BURKHART GROB

LUFT-UND RAUMFAHRT GmbH & Co. KG

8939 Mattsies

MAINTENANCE MANUAL

Type	:	GROB G 103 C "TWIN III ACRO"
Serial No.	:	34120
Registration No.	:	.....
Date of Issue	:	January 1989

Owner : .....

.....

.....

The translation has been accomplished to our best knowledge and judgement. In case of doubt, the German original is authoritative.

Current State of Revisions

Rev.No.	Page	Reference	Date	Signature
1	0.2, 4.2	TM 315-42	23.11.89	
2	0.2, 0.3, 0.4, 5.3, 8.2, 11.2, 11.3	TM 315-45	11.10.91	
3	0.2, 0.3, 0.4, 0.5, 1.2, 2.3, 3.2, 3.5, 3.7, 4.1, 5.2, 5.3, 6.5, 6.6, 8.2, 8.3, 8.4, 8.5, A1.3, A1.4, A5.2, A5.4, A5.5	ÄM 315-18	08.05.92	
4	0.2, 0.3, 0.4, 2.3, 3.5, 9.7, A1.4	TM 315-53	14.01.93	
5	0.2, 0.3, 9.2,	MSB 315-65	15.09.03	
6	0.2, 0.3, 3.1, 3.2, 3.5, 9.2,	OSB 315-66	16.10.03	

List of pages

Section	Page	Date	Reference
0	Front Page		
	0.1		
	0.2	16.10.03	OSB 315-66
	0.3	16.10.03	OSB 315-66
	0.4	14.01.93	
	0.5	08.05.92	
	0.6	Jan. 89	
	0.7	Jan. 89	
1	1.1	Jan. 89	
	1.2	08.05.92	
2	2.1	Jan. 89	
	2.2	Jan. 89	
	2.3	14.01.93	
	2.4	Jan. 89	
	2.5	Jan. 89	
	2.6	Jan. 89	
	2.7	Jan. 89	
	2.8	Jan. 89	
3	3.1	16.10.03	SB 315-66
	3.2	16.10.03	SB 315-66
	3.2	Jan. 89	
	3.4	Jan. 89	
	3.5	16.10.03	SB 315-66
	3.6	Jan. 89	
	3.7	08.05.92	
4	4.1	08.05.92	
	4.2	23.11.89	
	4.3	Jan. 89	
	4.4	18.07.89	

Section	Page	Date	Reference
5	5.1	Jan. 89	
	5.2	08.05.92	
	5.3	08.05.92	
6	6.1	Jan. 89	
	6.2	Jan. 89	
	6.3	Jan. 89	
	6.4	Jan. 89	
	6.5	08.05.92	
	6.6	08.05.92	
7	7.1	Jan. 89	
	7.2	Jan. 89	
	7.3	Jan. 89	
	7.4	Jan. 89	
	7.5	18.07.89	
	7.6	Jan. 89	
	7.7	Jan. 89	
	7.8	18.07.89	
	7.9	Jan. 89	
	7.10	Jan. 89	
8	8.1	Jan. 89	
	8.2	08.05.92	
	8.3	08.05.92	
	8.4	08.05.92	
	8.5	08.05.92	
9	9.1	Jan. 89	
	9.2	16.10.03	OSB 315-66
	9.3	Jan. 89	
	9.4	Jan. 89	
	9.5	Jan. 89	
	9.6	Jan. 89	
	9.7	14.01.93	
10	10.1	Jan. 89	

S/N 34120

Section	Page	Date	Reference
10	10.1	Jan. 89	
11	11.1	Jan. 89	
	11.2	11.10.91	
	11.3	11.10.91	
	11.4	Jan. 89	
12	12.1	Jan. 89	
A 1	A 1.1	Jan. 89	
	A 1.2	Jan. 89	
	A 1.3	14.01.93	TM 315-53
	A 1.4	14.01.93	TM 315-53
A 2	A 2.1	Jan. 89	
	A 2.2	Jan. 89	
A 3	A 3.1	Jan. 89	
A 4	A 4.1	Jan. 89	
A 5	front page	Jan. 89	
	A 5.1	Jan. 89	
	A 5.2	08.05.92	ÄM 315-18
	A 5.3	Jan. 89	
	A 5.4	08.05.92	ÄM 315-18
	A 5.5	08.05.92	ÄM 315-18
	A 5.6	Jan. 89	
	A 5.7	Jan. 89	
	A 5.8	Jan. 89	
	A 5.9	Jan. 89	
	A 5.10	Jan. 89	
	A 5.11	Jan. 89	
	A 5.12	Jan. 89	
	A 5.13	Jan. 89	
	A 5.14	Jan. 89	
	A 5.15	Jan. 89	

Table of Contents

Appendix

A1. Fuselage Controls

A2. Wing Controls: Ailerons and Airbrakes

A3. Inspection Holes

A4. Colour Markings

A5. Repair Instructions

A6. Technical Bulletins and Airworthiness Directives

Note: Technical Bulletins and Airworthiness Directives shall be filed behind this page.

S/N 34120

1. Technical Data

- Wing

Airfoil		Eppler E 583		
Span	b =	18.00	m	(59.06 ft.)
Area	S =	17.52	m²	(188.6 sq.ft.)
Aspect Ratio		18.50		

- Ailerons

Span	b_{QR} =	4.000	m	(13.12 ft.)
Chord inner	t_i =	0.210	m	(8.27 in.)
outer	t_a =	0.100	m	(3.94 in.)
Area (both)	S_{QR} =	1.240	m²	(13.3 sq.ft.)
% of Wing area		7.09	%	

- Fuselage

Length	l =	8.200	m	(26.90 ft.)
Width of Cockpit	b =	0.710	m	(2.33 ft.)
Height of Cockpit	h =	1.020	m	(3.35 ft.)
Height of Tailplane	h =	1.550	m	(5.09 ft.)
Surface area appr.	S =	13.0	m²	(139.9 sq.ft.)

- Fin

Height	h =	1.30	m	(4.27 ft.)
Area	S_{SLW} =	1.37	m²	(14.7 sq.ft.)
Aspect Ratio		1.23		
Chord bottom	t_u =	1.25	m	(4.10 ft.)
top	t_o =	0.86	m	(2.82 ft.)

- Rudder

% of fin		37	%	
Area	S_{SR} =	0.505	m²	(5.4 sq.ft.)

- Horizontal Tail

Span	b	=	3.390 m	(11.12 ft.)
Area	S_{HLW}	=	2.177 m²	(23.4 sq.ft.)
Aspect Ratio			5.28	
Chord inner	t_i	=	0.824 m	(2.70 ft.)
outer	t_a	=	0.460 m	(1.51 ft.)

- Elevator

Area	S_{HR}	=	0.61 m	(2.00 ft.)
Chord inner	t_i	=	0.24 m	(0.79 ft.)

- Airbrakes (Type GROB)

Area (both)	S_{BK}	=	0.476 m²	(5.1 sq.ft.)
Span	b	=	1.700 m	(5.58 ft.)
Height	h	=	0.140 m	(0.46 ft.)

Mass (Weights)

Standard Empty Weight	appr.	380 kg	(838 lbs.)
Max. Useful Load		220 kg	(485 lbs.)
1st seat max.		110 kg	(243 lbs.)
2nd seat max.		110 kg	(243 lbs.)
Min. Useful Load		70 kg	(154 lbs.)
Max. Flying Weight		600 kg	(1323 lbs.)
Load % of Flying Weight		37 %	
Wing Loading		25.7 - 34.3 kg/m²	
		(5.26 - 7.03 lbs./sq.ft.)	
Max. Weight of Non-Lifting Parts		420 kg	(926 lbs.)

2. Description of Components and Systems

2.1 Airframe

The GROB G 103 C "TWIN III ACRO" is a two-seater mid-wing glider with a damped T-type tail. State-of-the Art technology is used to manufacture the glider in industrial FRP construction. It is used for instruction, training, performance and aerobatics.

The two seats are in tandem arrangement. The two canopies are independent of each other and open to the right.

The main wheel of the non-retractable tandem landing gear is equipped with a hydraulic disk brake.

- Wing

The 2-section wing is triple tapered with airbrakes (Type GROB) on the upper side.

The wings consist of GRP sandwich shells with spar flanges made of carbon fibres and a spar web made of GRP-foam-sandwich.

- Fuselage

The fuselage consists of a GRP shell. For stiffening, ribs and stringers have been incorporated.
The fin is a sandwich structure with tridimensional cloth.
The rudder is made of carbon fibre.

- Horizontal Tail

The horizontal tail consists of horizontal fin and elevator.
The fin is a GRP-foam-sandwich construction with spar. The elevator is made of carbon fibre.

S/N 34120

2.2 Controls

The control system of the GROB G 103 C "TWIN III ACRO" is designed as pushrod control system (see also Appendix A1 and A2). Handles, shift and driving levers are made of welded steel tube or aluminium respectively. The pushrods are made of steel or aluminium tubes with riveted linkages.

- Elevator Control

Control stick force is transmitted from the control stick to the elevator pushrod via the control stick split billet. The two control sticks are rigidly connected. The rear control stick is tightend by a butterfly nut and can be removed. Four elevator pushrods are leading from the rear split billet to the automatic elevator linkage in the upper section of the rudder fin.

Any elevator control elements inside the fuselage can be removed. The driving lever is laminated into the elevator. Elevator detents are inside both split billets below the seats.

- Elevator Trim

The trim levers are both at the left cockpit wall near the air-brake lever. The operating handles are green. Both trim levers are rigidly connected. Between the trim rods and the elevator rods, there is one trim spring below each seat shell. There is another spring between the front elevator rod and the frame. The control sticks are moving while adjusting the trim.

- Aileron Control

The aileron control force is transmitted from the control stick to the aileron shift lever (fuselage wall) via a short intermediate rod. Two pushrods are rigidly coupling the two control sticks. Two push-rods are leading from the rear lever via an intermediate rod to the bottom driving lever of the control spider (fuselage center). The top lever is driving the aileron connectors and the pushrods inside the wing. The aileron differential lever inside the outer wing is directly driving the aileron via the short connecting rod.

Any aileron control elements inside the fuselage can be removed.
The aileron differential lever and the swivel inside the wing can only be removed by opening the GRP skin.
Aileron detents are on the two control sticks.

- Rudder Control

The front pedal support is designed as cable control and infinitely variable. There are two sheaves each at the pedals which provide a constant cable tension by means of springs. The cables lead to the rudder split billet which is mounted below the rear pedal assembly. Pushrods inside the fuselage tube are driving the rudder.

The entire rudder control can be removed.
The detents are at the rear control mounting frame.

Manual control for the rudder
A manual control for the rudder according to SB 315-53 or ÄM 315-34107 or ÄM 315-34156 may be installed for operation of the glider by instructed pilots.
The hand lever is located on the left side of the front cockpit behind the airbrake lever. This lever actuates the left pedal in the rear cockpit via a pushrod.
Before operation by other pilots this system must be removed.

- Nose wheel steering (as standard as of S/N 34171)

The installed nose wheel steering is connected to the rudder controls by a cable and two tension springs.

- Airbrake Control

Both airbrake operating levers are rigidly connected through pushrods. Pushrods lead from the rear lever to the bottom driving lever of the control spider (fuselage center) via intermediate rods. The locking rods in the wings are driven by the top driving lever via connectors (quick-locks of type GROB). Pushrods are leading from the locking rods to the swivels. The airbrake sheets are mounted to the swivels.

Any airbrake control elements inside the fuselage can be removed. The airbrake sheets and the cover may also be removed. The locking lever and the swivel inside the wing can only be removed by opening the GRP skin.
The detents are at the outer swivel.

2.3 Radio Installation

The front instrument panel is available in two versions and can accommodate both, rectangular instruments (60*80 mm) and 58 mm diameter instruments. The internal loudspeaker is mounted to the side of the rear instrument panel. "Swan neck" microphones may be mounted to the pilot's right on the canopy frame. The baggage compartment floor is prepared for battery installation (see also Sec. 2.6). Drawings for radio installation may be obtained on request.

Suitable LBA-approved units can be seen from the equipment list Sec. 8.

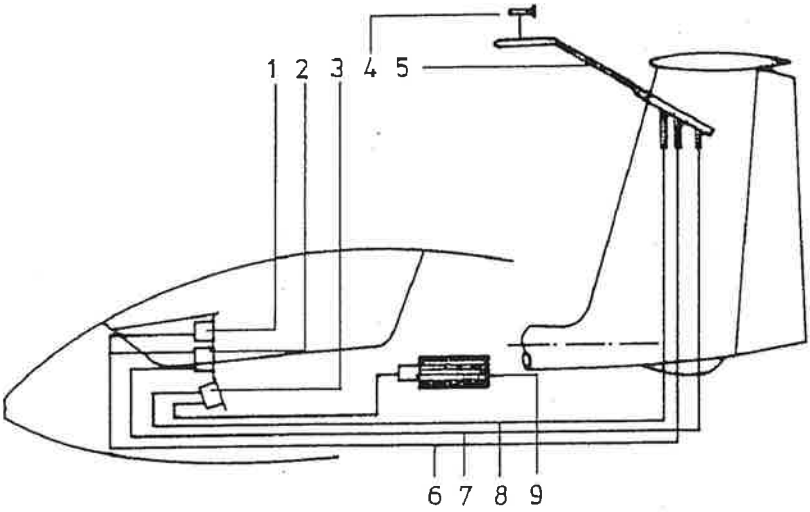
2.4 Oxygen Installation

Plates with bolts on the right fuselage shell above the baggage compartment for attaching oxygen bottles belong to the standard equipment of the glider. Suitable mounting supports are obtainable from Messrs. GROB.
For installation of the oxygen system, drawings are also available.

Suitable LBA-approved units can be seen from the equipment list Sec. 8.

Caution: After the oxygen system has been installed, the empty weight CoG position shall be determined to prove the CoG to be within the permissible range.

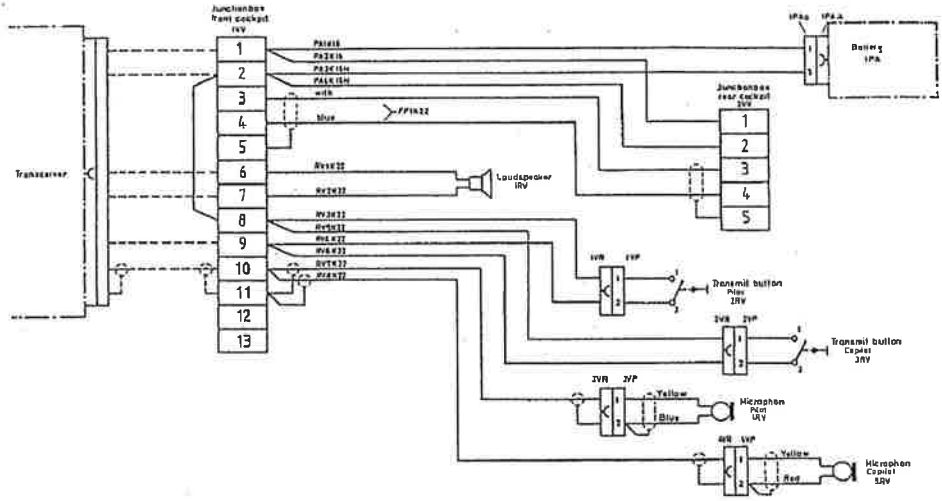
2.5 Pressure Tubings and Connections to the Instruments
(schematic drawing)



1	Altimeter	
2	Airspeed indicator	
3	Vertical speed indicator	
4	Total energy tube	
5	Pitot static tube	
6	Static pressure	colourless
7	Pitot pressure	green
8	Total energy	red
9	Compensating tank	blue

Total and static pressure as well as the pressure of the vertical speed indicator are measured inside a multi-probe at the vertical fin.

2.6 Electrical System



St	S.No.	Designation	P.N.	Inst.
1	1 RV	Loudspeaker Beru	24002 40 hm	G
2	2 RV	Talk Button Secme	171755230HDPO 2A	G
3	3 RV	Talk Button Secme	171755230HDPO 2A	G
4	4 RV	Swan Neck Mike A-Dittel	SHM 1010	G
5	5 RV	Swan Neck Mike A-Dittel	SHM 1010	G

S/N 34120

1	2	3	4	5	6	7	8
ITEM	Ident Code	Wire	Length	From Unit	●	To Unit	●
1	PA 1 K 16	LN 29864	4,80 m	1 VV/1	X	1 PA/1	0
2	PA 2 K 16	"	2,21 m	1 VV/1	X	2 VV/1	X
3	PA 3 K 16 N	"	4,80 m	1 VV/2	X	1 PA/5	0
4	PA 4 K 16 N	"	2,21 m	1 VV/2	X	2 VV/2	X
5	FF 1 K 22	LN 29871	2,21 m	1 VV/3/4/5	X	2 VV/3/4/5	X
6	RV 1 K 22	LN 29864	2,30 m	1 VV/6	X	1 RV/+	X
7	RV 2 K 22	LN 29864	2,30 m	1 VV/7	X	1 RV/ -	X
8	RV 3 K 22	"	1,35 m	1 VV/8	X	1 VR/2	-
9	RV 4 K 22	"	1,35 m	1 VV/9	X	1 VR/2	-
10	RV 5 K 22	"	2,85 m	1 VV/9	X	2 VR/2	-
11	RV 6 K 22	"	2,85 m	1 VV/9	X	2 VR/2	-
12	RV 7 K 22	LN 29871	1,40 m	1 VV/10/11	X	3 VR/1/2	-
13	RV 8 K 22	LN 29871	2,45 m	1 VV/10/11	X	4 VR/1/2	-
14	Interconnection Wire	LN 29864	0,10 m	1 VV/2	X	1 VV/8	X
15	Wire Transmit button Pilot	LN 29864	0,13 m	1 VP/1	-	2 RV/1	0
16	Wire Transmit button Pilot	LN 29864	0,13 m	1 VP/2	-	2 RV/3	0
17	Wire Transmit button Copilot	LN 29864	0,13 m	2 VP/1	-	3 RV/1	0
18	Wire Transmit button Copilot	LN 29864	0,13 m	2 VP/2	-	3 RV/3	0
19	Wire Microphone Pilot	--	0,70 m	3 VP/1/2	-	4 RV	0
20	Wire Microphone Copilot	--	0,70 m	4 VP/1/2	-	5 RV	0

● { 0 Connect with soldering
X Connect with isolated crimping lug
- Connect with other contact mechanism

3. Adjusting Data

3.1 Rigging Data and Control Adjustment

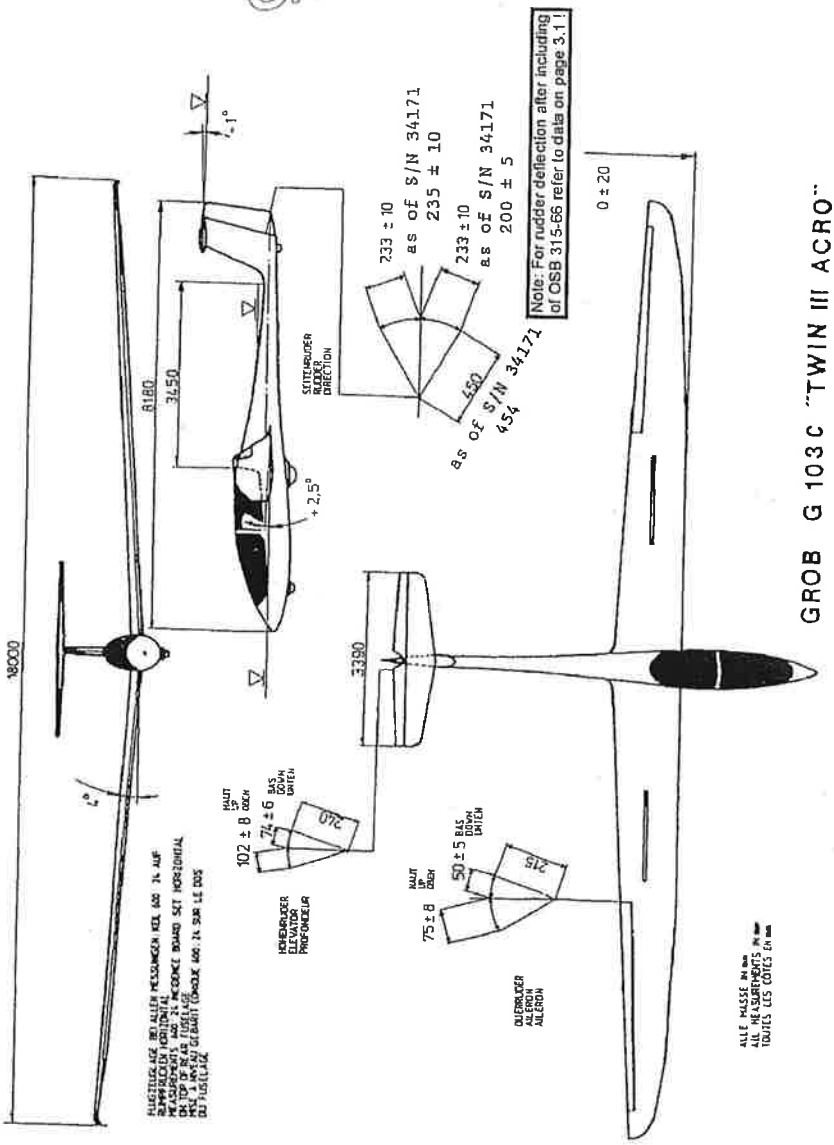
Adjustment	Reference Line	Nominal Value	Tolerance
Wing-angle of Incidence	Angle between wing chord an longitudinal axis of the fuselage	2°30'	± 15'
Wing-Sweep Forward	Distance of wing leading edge connecting line at BMET 4500 to datum	0	± 20 mm (0.79 in.)
Wing – Dihedral	Angle between upper wing surface and horizontal	4°	± 30'
Tailplane – Angle of Incidence	Angle between tailplane chord and longitudinal axis of the fuselage	- 1°	± 30'
Datum	Wing leading edge at the root rib	QE 2980	

Control deflections	Nach oben Soll	Nach oben Toleranz	Nach unten Soll	Nach unten Toleranz	Meßpunktentfernung vom Drehpunkt
Aileron left [mm]	75	± 8	50	± 5	215
[in.]	2.95	± 0.31	1.97	± 0.20	8.46
rechts [mm]	75	± 8	50	± 5	215
[in.]	2.95	± 0.31	1.97	± 0.20	8.46
Elevator [mm]	102	± 8	74	± 6	240
[in.]	4.02	± 0.31	2.91	± 0.24	9.45
Rudder [mm]	233	± 10	233	± 10	450
[in.]	9.17	± 0.39	9.17	± 0.39	17.72
As of S/N 34171	200	± 5 (LH)	235	± 10 (RH)	454
	7.87	± 0.20	9.25	± 0.39	17.87
After including of OSB 315-66 As of S/N 34171	233	+5/-10 (LH)	233	+5/ -10 (RH)	454
	9.17	+0.20/-0.39	9.17	± 0.39	17.87
	200	± 5 (LH)	235	+5/ -10 (RH)	
	7.87	± 0.20	9.25	+ 0.20/ -0.39	

QE = longitudinal station (QE 0 = 480 mm / 18.89 in. from fuselage nose)
ME = middle plane (ME 0 = separation plane centre of fuselage)
BMET = reference middle plane wing (considering wing - dihedral)

(BMET 0 = ME 0)

S/N 34120


GROB G 103 C "TWIN III ACRO"
Note: For rudder deflection after including of OSB 315-66 refer to data on page 3.1!
233 ± 10
as of S/N 34171
235 ± 10
233 ± 10
as of S/N 34171
200 ± 5
as of S/N 34171
454
0 ± 20
+1°
-1°
+2,5°
18000
8180
3650
3390
102 ± 8
74 ± 6
240
50 ± 5
75 ± 8
215

3.2 Adjustment of Towing Hooks, Airbrake Locking and Trim

Towing Hook	Tension of return spring 0.5 - 1 daN Max. release force under load 7 daN

Airbrake Locking	max. 15 - 20 daN at the front operating lever

Trim Adjustment

- trim lever fully "nose down"
- elevator control fully pulled

Operating force at the front control stick has to be 6 daN.

- trim lever fully "nose up"
- elevator control fully pushed

Operating force at the front control stick has to be 3 daN.

Setting of trim gradient shall be at :

- mounted tailplane
- elevator deflection being adjusted

3.3 Moments and Weights of the Control Surfaces

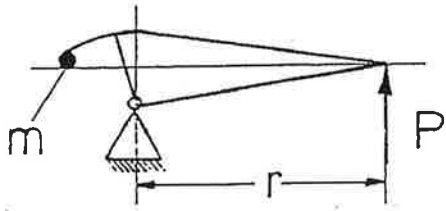
After repainting or repair, the moments and weights of the control surfaces shall be checked and corrected, if necessary.

For measuring of the control surface moments, the surfaces shall be removed.

For determination of the control surface moment M = P * r, the control surface shall be pivoted in the fulcrum (as frictionless as possible). Force P may be measured e.g. by means of a letter scale.

If the residual moments are exceeded mass correction m shall be completed. Mass correcting material such as rounds made of steel or lead shall be inserted in the tubes of the control surfaces and fixed with M5 screws (at least every 100 mm/ 3.94 in.).

If the weight values have been exceeded the weight of control surfaces shall be reduced (e.g. by grinding). In particular weight reduction is worthwhile near the trailing edge because at this point the moment is at its maximum and mass correcting material may be removed additionally.



After repainting or repair, the moments and weights of the control surfaces shall be within the following range:

	Residual Moment	Weight	Mass Correction (included)
Elevator	180 – 220 Ncm 15.93 – 19.46 in.lbs	3,30 – 4,05 kg 7.28 – 8.93 in.lbs	0,00 kg 0.00 in.lbs
Rudder	0 – 100 Ncm 0.00 – 8.85 in.lbs	5,30 – 6,50 kg 11.68 – 14.33 lbs	3,30 kg 7.28 lbs
TM 315-53 included	0 – 91 Ncm 0.00 – 8.05 in.lbs	5,30 – 6,50 kg 11.68 – 14.33 lbs	3,30 kg 7.28 lbs
OSB 315-66 included	0 – 80 Ncm 0.00 – 7.08 in.lbs	5,50 – 6,70 kg 12.13 – 14.77 lbs	3,50 kg 7.71 lbs
Aileron	130 – 170 Ncm 11.50 – 15.04 in.lbs	5,60 – 6,60 kg 12.35 – 14.55 lbs	1,11 kg 2.45 lbs

Mass correction shall be in the prescribed sections (aileron and rudder):

- Aileron: uniform distribution from the centre to the outer end of the aileron
- Rudder: Above the upper rudder bearing

3.4 Control Play

With the front control stick and the front rudder pedals locked, no play at the control surfaces is permitted.

Bearings and hinges with movement or play shall be replaced or a request made to the manufacturer for means of repair.

Note: Control elasticity is permitted.

3.5 Wink Linkage Play

Tangential play of the wings (movement of wing tips fore and aft) is usually cleared by tightening the slide sleeves of wing linkage tubes.

Wear of the slide sleeves could result in the minimum value of 1 mm no longer being available (see also Pilot's Operating Handbook, Sec. 4.2, Page 4.3) or in the worst case, the guide pins could bottom at the end of the milled slot. Thus making it impossible to compensate the play.

For clearing this play, either replace the slide sleeves or use oversize balls in the wing linkage tubes.
Detailed repair instructions are available from Messrs. GROB.

Note: Unpermissible play in the wing linkage tubes is mainly caused by pushing or pulling the glider at the wing tips.

3.6 Main Bolt Torque

The permissible torque for the main bolts is 75 Nm (55.3 lb.ft.).

4. Inspections

4.1 Prescribed Inspections of Component Parts

- **Rudder Cables**

  Every 200 operating hours plus at the annual inspection, the rudder cables shall be checked at the front pedal assembly especially at the sheaves. In case of damage (even on thimbles and clamps), wear or corrosion, the rudder cables should be replaced.
  Single strand wear of max. 50% is permitted.

- **Towing Hooks**

  Inspections shall be conducted in accordance with the Operating Manual for Towing Hooks (see also Maintenance Manual, Sec. 10).

- **Instruments**

  The instructions of the corresponding manufacturers are valid for the inspection of the installed instruments and gauges.

- **Quick-locks Type GROB**

  Check the quick-locks of the control connectors for being clean. For cleaning these parts, use oil sprays only.
  Lubrication is not necessary.
  Tolerances: The axial play of the ball part must not exceed
  0.10 mm + 0.15 mm/-0 mm
  (0.004 in. + 0.006 in./ -0 in.).

- **Gas Springs**

  If gas springs are mounted to open the canopies check them for being clean and for sufficient thrust.

Note: See also Sec. 11.4: Devices Subject to Life Limitations.

4.2 Periodical Inspections

At regular intervals, latest during the annual inspection or every 100 hours (depending on the national requirements) - which ever occurs first -, at least the following maintenance work shall be conducted:

The control system (see also Appendix A1 and A2) is accessible as follows:

- Wing Control

  The aileron drive is accessible through the root rib and the inspection holes at the bottom.
  The airbrake drive is accessible through an inspection hole and the airbrake box.

- Fuselage Control

  After removing the seats and the sliding floor above the main wheel, the entire control system installed in the front fuselage will be accessible. The shift levers in the rear fuselage and the elevator linkage are accessible through inspection holes and by removing the rudder.

- Elevator Drive

  The drive is accessible after the tailplane has been removed.

After cleaning the entire glider, the following checks should be carried out:

1. Check the entire glider for damage such as cracks, holes, bucklings or delamination.

2. Check state of joint fittings (play, cracks, corrosion) and correct connection to the structure.

3. Check any metal parts for corrosion. Rework and preserve them, if necessary.

4. Check wing and tailplane to fuselage connections for being free of play.

5. Check state of control elements (bearings, fittings, detents, control cables).

6. Check functioning of control system including airbrakes; check control deflection.

7. If they do not move freely, determine the cause and clear the fault.

8. Check state of the three wheels. Check them for lateral play. Check state and action of the wheel brake.

9. The towing hooks shall be treated in accordance with the corresponding operating and maintenance instructions.

10. Check the pressure ports of the airspeed indicating system for cleanliness, check the tubes for leaks.

11. Check state and correct functioning of any instruments, gauges and other equipment.

12. Determine wing oscillation number and compare it to the value in the acception report. The glider stands on its main and tail wheels. Tire pressure shall be 2.5 bar (36 PSI).

13. Check installed equipment and instruments against the equipment list.

14. After repairs and change of equipment, determine empty weight and CoG position by calculation or weighing and enter the data into the weighing record.

4.3 Inspections in Specific Cases

- Inspection Check List

  Daily inspection and preflight check: see Pilot's Operating Handbook Sec. 4.3, Page 4.6 and Sec. 4.4, Page 4.9.

- Inspections in Specific Cases

• Inspections after rough landings:

  Check wheels and fuselage near the landing gear. Check spar stubs at the root rib for white patches in the laminate.

  Check wing connection inside the fuselage and bolts in the root rib.

  Check any control bearings and mass correction in the controls.

• Inspection after ground looping

  Check the fuselage near the landing gear, check rudder control linkage and shift levers.

  Check wing connection inside the fuselage and bolts in the root rib.

  Check tailplane suspension.

• After exceeding the permissible speed limits or manoeuvring load factor:

  Check the glider for white patches in the laminate of wing, fuselage or tailplane connections, surface cracks, folds or bucklings. Check for undue attitude during rigging and undue oscillation number.

5. Maintenance

5.1 Airframe Maintenance

Under normal operating conditions, the airframe is maintenance-free between annual inspections.

Re-lubrication to areas, other than the connecting points for wings and horizontal tail is not required.

According to contamination, clean and lubricate the towing hooks and the wheels, if and when necessary.

5.2 Damage

In cases where it is unclear whether any action be taken consult an GRP expert for damage survey.

Minor damage of the secondary structure which does not affect the airworthiness of the glider shall be repaired by a person with the corresponding licence. Minor damage also comprises varnish damage as well as scratches and small cracks in the plexiglass canopies.

Repair of major damage and damage of the main structure - thus comprising nearly all parts of the glider - shall be conducted by an authorized repair shop only.
The enclosed repair instructions (see appendix) provide information on conducting minor repairs.

5.3 Lubrication

All roller bearings are provided with a permanent lubrication and encased and do not require re-lubrication.

All friction and roller bearings in the control system are maintenance-free and do not require re-lubrication. The friction bearings in the root ribs and the tailplane fin shall be cleaned with gasoline when dirty and re-lubricated.

Before rigging the glider, the bolts and bores of the wing junction shall be re-lubricated, if necessary. The bolts of the horizontal tail suspension and the thread of the fixing screw shall be re-lubricated from time to time.

The linkage of canopy locking and canopy emergency jettison shall be re-lubricated in regular intervals.

Dirty towing hooks are best cleaned by using compressed air and a brush and by operating the mechanism.

The winch launching hook is accessible from inside the cockpit and may be lubricated with oil sprays or similar.

Caution: All utilized lubrications, solvents or other fuels and materials must be stored in separate containers and disposed of in accordance with national regulations.

5.4 Care

- Moisture

As far as possible, protect the glider against moisture.

Though all metal parts, except for the wing and tailplane fittings, are surface-protected, corrosion cannot be avoided during extended exposure to moisture. After any flights in rain, penetrated water has to be soaked up and the surfaces dried with a chamois leather. Re-grease any bright fittings (condensed water).

- Sunlight

To prevent the surfaces from heating up, all members of the primary structure of GRP sailplanes shall have a white surface.

- Finish Protection

The swab-applied wax coat is very resistant. Clean it with a mild detergent. Heavy dirt such as grease or dead flies are best removed with a silicone-free polish (e.g. "1 Z - Spezialreiniger D 2", Messrs. W. Sauer & Co., D-5060 Bensberg or "Reinigungspolish", Messrs. Lesonal, Stuttgart).

Remaining adhesive of the covering film at wing and horizontal tail joints may be removed with gasoline.

The care of the finish should be carried out according to the instruction "Pflege für UP-Beschichtungen an Segelflugzeugen" GROB - AKZO Ident-Nr. 4319H dated 13 July 1989.

- Cleaning of the Plexiglass Canopies

Cleaning of the canopies shall be with soft fabric or a sponge and a mild cleaner only. Use clear water and dry the canopies with a chamois leather. "Plexipol" is a suitable polish.

- Parking

Parking sailplanes in the open air should be avoided. The sailplane should only be stored or parked in well ventilated buildings.

6. Rigging and Maintenance Instructions

6.1 Assembly and Dis-Assembly of the Rudder

- Dis-Assembly

Before dis-assembly rudder, remove the adhesive film from the slot first.
The rudder is only fixed by a M6 socket head cap screw at the left side of the rudder fin. Remove the stop nut and the socket head cap screw so that a second person can slightly lift the rudder to take it from the upper guide pivot. The M6 screw of the rudder driving rod can be unscrewed after the stop nut has been removed.

- Assembly

While assembly the rudder it is advisable to connect the rudder driving rod first and then replace the rudder.
Insert the socket head cap screw and provide it with a stop nut. Apply adhesive film to the rudder slot. See to free motion of the rudder.

Note:
- Always use new stop nuts when mounting the rudder.
- When removing the fixing screw before taking the rudder from the upper guide pivot or when fixing it after the rudder has been replaced, special attention should be paid to avoid damaging the upper rudder bearing.
- Bear in mind that adhesive film contracts after fitting. Therefore sufficient slack must be allowed for free rudder motion after contraction.

6.2 Assembly and Dis-Assembly of Elevator and Aileron

- Dis-Assembly

Dis-Assembly is best with the wings and horizontal tail being de-rigged.
Remove adhesive film first.

Remove the M6 screws of the aileron driving rods.

Now remove the spiral clamping pin from the bearings by means of pin punches (diameter 1.8 mm). Displace the fitted bolts to remove the corresponding control surface.

- Assembly

Assembly is in reverse order.

Note: Observe from which bearing the fitted bolts come from and return in the same order (clamping pin bores are made during control surface mounting).

6.3 Assembly and Dis-Assembly of the Tow Hooks

- Winch Launching Hook

Due to the place where the winch launching hook is installed, it is subject to heavy dirt. Therefore, permanent damage inspection, cleaning and lubrication is required.

• Dis-Assembly

The winch launching hook is accessed easily after the rear seat has been removed.
By removing the two front fixing screws of the hook and the two rear connecting screws of the hook attachment, the winch launching hook can be removed. Remove the screw of the hook cable fixing to take out the hook.

• Assembly

Assembly is in reverse order.
After assembly the launching hook, conduct an inspection in accordance with instructions of the hook manufacturer.

Note: Care should be taken to avoid losing the small parts.

- Tow Hook

The tow hook is mounted in the fuselage nose.
It requires permanent damage inspection, cleaning and lubrication.

• Dis-Assembly

For easy dis-assembly, it is advisable to remove the front instrument panel cover.
By releasing the four fixing screws of the front tow hook frame, the hook including the fairing can be drawn backward. Now remove the screw of the cable line.

• Assembly

Assembly is in reverse order.
After assembly the tow hook, conduct an inspection in accordance with the instructions of the hook manufacturer.

Note: See to it that the bearing pedestal of the guide pulley is tightened by means of the bottom screws.

6.4 Landing Gear and Hydraulic Brake

Maintenance of the Brake System

- Replacement of the brake linings

a) Remove the wheel fairings
b) Release the 1/4" hex screws (wrench size 11 mm) to remove the brake. Do not remove the brake hose for not bleeding the brake.
c) Remove the two parts to which the two brake linings are rivetted.
d) Drill the old rivets; remove old brake linings.
e) Rivet the new brake linings.
   Assembly is in reverse order.
f) Shape of the brake linings:

66-30
M1:1

- Bleeding of the brake system

a) Put the one end of a transparent plastic tube onto the release screw and the other into a pot filled with brake fluid.
b) Loosen the release screw when the brake is pressing the brake fluid through the brake via lever and brake cylinder.
c) Bleeding is completed when no more air bubbles are to be seen in the plastic tube.

Note:

The brake fluid DOT 3 (colour amber) is available in motorcar shops. DOT 3 meets the standard everywhere in Europe.
The main brake cylinder and the brake fluid reservoir are located below the rear seat.

Caution: Avoid spilling brake fluid.

- Removal and Installation of the Main Wheel

The wheel shall be removed for cleaning, lubrication or tire replacement. Release the M8 Poly stop nuts and displace the wheel axle to the left. Extract the spacer tube (diameter 42 x 2 mm) to the right. Remove the wheel to the bottom, clean all parts and grease them before mounting.

See to it that no washers or sleeves get lost. Clean all parts and grease them, if accessible.

Note: Do not remove the hydaulic brake hose and do not operate the brake if the cylinder assembly has been removed from the brake disk.

Installation in reverse order.

- Removal and Installation of the Steerable Nose Wheel (as standard as of S/N 34171)

Note: Before removing the nose wheel ensure that the rudder is in the neutral position.

a) Remove wheel fairing.
b) Remove cotter pin and castle nut from the axle bolt.
c) Remove axle bolt.

Note: Two spacer bushes are installed on the LH side of the wheel and one bush on the RH side. These bushes fall out when the wheel is removed. Ensure that the bushes are not interchanged!

d) Remove the nose wheel downwards.

Installation is in reverse order.

The adjustment of the nose wheel steering to ± 2° is achieved by turning the LH or RH turnbuckle of the control cables on the rudder pedals.

7. Determination of the Centre of Gravity Position and the Useful Load

7.1 Introduction

This section covers methods for determining the empty weight, the empty weight CoG position, the flight weight and the flight weight CoG position of the glider.

Furthermore, it covers methods for determining CoG positions and the useful load.

A list of available equipment can be seen from Section 8.

7.2 Weighing Procedure

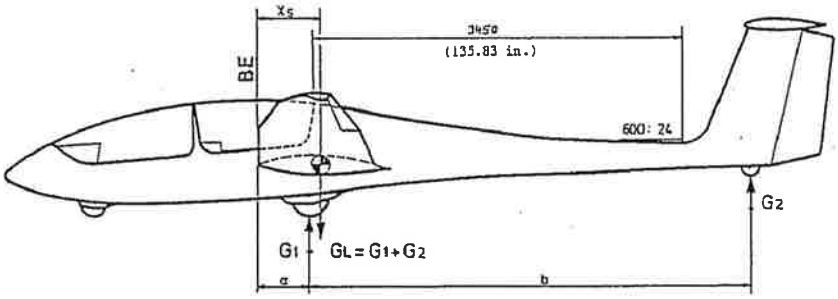
Determination of the Empty Weight CoG

For determining the CoG, the glider is placed on two scales so that the upper side of an incidence board (600:24), being located on the fuselage top, is in the horizontal position.

The datum (BE) is at the wing leading edge at the root rib. The distances a and b are determined by means of a perpendicular. The empty weight is the total of the masses G_1 and G_2.

For weighing, the glider's state has to be as follows:

- completely rigged and placed in flight attitude
- equipment in accordance with the equipment list
- flight log and Pilot's Operating Handbook aboard
- canopies closed
- no removable ballast aboard
- no parachutes aboard



Datum (BE): Wing leading edge at the root rib
Glider attitude: Incidence board 600:24 on the fuselage top in front of the vertical fin

Weight on main wheel		G_1 =	kg (lbs)
Weight on tail wheel		G_2 =	kg (lbs)
Empty Weight	$G_L = G_1 + G_2$		kg (lbs)
Distance to main wheel		a =	mm (in)
Distance to tail wheel		b =	mm (in)

Empty Weight CoG

$$X_{EMPTY} = \frac{G_2 * b}{G_L} + a = \quad \text{mm (in) aft of datum (BE)}$$

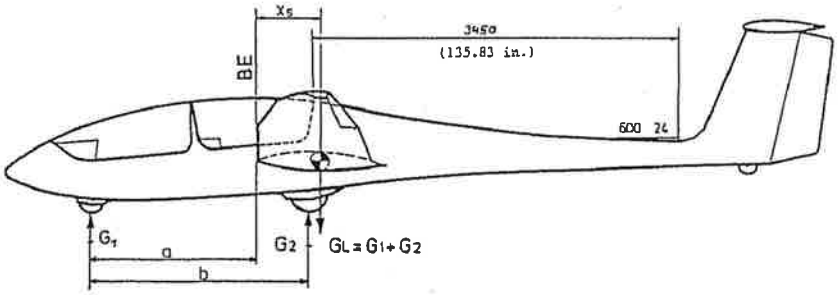
Determination of the Flight Weight CoG

Place the glider on two scales so that the upper side of an incidence board (600:24), located on the fuselage top, is in the horizontal attitude.

For weighing, the glider's state has to be as follows:

- as being described under Determination of the Empty Weight CoG, however including
- the pilot(s)
- the parachute(s)
- installed trim ballast
- the entire equipment such as barograph, cushions, cameras etc.

Pay attention to the correct setting of the rudder pedals.



Flight Weight CoG

$$X_{FLIGHT} = \frac{G_2 * b}{G_L} - a = \quad \text{mm (in) aft of datum (BE)}$$

7.3 Weight and Balance Report

BURKHART GROB
LUFT- UND RAUMFAHRT GmbH & Co. KG
Postfach 12 57
Am Flugplatz
8939 Mattsies
LBA Nr. 1-8 21

WEIGHT AND BALANCE REPORT

Model: Registration-No.: Serial-No.:

Datum Line (B. P.): Leading edge of the wing at the root

Level Means (B. L.): Incidence board 600 : 24 mm on top of the rear fuselage

Weighing:	Empty weight	Weight of non lifting parts
Wing right		
Wing left		
Fuselage incl. rudder and canopy		
Tailplane		
Payload		
Result		

Weight Limits:

Empty weight _____

Maximum payload _____

Maximum gross weight without water ballast _____

Maximum gross weight with water ballast _____

Maximum permitted weight of non lifting parts acc. to Type Cert. Data Sheet _____

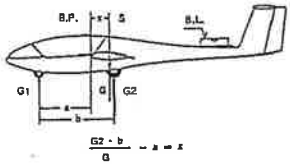
Partition of payload see instructions in Flight Manual)

Remarks:

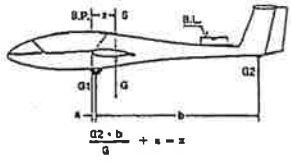
C. G. Determination:

Weighing point	Gross	Tare	Net	Moment arm
front G 1				a =
rear G 2				b =

Empty weight _____



$\frac{G2 \cdot b}{G} - a = x$



$\frac{G2 \cdot b}{G} + a = x$

Empty weight center of gravity (EWCG): aft of datum (B. P.)

_____ – _____ = _____ + _____ = _____

C. G.-range acc. flight manual from _____ upto _____

at empty weight _____

The determined empty weight C. G. is within the limits.

Equipment by weighing see equipment list of _____

_____ Date

_____ Signature of authorizedindividual

7.4 Weighing Record

The determination of the empty weight CoG is required

- if additional equipment has been installed
- if the glider has been freshly painted
- after repairs or other alterations which might alter the glider's weight
- at least every four years

A weight and balance report shall be established and entered into the glider's file.

After weighing has been conducted, the empty weight, the useful load (in seats and baggage compartment) and the empty weight CoG (with reference to the equipment list) shall be entered into the weighing record (see also Pilot's Operating Handbook Sec. 6.2, Page 6.5) and signed by an authorized inspector.

7.5 Empty Weight and Empty Weight Centre of Gravity Position

The empty weight of the glider is the weight

- excluding the pilots
- excluding the parachutes
- including the entire equipment according to the equipment list

- **Empty Weight CoG**

With the empty weight CoG within the range listed below and the pilots' weights in accordance with the weight and balance placard inside the cockpit, the flight weight CoG is within the permissible range.

Empty weight acc. to equipment list		Permissible CoG position aft of datum (BE)			
		forward		aft	
kg	lbs	mm	in	mm	in
370	816	757	29.80	776	30.55
375	827	750	29.53	772	30.39
380	838	744	29.29	768	30.24
385	849	735	28.94	764	30.08
390	860	726	28.58	761	29.96
395	871	717	28.23	757	29.80
400	882	708	27.87	754	29.69
405	893	700	27.56	750	29.53
410	904	692	27.24	747	29.41
415	915	684	26.93	744	29.29
420	926	676	26.61	741	29.17
425	937	669	26.34	738	29.06

We strictly advise that you observe the above limits as the CoG position greatly influences safe flight execution.

A list of the installed equipment can be seen from the latest valid inspection report.

Empty weight, empty weight CoG and useful load shall be attested under Sec. 6.2 (Page 6.5) of the Pilot's Operating Handbook by an authorized inspector (similar to the German Prüfer für Luftfahrtgerät Klasse 3).

7.6 Flight Weight and Flight Weight Centre of Gravity Position

The max. permissible flight weight is 600 kg (1323 lbs).

The permissible CoG positions are within the range of

270 - 480 mm (10.63 - 18.90 in)

aft of datum plane corresponding to

21.5 - 41.7 %

of the mean aerodynamic wing chord.

7.7 Mass of Non-Lifting Parts

Max. mass of all non-lifting parts 420 kg (926 lbs)

The mass of the non-lifting parts is the total of:

- fuselage and empennage
- equipment in the fuselage according to equipment list
- pilots and parachutes
- baggage
- additional equipment, not necessary for flight execution and which has not been subject to weighing.

7.8 Useful Load

The useful load is affected and limited by various factors:

- Mass of non-lifting parts
  The max. mass of the non-lifting parts (420 kg/926 lbs) minus fuselage mass, mass of the horizontal tail and the mass of the minimum equipment according to the Pilot's Operating Handbook Sec. 2.12 is one useful load value.

- Max. takeoff weight
  The max. takeoff weight of the glider (600 kg/1323 lbs) minus the empty weight is a second useful load value.

  The leading useful load value is the lower one.

The useful load comprises:

- pilots and parachutes
- baggage
- additional equipment

Useful Load in the Pilots' Seats

The max. useful load per seat is 110 kg (243 lbs) if there is no limitation with regard to the max. mass of the non-lifting parts or the max. takeoff weight.

The min. useful load in the front seat is 70 kg (154 lbs). Less must be compensated by trim weights.

Useful Load in the Baggage Compartment

The max. useful load in the baggage compartment is 10 kg/22 lbs (no baggage permitted during aerobatics) if the total useful load is not exceeded.

7.9 Lever Arms

Pilot:	1132 mm forward of datum for the front seat (44.57 in)
Copilot:	35 mm aft of datum for the rear seat (1.38 in)
Baggage:	810 mm aft of datum (mean lever arm) (31.89 in)
Pilot's trim weights:	1543 mm forward of datum with 1 trim weight (60.75 in) 1560 mm forward of datum with 2 trim weights (61.42 in)
Fixed nose ballast:	2350 mm forward of datum (92.52 in)
Fixed tail ballast:	4900 mm aft of datum (192.91 in)

8. List of Available Equipment

8.1 Safety Belts and Harnesses

5-part safety belts are required.

Belly Bands

Type	Manufacturer	Technical Data Sheet No.
Bagu FAG-7D/0	Autoflug	40.070/30
Bagu V	Gadringer	40.070/32

Attachments:
Both inside the fuselage shell on the right and left side of the seats.

Harnesses

Type	Manufacturer	Technical Data Sheet No.
Schugu FAG-7H/0	Autoflug	40.071/21
Schugu II	Gadringer	40.071/05

Attachments:
Both at the fuselage cross tube mounted behind the seats.

Floor Belts

Type	Manufacturer	Technical Data Sheet No.
Bogu FAG-7D/0	Autoflug	40.072/3
Bogu I	Gadringer	40.072/4

Attachments:
Belt attachment on the fuselage floor below the seats.

8.2 Instruments and Equipment

The following instruments are available to cover the minimum equipment of the glider (see also Pilot's Operating Handbook, Sec. 2.12)

- **Minimum Equipment**

Pitot Static Airspeed Indicator

Type	Art. No.	Manufacturer	Technical Data Sheet No.
6 FMS 4	6421	Winter	10.210/15
6 FMS 4	6423*	Winter	10.210/15

* for gliders with foreign certification and airspeed indication in kts only

Altimeter

Type	Art. No.	Manufacturer	Technical Data Sheet No.
4 FGH 10	411	Winter	10.220/46
4 FGH 10	433**	Winter	10.220/46
4 FGH 20	422	Winter	10.220/47
A-30		ACK Technologies	10.221/4
5934 M-1	**	United Instruments Inc.	TSO C10b

** for gliders with foreign certification and altitude indication in ft only

Encoding Altimeter (without indication)

Type	Art. No.	Manufacturer	Technical Data Sheet No.
A - 30	A - 30	ACK Technologies (USA)	10.221/4

G-Meter

Type	Art. No.	Manufacturer	Spec. No.
BM 470-RL		AOA Apparatebau Gauting	MIL-A-5885 A
2" 5V LITE		Bendix	MS 28025-1
3419-5A-A1	10-101	Bendix	MS 28025-1
B-6		Burton Manufacturing Co	MS 28025-1
6610	1007	INSCO	MS 33638
KAE 0504K		Kelvin & Hughes Ltd.	MS 23009-1
ABU-4/A		Milhard Engineering Co.	MS 23009-1
ABU-4/A	2094-6	QED/Inc.	MIL-A-25949 (ASG)
KAE 0504/K		Smiths	MS 23009-1

- Additional Equipment

Turn and Bank Indicator

Type	Art. No.	Manufacturer	Technical Data Sheet No.
WZ 402/ WZ 404		AOA Apparatebau Gauting	10.241/8
WZ-405		AOA Apparatebau Gauting	10.241/3
IFR 51	51-12-1	Instruments & Flight Research	TSO C3b

Vertical Speed Indicator

Type	Art. No.	Manufacturer	Technical Data Sheet No.
5 StVL	5361	Winter	10.230/11
5 StVLM	5561	Winter	10.230/12
5 StV	5231	Winter	10.230/13
5 StV	5251	Winter	10.230/13
5 StV	5253	Winter	10.230/13
5 StV	5261	Winter	10.230/13
5 StV	5281	Winter	10.230/13
5 StV	5291	Winter	10.230/13
5 StVM	5451	Winter	10.230/14
5 StVM	5453	Winter	10.230/14

Magneto Compass

Type	Art. No.	Manufacturer	FAA No.
C 2300		Airpath	ACE-FSD 042

VHF Transceiver

Type	Manufacturer	Technical Data Sheet No.
AR 3201	Becker	10.911/76
FSG 40-System	W. Dittel	10.911/45
FSG 50	W. Dittel	10.911/71
FSG 60 M	W. Dittel	10.911/72
FSG 70-System	W. Dittel	10.911/81
ATR 720 A	Avionik Dittel (Austria)	10.911/74
ATR 720 B	Avionik Dittel (Austria)	10.911/80

Oxygen System

Type	Manufacturer	Technical Data Sheet No.
Automatic Breathing System HLa	Drägerwerk	40.110/1
Respirator CM 71	Drägerwerk	40.110/13
OXYPORT	Drägerwerk	40.110/18

Emergency Locator Transmitter

Type	Manufacturer	Technical Data Sheet No.
EB-2B(CD) Eagle	Mar.Tech.Div.(USA)	10.915/2
Pointer 3000 AP/AF	Pointer	10.915/6*
JE 2 **	Jolliet Electronique	------

* different from the Technical Data Sheet, this ELT was also certified with a rubber coated helical antenna (Dittel, Part No. 340.0/00)

** only for French registered gliders

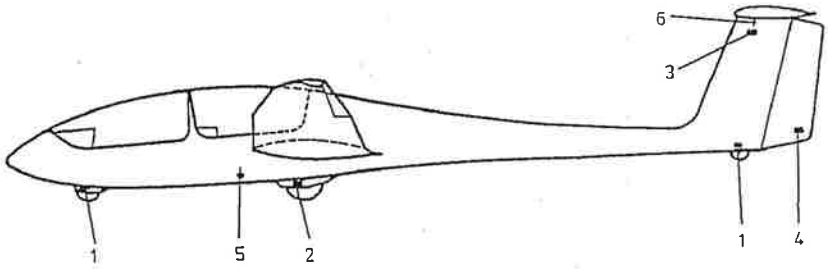
Hint for Equipment Installation

For information on approved items other than the above listed units please contact the aviation authorities.

(The installation of oxygen systems is also subject to approval and detailed inspection).

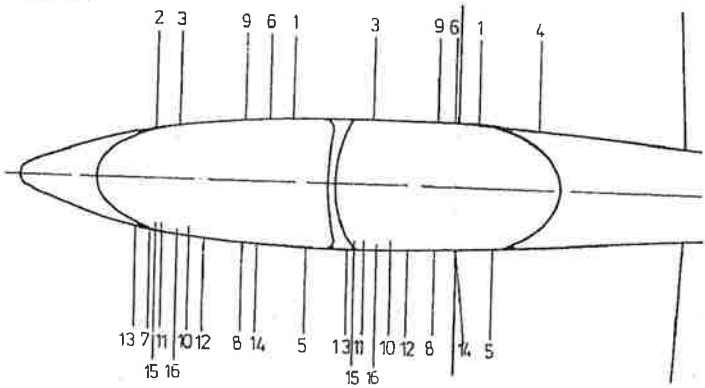
9. Placards and Symbols

9.1 Placards Outside



1	Tire Pressure 36 PSI 2.5 bar	Nose and tail wheel (right side)
2	Tire Pressure 39.8 PSI 2.8 bar	Main wheel fairing (right side)
3	Markings notice Rotating knob turned in Tailplane secured (cover closed)	Vertical fin (left side)
4	Don't push here	Rudder left and right side
5		Arrow to find winch-launching hook (left and right side)
6		Marking controlling correct rigging of the tailplane (four markings, two each at vertical and horizontal tail)

9.2. Placards Inside



1

Maximum flying weight		600 kg / 1323 lbs		
Maximum airspeeds:		**km/h**	**kts**	**mph**
in calm air:	V_{NE}	250	135	155
in rough air:	V_{RA}	170	92	105,5
aerotow:	V_T	170	92	105,5
winch or auto tow:	V_W	140	76	87
airbrakes extended:	V_{FE}	250	135	155
manoeuvering speed:	V_A	170	92	105,5

After OSB 315-66 had been completed:

Maximum flying weight		600 kg / 1323 lbs		
Maximum airspeeds:		**km/h**	**kts**	**mph**
in calm air:	V_{NE}	280	151	174
in rough air:	V_{RA}	200	108	124
aerotow:	V_T	185	100	115
winch or auto tow:	V_W	140	76	87
airbrakes extended:	V_{FE}	280	151	174
manoeuvering speed:	V_A	185	100	115

Right side wall of front and rear cockpit

2

Towing cable weak link

aero-, winch and automobile tow:	max. 845 daN max. 1863 lbs

Tire pressure

Main wheel:	36-39.8 psi	2,5 – 2,8 bar
Nose- and tail wheel:	36 psi	2,5 bar

Right side wall of front cockpit

3

Payload (Pilot and Parachute)		
Minimum in Front cockpit for all flight	70 kg	154 lbs
Less must be compensated with Trim Weights		
Maximum load front	110 kg	242 lbs
The maximum weight must not be exceeded		

right side wall of front and rear cockpit

4

Max. baggage:	10 kg	(22 lbs)
No baggage permitted during acrobatics		

right side wall above baggage compartment floor

5

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!

left side wall of front and rear cockpit

6

Canopy Jettison and Emergency Exit

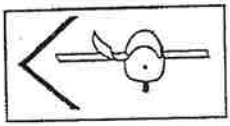
- Pull red handles on right and left of canopy fully back together
- Push canopy up and away with the left hand
- Release safety harness
- Stand up and get out over left or right side depending on the attitude
- When using a manual parachute grip release and pull firmly to full extent after 1-3 seconds

front and rear canopy frame right side near handle for emergency exit.

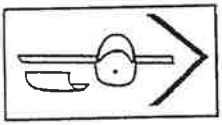
7

TRIM WEIGHTS				
PILOTS WEIGHT INCLUDING PARACHUTE	kg	55-62.4	62.5-69.9	70-110
	lbs	121-137	138-153	154-242
NUMBER		2	1	0
1 TRIM WEIGHT 5.6 kg (12.3 lbs)				

Left side wall of front cockpit

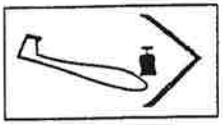
8 

front and rear canopy release

9 

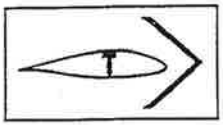
front and rear canopy jettison handle

10 

11 

each at the trim lever gate in the front and rear cockpit

12 

13 

each at the front and rear canopy frame above the airbrake lever

14 

at the canopy frame above the wheel brake lever

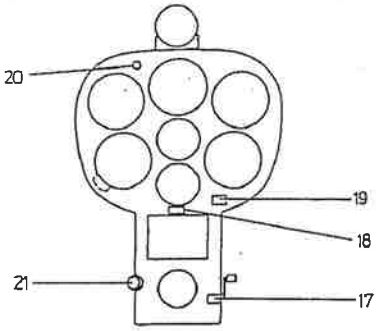
15

Caution! The guide plate acts as a stop! Do not enlarge the guides of the guide plate. Remove plate only for servicing!

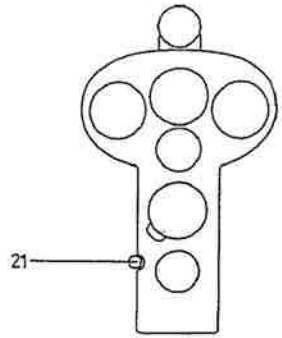
at the gate below the front and rear seat

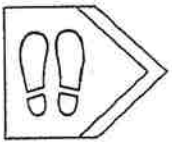
16 ■ green marking for neutral position of front and rear trim device

Front instrument panel



Rear instrument panel



17 

pedal adjustment

18

If trailing
lock g-meter

19

FÜR	N	30	60	O	120	150
FLIEGE						
FÜR	S	210	240	W	300	330
FLIEGE						

DATUM ASTIR

20 

near ventilation button

21 

front and rear cable
release button

The following placards are only in cockpits with English placards:

22

Simple aerobatics airspeeds

Recommended entry speed	km/hr	knots	mph
Loop	200	108	124
Stall turn	190	103	118
Spin	70	38	43
Chandelle	180	97	112
Roll	185	100	115

right side wall of front and rear cockpit

23

This sailplane must be operated in compliance with operating limitations as stated in the form of markings, placards and Flight Manual

left side wall of front and rear cockpit

24 depending on instruments

Altitude (ft)	0-6500	10000	16500	23000	29500
V_{NE} (KIAS)	151	143	130	116	103

left side wall of front and rear cockpit

or

Altitude (m)	V_{NE} IAS (km/h)
0-2000	280
-3000	265
-5000	240
-7000	215
-9000	190

near airspeed indicator

25 Only if SB 315-53 or ÄM 315-34107 or ÄM 315-34156 has been performed

When manual control for rudder is installed: - Pedals in the most forward position? - Check of airbrake gate-stop device! - Free movement of control and connections secured?	front cockpit

26 Only for ÄM 315-34107 or ÄM 315-34156

When manual control for rudder is installed: Airbrakes can only be actuated if front airbrake operating lever is kept disengaged!	rear cockpit

10. Maintenance References

- Hooks

  Operating Manual for Safety Tow Releases
  Series: Europa G 72 Safety Tow Release
  Europa G 73 Safety Tow Release
  Date of Issue: January 1989

  Operating Manual for Safety Tow Releases
  Series: Europa G 88 Safety Tow Release
  Date of Issue: February 1989

  Operating Manual for Tow Releases
  Series: E 72 Nose Tow Release
  E 75 Nose Tow Release
  Date of Issue: March 1989

  Operating Manual for Tow Releases
  Series: E 85 Nose Tow Release
  Date of Issue: March 1989

- Oxygen System

  Maintenance instructions of the different manufacturers.
  See also Technical Data Sheets concerned.

- VHF Transceiver

  Maintenance instructions of the different manufacturers.
  See also Technical Data Sheets concerned.

- Miscellaneous

  For other operating and maintenance instructions see documentation provided by the manufacturer of the unit concerned.

11. Airworthiness Limitations

11.1 Recording of Operating Hours

Any operating hours shall be recorded in the flight log.

11.2 Service Life

The original service life was established at 3000 operating hours. Within this period the presribed scheduled maintenance ensures airworthiness. Now, by means of special inspections, the service life can be extended step by step to 12000 operating hours.

11.3 Inspection Procedure for Increase of Service Life

1. General

   Fatigue tests with wing spars proved that the service life of FRP-gliders and motorgliders can be increased to 12000 operating hours, if the airworthiness of each aircraft can be proved again by means of a special multistage service life test programme (in addition to the mandatory periodical inspections).

2. Time Limits

   If an aircraft has reached a service life of 3000 operating hours a detailed inspection shall be conducted according to the programme described under Item 3. If the inspection results are positive or after the determined defects have been duly repaired the service life of the aircraft is increased by 3000 hours i.e. to a total of 6000 operating hours (1st stage).

   The inspection programme shall be repeated at 6000 operating hours. If the results are positive and the determined defects duly repaired the service life is increased to 7000 operating hours (2nd stage).

   If the glider has reached a service life of 7000 operating hours conduct the prescribed inspection programme again. If the results are also positive and the determined defects duly repaired the service life is increased to 8000 operating hours (3rd stage).

   The gradual extension of service life will be performed by steps of 1000 flight hours up to max. 12000 flight hours at this time (4th - 7th stage).

Additionally at 9500, 10500, 11500 operating hours inspection of the wing connecting bolts and the main spar spigots must be performed according to Service Bulletin TM 315-45, action 6.

3. In any case, ask for the latest issue of the inspection record which comprises the latest inspection results.

4. Inspections shall only be conducted by the manufacturer or an authorized repair shop.

5. The inspection results shall be entered into the inspection record provided with a comment on each means. If the inspection is conducted in an authorized repair shop a copy of the inspection record shall be forwarded to the manufacturer for information and evaluation.

6. The annual inspection according to § 27 (1) German LuftGerPO does not fall within the purview of this regulation.

11.4 Devices Subject to Life Limitation

- Tow Hooks

The installed TOST hooks (standard equipment) are subject to detailed inspection after 48 months of operation or 2000 tows or launchings.

- Oxygen System

TBO of installed oxygen systems can be seen from the corresponding acception report.
In addition, regulations similar to the German Druckgasverordnung require a detailed inspection of the oxygen bottles every five years, conducted by an authorized institution (similar to the German TÜV).

- Safety Belts and Harnesses

The service life data provided by the safety belt and harness manufacturers are obligatory.

12. List of Special Tools

Tool	Application
Nicropress pliers and reference gauge	cable connections

BURKHART GROB

LUFT-UND RAUMFAHRT GmbH & Co. KG

8939 Mattsies

REPAIR INSTRUCTIONS

Type : GROB G 103 C "TWIN III ACRO"

Serial No. : .....

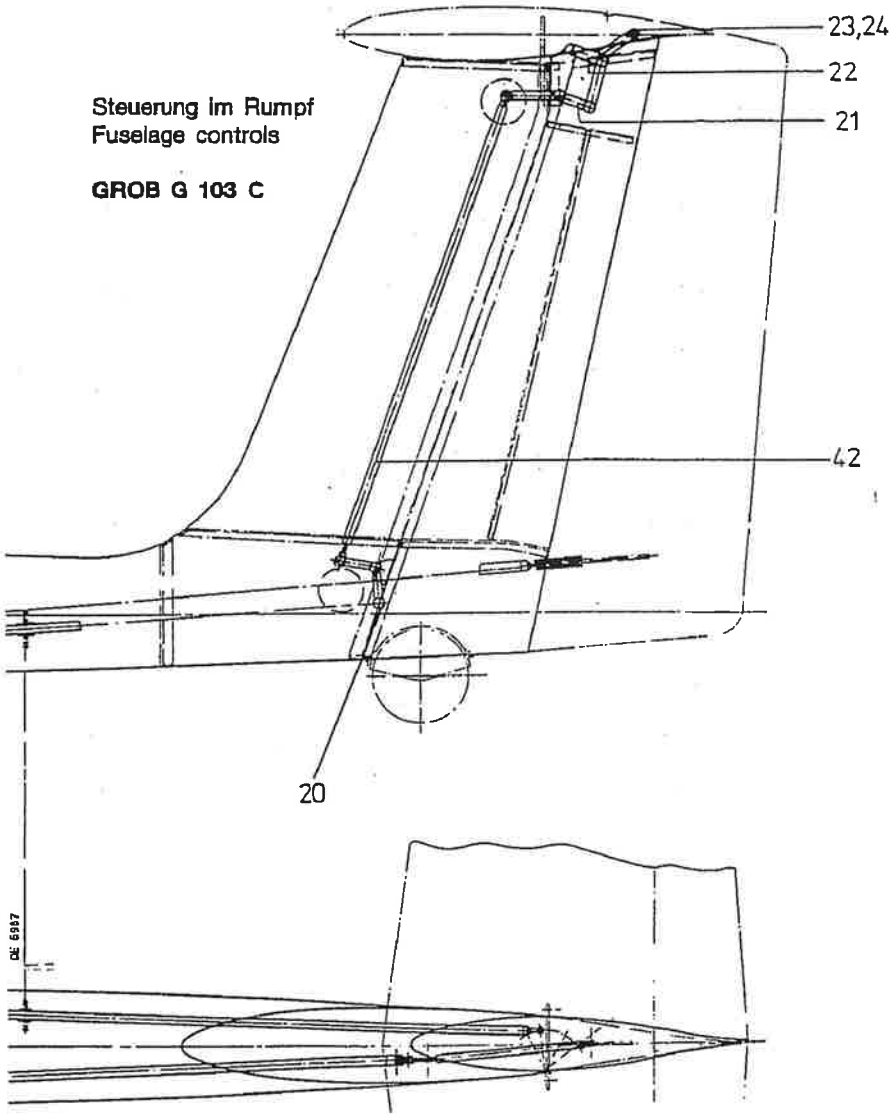
Registration No.: .....

Date of Issue : January 1989

Owner : .....

.....

.....


Steuerung im Rumpf
Fuselage controls
GROB G 103 C
23,24
22
21
42
20
DE 6917

Parts List: Fuselage Controls

Item	Designation	Part No.
1	Stick assembly front	103 C - 4701
2	Stick assembly rear	103 C - 4710
	as standard as of S/N 34171	103 SL- 4710
5	Pedal assembly front	103 C - 4800
	as standard as of S/N 34171	103 SL- 4800
6	Pedal assembly rear	103 C - 4420
	as standard as of S/N 34171	103 SL- 4420
7	Airbrake-trim unit front	103 C - 4405
8	Airbrake-trim unit rear	103 C - 4412
	as standard as of S/N 34171	103 SL- 4412
10	Swivel unit	103 C - 4419
11	Rudder lever	103 B - 4430/1
13	Reversing left	103 C - 4431
14	Reversing right	103 B - 4434/1
15	Airbrake reversing	103 B - 4437
16	Rudder swivel	103 B - 4441
17	Aileron lever	103 B - 4454/1
18	Airbrake lever	103 B - 4451/1
		103 C - 4451
20	Lever	103 B - 4761
21	Lever	103 C - 4763
22	Lever	103 B - 4765
23	Elevator connector left	103 B - 4767
24	Elevator connector right	103 B - 4768
30	Aileron rod 1	102C3 - 4351/1
31	Aileron rod 2	103 C - 4552
32	Aileron rod 3	103 B - 4553/1
33	Aileron rod 4	103 B - 4554
34	Aileron rod 5	103 B - 4555
35	Aileron connector left	103 B - 4557
36	Aileron connector right	103 B - 4556
37	Elevator rod 1	103 B - 4560
38	Elevator rod 2	103 B - 4561
39	Elevator rod 3	103 C - 4562
40	Elevator rod 4	103 B - 4563
41	Elevator rod 5	103 A - 4790
42	Elevator rod 6	103 C - 4794
43	Airbrake rod 1	103 C - 4570
44	Airbrake rod 2	103 B - 4571
45	Airbrake rod 3	103 C - 4572
46	Airbrake rod 4	103 B - 4573
47	Airbrake rod 5	103 B - 4574

Parts List: Fuselage Controls (continued)

Item	Designation	Part No.
48	Airbrake connector left	103 B - 4591
49	Airbrake connector right	103 B - 4558
50	Trim rod 1	103 C - 4785
51	Trim rod 2	103 C - 4786
52	Rudder rod 1	103 B - 4586/1
53	Rudder rod 2	103 B - 4587
54	Rudder rod 3	103 A - 4692
60	Spring	103 C - 4760.02
61	Spring	103 C - 4760.03

If SB 315-53 is included

replace

Item	Designation	Part No.
1	Stick assembly front	103 C - 4701
7	Airbrake trim unit front	103 C - 4405
8	Airbrake trim unit rear	103 C - 4412
43	Airbrake rod 1	103 C - 4570

by

Item	Designation	Part No.
	Stick assembly front	103 C - 4905
	Airbrake trim unit front	103 C - 4910
	Airbrake trim unit rear	103 C - 4915
	Airbrake rod	103 C - 4920

Additional parts

Item	Designation	Part No.
	Rudder hand lever	103 C - 4930
	Rod	103 C - 4950
	Connection	103 C - 4935

Parts List: Wing Controls

Aileron Controls:

Item	Designation	Part No.
1	Connection lever left	103 B - 4735
	Connection lever right	103 B - 4736
3	Differential lever left	103 B - 4737
	Differential lever right	103 B - 4738
5	Aileron lever	115 - 4254
6	Aileron rod 6	103 C - 4113
7	Aileron rod 7	103 C - 4114
8	Aileron rod 8	103 C - 4115
9	Yoke	102 - 4249
10	Bracket	109 - 2053
11	Bracket	102C3 - 2054

Air Brake Controls:

Item	Designation	Part No.
1	Swivel left	103 C - 4721
	Swivel right	103 C - 4722
3	Locking lever left	103 C - 4723
	Locking lever right	103 C - 4724
5	Airbrake rod 6 left	103 C - 4117
6	Airbrake rod 6 right	103 C - 4118
7	Airbrake rod 7	103 C - 4119
8	Airbrake rod 8	103 C - 4120
9	Bracket left	103 C - 4105
	Bracket right	103 C - 4106

A3. Inspection Holes

The control elements in the rear fuselage are easily accessed through two plexiglass inspection holes on the left side of the fuselage.

The bottom inspection hole is at the lower part of the vertical fin thus allowing the access of the bottom elevator guide if the rudder is removed. The top inspection hole provides for easy access of the automatic control junction. See also Appendix A1.

Access of the wing controls is provided by three plexiglass inspection holes each on the lower side of the wings. They are near the aileron shift levers and the airbrake locking lever. See also Appendix A2.

A4. Colour Markings

The colour markings on the fuselage consist of ornamental stripes leading from the tow hook to the canopy louver and from the tow hook to the wing roots below the canopy. There is another ornamental stripe on the left and right side of the vertical tail.

The colour of the ornamental stripes is RAL 3003.

Table of Contents

S/N 34120

1. General

The "TWIN III" glider is made of composite material (FRP). The fuselage consists of GRP (laminate). Wings and horizontal tail are GRP-foam-sandwiches, the vertical tail consists of GRP-tridimensional-cloth-sandwich.
The wing spar is made of carbon rovings. Rudder and elevator control surfaces are made of CRP.

2. Used Material and Suppliers

Resin:	GE 162/163 100 GWT SHELL	or	Rütapox L 20 100 GWT BAKELITE
Hardener:	SL 38 GWT BAKELITE		Rütapox VE 2896 18 GWT BAKELITE

as standard as of S/N 34171:

Resin:	L 285 100 GWT
Hardener:	285/286/287 38 - 40 GWT Fa. MGS

GWT = parts by weight (mixture ratio)

Suppliers:

Bäder GmbH & Co. KG
Lackfabrik
P.O.Box 25
D-7300 Esslingen

Bakelite
Varziner Str. 49
D-4100 Duisburg 12

MGS
Martin G. Scheufler
Kunstharzprodukte GmbH
P.O.Box 610238
D-7000 Stuttgart 61

Glass Fibre Cloth:

Use	Cloth	Weight g/m²	INTERGLAS No.
Fuselage	Twill 2/2 Twill 2/2 Basket weave	161 390 433	92 110 92 140 92 146
Wings	Twill 2/2 Twill 2/2 Twill 2/2	161 276 390	92 110 92 125 92 140
Ailerons	Twill 2/2 Twill 2/2	161 276	92 110 92 125
Rudder and Elevator	Basket weave	80	90 070

All glass fibre cloth consists of alkali-free E-glass with Volan-A-Finish or Finish I 550.

Supplier: Interglas Textil GmbH
Söflinger Str. 246
D-7900 Ulm

Carbon Fibre Cloth:

Use	Cloth	Weight g/m²	CRAMER No.
Elevator and rudder	Basket weave	122	490

Supplier: C. Cramer
Weberei Heek-Nienburg GmbH & Co. KG
P.O.Box 209
D-4438 Heek-Nienburg

	Supplier:
Glass Roving: EC 9-756 K 43	Gevetex P.O.Box 12 05 D-4000 Düsseldorf
Tridimensional Cloth: 83 108 13 413 (as of S/N 34171)	Vorwerk Möbelstoffwerke GmbH & Co. P.O.Box 2029 D-8650 Kulmbach
Carbon Roving: Tenax HTA 12 K	ENKA AG P.O.Box 10 01 49 D-5600 Wuppertal 1
Carbon Fibre Layer: KDU 1009	SIGRI GmbH P.O.Box 11 60 D-8901 Meitingen
Foam Material: PVC Hard Foam Divinycell H 60 Thickness: 3, 4, 6 and 8 mm Spec. weight 60 kp/mS3T	Diab-Barracuda Am Bahndamm 20 D-3000 Hannover 91
Filling Material for Resin: Microballoons brown	Bäder GmbH & Co. KG Lackfabrik P.O.Box 25 D-7300 Esslingen
Cotton Flocks	Schwarzwälder Textil-Werke P.O.Box 4 D-7623 Schenkenzell

S/N 34120

Paint:
PE-Gel-Coat
white, No. 03-69066
UP Hardener No. 07-20510
100 GWT Gel-Coat
3 GWT Hardener
Thinner No. 06-30260

Lesonal-Werke
P.O.Box 30 07 09
D-7000 Stuttgart 30

as of S/N 34171:
UP-Vorgelat T 35
UP-Hardener SF 2
Thinner SF

MGS
Martin G. Scheufler
Kunstharzprodukte GmbH
P.O.Box 610238
D-7000 Stuttgart 61

Red Paint:
Nitro-Cellulose-Kombilack
RAL 3003

Bäder GmbH & Co. KG
Lackfabrik
P.O.Box 25
D-7300 Esslingen

Canopy Glazing:
Material: - white 245; 3 mm acc. to WL 5.1412
- blue 2421; 3 mm Röhm
- blue 7704; 3 mm Perspex

Cables:
B 2.4 LN 9374 galvanized C steel wire
B 3.2 LN 9374 galvanized C steel wire

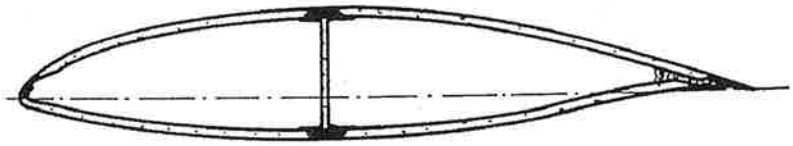
Cable Connections:
Thimbles: A 3.5 DIN 6899 hot galvanized
Clamps: Nicropress NT 28 2 G or NT 28 3 M

3. Simplified Lamination Layup Plan

Reinforced areas subject to special loads and stress have not been considered.

- Wing

Outer Laminate:	1 layer 92 110 diagonal 1 layer 92 125 diagonal
Core:	Dininycell H 60 8 mm
Inner Laminate:	1 layer 92 140 diagonal to BMET 5500* 1 layer 92 125 diagonal to BMET 7000* 1 layer 92 110 diagonal to wing tip



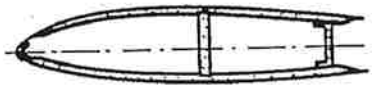
- Fuselage

1 layer 92 110 lengthwise
1 layer 92 146 lengthwise
3 layers 92 140 diagonal

* BMET = reference middle plane wing

- Elevator Fin

Outer Laminate:	2 layers 92 110 diagonal
Core:	Dininycell H 60 6 mm
Inner Laminate:	1 layer 92 110 diagonal



- Elevator

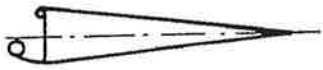
Outer Laminate:	1 layer 90 070 lengthwise 1 layer 490 diagonal
Core:	Dininycell H 60 3 mm
Inner Laminate:	1 layer 490 diagonal

- Rudder

Outer Laminate:	1 layer 90 070 lengthwise 1 layer 490 diagonal
Core:	Divinycell H 60 3 mm
Inner Laminate:	1 layer 490 diagonal

- Aileron

Outer Laminate:	1 layer 92 110 diagonal 1 layer 92 125 diagonal
Core:	Divinycell H 60 4 mm
Inner laminate:	1 layer 92 110 diagonal



4. Repair of FRP Members

If the glider is damaged, first examine the extent of damage. Most frequently, other structural parts are involved, fractures extend invisibly underneath the outer surface.
Repairs shall be carried out with extreme care. The outer skin of FRP aircraft is load bearing; structural failure could lead to a crash.
Keep to the exact resin-hardener mixture ratio (± 0.5%), using a clean mixing pot. The glass fibre to resin mixture ratio is appr. 50:50. Grind the sections to be repaired only before laying up the saturated laminate to avoid dirt penetration and thus loss of safe adhesion.
Similar to plywood, the direction of the single fibres (lengthwise or diagonal) is of great importance to strength. You can see from the simplified lamination layup plan how many layers are necessary to recover the structural strength of the repaired section. In any case, determine the thickness of the destroyed laminate. If you break off a piece and burn it, the resin will burn out. The glass cloth will remain thus allowing to determine kind, number of layers and direction.
Splicing is time-consuming. Grind the surface so that the cloth patches do not protrude the contour. Do not grind them off.
If you want to decrease the hardening time, increase the ambient temperature by means of a fanforced heater.

Attention: A too higher temperature will produce large air bubbles in the cloth. Establish a foil tent into which the hot air is passed thus avoiding local overheat.

See to it that the weight of repaired control surfaces does not increase to avoid the danger of flutter (see also Sec. 3.3).

5. Damage to Sections of FRP-Foam-Sandwich
(FRP-Hard-Foam-Sandwich)

It might appear that only the surface (outer laminate) is damaged, however it can easily be that the entire skin (outer and inner laminate and hard foam) is destroyed.

a) Simple Surface Damage (Pic. 1 Page A 5.12)

In the proximity of a crack, the laminate can become detached from the supporting foam. Determine the section by knocking. Remove the detached laminate (grinding disk, grinding block or sharp knife). Splice the cloth around the damage by means of a grinding sheet. Splice length per layer appr. 20 mm; laminate thickness to splice length ratio appr. 1:50.

After splicing, clean the repaired section thoroughly as follows:
- Remove the grinding dust (also from the foam pores!) with compressed air
- Clean the splice with carbon tetrachloride or acetone in case it had been contaminated with dirt or grease.

Attention: Do not wipe Gel-Coat into the splice.

Fill the dimples and foam pores with resin and Micro-balloons. Then apply the required laminate in the correct direction.

Important: Large patches first - repairs must be free from dirt and grease.

At ambient temperature, the resin will harden in about 8 hours. The repaired section may now be grinded, primed and painted.

Attention: Grind the edges of the cloth patches only!

b) Damage to the Entire Sandwich (Pic. 2 + 3 Page A 5.12)

If the inner laminate is destroyed first remove the outer laminate not adhering to the foam. Now open out the hole until the inner laminate is adhering to the foam. For repair of the inner laminate, remove the supporting foam to obtain an edge of at least 20 mm (laminat??thickness to edge ratio: appr. 1:50).
The outer laminate shall be spliced in accordance with the description under a), the inner laminate be cleaned from foam and ground thoroughly. With minor damage a piece of thin plywood can be glued with Pattex on the inner skin. Lay the cloth patches of the inner laminate in and fill the hole with resin and Microballoons, mixed with Styroporballs. When hardened (appr. 8 hours at ambient temperature), grind the surface and lay up the outer cloth.
The plywood support can be inserted through the skin if the hole is of slotted shape. If you provided the plywood with one or more thin nails you can now press the plywood to the skin from outside.

Attention: The plywood support must fit well to avoid wrinkles in the cloth.

With large holes in the sandwich, use hard foam instead of Microballoons due to weight reasons. Prepare a piece of foam which exactly fits into the existing hole. Fill the inside pores with resin and Microballoons and lay on the inner cloth to harden. After hardening, the one-side laid foam is still bending (use fanforced heater). Now apply the foam with stiffened resin (cotton flocks, Microballoons) to the hole. Grind the upper side and fill the pores with Microballoons. Lay up the outer cloth.

6. Damage to Sections of FRP-Tridimensional-Cloth-Sandwich

(Pic. 4 Page A 5.12)

Repair is similar to repair of damage to foam sandwich.
The damaged section must be spliced and cleaned.
With minor damage, it is advisable to replace the tridimensional cloth by three layers 92 125 and Microballoons.
For major damage, three methods of repair are possible.

- Tridimensional cloth shall be laid up and hardened. Splice the edges, lay up the usual layers and laminate the splice with additional layers 92125.

- Build a pressure frame for the splice. Laminate tridimensional cloth and residual layups. Tighten the frame and press the tridimensional cloth (wedge-shaped) in the splice.

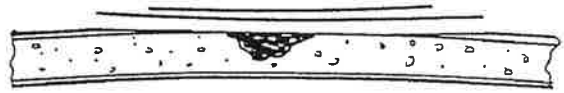
- Make a shape with skin layup and insert it form-closed after hardening. Splice the damage edges and replace the tridimensional cloth at the splice by 3 layers 92 125 and Microballoons.

7. Damage to Sections of FRP Laminate

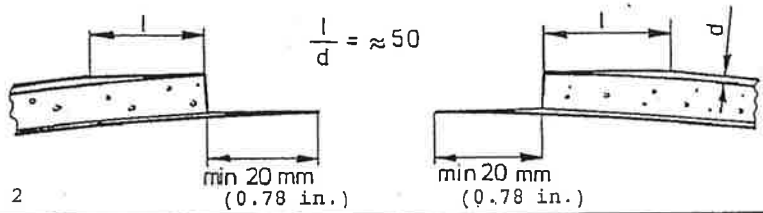
(Pic. 5 Page A 5.12)

Repair is quite simple. Splice the laminate around the hole, lay up the cloth (large patches first) and after 2 to 3 hours when the resin starts hardening, fill the damage with resin and Microballoons. Splice length per layer appr. 20 mm, laminate thickness to splice length ratio appr. 1:50. If the splice is contaminated clean it with carbon tetrachloride or acetone.

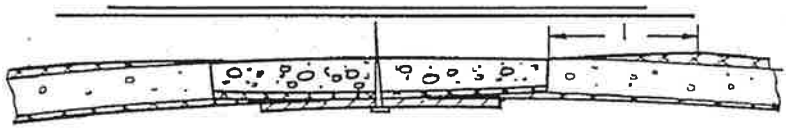
With major damage, build a support (plywood). Saturated laminate should not bridge a gap of more than 20 mm without support. Apply the plywood with Pattex glue and remove it with nails to outside (e.g. at damage to the fuselage).



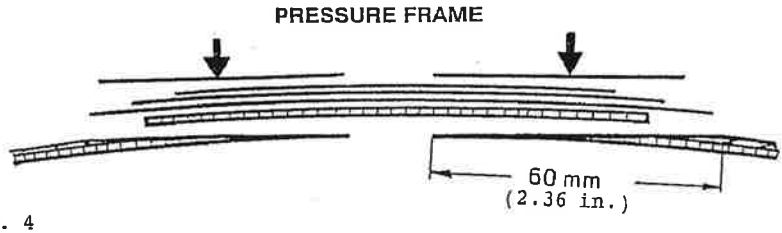
Pic. 1



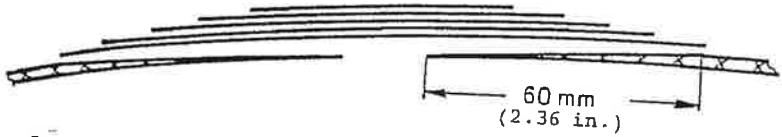
Pic. 2



Pic. 3



Pic. 4



Pic. 5

8. Damage to Spar Flange

The spar flanges consists of CRP rovings, at the outer wing (from 7500 mm of semi-span) of carbon layup band. In any case, broken spar flanges require a major repair (see Item 12). The laminate thickness to splice length ratio shall be 1:100.

9. Paint-Work

As soon as the laminate of the repaired section has hardened use sandpaper (80 grit) for coarse-grinding. Large unevenness must be filled with white Polyester filler.

Then use fine dry-grinding paper (150 grit) to obtain a uniformly rough surface.
Before painting, clean the repaired section entirely from grinding dust, parting compounds and other foreign bodies.

Apply the paint (Gel-Coat + Hardener) with a not too soft brush, put on several thin coats until the laminate can no longer be seen. The different coats should be allowed to harden. Then grind them with 360-grit wet-grinding paper to determine the sections that require additional Gel-Coat. Finish is with 600- or even 800-grit wet-grinding paper. Paint-work is terminated by polishing.

10. Repair of Fittings

a) Steel Fittings

Steel fittings should only be repaired after consultation with the manufacturer.
Welded fittings (pushrods) consist of 1.7734.4 or St 35 BK. Only the WIG (Wolfram-Inert-Autogenous) method of welding shall be applied by using the additional welding materials 1.7734.2 (for 1.7734.4) and 1.7324.0 (for St 35 BK or combinations of 1.7734.4 and St 35 BK)

b) Plug Junction Wing-Fuselage

The plug junction (4x in the fuselage) between wing and fuselage is by 6 steel balls (diameter 7 mm) which are kept in the groove of the flexible transverse force bolt by means of the connecting bush.
If one or more balls are missing, the connecting tube shall be replaced.

c) Pushrods

The pushrods consist of:

Tube 16 x 1	Material 1.7734.4
Tube 16 x 0.75	Material St 35 BK acc. to DIN 2391
Tube 20 x 1	Material 3.2315.51 or 3.3206.71

Buckled or extremely bent aluminium tubes may not be straightened.

S/N 34120

11. Replacement of Cables

Cable connections shall be established in accordance with

GAircraft Inspection and Repair FAA AC 43.13-1AH.

Any established connection has to be inspected.

12. Major Repairs

Major repairs shall only be conducted by the manufacturer or an authorized repair shop (according to the manufacturer's instructions).
To the major repairs belong the following:

- Broken wings, fuselages, tails, control surfaces, spar stubs
- Torn-out main fittings (in the fuselage: tubes diameter 55 x 3; horizontal tail connection inside the vertical tail; in the wing: flexible transverse force bolts diameter 24 mm, ball-and socket-joint GE 25, stub bolt diameter 25 mm)
- Damaged GRP laminate (white spots, cracks) in close proximity to the main fittings.