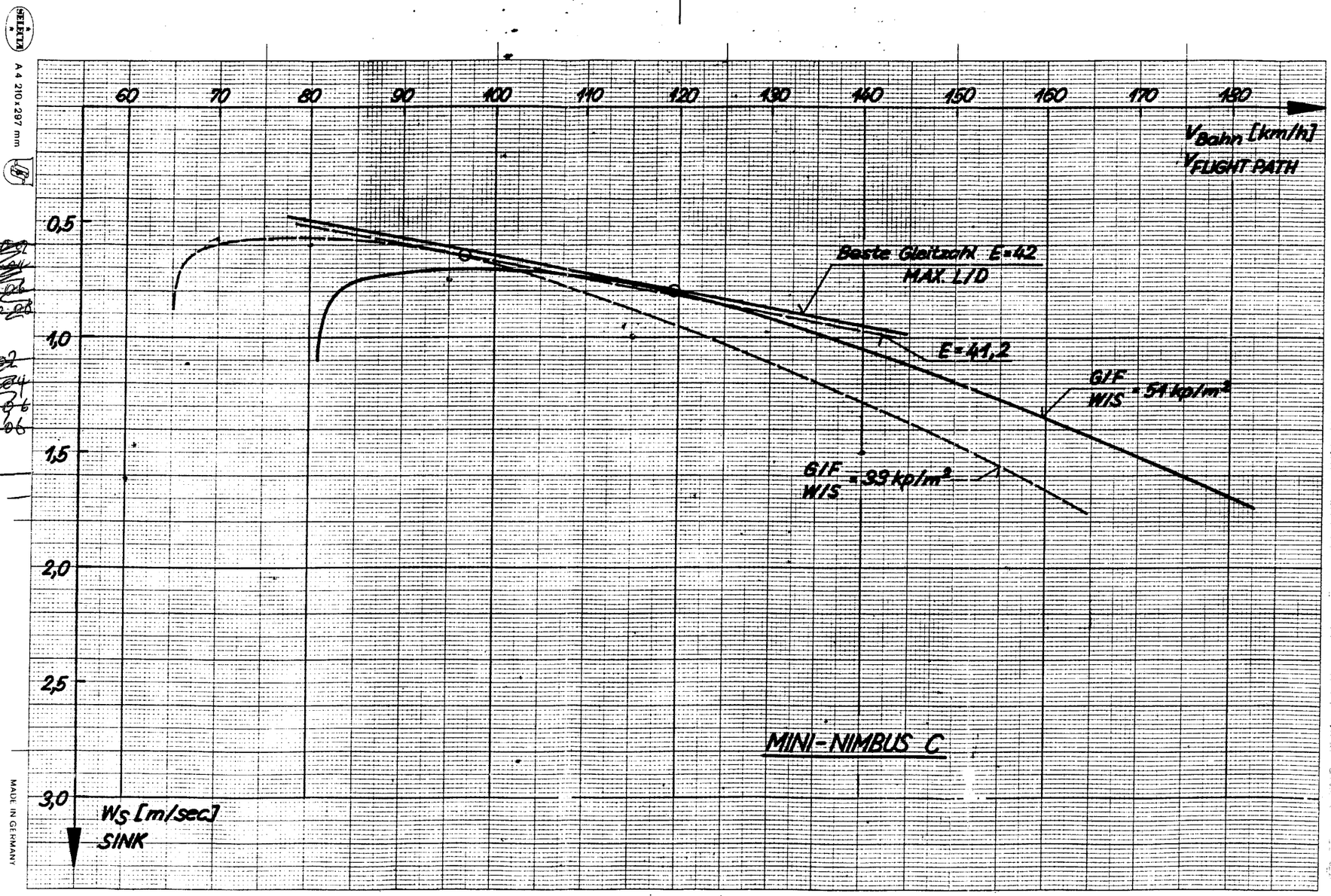
Wing flaps
Ailerons
Airbrakes
Elevator

MINI-NIMBUS C



Seitensteuerung im Rumpf

Rudder control in the fuselage


60
70
80
90
100
110
120
130
140
150
160
170
180
V_{Bahn} [km/h]
$V_{FLIGHT\ PATH}$
0,5
1,0
1,5
2,0
2,5
3,0
W_S [m/sec]
SINK
Beste Gleitzahl E=42
MAX. L/D
E=41,2
G/F = 51 kp/m²
W/S
G/F = 33 kp/m²
W/S
MINI-NIMBUS C
0.8
0.7
0.8
0.9
1.1
1.2
1.3
1.4
1.6
1.7
1.8
A4 210x297 mm
MADE IN GERMANY

Repair Instructions for the Sailplane

Mini-Nimbus C

The construction methods on the sailplane Mini-Nimbus C are similar to those on the OPEN CIRRUS. Therefore repairs can be carried out in the same way as described by the enclosed instructions for the Cirrus.

In the Mini-Nimbus C we find the following construction methods:

1. Inner wing panel

   Glass-fiber foam sandwich
   Foam: CONTICELL 60, 8 mm thick

2. Outer wing panel

   Glass-fiber foam sandwich
   Foam: CONTICELL 60, 6 mm thick

3. Flaps, Ailerons, Air brakes

   Pure glass-fiber layup

4. Fuselage

   Pure glass-fiber layup

5. Vertical tail plane

   Fin: Glass-fiber foam sandwich
   Foam: CONTICELL 60,
   in front of the spar 6 mm thick
   aft of the spar 4 mm thick

   Rudder: Glass-fiber foam sandwich
   Foam: CONTICELL 60, 4 mm thick

6. Horizontal tail plane

   Stabilizer: Glass-fiber foam sandwich
   Foam: CONTICELL 60, 6 mm thick

   Elevator: Pure glass-fiber layup

If a fracture or damage occurs to the sailplane, you should first inspect the damaged area to determine exactly the type of construction and to find the appropriate method for the repair.

Repair Instructions for the Sailplane Mini-Nimbus C

In the Mini-Nimbus C we find the following construction methods:

1. Inner wing panel

   Carbon-glass-fiber foam sandwich
   Foam: CONTICELL 60, 8 mm thick

2. Outer wing panel

   Carbon-glass-fiber foam sandwich
   Foam: CONTICELL 60, 6 mm thick

3. Flaps, Ailerons, Air brakes

   Pure glass-fiber layup

4. Fuselage

   Pure glass-fiber layup

5. Vertical tail plane

   Fin: Glass-fiber foam sandwich
   Foam: CONTICELL 60,
   in front of the spar 6 mm thick
   aft of the spar 4 mm thick

   Rudder: Glass-fiber foam sandwich
   Foam: CONTICELL 60, 4 mm thick

6. Horizontal tail plane

   Stabilizer: Glass-fiber foam sandwich
   Foam: CONTICELL 60, 6 mm thic

   Elevator: Pure glass fiber layup

If a fracture or damage occurs to the sailplane, you should first inspect the damaged area todetermine exactly the type of construction and to find the appropriate method for the repair. Repairs can be carried out as described by the enclosed instructions for the "Cirrus" as far as glass-fiber structures are concerned. If repairs on carbon-glass-fiber parts should be necessary, ask the manufacturer for advice.

Note

At the construction of this sailplane Mini-Nimbus C the following CIBA resin system was used :

Resin	XB 2878 A
Hardener	XB 2878 B

Mixing proportions :
by weight - 100 resin to 36 hardener

Curing instructions :
(After precuring or during the cure)

15 hours at 50 °C (122°F) or
10 hours at 80 °C (176°F)

Recommended maximum curing temperature
100 °C (212 °F)

Repairs on this sailplane should be made using the above CIBA resin system.
Do not use the resin system Epikote 162 with Laromin C 260 as specified by the repair instructions for the "CIRRUS".

Schempp-Hirth KG. 7312 Kirchheim-Teck W.Germany

Repair Instructions for the Glass Fiber-Plastic Sailplane "CIRRUS"

Construction

In the CIRRUS sailplane we find three basically different construction methods. Repairs must for this reason be performed differently on the respective parts.

We differentiate

1. Wing and stabilizer
2. Rudder, elevator and ailerons
3. Fuselage

1.) Wings and stabilizer are built in a ribless glass fiber-plastic foam sandwich construction. This means in event of damage that we find a PVC rigid foam (5/16 inch thick, 3.7 lb./cu.ft.) bonded on both sides with a glass cloth laminate.

2.) The controls likewise consist of a sandwich construction. However here the supporting core is not PVC rigid foam but a 5/32 inch thick foamed polystyrene (Styropor) sheet with a specific weight of only one lb./cu.ft.

3.) The fuselage, in contrast to the above parts, is not in sandwich construction but in a pure approximately 1/16 to 3/32 in. thick glass fiber-plastic layup which is reinforced at two locations with bonded-in foam rings.

The following materials apply to all parts:

Resin	Shell Epikote 162
Hardener	BASF Laromin C 260
Mixing proportions by weight	100 resin to 38 hardener
by volume	2 resin to 1 hardener

After proportioning stir until striations disappear. Add filler after stirring.

Glass fibers and cloth

Use only alkali-free "E" glass cloth with Volan A or I-550 finish (INTERGLAS).

INTERGLAS Style	U.S. Style	Weave	Weight lb./sq.ft.	Application
91110	120	↑ Crosstwill	.022	Elevator & rudder
92110	---		.033	Fuselage, ailerons, stabilizer
92125	---		.058	Wings & fuselage
92140	152-150	↓ uni-directional	.082	Fuselage
92145	181-150		.044	Wings

Rovings

GEVETEX Type ES 10-40x60 K 43	Textilglas GmbH GEVETEX

Foams

PVC Rigid Foam Conticell 60 5/16 in. thick, 3.7 lb./cu.ft.	Continental AG
Styropor THERMOPETE Super 5/32 in. thick, 1 lb./cu.ft.	PORON Kunststoff Werke

Resin - Fillers

Microballoons, white	Union Carbide
Microballoons, brown	(Brenntag GmbH)
Aerosil	Degussa-Wolfgang
Styropor kernels 1/16 - 3/32 dia. (expanded polystyrene kernels)	BASF
Chopped cotton wool	

Lacquer — Lesonal-Werke

PE - Lackvorgelat, white (resin paint) No. 3-6910

PE - Hardener No. 7-2050 *or 7-2051 (100 to 1,5)*

Mixing proportions by weight

100 parts Lackvorgelat to 10 parts hardener

PE - Thinner No. 6-3026

~~PE - Filler, white No. 62507~~

PE - Hardener No. 7-2050

Mixing proportions by weight

100 parts ~~filler~~ to 10 parts hardener

Resin ~~paint~~ "Lackvorgelat" and filler can be mixed in ~~one to one or other proportions.~~

Repair

Should a fracture or damage occur to the sailplane, you should first inspect the damaged area to determine exactly the extent of damage and type of construction. The type and density of weave can usually be determined by sanding to the cloth. If this is not possible, break off a piece of the laminate and ignite it. After the resin is burned the type, density and direction of the weave will be evident.

I. Damage to Wing or Stabilizer

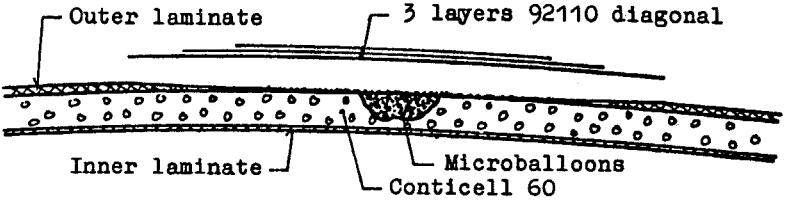
The damages which can be repaired by you fall into two groups.

a) Simple surface damage (only the outer glass fiber laminate damaged)

b) Destruction of the whole shell (also the inner glass fiber laminate destroyed)

a.) If the outer shell receives a puncture or a fracture, tap to determine the extent of delamination from the foam. Follow by removing the lacquer with a sanding disc or block and remove from the foam the portion of the shell which has become delaminated. Around the edge of the damaged area where the shell is still firmly bonded, scarf with an abrasive block or a plane blade at least 1-1/2 inches (for each cloth layer about 3/4 inch is necessary).
After scarfing the shell, blow out thoroughly the whole repair area including the pores of the foam and wash the scarf with carbon tetrachloride or acetone.

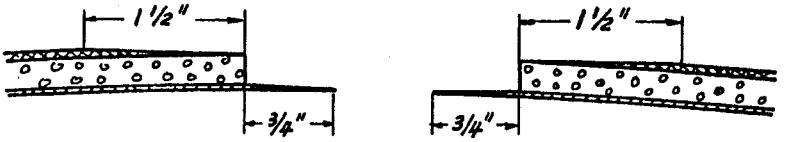
Now fill the hole in the foam with microballoons and simultaneously fill the pores of the exposed foam. Then lay three patches of the 92110 cloth with diagonal weave direction (stepwise largest patch first) over the damaged area. The applied cloth must be dry and dust free.



After hardening (appr. 8 hrs. at 20 deg. C. or 68 deg. F.) the damaged area should be smoothed, filled and painted. In smoothing take care that only the edges of the patches are sanded.

b.) If there is a through hole in the sandwich shell then the inner laminate must be repaired.

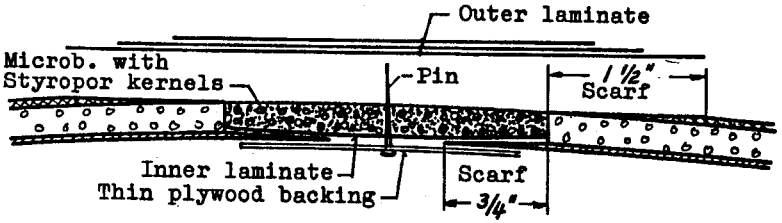
We remove the outer laminate in the region of the damage which is no longer bonded to the foam and enlarge the hole in the foam and inner laminate until good bonding to the foam is evidenced. Then the foam is further removed 3/4 inch around the hole in the inner laminate and the outer laminate scarfed as under paragraph a. Now the projecting inner laminate is cleaned of any foam and feathered.



If the hole in the foam is smaller than a fist then glue with Patex a thin plywood or polyester plate from the inside to the laminate, lay on the inner laminate (1 layer 92125 ※ or 2 layers 92110 ※) and fill the hole in the foam with microballoons mixed with Styropor kernels or crumbled Styropor.

If you are not hurried let it harden (8 hrs. at 68 deg. F.) sand and apply the outer patches.

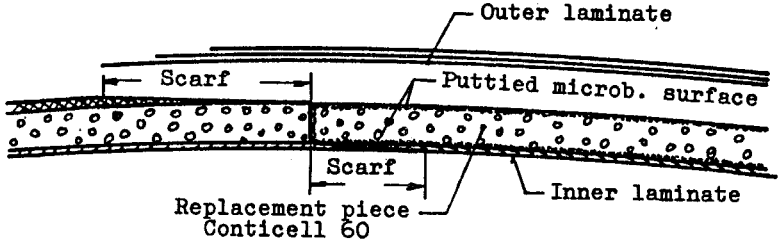
A tip on gluing the plywood plate - the hole in the inner laminate should always be a bit oblong so as to insert the plywood backing plate. Before inserting the plywood drive through the middle of the ply a pin or nail by which it can be drawn against the inner shell. With additional nails or pins it is in this manner possible to close very large holes to the proper contour to lay the cloth patch on.



Basically it is possible to repair also larger shell parts in the foregoing manner. Because of weight you should use a plug of foam in place of the microballoons and Styropor kernels.

In these cases proceed as follows: You cut or sand a plug of foam (Conticell 60) to fit the hole, spread the inner side thinly with microballoons (to close the pores) and lay on it the inner laminate. The inner laminate must harden before doing further work. If the hardening is complete or at least progressed so that the laminate does not separate from the foam, then glue the plug in the hole with thickened resin (chopped cotton wool, microballoons). The foam with laminate on one side is flexible so that it can be fitted to the wing contour (if necessary warm the foam with a hairdryer and bend). Once the foam is glued it can be smoothed, puttied with microballoons and the outer laminate applied.

Caution: Avoid strong heat, otherwise air bubbles form.



II. Damage to the Controls

Basically the same procedure can be used as on the wing. Only in place of the PVC foam a polystyrene foam layer, "Styropor Thermopete Super" 5/32 inch thick, is used. The Styropor piece need not be coated with microballoons, the cloth adheres very well with pure or slightly

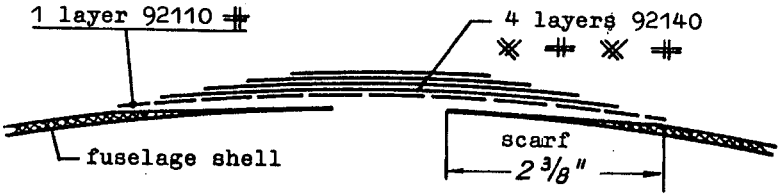
thickened resin which must not harden in any case before doing further work. However with larger replacement pieces you should let the laminate harden on one side and glue the foam thereto in order to keep the surface wave free.

Caution: Do not apply too much heat to freshly laid cloth otherwise it causes ugly blisters and you must start over.

Caution: On the controls minimize weight in the repair. The surface should require very little filling.

III. Damage to the Fuselage

In the repair of the fuselage we save the annoying replacement of the foam. We have here, as already mentioned, only to do with the simple glass laminate which in most places consists of five layers. Therefore we need larger scarfs. These should, for larger holes or cuts, never be less than 2-3/8 inches wide. With all fuselage shell repairs apply resin first to a layer of 92110 ╫ cloth following with four layers of 92140 cloth alternating the weave lengthwise and diagonally. Then you are always on the safe side. Each succeeding layer should be about 3/8 to 1/2 inch smaller than that under it.



For small holes or fractures the repair is no problem. You sand your scarf, clean well with carbon tetrachloride or acetone, lay on the cloth layers and, if the resin is dry, can finish the whole repair with microballoons after 2 or 3 hours.

Caution: If the room is cold or if you are hurried you should nonetheless not use a concentrated hot air stream. Better, make a large tent over the area from aluminum foil and heat the space from a safe distance. There is little likelihood of blisters but overheating can occur and the resin may become brown. If you do not have a source of hot air, put a sheet of foil over the applied cloth and use a heat pad or hot water bottle.

For larger holes in the tailcone not accessible from the inside, we must again fabricate a backing on which to contour the repair cloth. This can be retained as discussed previously with the aid of plywood, a nail and a little Patex. It cannot later fall out, the cloth being directly on the plywood and so is bonded thereto. After the plywood backing is secured proceed as previously discussed.

Lacquer Work

After sanding the edges of the patch or the area filled with microballoons until the original contour is attained the puttying can be abandoned and the lacquer (PE-Vorgelat or PE-Vorgelat and filler in 1 to 1 proportion) applied directly with a brush (not sprayed). After hardening sand the area and wet sand with 360 grit wet-or-dry paper. If at no place the weave shows then final sanding can be done with 600 grit wet-or-dry. Polish with rubbing compound. If the weave shows repaint with lacquer.

Repairs to Fittings

At the appearance of a damage to a fitting, the cause of which is not known, contact the factory.

Welding should be carried out only by an approved aircraft welder.

All weldments made by the factory are by the Argon-arc method using 1.7324.0 welding rod.

Larger Repairs

You should not attempt to make larger repairs of the following types:

If the wing, fuselage or controls are broken apart.

If the spar flanges are damaged.

If the main fittings at the root rib, fuselage or in the controls are broken out.

If in the area of the fittings the laminate shows white areas or cracks.

When you cannot guarantee the repair.

Kirchheim-Teck
26th March 1968
Schempp-Hirth K.G.

ss Klaus Holighaus

Translation by F. H. Matteson