GROB-FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
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Telex 539 623

Maintenance Handbook

GROB G 103

»TWIN II«

This handbook must be carried on board at all times.

It refers to the GROB G 103 Sailplane.

Registration: --- Factory Serial Number: 3735

Owner: Edmund Schneider PTY. LTD.
Herrn Harry Schneider
Two Wells Road, Aerodrome
Gawler, S.A. 5118
Australien

German edition of operating instructions are approved under § 12(1)2. of LuftGerPO.

Published December 1980

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Updates:

Current number	Page	Reference	Date	Signature
1	2.4, 12, 13, 17	Modified elevator (TM 315-16)	19. Nov. 81	
2	2, 4, 5, 6, 7, 8, 12, 13, 17, 18, 21, 24, 26a	Modification of serial no. 3730	1. Apr. 82	

1. April 1982

I. Technical Data

Wings

Profile Eppler		E 603	
Span	b	= 17,5 m	57.4 ft.
Area	F	= 17,8 m²	191.6 sq. ft.
Aspect Ratio		17,1	

Allerons

Span	b_{QR}	= 3,65m	12 ft.
Chord inner	ti	= 0,208 m	.68 ft.
outer	ta	= 0,105m	. 34ft.
Area	F_{QR}	= 1,14m²	12. 27sq. ft.
% of Wing area		640 %	

Fuselage

Length	l	=8,18 m	26,8 ft.
Width of cockpit	b	=0,71 m	28 inches
Height of cockpit	h	=1,02 m	40 inches
Height of tailplane	h	=1,55 m	5. 09 ft.
Surface area ca.	F	= 13 m²	139.94sq. ft.

Fin

Height	h	= 1,.3 m	4,27 ft.
Area	F	= 1,37 m²	14. 75sq. ft.
Aspect Ratio		1,23	
Chord bottom	tu	= 1,25m	4. 1 ft.
top	to	= 0,86m	2. 82 ft.

Rudder

% of Fin		370 %	
Area	F	=0,505m²	5. 44sq. ft.

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Tailplane

Span	b	- 3,3 m	10,8 ft
Area	F	- 2,18 m^2	23,5 sqft
Aspect Ratio		5,0	5,0
Chord Inner	ti	- 0,84 m	2,76 ft
Outer	ta	- 0,48 m	1,57 ft

Elevator

Area	F	- 0,64 m^2	6,89 sqft
Chord inner	ti	=0,245 m	0,80 ft

Trimm tab

Span	b =	0,95 m_2	3,12 ft
Area	F =	0,07 m^2	0,75 sqft
Chord Inner	ti =	0,09 m	0,30 ft

Airbrakes (Grob System)

Area (Each)	F_{BK} =	0,504 m^2	5.425 sq. ft.
Span	b =	1,4 m	4.59 ft.
Height	h =	0, 18 m	7. 1 inches

Weights

Empty weight	ca.	380 kg	838 lbs.
Load Maximum		280 kg	441 lbs.
1. Seat		110 kg	242 lbs.
2. Seat		110 kg	242 lbs
Baggage	ca.	10 kg	22 lbs.
Load Minimum (1. Seat)		70 kg	154 lbs.
Maximum Flying Weight		580 kg	1279 lbs.
Load% of Flying Weight		36 %	
Wing Loading 25, 3-32, 6 kg/m^2		5. 18-6. 68	lbs./sq. ft.

Maximum weight of non-lifting parts 400 kg 882 lbs.

II. Description of Components

II. 1 Control Linkages

The control of the TWIN II is designed as a push-rod system. The stick, bellcranks and horns are made from steel tubs or aluminium, the pushrods are made of aluminium tubing.

Elevator

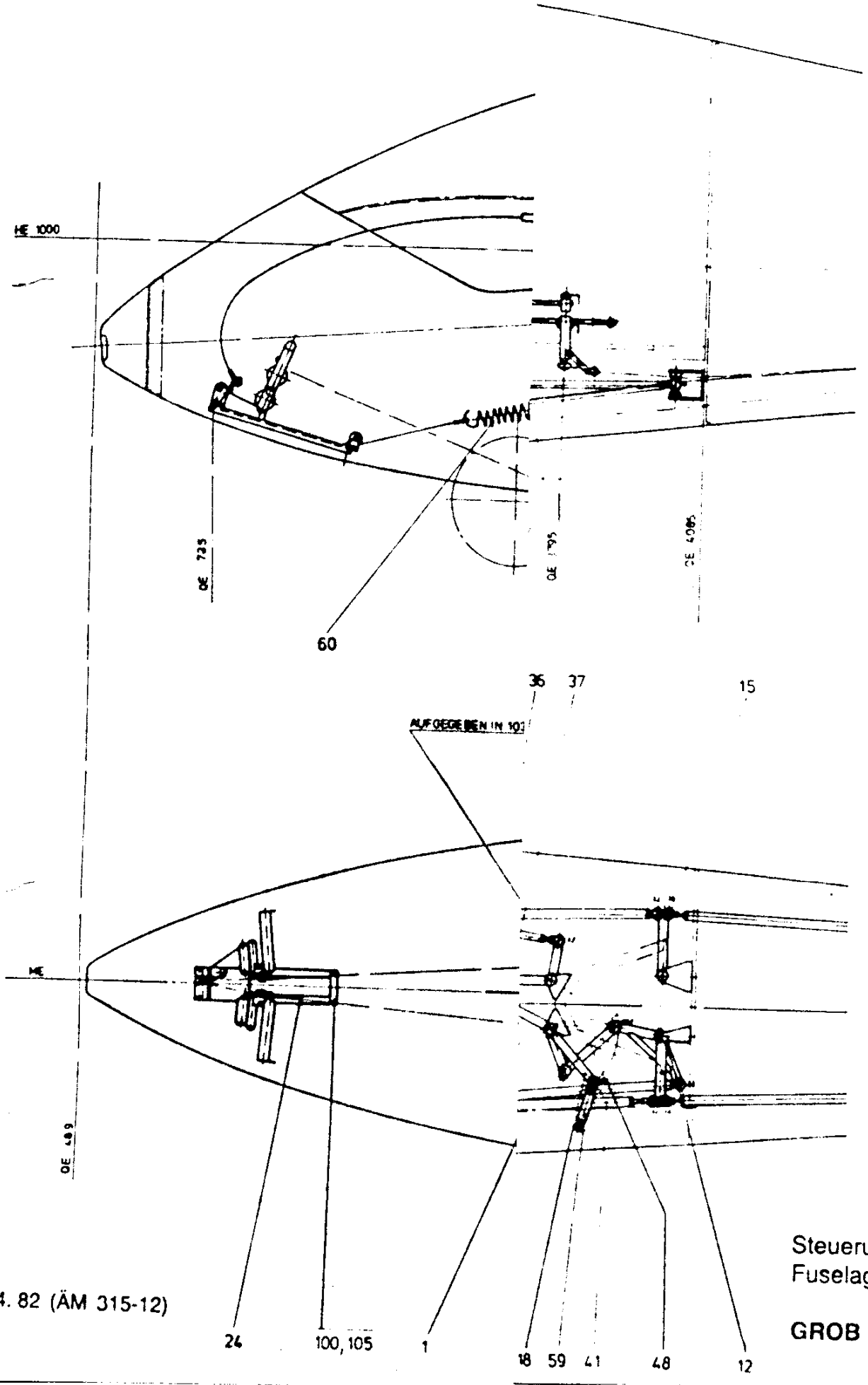
The control stick force is transfered from the control stick via the stick mounting frames to the elevator pushrod. The two control sticks are firmly connected. The rear control stick is detachable and held in place by a butflynut.Three elevator pushrod leads from the rear stick to the elevator horn in the side fin. A connection rod with snap fastener drives the horn in the elevator. All the components in the fuselage may be dismantled. The elevator horn is laminated into the elevator. Stops for the elevator are situated on both stick mounting frames under the seats.

Aileron controls

The lateral control force is transfered from the control stick via a short connection rod to the aileron control bellcrank on the side of the fuselage. The aileron control bellcranks for both control sticks are rigidly connected by means of 2 pushrod. Pushrods lead from the rear crank via an intermediate crank at the wheel box to the lower connection to the linkage assembly in the bottom of the fuselage. The aileron control connection and the pushrods in the wing are driven via the uppercrank of the linkage assembly. The outboard aileron control differential lever in the wing drives the aileron directly via a short pushrod. All components of the aileron control system in the fuselage may be dismantled. The aileron control differential lever and the pushrod in the wing may only be dismantled through an opening made in the GFK skin. Stops for the aileron linkage are present on both control sticks.

Rudder Linkages

Control cables lead from the front pedal mounting which can be adjusted in steps. The cables lie on the inside of the pedals and are routed to the bell crank of the rear pedal unitThe complete rudder linkage system may be dismantled. The stops for the rudder and the bellcrank are mounted near the rear pedal mounting.



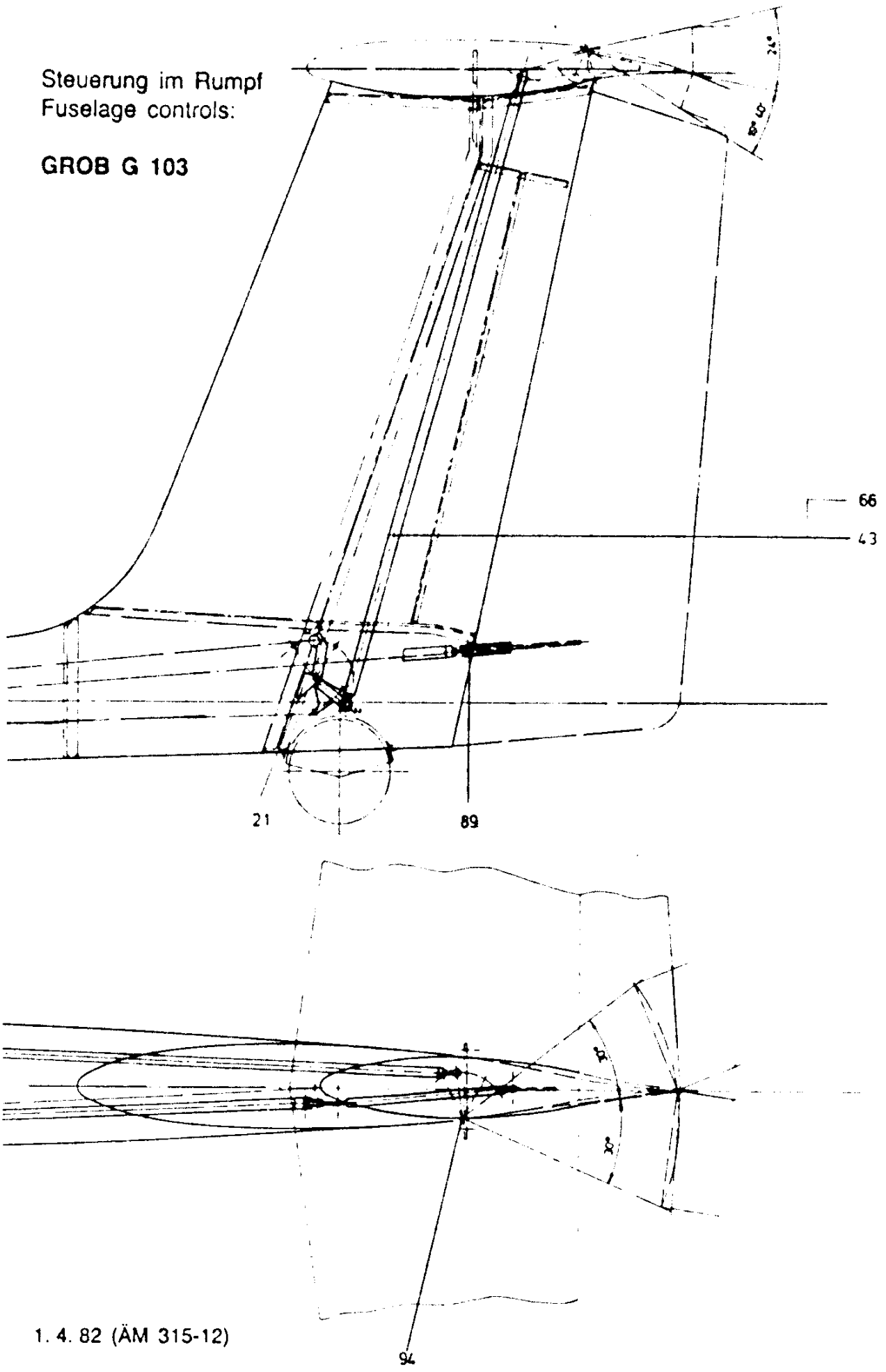
Steuerung im Rum
Fuselage controls:

GROB G 103

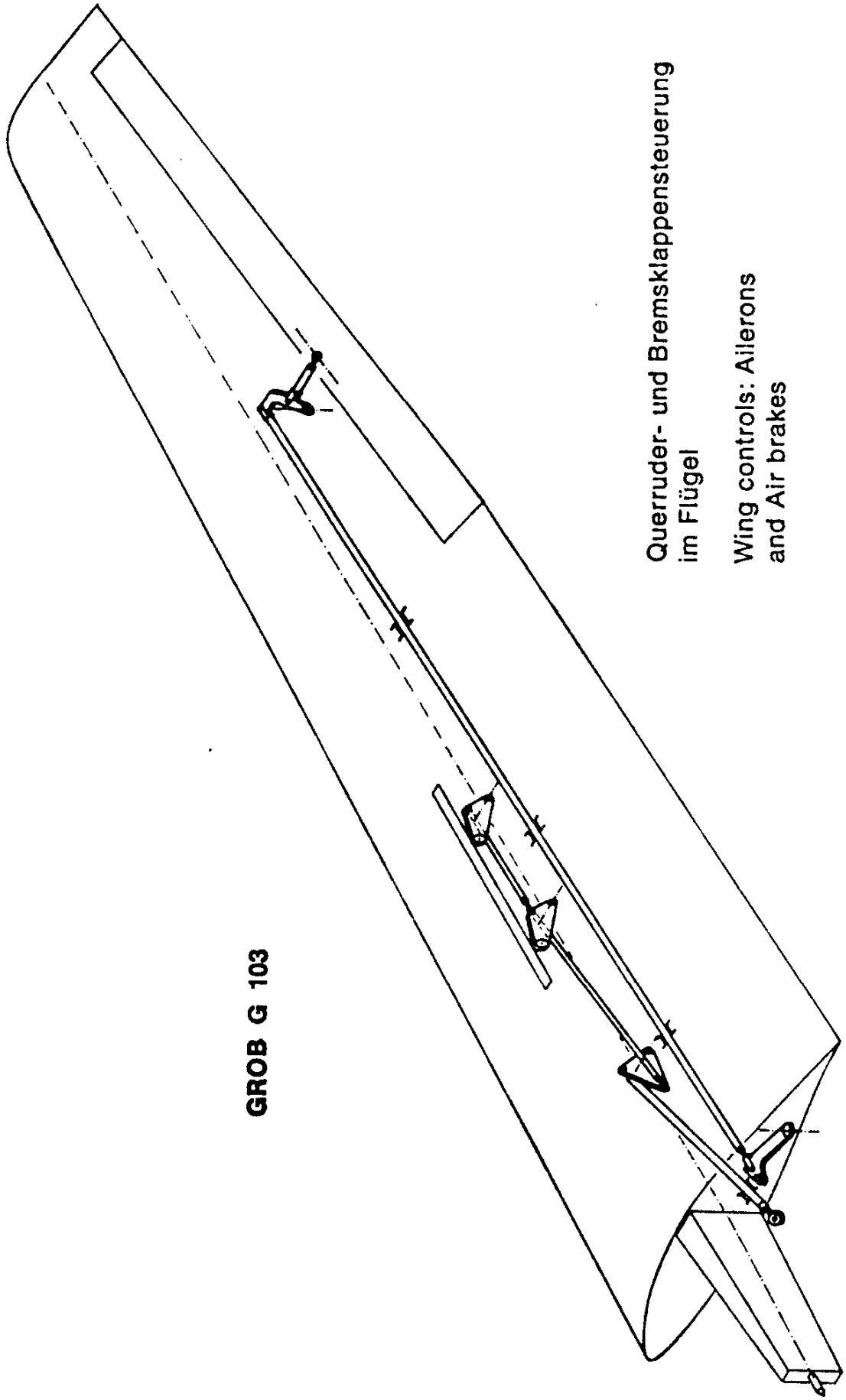
1. 4. 82 (ÄM 315-12)

Steuerung im Rumpf
Fuselage controls:

GROB G 103



1. 4. 82 (ÄM 315-12)



Querruder- und Bremsklappensteuerung im Flügel

Wing controls: Ailerons and Air brakes

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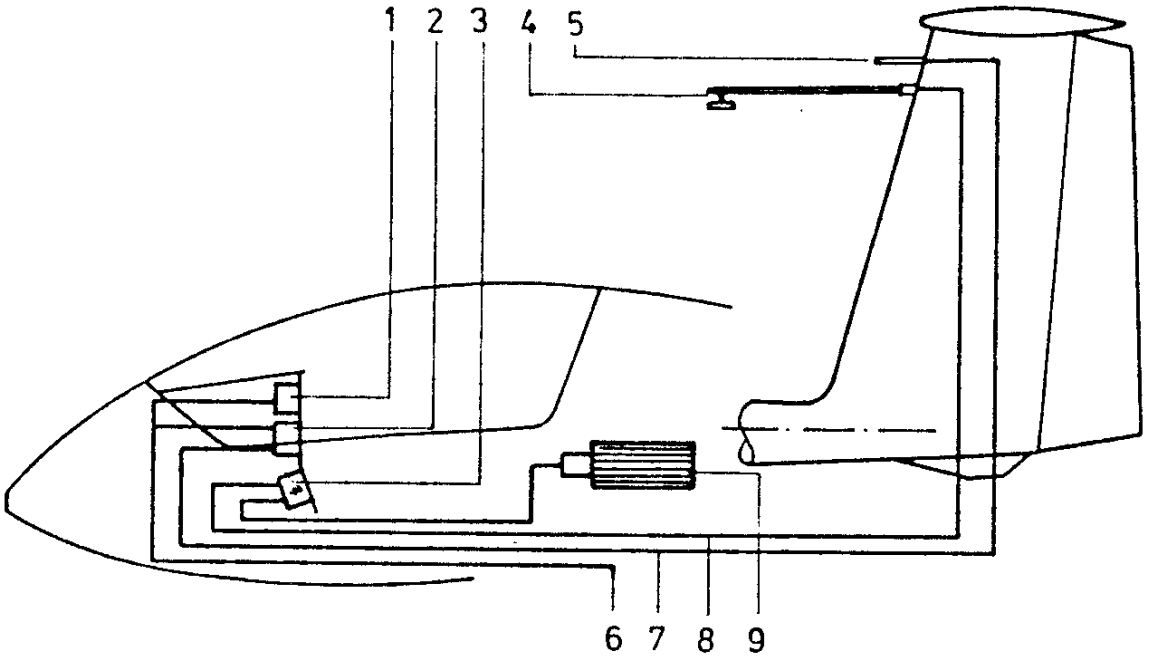
II. 2 **Installation of Radio**

The front instrument panel may be obtained in three layouts and can accommodate a rectangular instrument (60 x 80 mm or 146 x 47 mm) as well as 80 mm diameter instruments. The internal loudspeaker should be mounted on the rear instrument panel. "Swan neck" microphone booms may be mounted to the pilots right on the canopy frame. The shelf under the rear control linkage complex is prepared for fixing a battery. Drawings for the installation of the radio unit can be obtained on request.

II. 3 **Installation of Oxygen**

An Oxygen cylinder may be mounted behind the rear seat. Drawings for the installation of the Oxygen equipment can be obtained on request.

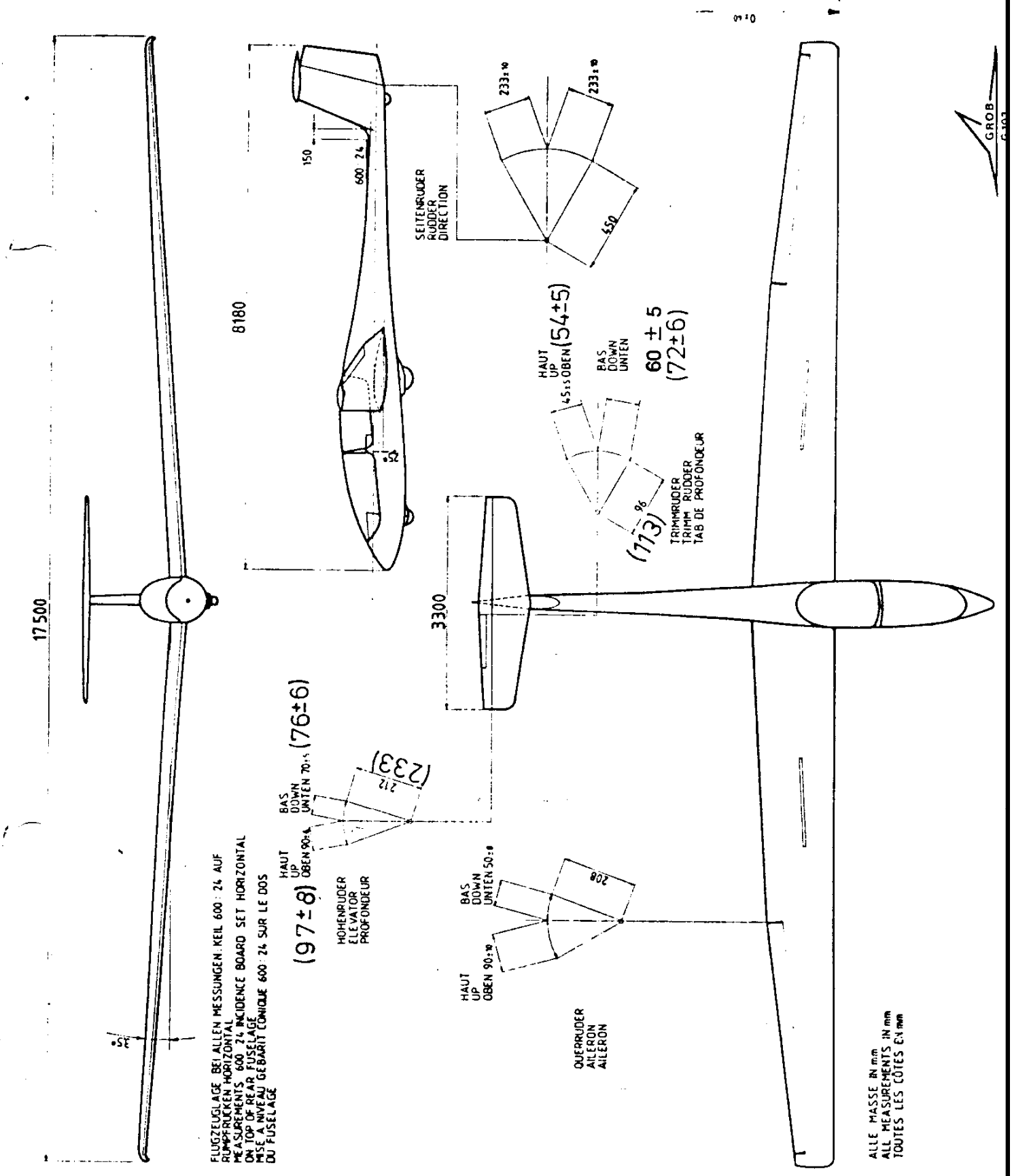
II. 4 Pressure tubing and connections to the instruments



1 Höhenmesser (altimeter)
2 Fahrtmesser (air speed indicator)
3 Variometer (variometer)
4 Kompensationsdüse (total energy tube)
5 Staurohr (pitot tube)
6 Statischer Druck (static pressure) farblos (colourless)
7 Staudruck (pitot pressure) grün (green)
8 Düse (Totalenergy) rot (red)
9 Ausgleichsflasche (flask) blau (blue)

Adjustment	Reference Line	Value	Tolerance
Wing — Incidence angle	Angle between the centre line of the wing and the longitudinal axis of the fuselage	2° 30′	± 15′
Wing — Sweep forward	Distance of line joining the wing tips from the reference line	0	± 40 mm (1.57 in)
Wing — Dihedral	Angle between the top surface of the wing and horizontal .	3.5°	± 30′
Tailplane — Incidence angle	Angle between the chord of the tailplane and the longitudinal axis of the fuselage	0	± 15′
Reference line	Front of the wing at the root rib	QE 2980	(117.32 in.)

Control defections	Upwards (right) Value	Upwards (right) Tolerance	Downwards (left) Value	Downwards (left) Tolerance	Measurement point from centre of rotation
Aileron Port	90	± 10	50	± 8	
Aileron Starboard	90	± 10	50	± 8	208 mm (8.19 in)
Elevator	97	± 8	76	± 6	245 mm (9,65 in)
Rudder	233	± 10	233	± 10	450 mm (17.72 in)
Release Hook	Backrelease load 0.5 to 1 kg (1.1 to 2.2 lbs) Maximum pull to release 7 kg (15.4 lbs)				
Trimm tab (elevator neutral)	70	± 7	70	± 7	90 mm (3,54 in)


17500
8180
3300
150
600 24
SEITENRUDER
RUDDER
DIRECTION
233:10
233:10
450
HAUT
UP
OBEN (54±5)
BAS
DOWN
UNTEN
60 ± 5
(72±6)
45:15
(113) %
TRIMMRUDER
TRIMM RUDDER
TAB DE PROFONDEUR
BAS
DOWN
UNTEN 70:15 (76±6)
HAUT
UP
OBEN 90:8
(97±8)
HOHENRUDER
ELEVATOR
PROFONDEUR
212
(233)
BAS
DOWN
UNTEN 50:8
HAUT
UP
OBEN 90:10
208
QUERRUDER
AILERON
AILERON
FLUGZEUGLAGE BEI ALLEN MESSUNGEN: KEIL 600 : 24 AUF RUMPFRÜCKEN HORIZONTAL
MEASUREMENTS 600 24 INCIDENCE BOARD SET HORIZONTAL ON TOP OF REAR FUSELAGE
MISE A NIVEAU GABARIT CONIQUE 600 : 24 SUR LE DOS DU FUSELAGE
ALLE MASSE IN mm
ALL MEASUREMENTS IN mm
TOUTES LES COTES EN mm
GROB G 103

19. 11. 1981

IV. Components with a limited life time

Tow hooks

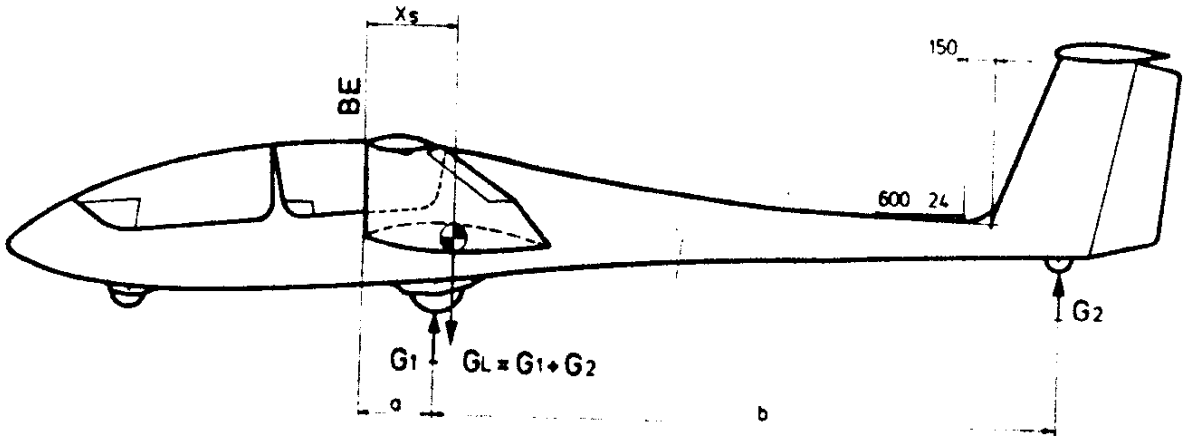
The standard Tost tow hooks have a life of 36 months, after which they must be checked (time counted from time of installation in the aircraft) or a maximum of 2000 launches.

Oxygen Equipment

Overhaul times for specific Oxygen equipment is given in their test certificates.

Oxygen bottles must also be checked by the technical service every 5 years or according to the local lanes on use of pressurized gases.

V. Measurement of Center of Gravity position



Datum Line: Front edge of the wing at the root

Level Means: With a 600:24 Incidence Board set up horizontal on the top of the rear fuselage.

Weight on main-wheel		G_1 =	kg/lbs
Weight on tail-skid		G_2 =	kg/lbs
Empty Weight	$G_L = G_1 + G_2$ =		kg/lbs
Distance to main-wheel		a =	mm/inches
Distance to tail-skid		b =	mm/inches

Empty weight C. of G.

$$X = \frac{G_2 \times b}{G_L} + a = \frac{\qquad}{\qquad} + =$$

mm/inches behind Datum Line

The measurements to determine the empty weight, the empty weight C. of G., and the loading limitations should always be taken with the glider empty.

	from	to	multiply with
Convertion:	kg	lbs	2,2
	mm	inches	0,0394

If the limits of the empty weight C. of G. positions and the loading limitations chart are adhered to the C. of G. of the loaded cylinder will be within permitted range.

Empty Weight		Range of C. of G. behind Datum			
		Forward		Aft	
kg	lbs	mm	inches	mm	inches
360	794	758	29.84	773	30.43
365	805	748	29.45	769	30.28
370	816	739	29.09	765	30.12
375	827	729	28.70	761	29.96
380	838	720	28.35	757	29.80
385	849	711	27.99	753	29.65
390	860	703	27.68	749	29.49
395	871	694	27.32	745	29.33
400	882	686	27.01	742	29.21

It should be noted that to make use of the maximum load the maximum admissable load for non-lifting parts must not be exceeded.

The weight of the non-lifting parts is the sum of the fuselage, tailplane and maximum load in the fuselage and must not exceed 400 kgs (882 lbs) or the maximum load permitted in the fuselage must be correspondingly decreased.

The Center of Gravity should be rechecked after repair, repainting, the installation of additional equipment or when a period of 4 years has elapsed after the last weighing.

The empty weight, empty weight C. of G. position and maximum load, should be recorded after each weighing on page 9 of the Flight Handbook.

VI. Weights and moments of the control surfaces

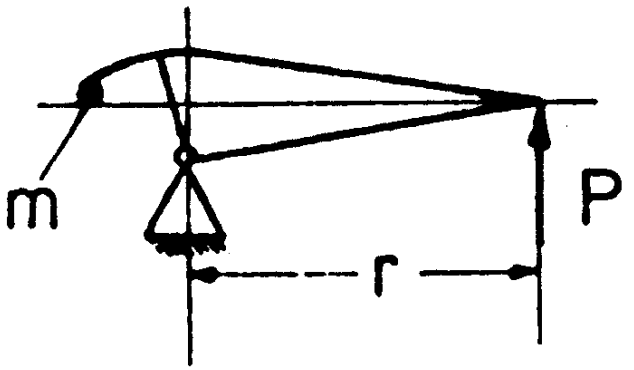
Control surface moments

The moments of the control surfaces must not exceed the following values:

Elevator (+ trimm tab)	33,5 kg cm $^{+12\%}_{-20\%}$	4,5 kg ± 15%
Trimm tab	1,5 kg cm ± 15%	0,52 kg ± 15%
Rudder	20,0 kg cm ± 10%	5,0 kg ± 10%
Aileron	12,0 kg cm ± 12%	6,0 kg ± 10%

The moments must be measured with the control surfaces removed. To determine the moment M = P.r the surface should be mounted at the hinge line with the minimum friction possible. The force P can be measured, for example, using a letter scale. If these values are exceeded the mass balance should be increased. Before carrying out repairs which for example involve charging the mass balance on a surface the manufacturer or his repair agent must be consulted.

(1 kg = 2,20 lbs, 1 kgcm = 7,23 ft.lbs)



VII. Checks

Check Lists

Daily checks and checks before launch: See Flight Handbook IV-2.

Checks in specific cases.

After a heavy landing:

Check the undercarriage mechanism under the rear seat, check the undercarriage mountings in the wheel well check the spar and root rib for white patches in the glassfibre reinforced plastics (GFK).

Check the wing fittings in the fuselage and the pins in the root rib.

Check all mounts of control surfaces.

After a Ground loop:

Check the undercarriage mounting, check the rudder controls rods and bellcranks behind the wheel well.

Check the GFK tube at the base of the fin.

Check the wing fittings in the fuselage and the connecting pins in the root rib.

Check the tail plane suspensions.

VIII. **Regular service**

The following schedule of service should be carried out every 100 hours or at the annual inspection, which ever occurs first.

1. The entire glider should be checked for cracks, holes and bumps.
2. All fittings should be inspected for satisfactory condition (play scores and corrosion).
3. All metal parts should be examined for corrosion, cracks, deformation and if necessary reconditioned and freshly protected.
4. Check that there is no play in the wing and tailplane to fuselage fittings.
5. The control linkages (Bearings, stops, fittings, hinges and control cables) should be inspected and replaced if there is evidence of bending or corrosion.
6. The controls including the brakes should be submitted to a functional test and the control deflections checked.
7. If the controls do not move free throughout their range, search for the cause and correct.
8. The 3 wheels and brake should be checked to be in good condition.
9. The two hooks should be treated in accordance with their appropriate maintenance manual.
10. Check the pitot for the ASI is clear and that the tubing to all instruments is in good condition and free of leaks or kinks.
11. The condition and calibration of all instruments should be checked and any other equipment inspected.
12. Equipment and instruments should be checked against the equipment list.
13. The wing bending mode has to be established and checked with the figure stated at the approval report (Stückprüfbericht) The glider has to be supported at mainwheel and tail. The tire pressure must be 2,5-2,8 bar.
14. After repair or change of equipment, the weight table should be updated with the new empty weight and center of Gravity by weighing or calculation.

After extended storage check accordingly to regular service pos. 1 to 11 and inspect for evidence of rodents and birdness.

IX. Lubrication

Ball Bearings

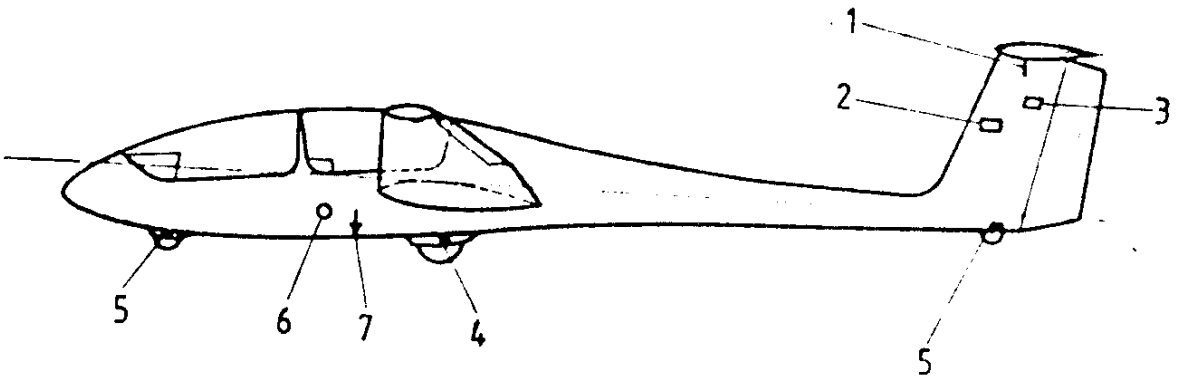
All bearings installed are sealed with a permanent grease filling. Greasing of bearings is therefore unnecessary.

Sliding Bearings

All slide bearings installed on the fixed control linkages do not require servicing or greasing. However, the push rod bearings in the root rib and on the tailplane mounting should be cleaned with petrol and regreased when dirty. The pins and bushes on the wing fittings should be regreased when necessary during rigging.

The pins on the tailplane fittings and the screw thread should be lubricated periodically. The hinge and catch of the cover should be occasionally oiled. Dirty release hooks are best cleaned using a brush and compressed air whilst operating the mechanism. The belly hook is accessible from inside and can be lubricated with Sprayoil or similar.

X. Labels and Markings



1. Marking controlling the correct rigging of the tailplane.
2. Label for the total energy tube.
3. Label for tailplane security
4. Label for tyre pressure (2,5 - 2,8 bar)
5. Label for tyre pressure (2,5 bar)
6. Red ring round the static pressure port
7. Marking to find the belly hook

ASI Markings

Speed mph	Speed knots	km/h	Mark	Significance
48–105	42–92	77–170	Green Arc	Normal range of flying speed
105–155	92–135	170–250	Yellow Arc	Range of flying speeds to be used with care
at 155	135	250	Radial Red Line	Maximum Speed
at 59	51	95	Yellow Triangle	Minimum recommended landing speed at full load

Required placards

Maximum flying weight	**580kg 1280lbs**			
Airspeed limits		**km/hr**	**knots**	**mph**
Never exceed	**V_{NE}**	**250**	**135**	**155**
In Rough Air	**V_B**	**170**	**92**	**105**
On Airotow	**V_T**	**170**	**92**	**105**
On Winch or Auto Launch	**V_W**	**120**	**64**	**74**
Airbrakes Open	**V_{DF}**	**250**	**135**	**155**
Manoeuvring	**V_A**	**170**	**92**	**105**

Front cockpit
Back cockpit

Payload (Pilot and Parachute)

Minimum in Front cockpit for all flight	**70kg**	**154 lb**
Less must be compensated with ballast secured in the seat		
Maximum load front	**110kg**	**242 lb**

The maximum weight must not be exceeded

Front cockpit
Back cockpit

Check before launch

Full and free movement of controls?
Parachute secured?
Straps tight and locked?
Pedals adjusted and locked?
Brakes closed and locked?
Trim correctly adjusted?
Altimeter adjusted?
Canopy locked?
Cable on correct hook?
Beware: – Crosswind! – Cable break!

Front cockpit

Canopy Jettison and Emergency Exit

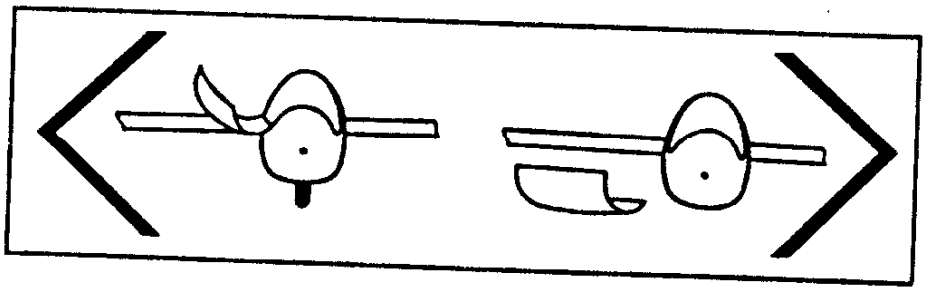
- **Pull red handles on right and left of canopy fully back together**
- **Push canopy up and away with the left hand**
- **Release safety harness**
- **Stand up and get out over left or right side depending on the altitude**
- **When using a manual parachute grip release and pull firmly to full extent after 1–3 seconds**

By Canopy release front and back

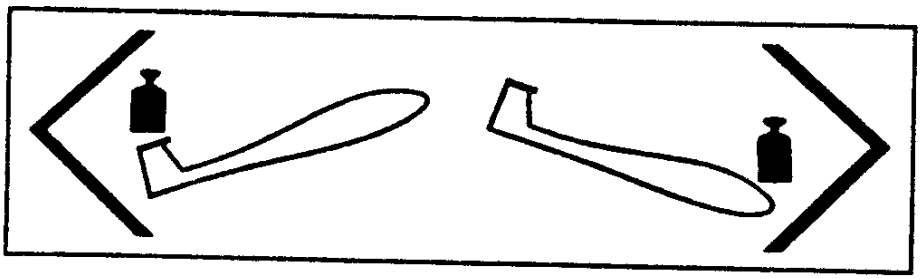
Tire Pressure
36 PSI 2,5 atm

mainwheel
nosewheel
tailwheel

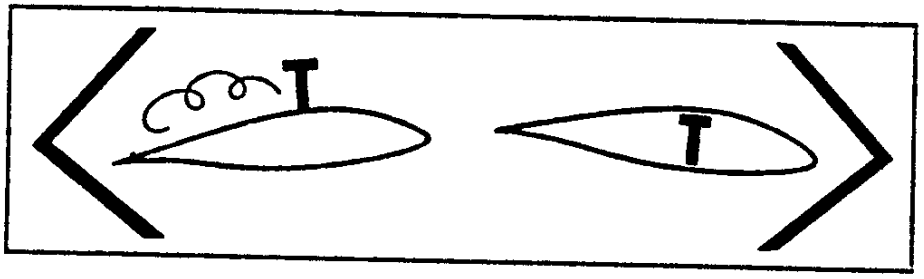
XX. Symbols



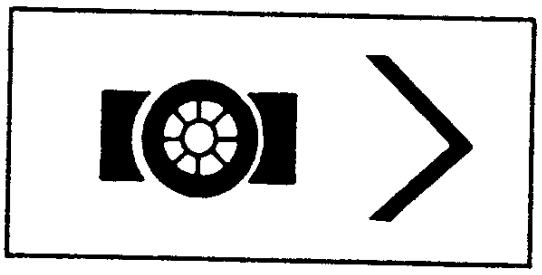
Canopy open
Canopy jetison



Trim

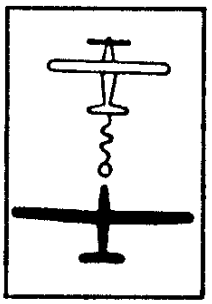


Airbrakes



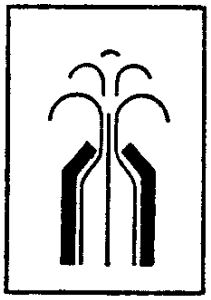
Wheelbrake

Symbols



Elevator quick lock connected
Markings notice
Rotating knob turned in
Tailplane secured (cover closed)

Rudder fin

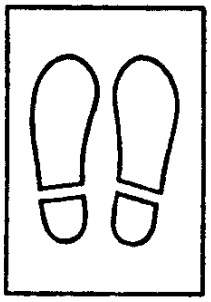


Air-vent
Top left of front instrument panel

Baggage maximum

22 lbs 10 kg

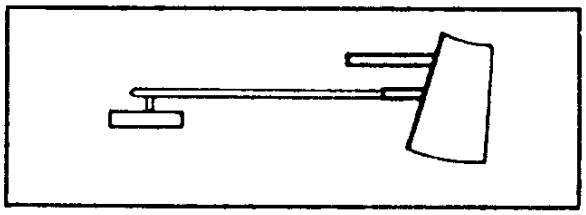
Baggage compartment



Pedal adjustment
Top right of front instrument panel

Dont push or lift here

Rudder



Total energy
compensation tube

XI. General care

Dampness

As far as possible the glider should be protected from damp. All the metal parts of the glider, with the exception of the wing and tailplane fittings are protected against damp. However, this will not prevent corrosion during extended exposure to moisture. Following any flights in rain any water which has entered the glider should be dried up and the exterior surfaces dried with a chamois leather. Polished metal parts should be regreased. Beware of condensation.

Sunlight

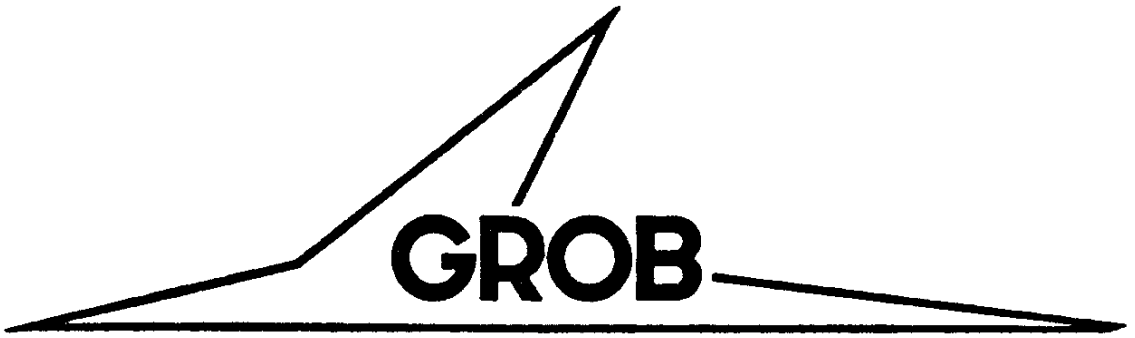
All structural parts of GFK glider should have white surfaces to avoid them heating up in sunlight.

Protection of the Finish

The Gelcoat surface layer is very resistant and can therefore be cleaned using a mild detergent. Ingrained dirt such as grease and dead flies, are best removed with a SILICONE-FREE polish (1 Z Spezial-Reiniger or "Reinigungspolish", Fa. Lesonal, Stuttgart). Sticky tape used for sealing the wing and tailplane joints may be removed using thinners of Petrol (Beware thinners may remove the markings).

Cleaning the Canopy

The canopy should only be cleaned using a soft clean cloth or sponge and a mild soap solution. It should be rinsed with clean water and dried with a chamois leather. "Plexipol" is a suitable polish. Never rub perspex with anything dry.



REPAIR INSTRUCTIONS
GROB G 103

»TWIN II«

Manufactured by:
Burkhart Grob Flugzeugbau
8939 Mattsies
Flugplatz Mindelheim-Mattsies
West Germany
Telefon 0 82 68 / 4 11
Telex 539 623

INDEX

1. Forword

The Glider "TWIN II" is constructed from Glass-Fibre reinforced Plastic (GFK). The fuselage consist of GFK laminate. The load bearing surfaces (wings) and the Tailplane consist of GFK laminate with a foam supporting layer (GFK foam-sandwich). The Tail-fin and control surfaces consists of GFK styropor sandwich.

December 1980

2. Authorized materials and suppliers

Resin: Shell Glycidäther 162 (Epikote 162)
Hardener: BASF Laromin C 260
Mixing: 100 parts Resin - 38 parts Hardener
Ratio by weight

Glass Fibre Cloth
Supplier: Interglas Textil GmbH. Söflinger Str. 246, 7900 Ulm

Use	Cloth	Weight g/qm	Interglas-Nr.
Fuselage	Double Twill	161	92 110
	Double Twill	390	92 140
	Chain Reinforced	433	92 146
Wings	Double Twill	161	92 110
	Double Twill	276	92 125
	Chain Reinforced	433	92 146
Elevator, Rudder and Ailerons	Double Twill	276	92 125
	Double Twill	161	92 110

All Glass-Fibre cloth is Alcholine free. E Glass with Votan-A-Finish or Finish I.550.

Rovings:
EC 10-80-2400 K 43

Supplier:

Gevetex
4000 Düsseldorf
Postfach 1205

Foam Material
PVC-Hartschaum
Conticell 60
8 and 8 mm large
Spec. Weight 60 kg/m³

Continental AG
3000 Hannover

Styropor:

Thermopete 4 mm large Spec. Weight 15 kg/m³	Poron-Werke GmbH 6122 Erbach Brunnenstraße 5
Depron 3 mm large Spec. Weight 15 kg/m³	Firma Kalle 6202 Wiesbaden/Bibrich

Filling Material for Resin

Microballoons Brown	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25
Cotton Flock Type FL 1 f	Schwarzwälder Textil-Werke 7623 Schenkenzell Postfach 12

Paint

PE-Schwabbellack White. No. 03-69120 UP-Hardener No. 07-20510 100 Schwabbellack Paint (Gel-Coat) 3 Hardener mix ratio by Weight. Thinners No. 06-30260	Lesonal-Werke 7000 Stuttgart 30 Postfach 30 07 09

Red Paint

Nitro-Cellulose-Kombilack Blood-Orange RAL 2002	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25

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3. Simplified "Texture" plan

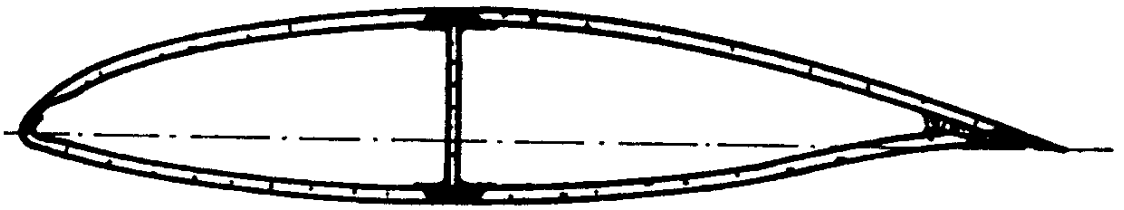
Reinforced regions for special loads and stress conducting are not shown.

1. Flügel

Außenlaminat
1 Lage 92 110 längs
1 Lage 92 125 längs
Kern
Conticell 60 8 mm
Innenlaminat
1 Lage 92 125 diagonal

Wing

Outer laminate
1 Layer 92 110 lengths
1 Layer 92 125 lengths
Core
Conticell 60 8 mm
Inner laminate
1 Layer 92 125 diagonal



2. Rumpf

Von außen nach innen
1 Lage 92 110 längs
1 Lage 92 146 längs
3 Lagen 92 140 diagonal

Fuselage

From outside to inside
1 Layer 92 110 lengths
1 Layer 92 146 lengths
3 Layers 92 140 diagonal

3. Ruder / **Controls**

Höhenruder oben	Elevator above
Querruder oben	Aileron above
Seitenruder rechts und links	Rudder left and right
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal
1 Lage 92 125 diagonal	1 Layer 92 125 diagonal
Kern Depron 3 mm	Core Depron 3 mm
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal

Höhenruder unten	Elevator below
Querruder unten	Aileron below
2 Lagen 92 125 diagonal	2 Layers 92 125 diagonal

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4. Höhenflosse / **Fin**

2 Lagen 92 110 diagonal	2 Layers 92 110 diagonal
Kern: Conticell 60 6 mm	Core: Conticell 60 6 mm
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal

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4. Repair of GFK material

If the glider is damaged, first examine the outer surface very carefully, frequently other structural parts are involved, fractures can run unseen under the outer surface.

Carry-out repairs with extreme care. As the outer surface of GFK gliders is stressed (loading bearing), failure of this skin can lead to structural failure.

Keep to the Resin-Hardening mixing ratio exactly = 0.5% using a clean mixing pot. The ratio of Glass fibre – to Resin mix is approximately 1 to 1. Grind or splice the repair, before laying damp laminate on it, so that dirt cannot penetrate and stop safe adhesion.

As in plywood, the direction of the fibre glass cloth lay (length or diagonal) is of extreme importance to its strength. It is necessary to know approximately how many fibre and their direction in the damaged part with reference to the simplified texture plan, so it may be restored to the correct wall strength. If a small piece of the damaged laminate is broken off and burnt, the remaining glass-fibres can be counted and identified.

Splicing and grinding are time consuming, to save trouble, grind only as much away as necessary, only to the size of the cloth patch. When it is necessary to shorten the repair time it may be done with a hot air blower to speed the resin hardening time.

Warning. A too high temperature will produce large air bubbles in the cloth. A tent can be built out of foil, through which hot air can be guided, and thereby avoiding local overheating. In making repairs to control surfaces, be careful not to increase their weight as there is danger of reating flutter conditions.

5. Damage to section GFK Foam-Sandwich

(GFK Hard-Foam-Sandwich)

It can appear that only the outer surface (the outside laminate) is damaged but it can also happen that the whole skin (outside and inside hard foam laminate) is destroyed.

a) Important

With a split or fracture, the laminate can become detached from the supporting foam. Start by removing loose laminate until firm laminate is reached. To remove the foam laminate use a grinding disk, grinding block or sharp knife. With a grinding block or sharp knife only remove the cloth around the damage. Splice ratio per cloth covering approximately 20 mm ratio laminate thicknes to splice: approximately 1:50.

After grinding out the splice, the repair must be throughly cleaned. Remove the dirt (also out of the foam pores) with compressed air. Wash the splice with carbon tetrachloride or Acetone, in case it has been contaminated with dirt or grease.

Fill up the pores of the foam with Resin and Microballoons until it is smooth. Then join the laminates with the correct cloth, laying it in the right direction.

Repairs must be dirt and grease free. (Figure 1)

At room temperature the resin will harden in about 8 hours.

The repair can now be ground smooth and be painted.

Warning: Grind only to the edge of the repair.

b) Damage to the whole of the Sandwich

When the inner laminate is destroyed, so there is no binding with the foam, widen the hole so far as foam material is secure, then it is possible to repair the inner laminate. A edge of at least 20 mm must be obtained (retaining laminates thickness : splice ratio approximately 1:50).

The inner laminate must be carefully ground and cleaned.

The outer laminate is repaired as described in section a). (Figure 2)

With „minor" damage a piece of thin plywood support can be glued with Pattex from within on the inner skin, the cloth patch of the inner laminate can then be layed in and the hole filled with resin and Microballoons mixed with Styroporballs. When hardened (ca. 8 hours room temperature) the outer surface can be ground smooth and the outer cloth put on.

The plywood support should remain as part of the repair. When the hole is of large or of long size the plywood support should be held in place with thin nails which can be removed later, by pushing them out from the top surface.

Warning: The plywood support must be well jointed to avoid wrinkles in the cloth. (Figure 3)

With large holes in the sandwich, the weight of the Microballoons filler must be considered. A piece of Conticell hard foam is made before-hand, which exactly fits into the existing hole. The inside pores are closed with resin and Microballoons and laid on the inner cloth to harden, until the foam is just bendable (evtl. hot air). Then the foam with

enthickened resin (cotton flock-Microballoons) can be glued in the hole. Microballoons are used to close the outside pores, the repair is then ground and the outside cloth is then laid on.

6. Damage to section of GFK Styropor-Sandwich

Repair of Styropor damage of section.

The Styropor has a closed upper surface, the cloth is held with pure or lightly thickened resin. Splits in the upper surface pores can be filled. With large damage put a patch inside and allow to harden first before working further. This will stop the structure wrinkling.

Warning: Do not use strong heat to speed up hardening time, or Styropor will develop blisters and the repair must be done again.

7. Damage to section of GFK Laminate

Repairs to GFK laminate are simple. Splice the laminate around the hole, lay the cloth in layers on (largest patch first) and after 2–3 hours, when the resin has partially hardened smooth over with resin and Microballoons. Splice length pro cloth layer ca. 20 mm. Retaining laminate thickness : Splice ratio 1:50. In case the splice is dirty it can be cleaned with Carbon Tetrochloride or Acetone.

With large damage a under laying support (plywood) should be used Wet laminate should not bridge a gap of more than 20 mm unsupported. The plywood support can be held in place with Pattex glue and nails (e. g. metal fitting in fuselage) which can be removed afterwards. (Figure 4).

8. Paint-work

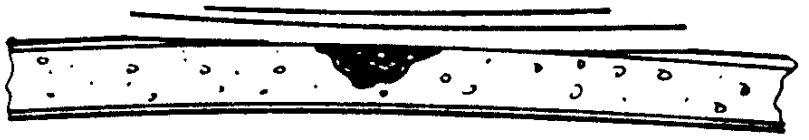
As soon as the laminate of the repaired section is hard, it can be rough ground with (80 grit) sandpaper. Large uneveness must be filled and smoothed with white polyester filler. Then with fine dry-grinding paper (150 grit) until a moderately smooth outer surface is produced. Before painting, the repaired section must be perfectly cleaned from grinding dust, separated mediums and other forgeign bodies.

For successful painting, with Gel-Coat (Schwabbellack + hardener) a not too large brush should be used, putting on several thin coats, until the laminate can no longer be seen.

The first coat should be allowed to harden and then ground with

1 Lage 92 110
1 Layer 92 110

1 Lage 92 125
1 Layer 92 125



Kern
Core
Conticell 60

Microballoons

Abb. 1
Fig. 1

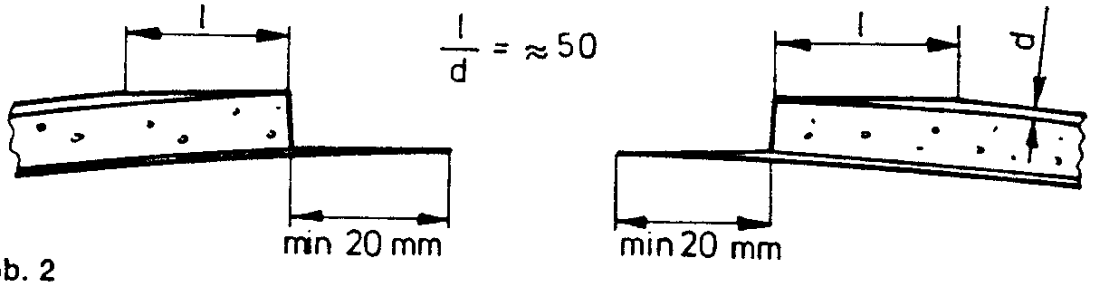
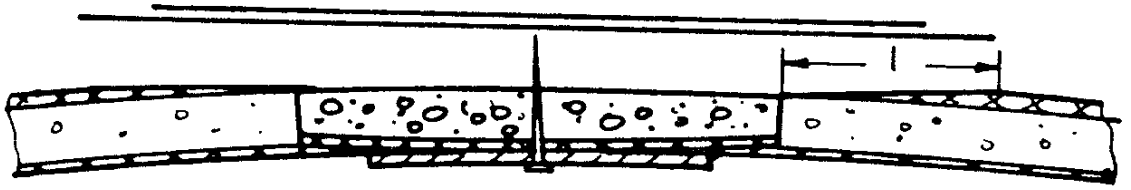


Abb. 2
Fig. 2

Außengewebe
outer cloth



Dünnes Sperrholz
Thin plywood

Microballoons
+ Styroporkugeln
Styropor balls

Abb. 3
Fig. 3

Rumpfschale
Fuselage skin

1 Lage 92 146
1 Layer 92 146

1 Lage 92 110
1 Layer 92 110

3 Lagen 92 140
3 Layers 92 140

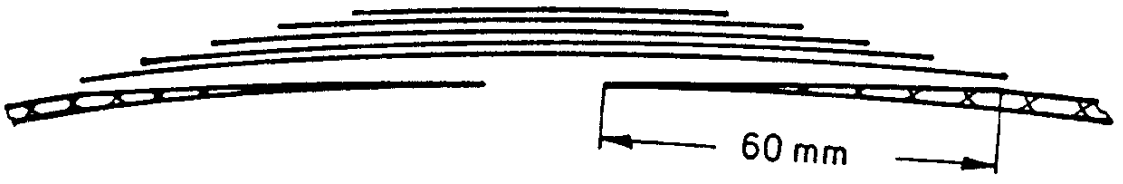


Abb. 4
Fig. 4

(360 grit wet paper) additional coats should then be added and likewise ground.

The final finish should be carried out with 600 grit or 800 grit Wet and Dry grinding paper and then polished with a silicon-free car polish or with hard-wax, using a polishing machine.

9. Repair of Metal Fittings

a) Damage to Steel Fittings

Repair of damage to fittings made of steel should only be accomplished after approved procedures are obtained from the manufacturer.

Welded steel fitting (push rods) out of 1.7734.4 or 1.0308.1 (St. 35.4). Welding only to be carried out with WIG Welding method (Wolfram-Inert-Gasschmelzschweißung) and with welding material 1.7734.2 (for 1.7734.4) and 1.7324.0 (for 1.0308.0 or combination of 1.7734.4 and 1.0308.1)

b) Damage to Aluminium Castings

Repair of Aluminium castings 3.2374.6 (GALSi7 Mgwa) cannot be carried out. Fractured or bent Aluminium castings must be replaced by new ones.

Warning: Bent or chipped Aluminium castings **are not** under any **circumstances** to be straightened.

c) Main Wing and Fuselage fittings

The main fitting between wing and fuselage (4x in the fuselage) 7 steel balls (ø 6 mm) have contained in each fitting. The balls are forced by a sliding cover through the lock shell into a groove in the moveable lateral axis force bolts in the spar caps thus securing the wings.

Faults of one or more balls, the connecting fitting should be changed.

10. Major repairs

Major repairs are only to be carried out by the manufacturer or by an agent (who has the authorization of the manufacturer.).
Major repairs are:

— **Broken** off wing, fuselage, tailplane, control surface, spar stumps (spar caps)

— **Ripped or torn-out** - Main fittings (in fuselage ø 55 x 3, Fitting of the tailplane in fin. In the wing, aileron securing both ø 24 mm, joining bearing GE 25. Spar cap bolts ø 25 mm).

— Destruction of main rib (vertical frame)

— Damage to the GFK laminate (tear, splits, cracks immediately near the main fittings).

11. Construction details of extra equipment attachment fittings

The fittings for the oxygen bottles are built in as standard on the right side of the luggage compartment. Bearing stands and quick action lock can be obtained from the manufacturer.

Other fitting points can be installed by the owner. (Figure 5)

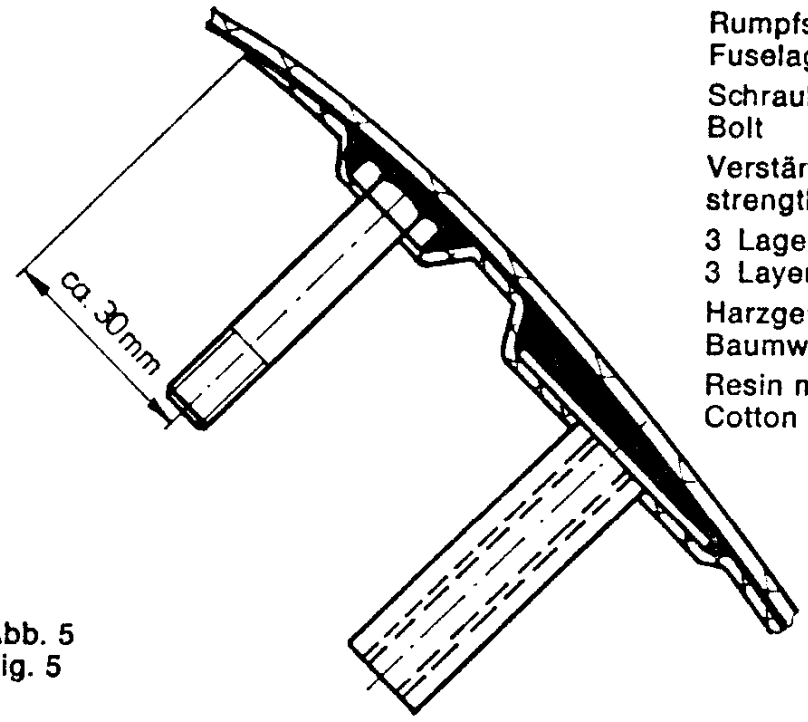


Abb. 5
Fig. 5

The fitting must be made as shown in the drawing so as to take the weight of the additional equipment. Fittings made in this manner must stand a load 10 g without failure.

When additional equipment is fitted the glider must be re-weighed to see whether the C of G is within the permitted limits.

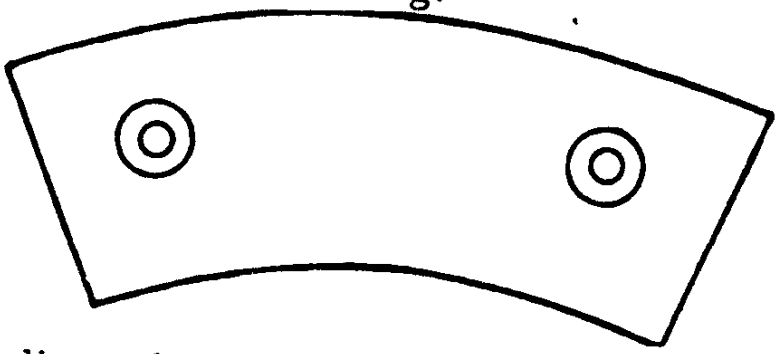
Blueprints for the installation of radio and oxygen equipment are obtainable from the manufacture.

11. Maintenance of Breaksystem

When dismantling the Mainwheel for cleaning or greasing purposes, or changing the tire, unscrew Poly-stop nuts M8 and remove wheelaxle to the left. Then remove distance pipe (p 42x2) to the right. (distance bush = Distanzbüchse). Remove wheel downwards, clean all parts and grease befor assemble again.

Chainging of breakshoes

a) Remove the wheelcover.
b) Loosen 1/4 inch screws (spanner size 11 mm) to take out break. Do not remove breakpipe or you have to bleed again.
c) Take off the two parts, on witch the breaklining are riveted on.
d) Mount new breaklining with rivets, assemble in reverse order.
e) Shape of breaklining.



66-30
M1:1

Bleeding of breaksystem

a) Mount transparent plasticpipe on bleedingscrew put other end of pipe in a container with breakfluid.
b) Loosen bleading screw, when break via leaver and breakzylinder pushes breakfluid trough the brake.
c) Bleeding is complete when no more airbubbles can be seen in transparent plastic pipe.

Remarks:

The breakfluid DOT 3 (ambercoloured) is available in every shop for car parts. Standardized within Europe.
The mainbreakzylinder with reservoir, is under the baggagcompertment.