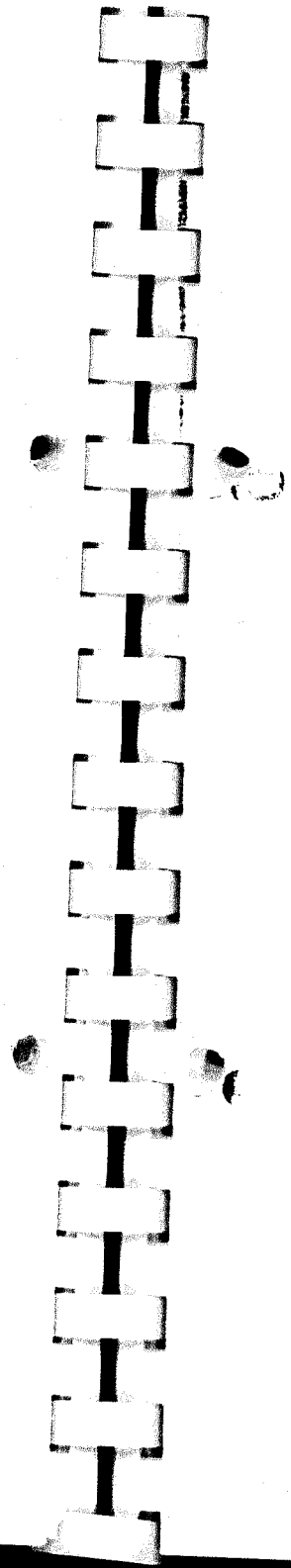

GROB

GROB-WERKE GMBH & CO. KG
Unternehmensbereich
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Am Flugplatz
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MAINTENANCE MANUAL

GROB G 103

»TWIN II«

This Maintenance Manual is for U.S. registered gliders.

Registration: ..... Factory Serial No.: ....

Owner: _____

_____

_____

Published September 1981

Approval of translation has been done by best knowledg and judgement - in any case the original text in Germa language is authoritative.

Log of revisions

Revision No.	Pages affected	Description	LBA approval signature	Date
1	1, 1a, 4, 12, 13, 21	Modified elevator (TM 315-16)		April 1982
2	1, 1a, 4, 5, 6, 7, 8, 12, 13, 14, 15, 21, 22	Modification from serial no. 3730 (ÄM 315-12)		June 1982
3	1, 1a, 11, 12, 13	Modification from serial no. 3839 (ÄM 315-13)		Febr. 1 1984

All handbooks for GROB G 103 can be ordered at:

- Burkhart Grob Inc.
  1070 Navajo Drive
  Bluffton, OH 45817 / USA (419) 358-9015
- Grob-Werke GmbH & Co. KG
  Unternehmensbereich Burkhart Grob Flugzeugbau
  Flugplatz Mindelheim-Mattsies
  8939 Mattsies, West Germany
  (08268) 411

Febr. 1, 1984

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4	June 82	31	17th march 82
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Febr. 1, 1984

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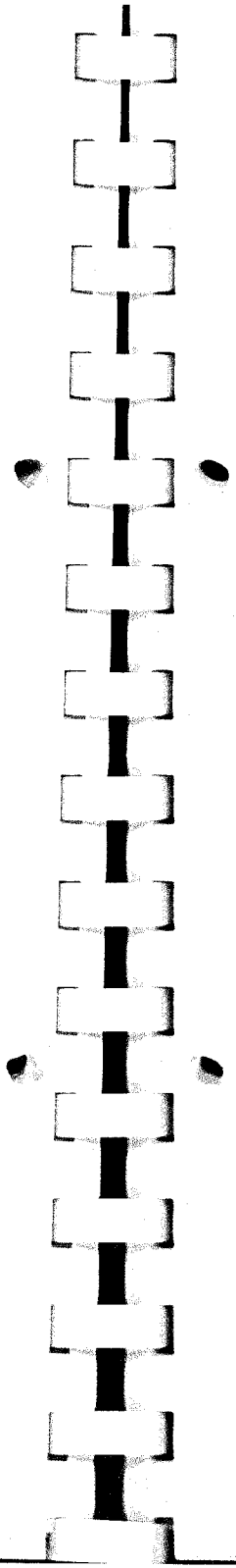


I. Technical Data

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	12,27 sq. ft.
% of Wing area		6,40 %	

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	= 1,37m²	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		3,70 %	
Area	F	= 0,505m²	5.44sq. ft.

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	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		200 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.

16th june 1982

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

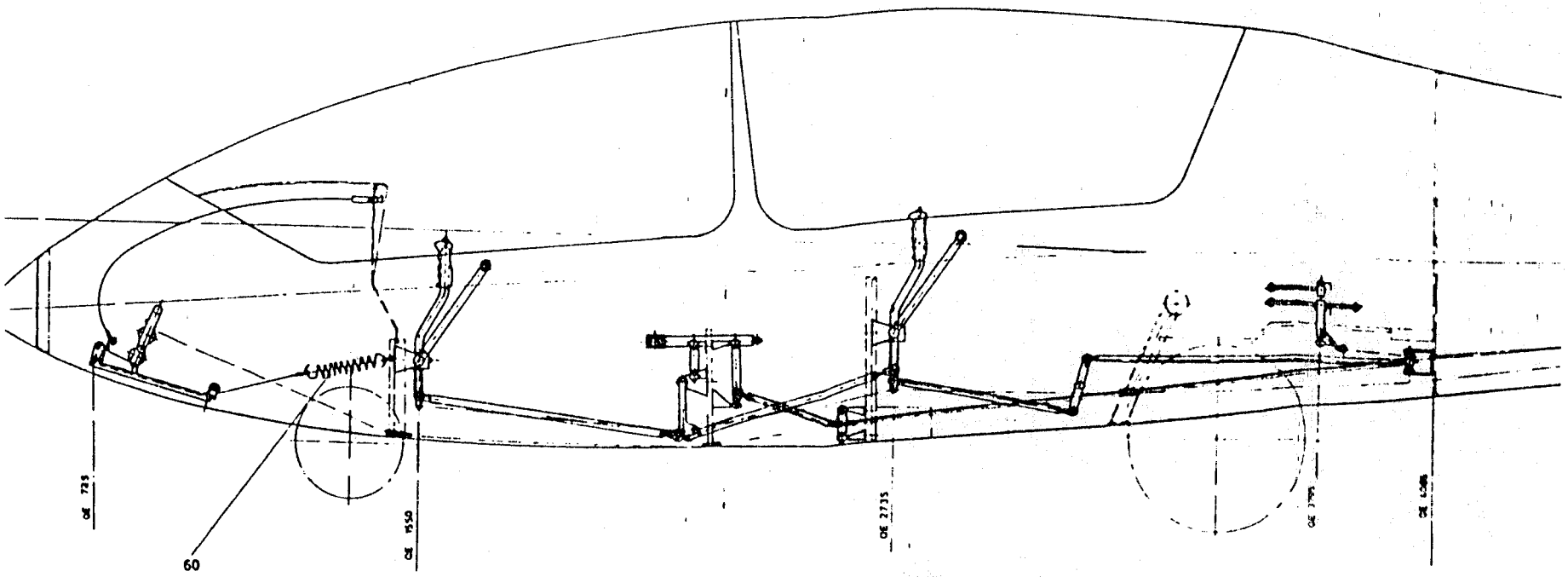
The lateral control force is transfered from the control stick via a short connection rod to the aileron control bellcrank on the side of the fuselage. The aileron control bellcranks for both control sticks are rigidly connected by means of 2 pushrod. Pushrods lead from the rear crank via an intermediate 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.

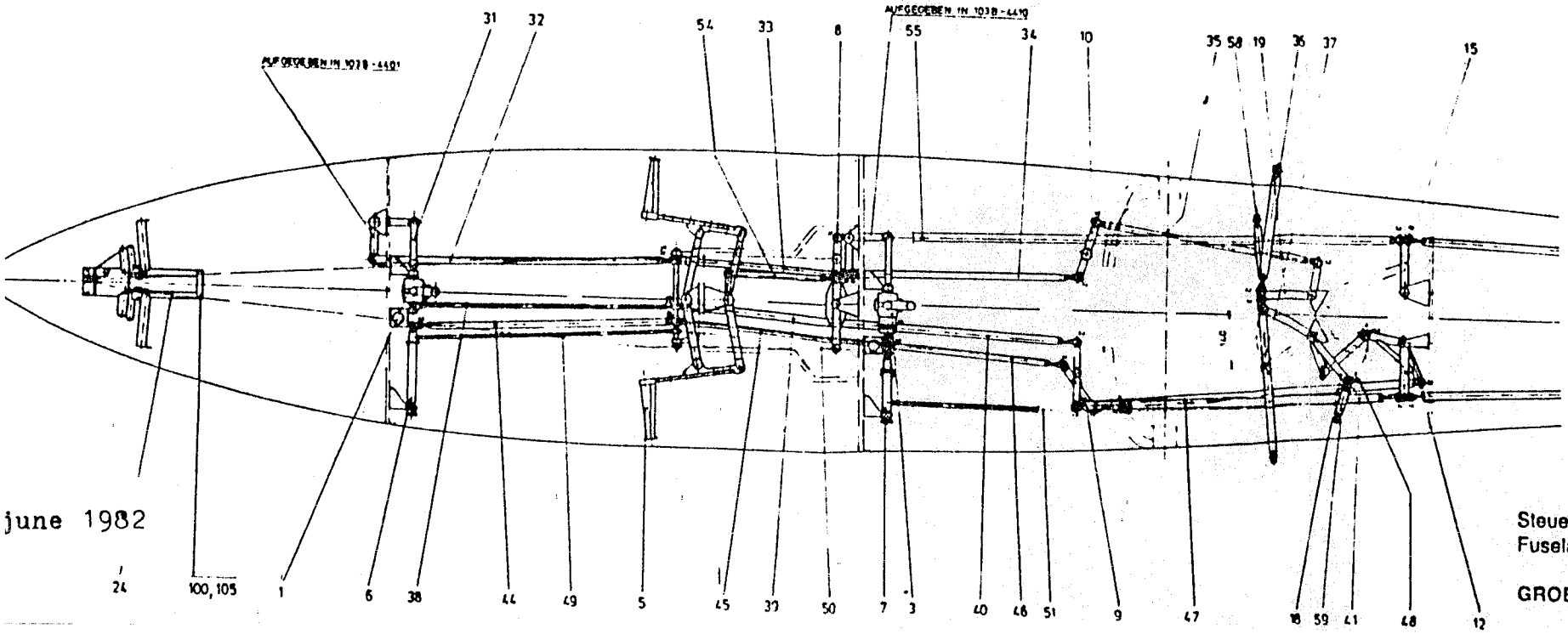
16th june 1982

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.

16th june 1982

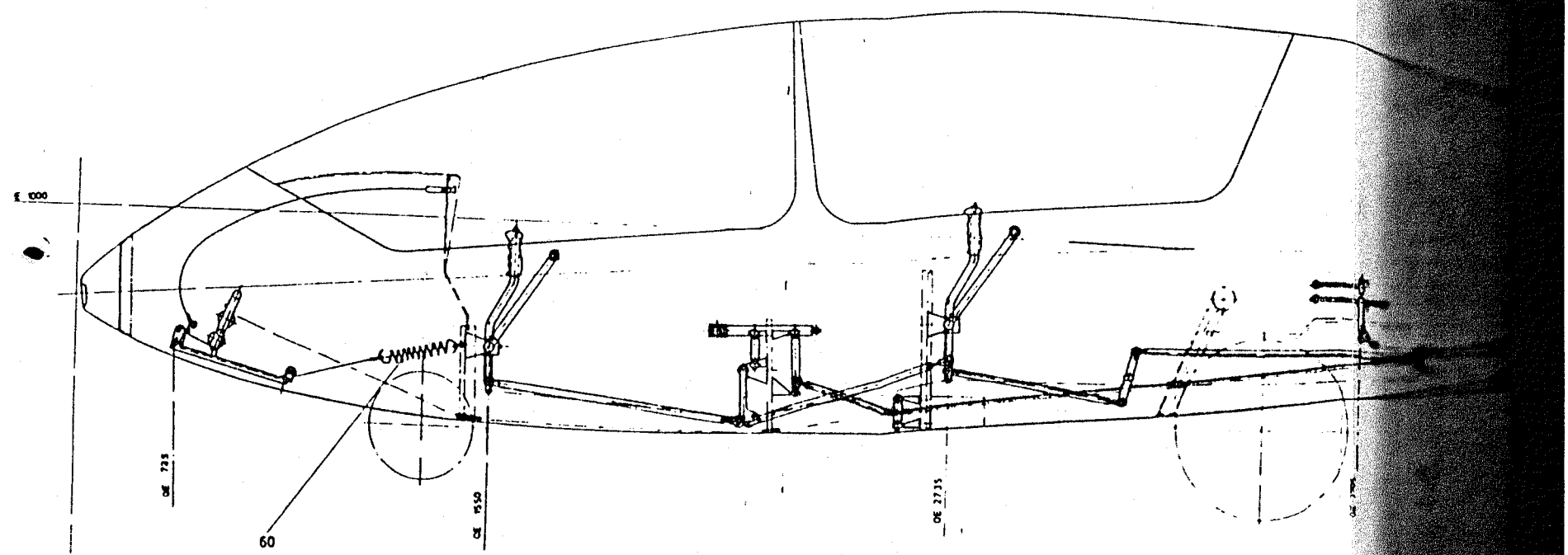


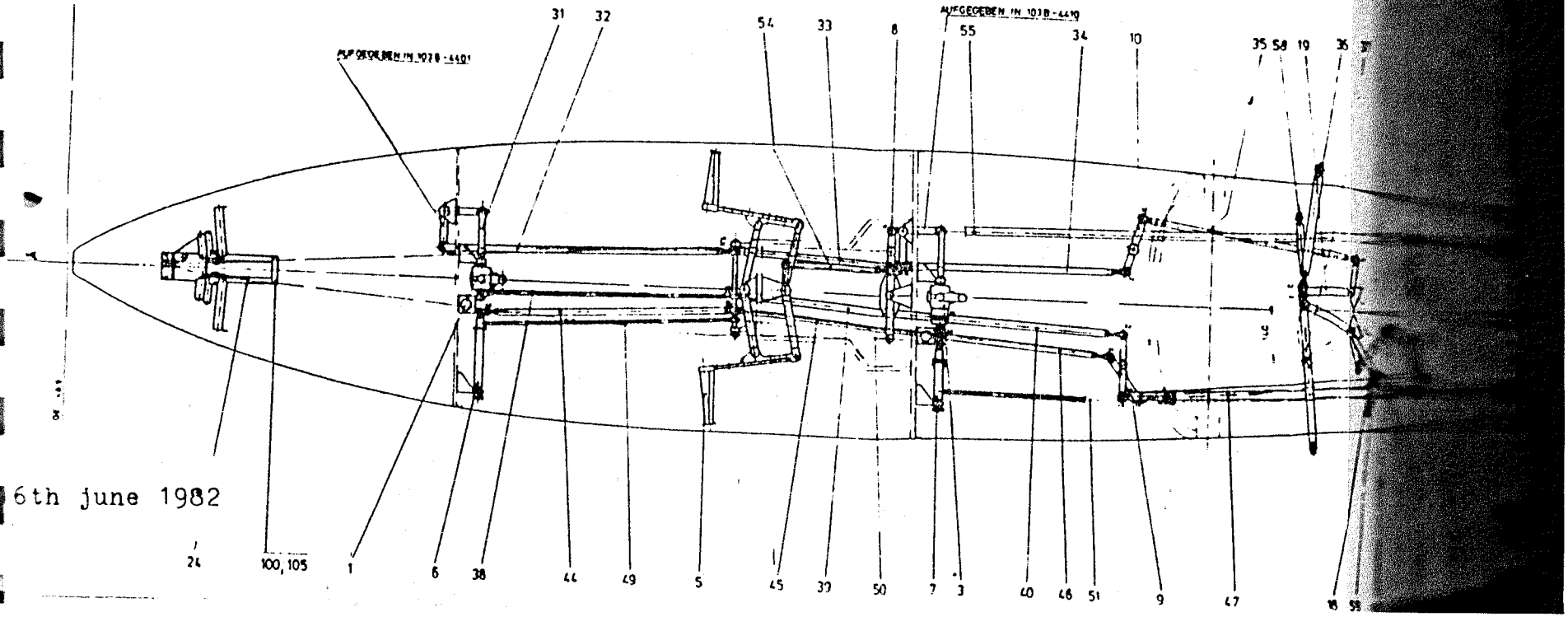


june 1982

Steuerung im Rum
Fuselage controls:

GROB G 103





6th june 1982

Steuerung im Rumpf
Fuselage controls:

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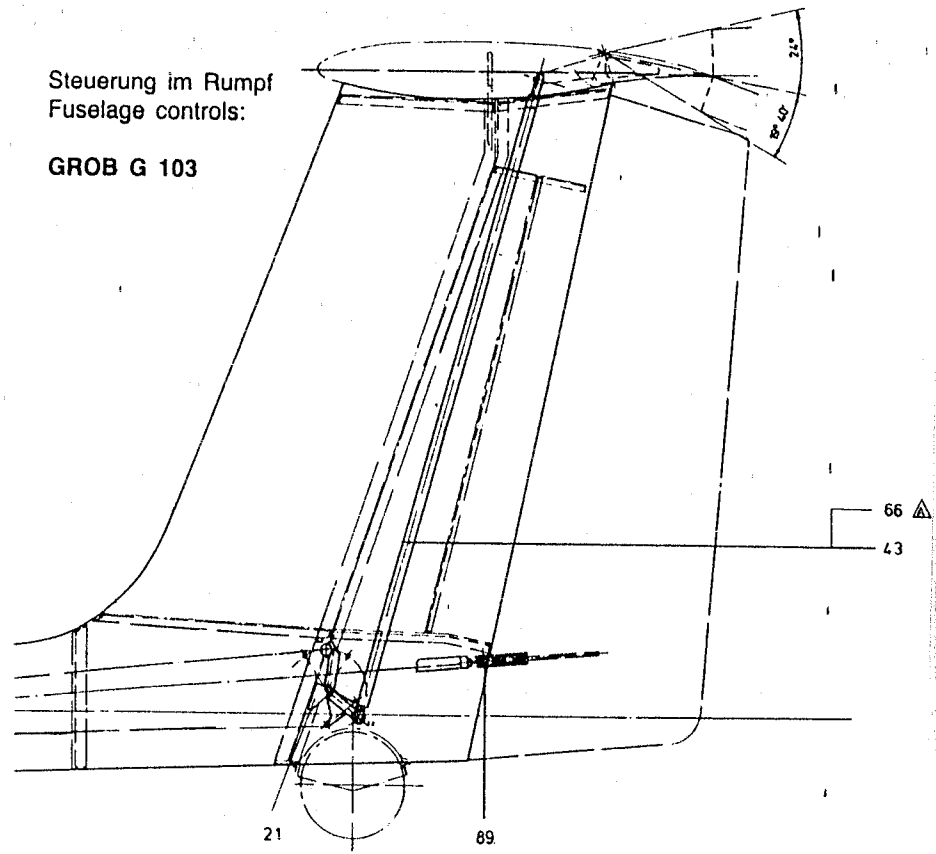
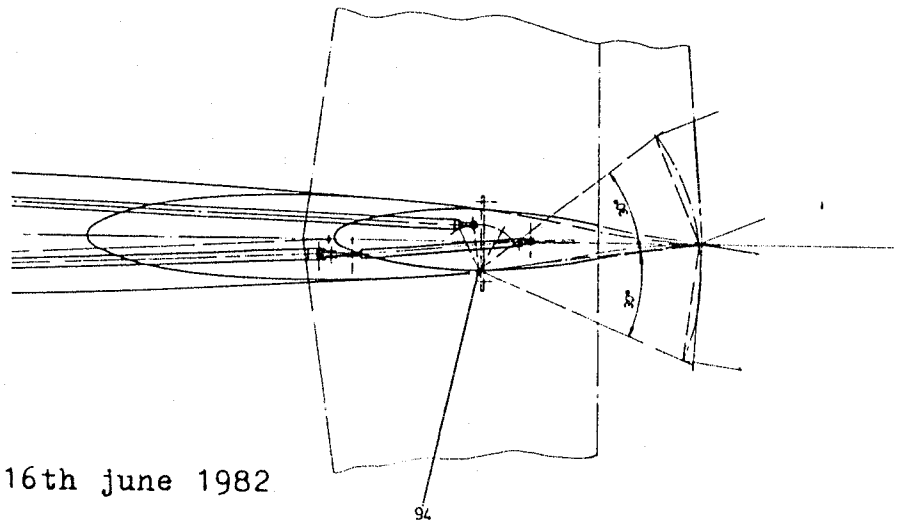




16th june 1982

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. Instruments specifications for basic equipment

Airspeed Indicator

The original certification was carried out using 2 Winter 6FMS4-2 Airspeed indicators.

A similiar FAA approved airspeed indicator to meet TSO C 2 reading to 300 km/h (162 kts, 187 mph) may be used. (For example PZL PR-400 S).

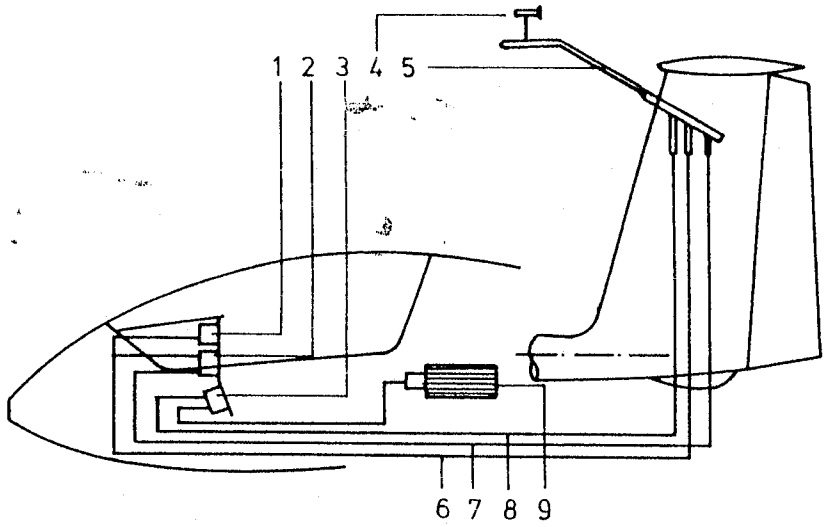
Altimeter

The original certification was carried out using a Winter 4FGH 10 and a Winter 4 HM 6.
A similiar FAA approved altimeter to meet TSO C 10 with a range to 35.000 feet may be used. (For example PZL W-12 S)

Magnetic Compass (compensated inside the glider)

The original certification was carried out using a Airpath C 2300.
A similar FAA approved magnetic compass to meet TSO C 7 may be used.
(For example PZL BS-1)

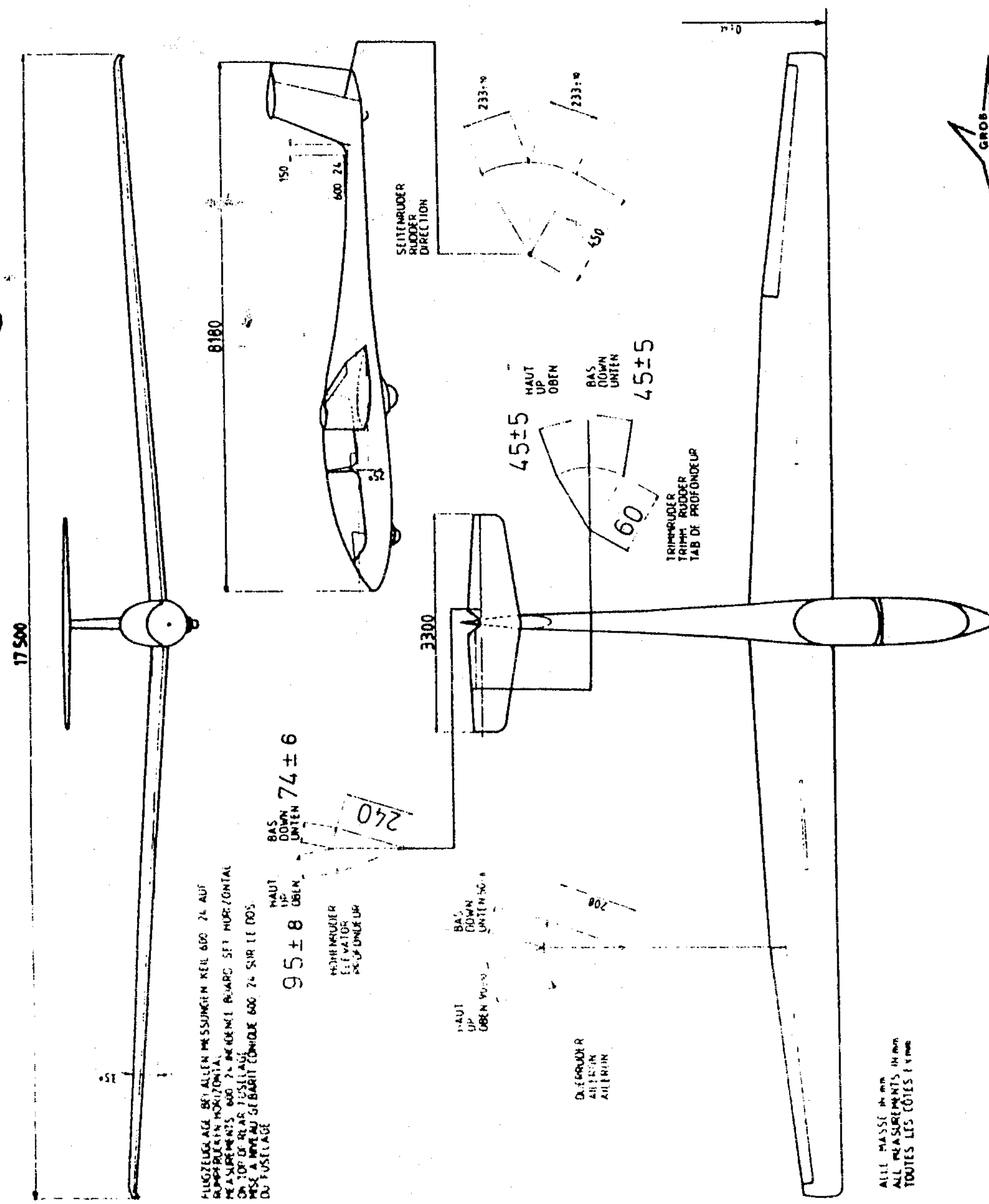
II. 5 Pressure tubing and connections to the instruments



1 Höhenmesser (altimeter)
2 Fahrtmesser (air speed indicator)
3 Variometer (variometer)
4 Kompensationsdüse (total energy tube)
5 Pitot-Static-Rohr (pitot static 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	95	± 8	74	± 6	240 mm (9,45 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)	45	± 5	45	± 5	60 mm (2,36 in)


17500
8180
3300
SEITENRUDER
RUDDER
DIRECTION
150
600 24
TRIMMRUDER
TRIMM RUDDER
TAB DE PROFONDEUR
HAUT
UP
OBEN
BAS
DOWN
UNTEN
45±5
45±5
60
74±6
240
95±8
HÖHENRUDER
ELEVATOR
PROFONDEUR
QUERRUDER
AILERON
AILERON
ALLE MASSE in mm
ALL MEASUREMENTS in mm
TOUTES LES COTES en mm

Febr. 1, 1984

IV. Rigging and derigging

IV. 1 Rigging

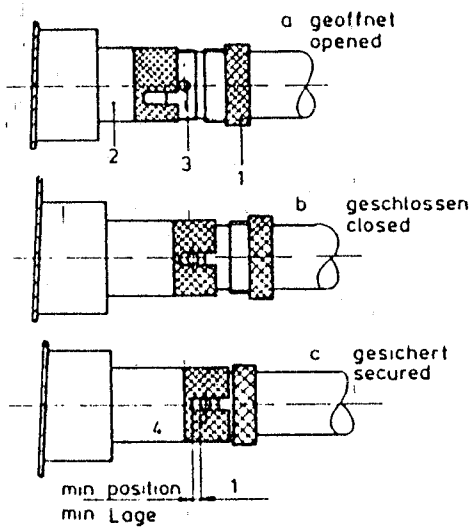
The fuselage must be held firmly in a horizontal position when rigging. It is recommended to use a fuselage stand or the trailer fittings are used.

The glider can be rigged by 4 people.

1. Wings

Unlock the 4 main wing fittings in the fuselage. Unlock the airbrakes on the wings. Guide the right wing into the fuselage. The safety catches on the fuselage fittings should now be released, and on gently moving the wing forward and aft it can be heard to snap into place. Next guide the left wing into the fuselage. Move the wing tips up or down so that the pin on the end of the spar stub is lined up with the appropriate hole in the opposite wing root and slide into place. Next release the safety catches on the left hand fuselage fitting and by gently moving the wing to and fro they too can be made to snap into place.

To secure the fuselage-wing linkage in the closed position the safety nut (1) must be turned into the threaded socket (2) so that the socket is pull inboards against the red ring which is held by the guide pin (3).



By moving the wings forward and aft strongly while turning the safety nut into the socket this linkage can be secured tight enough (4). The guide pin must not touch the end of the slot in the socket.

Check: The socket must cover the red ring.
The safety nuts must be turned hand-tight.

In the closed but unsured position (b) the wing bolt cannot be pulled out of the fitting.

The connecting rods can be connected by means of the quick lock fasteners through the inspection opening.
Having engaged the quick locks check that the safety pin cannot be moved without pressing it down. If it cannot be slid without pressing down when the controls are properly connected.

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3. Tailplane

Before assembly is commenced the front cover must be opened and the rotating wing bolt pulled out to the limit. It is important to ensure, that the larger opening of the conical crillings in the inner rings of the horizontal stabilizer spar bearing fall to the rear. The tailplane can be positioned by standing behind the rudder. The tailplane can be rested on top of the fin with the elevator angled upwards so that the quick lock (System Hotellier) on the trimm tab push rod can be attached to the ball on the trimm tab horn and the quick lock (System Grob) on the elevator push rod can be attached to the bearing on the elevator horn. The front of the tailplane can then be lowered and pushed back onto the three pins. It is then necessary to tighten the wing bolt clockwise to secure the tailplane. The assembly is complete when the wing bolt is sufficiently tight that there is no play in any direction. The cover provides a safety measure as it can only be attached with the wing bolt horizontal. If necessary the wing bolt has to be turned a 1/4 turn to suit. Derigging is carried out in the opposite order and the wing bolt is turned anticlockwise and pulled fully out.

To control the correct mounting of the horizontal stabilizer it is important to ensure that the peaks of the mark-arrows at fin and elevator tabs face each other.

Checks to be made after assembly

1. Check that the 4 main wing fittings are locked.
2. Check that aileron and brake quick-actions locks are properly located on the knobs.
3. Ensure that the tow hook is functioning correctly.
4. Test the operation of the wheelbrake and the tire pressure
5. Check that the tailplane is securely seated and that the elevator push-rod is connected, control the 4 markings.
6. Rudder movement.

IV 2. Derigging

Derigging is carried out in the opposite order and in this case it does not matter which wing is removed first. Excessive fore and aft rocking of the wing tips should be avoided.

IV. 3 Transport

We recommend the use of a closed trailer for transporting the glider. The parts must be carefully supported and secured so they cannot slide.

1. Fuselage

   A fuselage trolley moulded to the shape of the fuselage and positioned in front of the main wheel. The minimum length of the trolley should be 400 mm and it can be attached to the wing fittings if required. The tail skid should be secured so that it cannot slide sideways.

2. Wings

   The minimum length for the spar support should be 200 mm and should start at the face of the root rib. The mounting must be padded well with foam rubber or felt.

   The mounting under the aileron inboard end should be a shaped mounting block with a minimum length of 300 mm and height of 400 mm. The mounting must be padded with felt.

3. Tailplane

   Either horizontal on padded supports with the upper surface downwards and secured with straps or vertical supported on the leading edge in shaped mounting blocks.

   Profile drawings are available for the manufacture of fuselage, wing and tailplane fittings.

V. Maintenance

V. 1. **Maintenance of the glider**

The entire surface of the glider is coated with weather resistant white polyester gelcoat.

The greatest care should be taken in maintaining the fibre glass surface of the glider. Luke warm water should be used to wash off dust, grease, dead flies and other dirty marks. More resistant dirt should be removed by using a mild cleaning agent. Only special silicon-free preparations should be used in maintaining the painted surfaces. (1 Z-Spezialreiniger – D 2, Fa. W. Sauer and Co., 5060 Bensberg or Reinigungspolish Fa. Lesonal).

Although very resistant the glider should be protected as much as possible against rain and dampness. Water that has seeped in should be dealt with by storing the glider in a dry place, frequently turning over the dismantled parts.

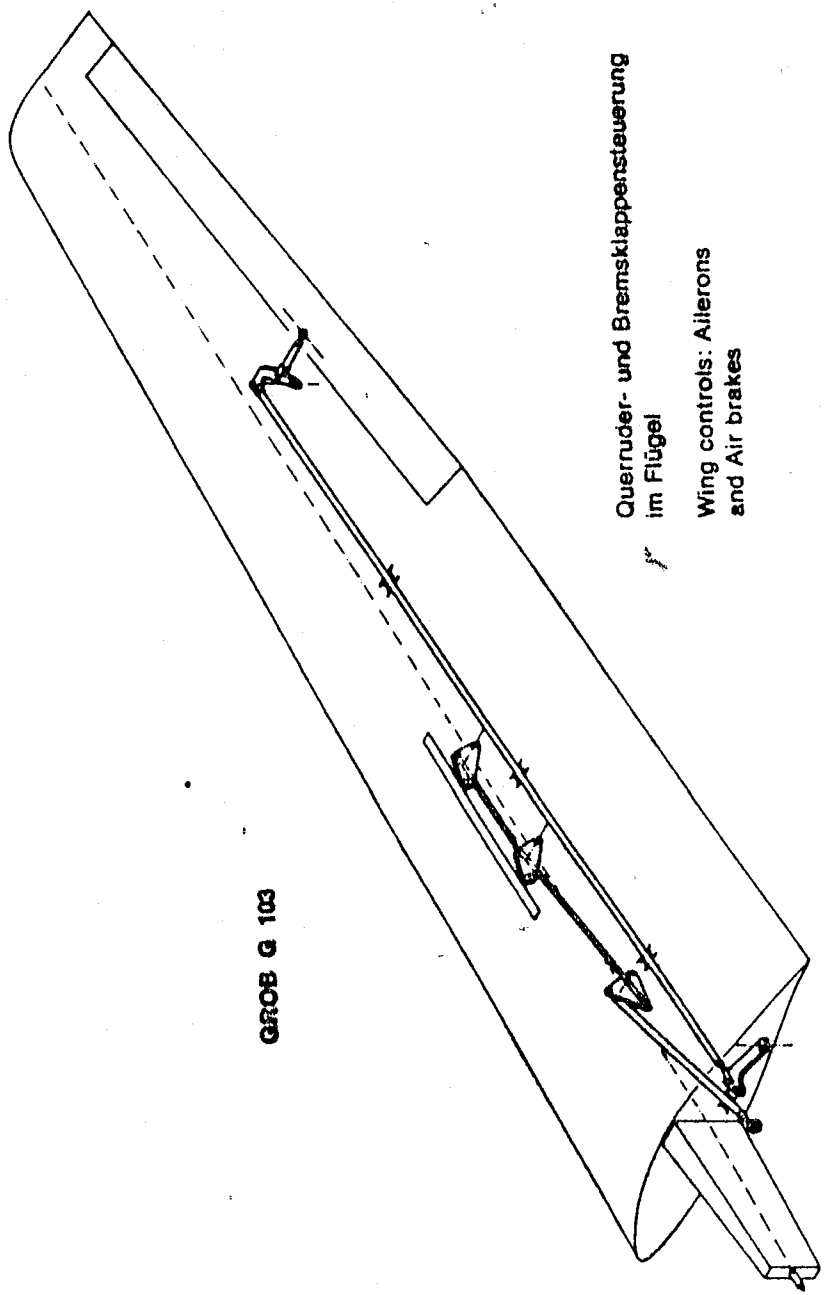
The most effective way to clean the canopy is to use a special perspex cleaner but if necessary luke warm water can be used. A soft, clean cloth or chamois-leather should be employed to wipe the canopy down. Never rub perspex with anything dry.

The Safety harness should be regularly checked for damage and general wear. The metal parts of the harness should be frequently checked for corrosion.

Because of its position, the winch launch hook is susceptible to getting very grimy and muddy. It must therefore be frequently inspected for damage, cleaned and greased. When the seat-well is removed the hook can easily be taken out. Remove the connecting wire from the lever and take out the retaining screws. For reconditioning, the tow hook should be sent with the record card to the tow hook manufacturer, Tost. For further details the manufacturers manuals should be consulted.

The cables and pulley for the nose and belly hooks should be checked for wear during the yearly inspection.

The main wheel tyre pressure should be kept at 2.5 to 2.8 bar
nosewheel and tailwheel 2, 5 bar



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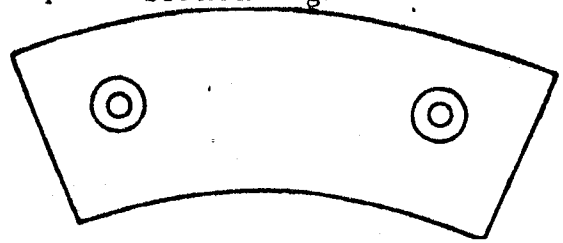
V. 2. Maintenance of Brakesystem

The wheelbrake of the "TWIN " is a disk brake. 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.

Changing of brakeshoes

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



66-30
M1.1

Bleeding of brakesystem

a) Mount transparent plasticpipe on bleedingscrew put other end of pipe in a container with brake-fluid.
b) Loosen bleading screw, when brake via lever andbrakezylinder pushes brakefluid trough the brake.
c) Bleeding is complete when no more airbubbles can be seen in transparent plastic pipe.

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Remarks:

The ATE brakefluid DOT 3 (ambercoloured) is available in every shop for car parts. Standardized within Europe.

The master brake cylinder with the brake fluid reservoir is located under the baggage compartment.

The marks for the lowest and highest level of the hydraulic brake fluid have to be observed.

VI. **Weights and moments of the control surfaces**

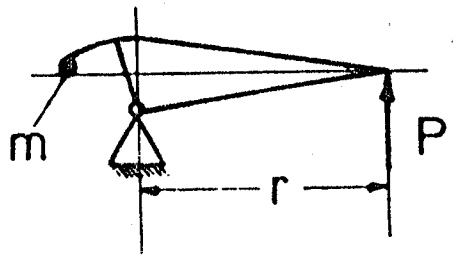
Control Surface moments

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 = Pr 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)



16th june 1982

VII. Checks

VII. 1. Daily checks

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

VII. 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.

VII. 3. 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.

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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.

VIII. 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 pertol 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 occassionally 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.

IX. General care

Dampness

As far as possible the glider should be protected from dampness. 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.

X . Airworthiness Limitations

This Airworthiness Limitations section is FAA approved for U.S. registered gliders in accordance with the provisions of 14 CFR section 21.29. In addition, this section is required by FAA Type Certificate Data Sheet No. G 39 EU and it specifies maintenance required under 14 CFR sections 43.16 and 91.163 unles an alternatice programm has been FAA approved.

LBA approved on : 17th march 1982

The following section specifies requirements for the instructions for continued airworthiness.

17 th march 1982

17. März 1982

XI. 1 Annual Inspection Checklist

WING

- Finish
- Shell
- Cracks in shell
- Root rib

- Spar stub
- Drain holes
- Fittings at root rib
- Aileron bearings
- Aileron drive
- Divebrake drive

TAILPLANE

- Finish
- Shell
- Cracks in shell
- Drain holes
- Bushes for mounting
- Elevator bearings

17 th march 1982

17. [illegible] 1982

FUSELAGE

- [ ] Finish
- [ ] Shell
- [ ] Cracks in shell
- [ ] Drain holes
- [ ] Rudder bearings
- [ ] Bushes for wing root pins
- [ ] Stabilizer mounting
- [ ] Cockpits
- [ ] Seats
- [ ] Frames
- [ ] Canopies
- [ ] Canopy mechanism
- [ ] Canopy emergency release
- [ ] Canopy window

- [ ] Control stick
- [ ] Elevator drive
- [ ] Divebrake drive
- [ ] Aileron drive
- [ ] Aileron connectors
- [ ] Divebrake connectors
- [ ] Trim control

- [ ] Pedals
- [ ] Pedal adjustment
- [ ] Steering cables
- [ ] Earth connections
- [ ] Cockpit ventilation
- [ ] Backrest adjustment
- [ ] Headrest adjustment

17 th march 1982

17. März 1982

Control surfaces (Aileron, Elevator, Rudder)
Finish
Shell
Rudder ventilation
Rudder drive
Bearings
Connecting means

LANDING GEAR (Mainwheel, Tailwheel, Nosewheel)
Undercarriage and axle
Tyre
Preset load at folding strut
Bearings and joints
Drive rod
Connecting means
Locking
Overcenter
Wheel brake system

EQUIPMENT
Minimum Instrumentation
Additional Instrumentation
Operating range
Limit marks
Oxygen bottles
Working of Instrumentation
Tubing
Total energy unit
Pitot system leakfree
Static system leakfree
T. E. system leakfree
Electrical cables
Battery and fitting
Radio
Antenna
Compass deviation list

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17.

Seat belt harness
C. G. release
Nose release
Weight and balance plan
Data placard
Cockpit placards
Placard with serial number
Cockpit pocket
Baggage compartment cover

ADJUSTMENT
Wings and horizontal tail
Play at root ribs
Zero setting of control surfaces
Control surfaces deflections
Dive brake deflection
Wheel brake
Trim control
Nose release function
C. G. release function
Automatic C. G. release
Aileron differentiation

Procedures and criteria for performing this inspection are contained in Section VII. 3, page 22 of this manual.

17 th march 1982

17. März 1982

NOTE: 2-23-1999. TELEPHONE CALL TO GROB SYSTEMS INC GEORGE ORDERED INSPECTION PROCEDURE.

XI. 2. Inspection Procedure For Increase Of Service Time

GEORGE SAID ANY A.I WITH EQUIPMENT CAN MAKE REPORT ON FORM, SENT TO FACTORY.

1. General

The results of fatigue tests of wingspar sections have demonstrated recently that the service time of FRP gliders may be extended to 6000 hours, if for each individual glider (in addition to the obligatory annual inspections) the airworthiness is demonstrated according to a special multi-step inspection program particularly with regard to the service life.

2. Dates

When the glider has reached a service time of 3000 hours, an inspection must be done in accordance with the inspection program mentioned under point 3. If the results of this inspection are positive or if any defects found have been duly repaired, the service time of the glider is extended by another 1000 hours to a total of 4000 hours (first step)

The above inspection program must be repeated when the glider has reached a service time of 4000 hours. If the results of this inspection are positive or if any defects found have been duly repaired, the service time of the glider is extended to 5000 hours (second step).

When the glider has reached a service time of 5000 hours, the above inspection program again must be repeated. If the results of the inspection are still positive or if any defects found have been duly repaired, the service time may be extended to a total of 6000 hours (third step).

17. M[illegible] 1982

For a possible service time exceeding 6000 hours procedures will be evaluated in the future.

3. In each case the latest issue of the inspection program, which will be updated according to incoming inspection results, has to be ordered from the manufacturer.

4. The inspection must only be done by the manufacturer or by a licensed repair station or inspector.

5. The results of the inspections have to be recorded in an inspection test report wherein comments are required for each inspection instruction. If the inspections are done outside the manufacturer`s facilities, a copy of the records must be sent to the manufacturer for his evaluation and information.

6. The annual inspection is not affected by this inspection programm.

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XI.3. Components with a limited life time

a) Tow hooks

The E 75 and the G 73 Tost hooks are limited to 36 months after installation or 2000 launches which ever occurs first, at which time they are to be recertified by the manufacturer.

One is bound by the Maintenance Manuals for the nose hooks 'E 72' and 'E 75' published in May 1975 and the Maintenance Manual for the belly hooks 'Europa G 72' and 'Europa G 73' published in May 1975.

b) 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.

17 th march 1982

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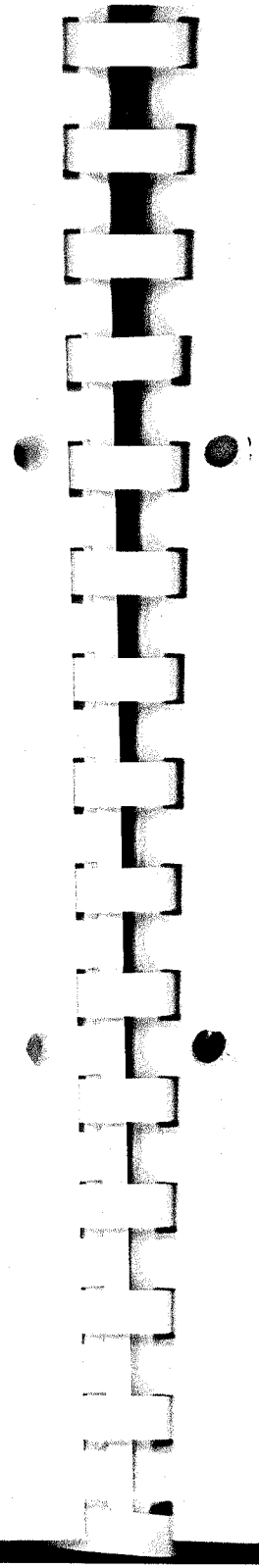

GROB

REPAIR INSTRUCTIONS
GROB G 103

»TWIN II«

This Repair Instructions is for U.S. registered gliders.

Published: September 1981

Manufactured by:
GROB-WERKE GMBH & CO. KG
Unternehmensbereich
Burkhart Grob Flugzeugbau
8939 Mattsies
Am Flugplatz
Telefon: 08268/411
Telex: 539 623

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1. Foreword

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.

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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 Allerons	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. 08-30260	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

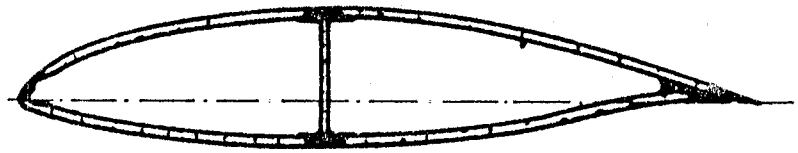
Reinforced regions for special loads and stress conducting are not shown.

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



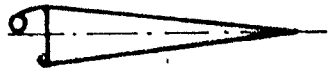
2. Rumpf

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

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

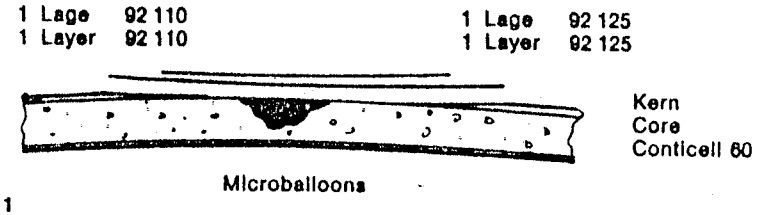

Abb. 1
Fig. 1

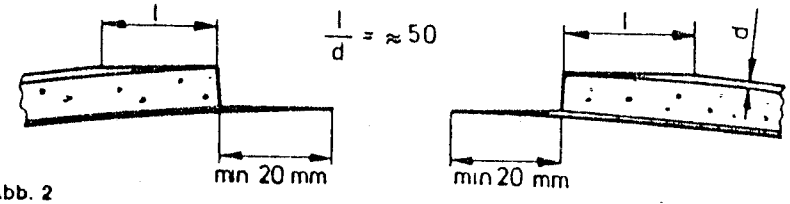

Abb. 2
Fig. 2

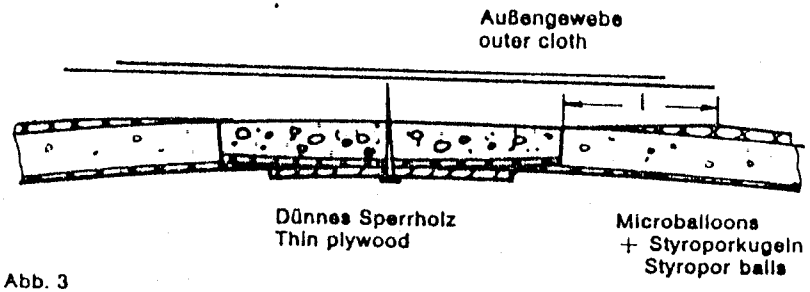

Abb. 3
Fig. 3

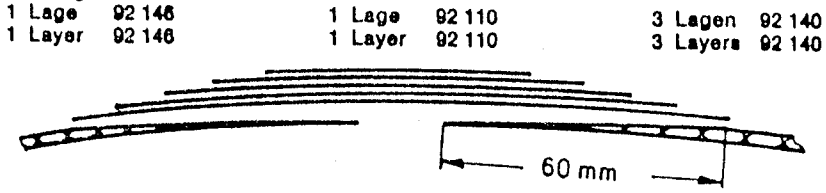

Abb. 4
Fig. 4

(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 in accordance with the glider information sheet are only to be carried out by the manufacturer or by an approved aeronautical workshop (who has the authorization of the manufacturer in any invidual case.)

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)

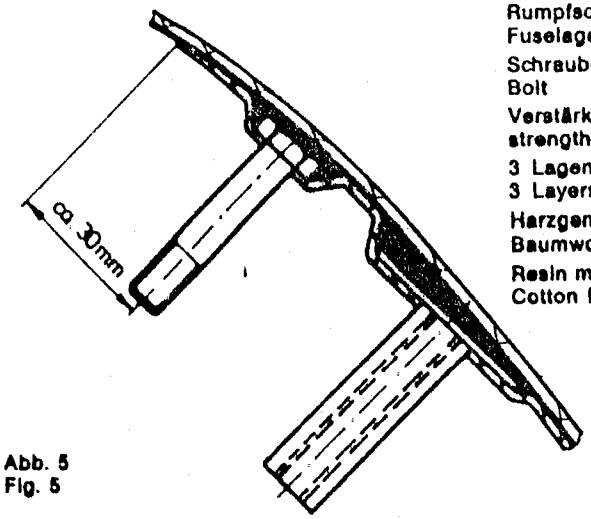

Abb. 5
Fig. 5

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.