I. 1. Updates

Current number	Page	Reference	Date	Signature
1	21	Control of tailplane (TM 315-11 only until serial no. 3550)	1. Oct. 80	
2	5a	Reference to flight manual for acrobatics (only for GROB G 103 A)	1. Dec. 80	
3	1, 8, 10, 12, 13, 20, 20 a	Modification of serial no. 3730 and subsequent	1. Apr. 82	
4	1, 7, 14, 21, 23 (5a)	Automatic connection of elevator and spring trimm system of serial no. 33879 and subsequent (only for GROB G 103 A)	30. June 84	

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FLIGHT HANDBOOK
GROB G 103 »TWIN II«

This handbook must be carried on board at all times.

It refers to the GROB G 103 Sailplane

Registration:

Factory Serial Number: 3557

Owner: _____

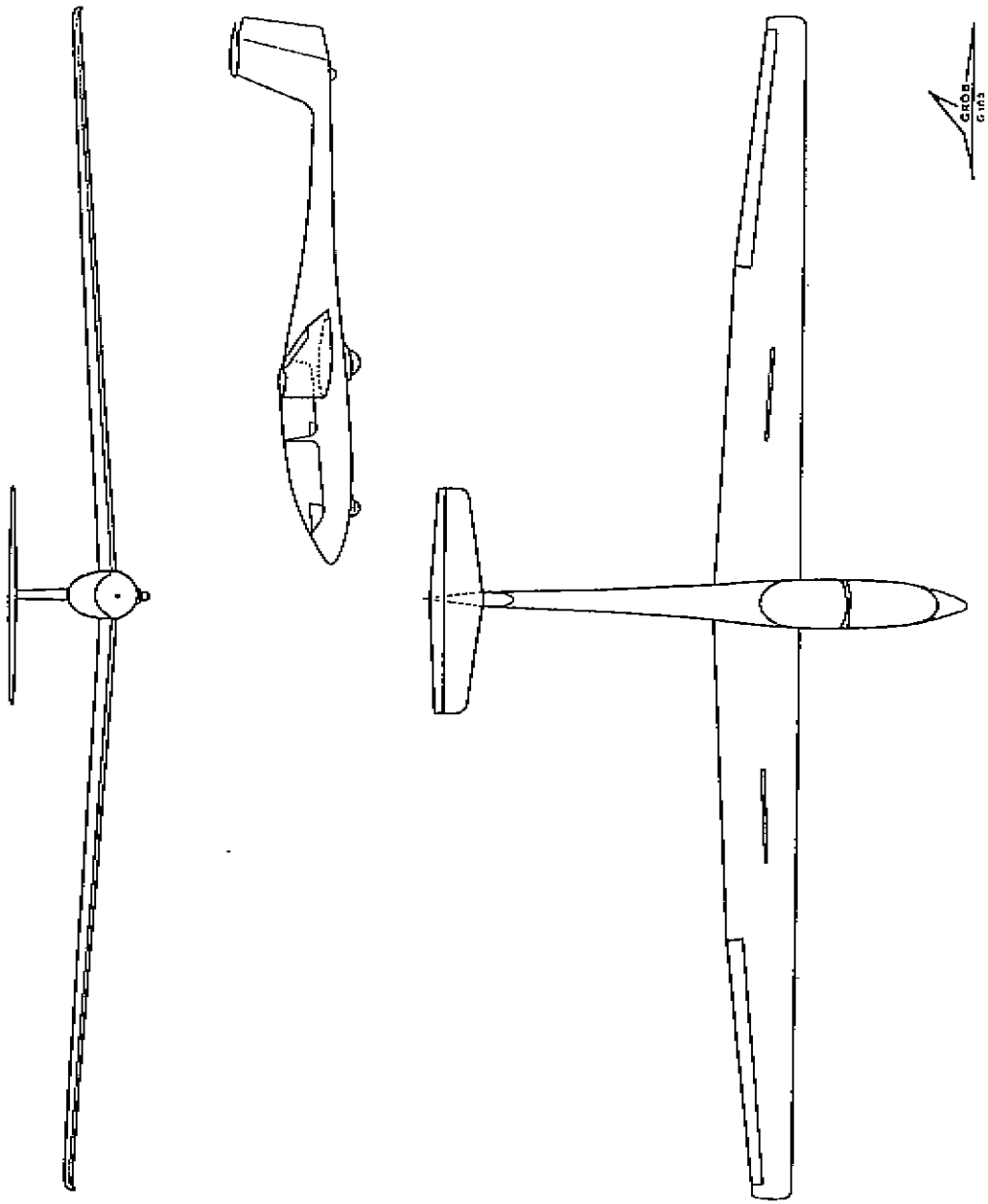
_____

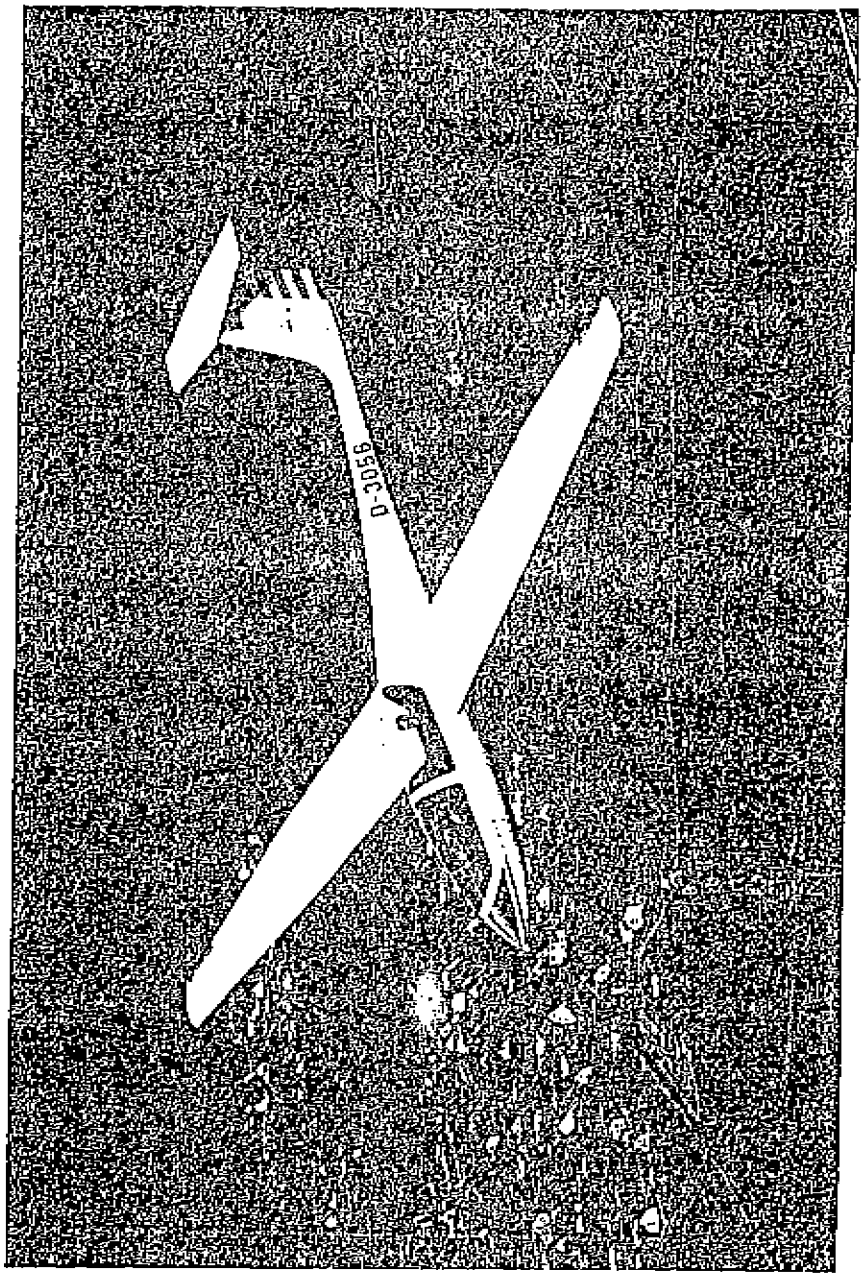
_____

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

Published December 1980

Contents





I. 5 Description

The „TWIN II" is a high performance two seater sailplane with a T-tail, fitted with a nonretractable tandem undercarriage and upper surface airbrakes.

This sailplane ist manufactured using the latest techniques in industrial Glass fibre construction.

It is designed for training, high performance and simple aerobatic flying.

Technical Data:

Span	17.5 m	(57.4 ft.)	Wing Area	17.8 m² (191.6 ft.²)
Length	8.18 m	(26.8 ft.)		
Height	1.55 m	(5.1 ft.)	Maximum Flying Weight	580 kg (1279 lbs)
Aspect Ratio	17.1		Maximum Wing Loading	32.6 kg/m² (6.68 lbs/ft.²)

II. Operating Limits

II. 1 Airworthiness Group

(U, Utility, LFSM)

The LFSM (Lufttüchtigkeitsforderung für Segelflugzeuge und Motorsegler) published 23. 10. 1975 are the basic rules and requirements for the licensing of a new type of glider or motor glider in Germany.

II. 2 Permitted operating conditions.

The plane is licensed for:

1. Flight In VMC
2. Simple Aerobatics (Loops, Stall turns, Lazy eight, Chandelle and Spin).
3. Cloud flying (When fitted with suitable instrumentation as defined in section II. 3).

II. 3 Minimum equipment

1. 2 Air speed Indicators reading to 300 km/h (162 kts, 187 mph)
2. 2 Altimeters.
3. Full Harness Straps in front and back cockpit.
4. Parachute or back cushion at least 7 cm (3 inch) thick for each occupant.
5. Loading limit plaque in front and back cockpit.
6. Flight Limits plaque.
7. Flight Handbook.

The glider GROB G 103 A „TWIN II ACRO" is derived from the GROB G 103 „TWIN II". Due to structural reinforcements the „TWIN II ACRO" is approved and certified for acrobatics in conjunction with the following valid operating instructions:

Flight handbook for acrobatics, GROB G 103 A „TWIN II ACRO", edition February 1984, LBA approved.

These operating instructions must be added to the flight manual and contain special instructions valid for acrobatic operations. Main modifications to the „normal" flight manual are contained in the following sections:

The following items were modified in the maintenance handbook with respect to the acrobatic version:

References to the flight handbook for acrobatics are shown on the affected pages of the „standard" flight manual.

II. 6 Weight limits

Empty weight . . . . . about 380 kg(837,7 lbs)
Maximum flying weight . . 580 kg(1278,67 lbs)
Maximum permitted weight of non lifting parts 400 kg(881,84 lbs)

II. 7 Centre of gravity position

The approved range of centre of gravity positions during flight is 260 mm (10.24 inches) to 460 mm (18.11 inches) behind the datum line, equivalent to 24.7% to 43.6% of the M.A.C. of the wing.
A/c attitude: incidence board of 600:24 angle.
The datum line is the front edge of the wing at the wing root.

The approved centre of gravity range does not get exceeded by the payload distribution specified in the loading plan II. 8.

The exact position of the centre of gravity at flying weight can be calculated according to VI. 5.

II. 8 Load scheme „TWIN II"

Minimum load in the front seat for all flight . .	70 kg (154 lbs)
Maximum load in the front seat	110 kg (242 lbs)
Maximum load in the back seat	110 kg (242 lbs)
Maximum load in both seats	220 kg (485 lbs)
Maximum load in the baggage compartment .	10 kg (22 lbs)

The maximum flying weight of 580 kg (1278,67 lbs) must not be exceeded.
Compensate missing weight in first seat through immovable ballast in first seat

December 1980

Date of weighing: carried out by.	Equipment list used for weighing (date)	Empty (Weight) kg/lbs	Position of cg empty behind reference mm/inches	Maximum total payload kg/lbs
TIMDENS	1996.	554 lbs	740 mm	422
Tim Dods	1996	388 KG	740 mm	192 KG

December 1980

Cloud Flying.

For cloud flying the additional instruments listed below must be installed.

1. Variometer.
2. Electric turn and slip indicator.
3. Magnetic Compass (Compensated inside the glider).
4. VHF-radio (operational).

II. 4 Maximum Speeds

Maximum permitted speed in calm air	V_{NE}	= 250 km/h (135 kts, 155 mph)
Maximum permitted speed in rough air	V_a	= 170 km/h (92 kts, 105 mph)
Maximum Manoeuvring speed	V_M	= 170 km/h (92 kts, 105 mph)
Maximum winch launch speed	V_W	= 120 km/h (65 kts, 74 mph)
Maximum Aerotow speed	V_T	= 170 km/h (92 kts, 105 mph)

Conditions in rough air are similar to those encountered in rotors, clouds, whirlwinds and when overflying mountain ranges.

Manoeuvring speed is the maximum speed at which full control deflections may be used. At maximum speed (VNE) the control deflections should be restricted to 1/3 of the full range.

Air speed indicator markings

77-170 km/h	=	42-95 kts =	48-105 mph	– Green arc
170-250 km/h	=	92-135 kts =	105-155 mph	– Yellow arc
at 250 km/h	=	135 kts =	155 mph	– Red line
at 95 km/h	=	51 kts =	59 mph	– Yellow triangle (minimum recommended appr. speed)

True airspeed is higher than indicated air speed at altitude.

Altitude (ft)	0-6500	10000	13000	16500	19000
VNE (indicated knots)	135	128	121	115	109
(indicated km/h)	250	237	225	213	202

II. 5 Flight envelope.

The sailplane design limit load factors are as follows:

At manoeuvring speed	+ 5.3 – 2.65
At VNE	+ 4.0 – 1.5

(Brakes closed and calm air)

30. June 84 (ÄM 315-14)

II. 9 Tow hooks

For Aerotow: Nose hook „E 75" with modification 1-79.

For Winch launch: Safety back release hook „G 72" or „G 73".

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 overhauled by the manufacturer.

II. 10 Weak link strength

Winch launch and aerotow max 754 daN, max 1662 lbs

II. 11 Tire Pressure

mainwheel	6.00-6	2.8	bar
nosewheel	260 x 85	2.5	bar
tailwheel	210 x 65	2.5	bar

II. 12 Crosswinds

The maximum crosswind component approved for take off and landing, is 20 km/h (11 kts, 12 mph).

III. Emergency procedures

III. 1 Spin recovery

Recovery from spin can be accomplished by the standard recovery procedure:

- Full opposite rudder
- Stick forward
- Ailerons should be neutral
- When rotation stops neutralise rudder and pull out gently.

III. 2 Canopy Jettison and Emergency Exit

- Pull red handles on right and left of canopy full back simultaneously.
- 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 extend after 1-3 seconds

III. 3 Miscellaneous

Flying in rain

No noticeable deterioration of flying characteristics is caused by wet or lightly iced wings. A heavy deposit on the wing raises the stall speed by about 6 knots:

Increase approach speed by 6 knots.

The characteristics during lift off and touch down remain the same.

Wing dropping

If a wing drops in a turn or straight flight, leave the stick neutral and apply rudder against the direction of rotation.

Ground looping

The aircraft is not prone to ground loop on take off.

If one wing touches the ground or the aircraft changes direction by more than 15 degrees, release cable immediately.

IV. 2 Daily preflight inspection

1. a) Open canopy.
   b) Check the 4 wing fastenings inside the fuselage if locked.
   c) Visually check all controls inside the cockpit.
   d) Check for foreign bodies.
   e) Test controls for full and free movement.
   f) Check tire pressure 2.5 – 2.8 alm. = 35.6 – 39.8 PSI
   g) Check condition of both hooks.
   h) Check functioning of releases and wheelbrake.

2. a) Check top and bottom of wing for damage
   b) Check ailerons for condition, freedom of movement and play.
   c) Check airbrakes for condition, locking and fit.

3. Check fuselage for damage especially on the underside including landing gear and undercarriage suspension.

4. Check tail unit for correct assembly and that safety lock is in position.

5. Check condition of the tail wheel.
   Check the pitot tube, total energy venturi and static vents are clean.

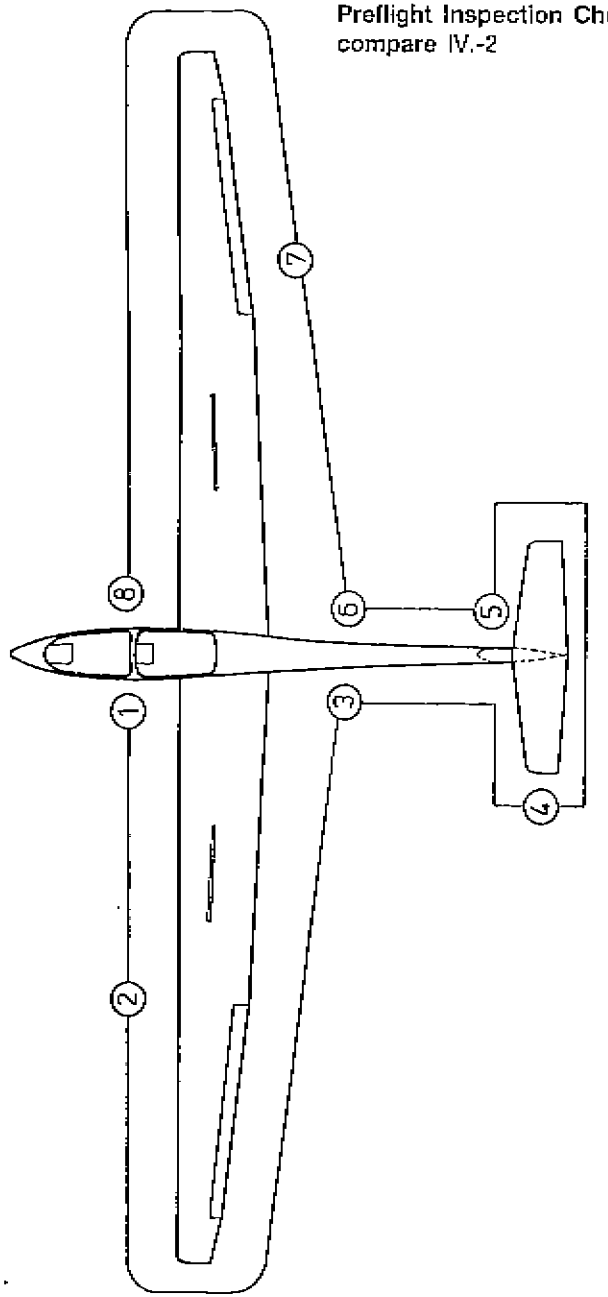
6. Repeat step 3 for right side of fuselage.

7. Repeat step 2 for right wing.

8. Check condition of the nose wheel.

After heavy landings or excessive flight loads the entire glider should be checked. The wings and tailplane should be removed for these checks and if any damage is found an inspector should be consulted. The plane should not be flown before any damage is repaired.

Preflight Inspection Checkpoints
compare IV.-2



IV. 3 Control checks before take off

1. Check all controls for full and free movement.
2. Check that the ballast limitations are being adhered to.
3. Check safety belt and parachute are firmly fastened.
4. Check altimeter is adjusted to zero or airfield height.
5. Check that transmitter is switched on and set to airfield frequency.
6. Check trim is neutral.
7. Check canopy is closed and locked.
8. Check airbrakes are closed and locked.

IV. 4 Take off

Winch launch

Trim lever should be in central position.
Maximum winch launch speed is 120 km/h (65 kts, 74 mph).
The glider has a release hook in front of the mainwheel.
Winch launches cause no difficulties at all allowed centre of gravity positions and wing loadings.
The plane has no tendency to balloon up or to swing on the ground.
One should push forward slightly on the stick below about 100 metres (330 ft.) in the case of fast launches from a powerful winch. When the cable slackens pull the release firmly to its limit.

Aerotow

Trim levers should be in central position.
Maximum aerotow speed ist 170 km/h (92 kts, 105 mph).
Aerotow should preferably use the nose hook.
The recommended length of tow rope is 40–60 m (120–200 ft.).
The glider can be controlled with coordinated rudder and aileron using full movements if required.
There is no tendency to swing in a strong crosswind.
The glider can be lifted off at about 70 km/h (38 kts, 44 mph).
The glider lifts off without assistance at a speed of about 80 km/h (43 kts, 50 mph) if the stick is kept in the neutral position.

The yellow release handle is mounted on the instrument panel and must be pulled to its limit when releasing.

IV. 5 Free flight

It is possible to fly the glider over the entire speed range in all attitudes.
Full control movements are only allowed up to the manoeuvring speed 170 km/h (92 kts, 105 mph). At higher speeds the controls should be used with the appropriate care.

IV. 6 Slow flight and stalling

The glider gives clear warning when about to stall by a distinct shaking of the elevator.
The stalling speed depends on the wing loading and the condition of the plane. The following are guidelines:

Single seater

Weight	Without Airbrakes	With Airbrakes
470 kg = 1036 lbs	66 km/h (36 kts, 41 mph)	75 km/h (40.5 kts, 47 mph)

Double seater

Weight	Without Airbrakes	With Airbrakes
580 kg = 1279 lbs	75 km/h (40.5 kts, 47 mph)	85 km/h (46 kts, 53 mph)

If the stick is pulled back further the glider goes into a controllable high rate of sink, during which rudder and aileron turns can be flown at up to 15 degrees of bank. When the stick is released the glider returns to a normal flying attitude immediately.
After the stick is pulled back quickly the glider pitches nose down and the bank can still be controlled with aileron.

IV. 7 High speed flight

There is no tendency for flutter to develope within the permitted speed range. Above 170 km/h (92 kts, 105 mph) control movements should be restricted to 1/3 of full range. The airbrakes limit the speed to under VNE in a 45° dive even at maximum flying weight.

IV. 8 Cloud flying

The minimum instrumentation required for flying in cloud is:

- Air speed indicator
- Variometer
- Turn and Slip
- Altimeter
- Compass

Experience to date shows that the ASI does not get affected by icing.

If the manouvering speed is exceeded unintentionally, pull out the airbrakes to avoid overstressing.

In emergency open brakes and leave cloud at aboud 170 km/h (92 kts, 105 mph).

Spin should not be used for rescue provision.

IV. 9 Simple Aerobatics

The glider is licenced for the following aerobatics

1. Loop

Entry speed	180 km/h (97 kts, 111 mph)
Maximum g	ca. 3 g
exit speed	ca. 180 km/h (97 kts, 111 mph)

2. Stall turn

Entry speed 180 km/h (97 kts, 111 mph)
At 140 km/h (76 kts, 87 mph) slowly apply rudder.
Shortly before the top apply opposite aileron.

Note: The stall turn is difficult to carry out because of the high moment of inertia. If a tailslide is accidently initiated during the climb hold all controls in the centred position firmly.

3. Spin (possible in aft c. G. positions only)

Preparation. Decrease speed slowly to 80 km/h (43 kts, 50 mph) pull stick back and apply full rudder. Glider spins slowly. Rotation rate is one turn every 3 seconds with a height loss of about 80 m (262 ft.) per turn.

Recovery: opposite rudder, stick forward and recover gently.

4. Chandelle

Entry speed 170 km/h (92 kts, 105 mph)

Pull up to fly 90° bank turn. During turn decrease speed and exit from turn with rudder and aileron. Chandelle should be completed heading in opposite direction.

5. Lazy Eight

Entry speed 140 km/h (76 kts, 87 mph)

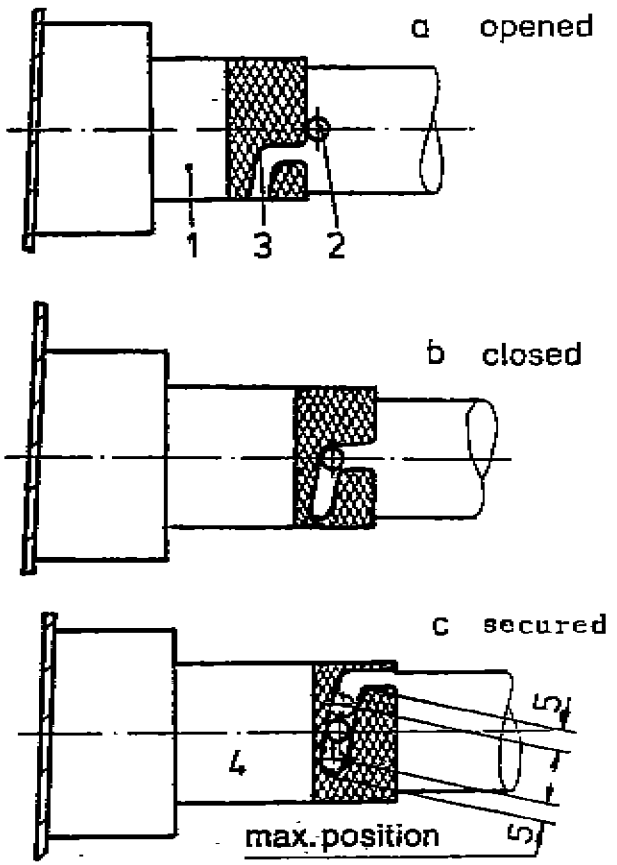
IV. 10 Approach and landing

Normal flying practice is to approach at 95 km/h = 51 kts. The airbrakes are sufficiently powerful for steep approaches. The use of brakes causes the glider to be slightly nose heavy, so that the glider holds the required speed by itself.

Fully extended the airbrakes increase the stalling speed: do not extend the airbrakes fully during the roundout to avoid heavy landings. Dont use the airbrakes to full extension during touch-down due to strong effect of the wheel-brake.

If the nosewheel touches the ground the direction can be controlled by rudder until 40 km/h (22 kts, 25 mph).

The side-slip is quite controllable and, if needed, this manoeuvre can be used for steeper approaches. It is effective by using a 15 degrees angle of sideslip and should be finished of a safe height (98 km/h; 54 kts; 61 mph).



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.

Dezember 1980

V. Rigging and derigging

V. 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 fittings 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).

V. 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. 4 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).

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 drillings in the inner rings of the horizontal stabilizer spar bearing fall to the rear. The tailplane can be positioned on top of the fin so that the automatical elevator connector can attach. The tailplane can then be pushed back into 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 control the 4 markings.
6. Control: Surfaces movement free.

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.

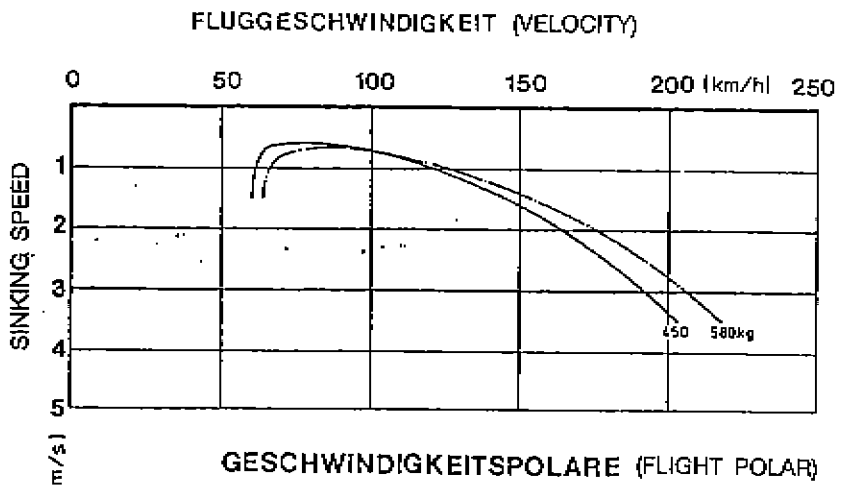
V. 2 Storage

When the glider is stored the canopy should be locked. To tie down the wing, a rope can be pulled through the wing tip skids.

VI. Appendices

VI. 1 Flight Performance

Flying weight	450 (992)	580 (1279)	kg (lbs)
Wing loading	25.3 (5.2)	32.6 (6.7)	kg/m² (lbs/ft²)
Best glide Angle	36.5	37.0	
at a speed of	95 (51)	105 (57)	km/h (kts)
Minimum sink	0.64 (126)	0.70 (138)	m/sec (ft/min)
at a speed of	80 (43)	85 (46)	km/h (kts)



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 2.8 bar nosewheel and tailwheel 2.5 bar

The wheelbrake of the „TWIN II" is a disk brake. The master brake cylinder with the brake fluid reservoir is located under the baggage compartment or under the rear seat.

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

To fill up use ATE hydraulic brake fluid DOT 3.

VI. 2 Service and Maintenance Instructions

Regular service.

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

1. The entire glider should be checked for cracks, holes and bumps.
2. All fittings should be inspected for satisfactory condition (play, scores and corrosion).
3. All metal parts should be examined for corrosion, cracks, deformation and if necessary reconditioned and freshly protected.
4. Check that there is no play in the wing and tailplane to fuselage fittings.
5. The control linkages (Bearings, stops, fittings, hinges and control cables) should be inspected and replaced if there is evidence of bending or corrosion.
6. The controls including the brakes should be submitted to a functional test and the control deflections checked.
7. If the controls do not move free throughout their range, search for the cause and correct.
8. The mainwheel, nosewheel, tailwheel and the brake have to be checked.
9. The tow 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.

VI. 3 Reference to Repairs

The attached repair instructions give information for the execution of minor repairs.

Major repairs, in accordance with the glider information sheet are only permitted to be carried out by an authorised aircraft works. Grob will name a company with the appropriate qualifications in any individual case.

VI. 4 Reference to release hooks

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.

VI. 5 Determination of the Center of Gravity

The determination of the center of gravity is made with the glider supported on two scales at heights such that an incidence board of 600:24 angle is set horizontal on the back of the fuselage.

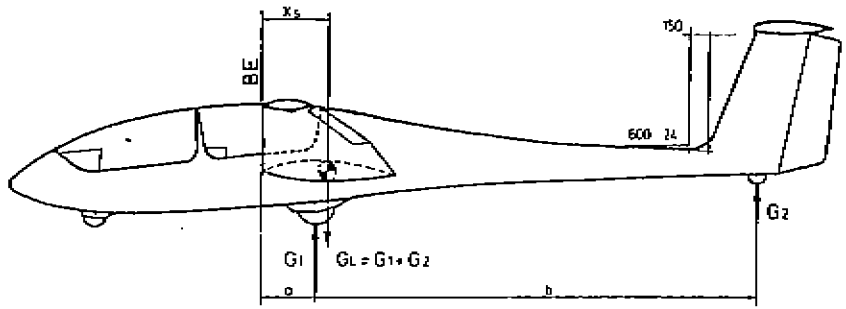
The reference plane lies at the front of the wing at the root. The distances a and b are measured with the help of a plumb line. The empty weight is the sum of the two weights G_1 and G_2.

The Center of Gravity of the pilots is located:

1150 mm in front of the Datum Line (1. Seat)

40 mm behind the Datum Line (2. Seat)

Procedure for determining C. of G. empty



Cof G = 617 × 550 + 37 × 4950 ÷ 854 = 740 mm

Datum Line: Front edge of the wing at the root

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

Weight on main-wheel	G_1 =	817	~~kg~~/lbs
Weight on tail-skid	G_2 =	37	~~kg~~ / lbs
Empty Weight G_L	= G_1 + G_2 =	854	~~kg~~ / lbs
Distance to main-wheel	a =	550	mm / ~~inches~~
Distance to tail-skid	b =	4950	mm/~~inches~~

Empty Weight C. of G.

$$X = \frac{G_2 \times b}{G_L} \div a = \frac{\quad}{\quad} + \quad =$$ mm/inches behind Datum/Line

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

	from	to	multiply with
Convertion	kg	lbs	2.2
	mm	inches	0.0394

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

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

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

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

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

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

Index

28. Feb. 1984 (TM 315-26)

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Maintenance Handbook
GROB G 103

»TWIN II«

This handbook must be carried on board at all times.

It refers to the GROB G 103 Sailplane.

Registration: Factory Serial Number: 3557

Owner: _____

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

Published December 1980

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	

Ailerons

Span	b_{QR}	=	3.65 m	12 ft.
Chord inner	ti	=	0.208 m	.68 ft.
outer	ta	=	0.105 m	.34 ft.
Area	F_{QR}	=	1.14 m²	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	139.94 sq. ft.

Fin

Height	h	=	1.3 m	4.27 ft.
Area	F	=	1.37 m²	14.75 sq. ft.
Aspect Ratio			1.23	
Chord bottom	tu	=	1.25 m	4.1 ft.
top	to	=	0.86 m	2.82 ft.

Rudder

			3.70%	
% of Fin Area	F	=	0.505 m²	5.44 sq. ft.

Updates:

Current number	Page	Reference	Date	Signature
1	2, 4, 12, 13, 17	Modifted elevator (TM 315-16)	19. Nov. 81	
2	2, 4, 5, 6, 7, 8, 12, 13, 17, 18, 21, 24, 26 a	Modification from serial no. 3730 and subsequent (ÄM 315-12)	1. Apr. 82	
3	2, 11, 12, 13,	Modification from serial no. 3839 and subsequent (ÄM 315-13)	1. Febr. 84	
4	1, 2, 28	Increase of service time (TM 315-26)	28. Febr. 84	
5	2, 4, 4a, 7, 8, 8a 9, 9a, 11 12, 13, 13a, 17, 17a, 26	Automatic connection of elevator and spring trim system of serial no. 33879 and subsequent (ÄM 315-14)	30. June 84	
6	2,27,28 8a,13	Extension of service life (TM 315-45) additional as of s/n 33879	11.10.91	

Table of technical data of tailplane of serial numbers before.

			G 103 „Twin II"				G 103 A „Twin II Acro"		
Serial number	from through		3501 3729	optional 3501 3729	3730 3878	from 33879	3544 K 3729 K	3730 K 3878 K	from 33879 K
Tailplane									
Span	b	m	3.3	3.3	3.3	3.39	3.3	3.3	3.39
Area	F	m²	2.1	2.14	2.14	2.18	2.14	2.14	2.18
Aspect ratio	–	–	5.2	5.1	5.1	5.3	5.1	5.1	5.3
Chord inner	ti	m	0.805	0.82	0.82	0.82	0.82	0.82	0.82
outer	ta	m	0.46	0.47	0.47	0.46	0.47	0.47	0.46
Elevator									
Area	F	m²	0.55	0.60	0.60	0.61	0.60	0.60	0.61
% of tailplane	–	%	26.4	28.0	28.0	28.0	28.0	28.0	28.0
Trim tab									
Span	b	m	0.95	0.95	0.95	(1)	0.95	0.95	(1)
Area	F	m²	0.08	0.095	0.7	(1)	0.095	0.7	(1)
Modification	No.		ÄM 315-8	TM 315-16	ÄM 315-12 (2)	ÄM 315-14	ÄM 315-10	ÄM 315-12 (2)	ÄM 315-14

All measurement in m or m² (1 m = 3.28 ft.; 1 m² = 10.76 sq. ft.)
- The data was valid for the mentioned serial numbers when leaving factory. There might be deviations after major repairs.
- Some technical data are corrected compare with handbooks before.
- See also rigging data of elevator and trim tab at page 13 a.

(1) Without trim tab but with spring system for trimming
(2) Beginning from s/n 3839 (K) elevator with V-Section in the middle.

Tailplane (beginning from s/n 33879)
(see also table at page 4a)

Span	b	=	3.39 m	11.12 ft.
Area	F	=	2.18 m²	23.5 sq. ft.
Aspect Ratio			5.3	5.3
Chord inner	ti	=	0.824 m	2.70 ft.
outer	ta	=	0.46 m	1.51 ft.

Elevator (beginning from s/n 33879)

Area	F	=	0.61 m²	6.56 sq. ft.
Chord inner	ti	=	0.24 m	0.79 ft.

Airbrakes (Grob System)

Area (Each)	F_{BK}	=	0.504 m²	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/m²	5.18-6.68lbs./sq. ft.
Maximum weight of non-lifting parts		400 kg	882 lbs.

II. Description of Components

II. 1 Control Linkages

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

Elevator

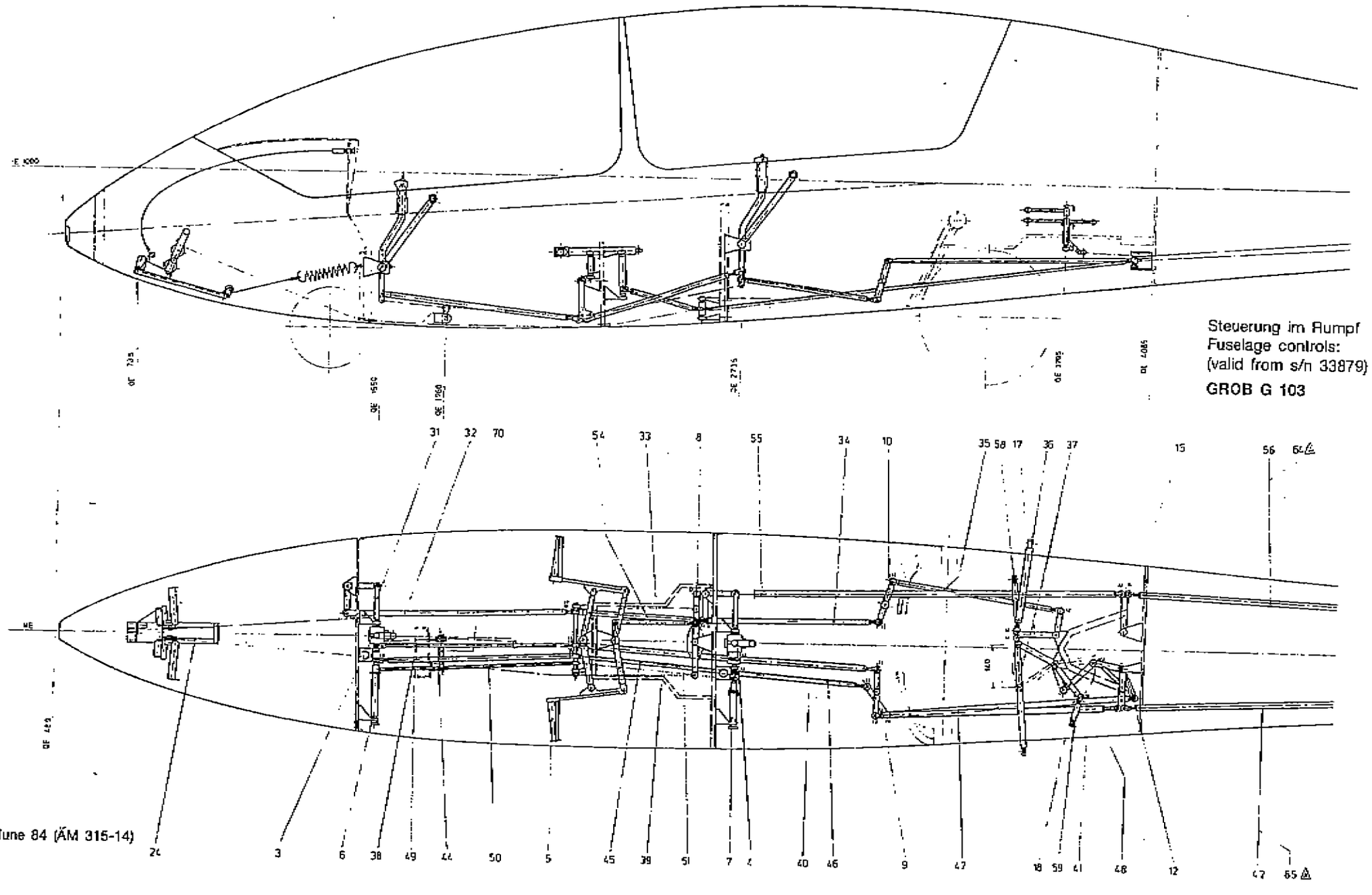
The control stick force is transfered from the control stick via the stick mounting frames to the elevator pushrod. The two control sticks are firmly connected. The rear control stick is detachable and held in place by a butflynut. Three elevator pushrod leads from the rear stick to the elevator horn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

Aileron controls

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

Rudder Linkages

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



Steuerung im Rumpf
Fuselage controls:
(valid from s/n 33879)

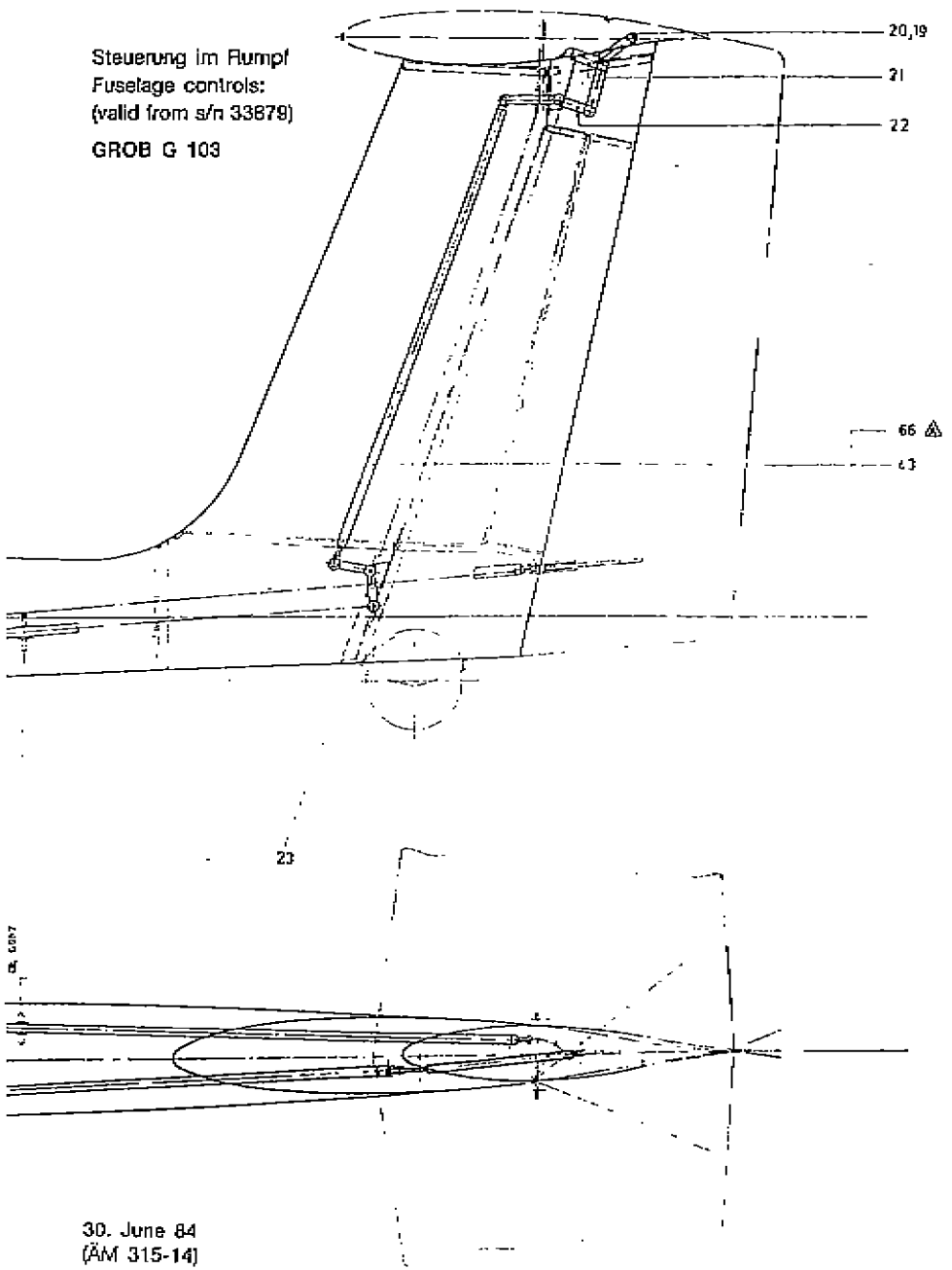
GROB G 103

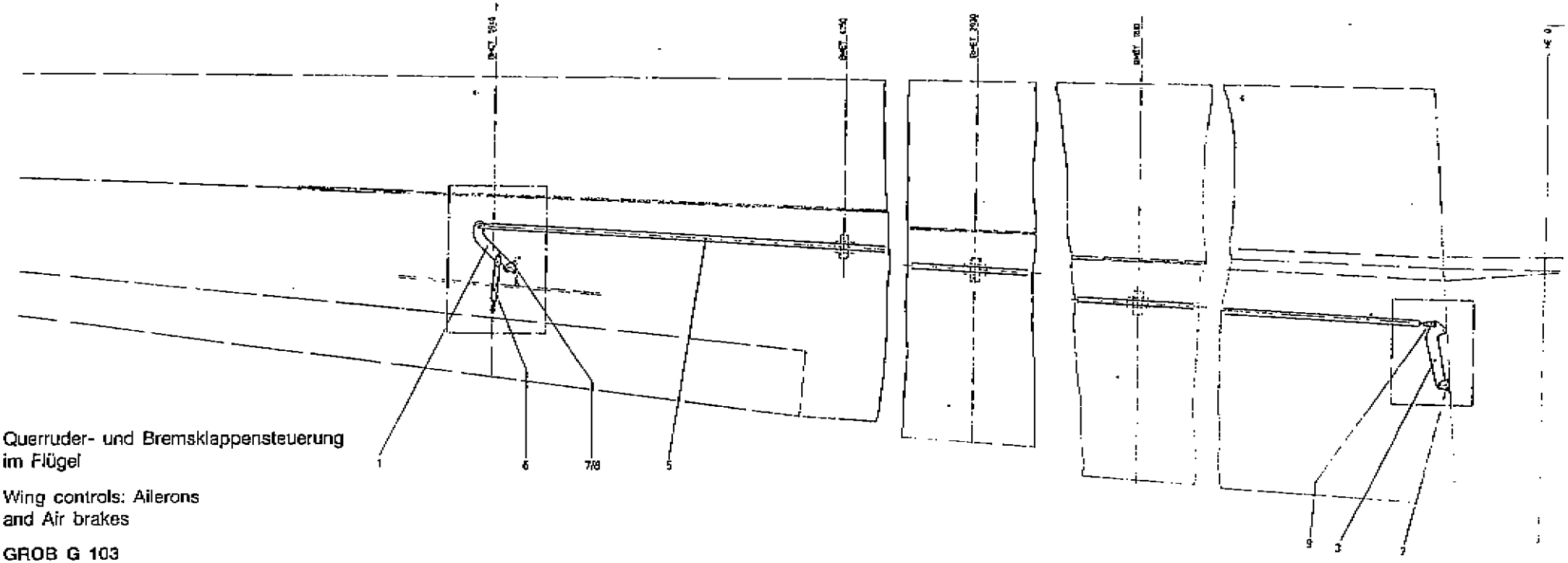
30. June 84 (ÄM 315-14)

Parts list: Controls in the fuselage

Lfd.-Nr.	Designation	Part number
3	Stick assembly front	103 B - 4401
4	Stick assembly rear	103 B - 4410
5	Pedal unit	103 B - 4420
6	Airbrake-trim unit	102C3 - 4230
7	Airbrake-trim unit	103 B - 4412/1
8	Rudder lever	103 B - 4430/1
9	Reversing right	103 B - 4431
10	Reversing left	103 B - 4434
12	Airbrake reversing	103 B - 4437
15	Rudder Swing	103 B - 4441
17	Aileron lever	103 B - 4454/1
18	Airbrake lever	103 B - 4451/1
19	Elevator connector right	103 B - 4768
20	Elevator connector left	103 B - 4767
21	Lever	103 B - 4765
22	Lever	103 B - 4763
23	Lever	103 B - 4761
24	Pedal unit front	103 B - 4778
31	Aileron rod 1	102 C3 - 4351/1
32	Aileron rod 2	103 B - 4552
33	Aileron rod 3	103 B - 4553/1
34	Aileron rod 4	103 B - 4554
35	Aileron rod 5	103 B - 4555
36	Connector right	103 B - 4556
37	Connector left	103 B - 4557
38	Elevator rod 1	103 B - 4560
39	Elevator rod 2	103 B - 4561
40	Elevator rod 3	103 B - 4562
41	Elevator rod 4	103 B - 4563
42	Elevator rod 5	103 B - 4564
43	Elevator rod 6	103 B - 4765
44	Airbrake rod 1	103 B - 4570
45	Airbrake rod 2	103 B - 4571
46	Airbrake rod 3	103 B - 4572
47	Airbrake rod 4	103 B - 4573
48	Airbrake rod 5	103 B - 4574
49	Trim rod 1	103 B - 4785
50	Trim rod 2	103 B - 4786
51	Trim rod 3	103 B - 4581
54	Rudder rod 1	103 B - 4586/1
55	Rudder rod 2	103 B - 4587
56	Rudder rod 3	103 B - 4247
58	Connector right	103 B - 4558
59	Connector left	104 - 4322
64	Rudder rod 3	103 A - 4592
65	Elevator rod 5	103 A - 4590
66	Elevator rod 6	103 A - 4794
70	Trim unit	103 B - 4780

Steuerung im Rumpf
Fuselage controls:
(valid from s/n 33879)
GROB G 103

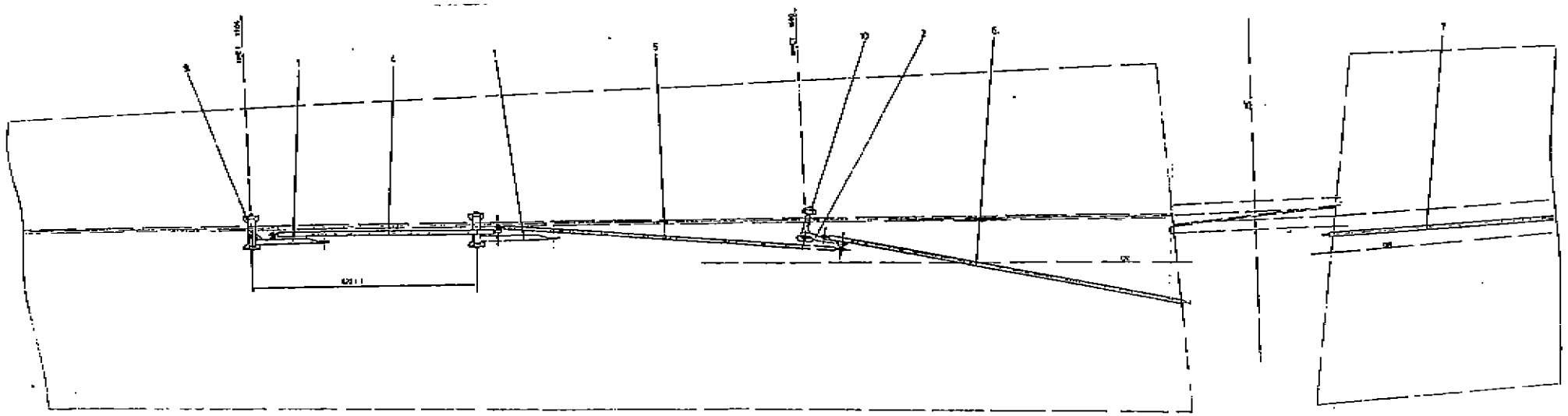




Querruder- und Bremsklappensteuerung
im Flügel

Wing controls: Ailerons
and Air brakes

GROB G 103
(valid from s/n 33879)



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.

Parts List: Controls in the wing unit

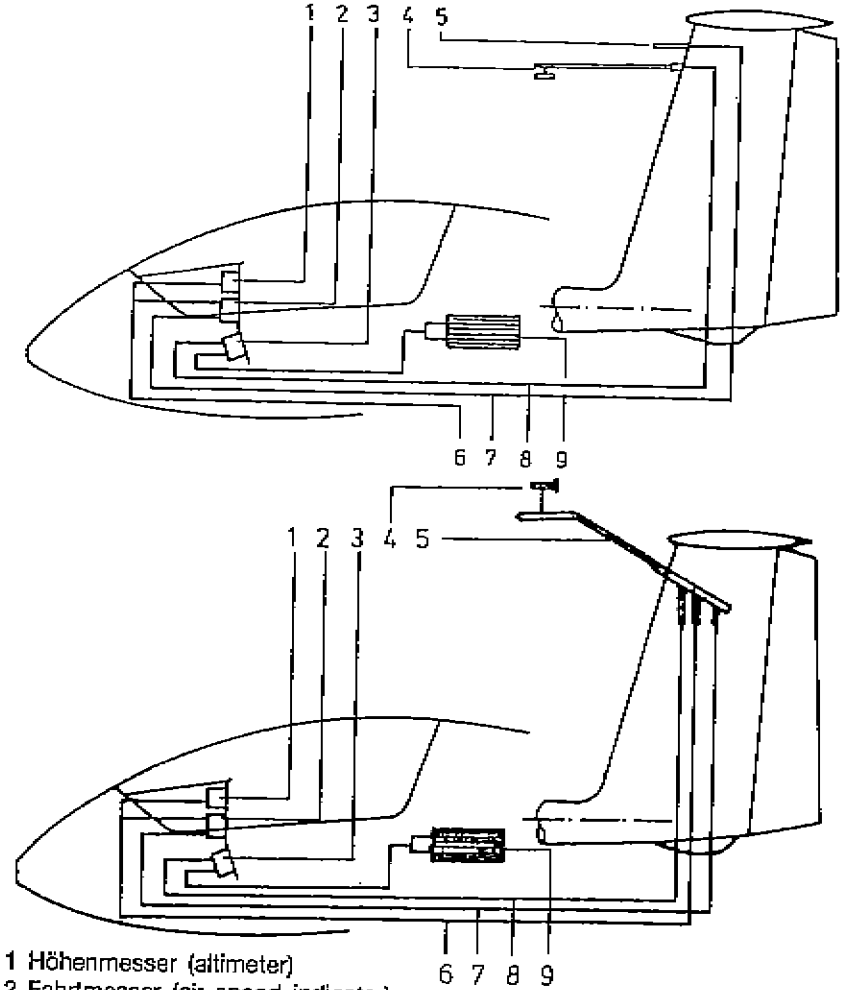
Aileron control system

Ref.-No.	Designation	Part number
1	Aileron lever left	103 B - 4737
	Aileron lever right	103 B - 4738
3	Connection lever left	103 B - 4735
	Connection lever right	103 B - 4736
5	Aileron rod VI	103 B - 4113
6	Aileron rod VII	103 B - 4115
7	Pillow block	109 - 2053
8	Pillow block	102C3 - 2054
9	Control rod fork end	104 - 4297

Airbrakes control system

Ref. No.	Designation	Part number
1	Pivoted lever left	103 B - 4721
	Pivoted lever right	103 B - 4722
2	Locking lever left	103 B - 4723
	Locking lever right	103 B - 4724
4	Airbrake rod V	103 B - 4117
5	Airbrake rod IV	103 B - 4118
6	Airbrake rod III left	103 B - 4119
7	Airbrake rod III right	103 B - 4120
9	Pillow block	109 - 2053
10	Pillow block	102C3 - 2054

II. 4 **Pressure tubing and connections to the Instruments** (two scheme of optional systems)



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)

III. **Rigging Data** (valid from s/n 33879)

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	± 30'
Reference line	Front of the wing at the root rib	QE 2980	(117.32" in)
Control deflections (mm)	Upwards (right) Value Tolerance / Downwards (left) Value Tolerance	Measurement point from centre of rotation	
Aileron Port Aileron Starboard	90 ± 10 90 ± 10 / 50 ± 8 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)		

(see also rigging data of tailplane at page 13a)

Table of rigging data of elevator and trim tab of serial numbers before.

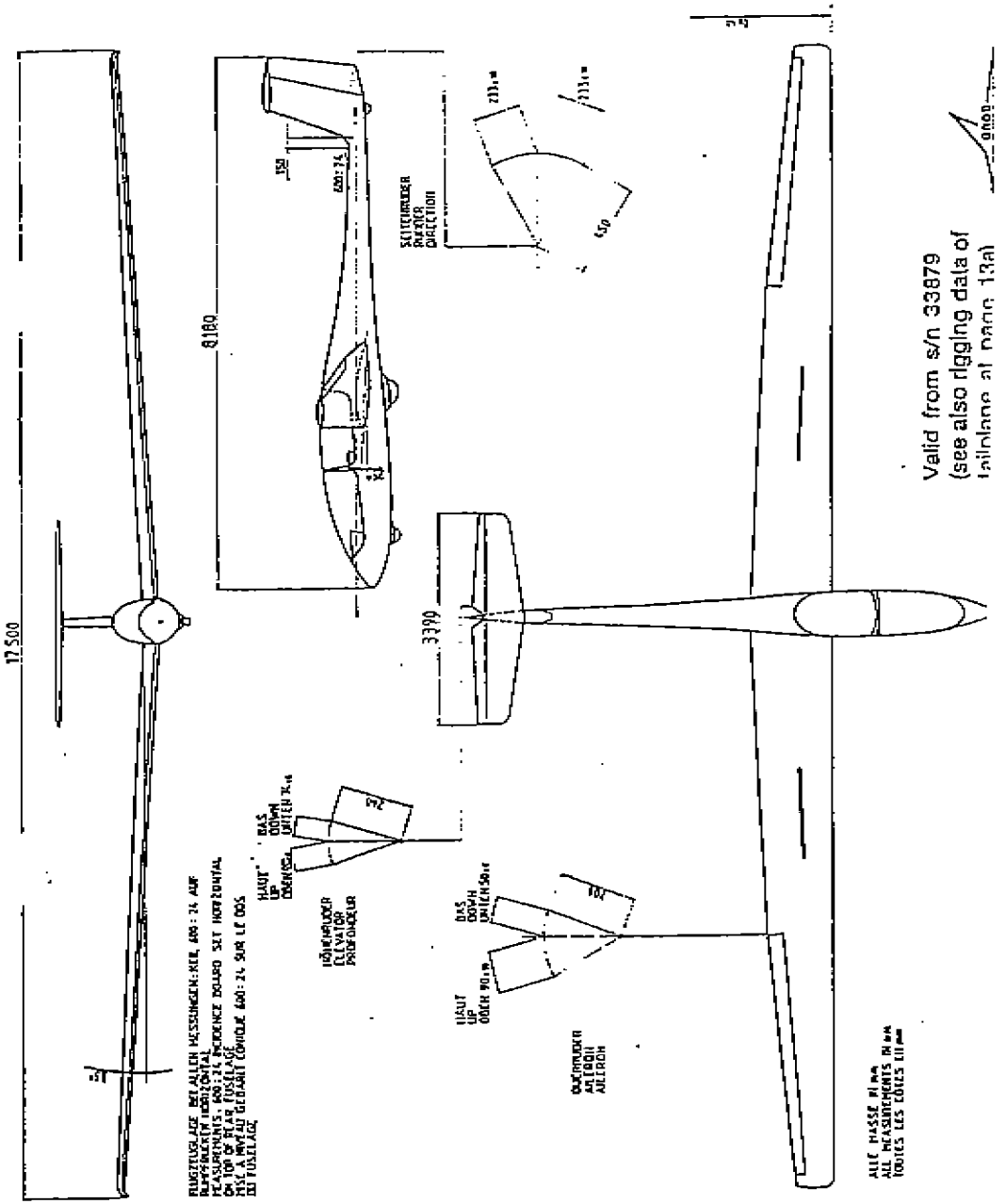
		G 103 „Twin II"					G 103 A „Twin II Arco"			
Serial number	from through	3501 3729	optional 3501 3729	3730 3838	3839 3878	from 33879	3544 K 3729 K	3730 K 3838 K	3839 K 3878 K	from 33879 K
Elevator (mm)	up-wards	90 ± 6	97 ± 8	97 ± 8	95 ± 8	95 ± 8	97 ± 8	97 ± 8	95 ± 8	95 ± 8
	down-wards	70 ± 5	76 ± 6	76 ± 6	74 ± 6	74 ± 6	76 ± 6	76 ± 6	74 ± 6	74 ± 6
	measure-ment point	212	233	245	240	240	233	245	240	240
Trim tab	up-wards	45 ± 5	54 ± 5	70 ± 7	45 ± 5	(1)	54 ± 5	70 ± 7	45 ± 5	(1)
elevator in neutral position	down-wards	60 ± 5	72 ± 6	70 ± 7	45 ± 5	(1)	72 ± 6	70 ± 7	45 ± 5	(1)
	measure-ment point	96	116	90	60	(1)	116	90	60	(1)
Modification	No.	ÄM 315-8	TM 315-16	ÄM 315-12	ÄM 315-13 (2)	ÄM 315-14 (2)	ÄM 315-10	ÄM 315-12	ÄM 315-13 (2)	ÄM 315-14 (2)

All measurement in mm (1 mm = 0.039 inch)
- The data was valid for the mentioned serial numbers when leaving factory. There might be deviations after major repairs.
- See also technical data of tailplane at page 4 a.

(1) Without trim tab but with spring system for trimming.

(2) Elevator with V-Section in the middle.

30. June 84 (ÄM 315-14)



11.10.91 (TM 315-45)

IV. Components with a limited life time

Tow hooks

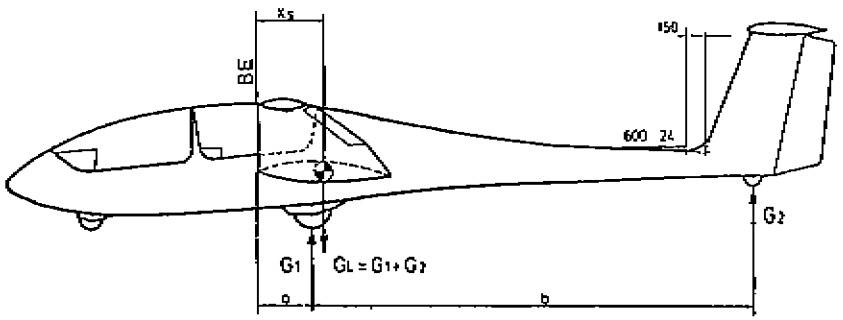
The standard Tost tow hooks have a life of 36 months, after which they must be overhauled (time counted from time of installation in the aircraft) or a maximum of 2000 launches.

Oxygen Equipment

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

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

V. Determination of the Center of Gravity position



Datum Line: Front edge of the wing at the root

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

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

Empty Weight C. of G.

$$X = \frac{G_2 \times b}{G_L} + a = \frac{\quad}{\quad} + \quad = \quad \text{mm/inches behind Datum Line}$$

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

	from	to	multiply with
Convertion	kg	lbs	2.2
	mm	inches	0.0394

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

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

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

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

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

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

VI. Weights and moments of the control surfaces

Control Surface moments (valid from s/n 33879)

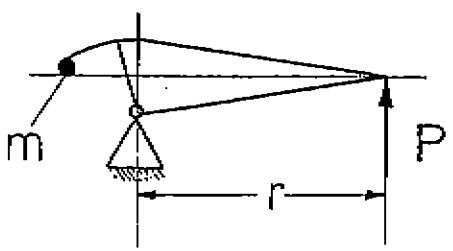
The moments of the control surfaces must not exceed the following values:

Elevator	26.0 kg cm $^{+\ 12\%}_{-\ 20\%}$	4.2 kg± 15%
Rudder	20.0 kg cm ± 10%	5.0 kg ± 10%
Aileron	12.0 kg cm ± 12%	6.0 kg ± 10%

(See also table at page 17a)

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

(1 kg = 2.20 lbs, 1 kg cm = 7.23 ft. lbs)



XI. Required placards and symbols

Maximum flying weight			580 kg	1279 lbs
Airspeed limits		km/h	knots	mph
Never exceed	V_{NE}	250	135	155
In Rough Air	V_B	170	92	105
On Airotow	V_T	170	92	105
On Winch or Auto Launch	V_W	120	64	74
Airbrakes Open	V_{CF}	250	135	155
Manoeuvring	V_A	170	92	105

Front cockpit
Back cockpit

Payload (Pilot and Parachute)		
Minimum in Front cockpit	70 kg	154 lb
for all flight		
Less must be compensated with		
ballast secured in the seat		
Maximum load front	110 kg	242 lb
The maximum weight must not be exceeded		

Front cockpit
Back cockpit

Check before launch

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

Front cockpit

Canopy Jettison and Emergency Exit

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

By Canopy release front and back

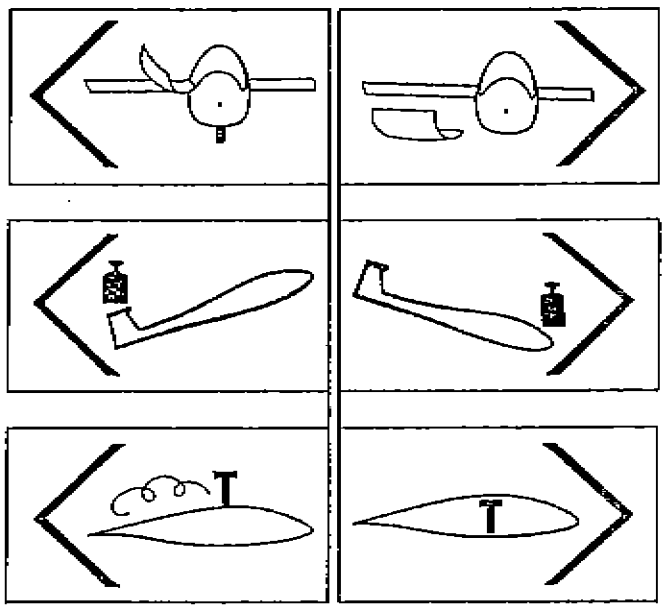
Tire Pressure
39.8 PSI 2.8 bar

mainwheel

Tire Pressure
36 PSI 2.5 bar

nosewheel
tailwheel

Symbols

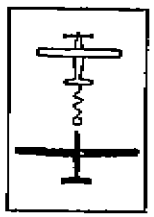


Canopy open
Canopy jettison

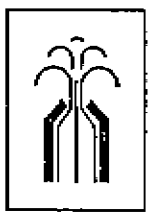
Trim

Airbrakes

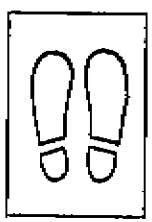
Wheelbrake



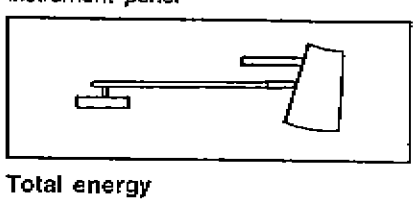
Cable release



Air-vent
Top left of front instrument panel



Pedal adjustment
Top right of front instrument panel



Total energy
compensation tube
(until s/n 3838)

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

Rudder fin (until s/n 3877)

Markings notice
Rotating knob turned in
Tailplane secured (cover closed)

Rudder fin (from s/n 33879)

Baggage maximum
22 lbs 10 kg

Baggage compartment

Dont push or
lift here

Rudder

XII. General care

Dampness

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

Sunlight

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

Protection of the Finish

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

Cleaning the Canopy

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

Parking

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

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)				

front cockpit

(if trim box is installed)

GROB WERKE GMBH & CO. KG
Unternehmensbereich
Burkhart Grob Flugzeugbau
Am Flugplatz
8939 Mattsies
West Germany
Telefon 08268/411
Telex 539 623

REPAIR INSTRUCTIONS
GROB G 103
»TWIN II«

XII. Inspection Procedures for Increase of Service Time

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:

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 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 maximum 12000 flight hours at this time (4rd – 7rd stage).
   Additionally at 9500, 10500, 11500 operating hours inspection of the wing connecting bolts and 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.

INDEX

1. Forword

The Glider "TWIN II" is constructed from Glass-Fibre reinforced Plastic (GFK). The fuselage consists 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.

2. Authorized materials and suppliers

Resin:	BASF Glycidäther 162 (Epikote 162)	Rütapox L 20
Hardener:	BASF Laromin C 260	Rütapox VE 2896
Mixing:	100 parts Resin - 38 parts Hardener	100 parts Resin – 18 parts Hardener

Ratio by weight

Glass Fibre Cloth

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

Use	Cloth	Weight g/m²	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
Elevator, Rudder and Ailerons	Double Twill	276	92 125
	Double Twill	161	92 110

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

Rovings:
EC 10-80-2400 K 43

Supplier:
Gevetex
4000 Düsseldorf
Postfach 1205

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

Continental AG
3000 Hannover

Styropor:

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

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. 03-69066 UP-Hardener No. 07-20510 100 Schwabbellack Paint (Gel-Coat) 3 Hardener mix ratio by Weight. Thinners No. 06-30260	Lesonal-Werke 7000 Stuttgart 30 Postfach 30 07 09

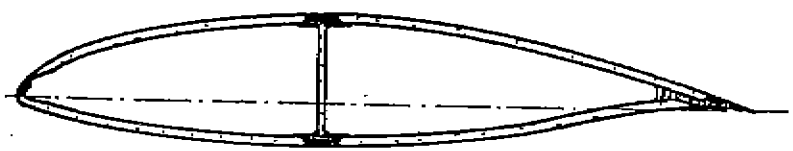
Red Paint

Nitro-Cellulose-Kombilack Orange RAL 2004	Lackfabrik Bäder KG 7300 Eßlingen Schließfach 25

3. Simplified "Texture" plan

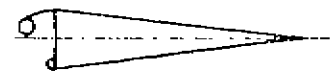
Reinforced regions for special loads and stress conducting are not shown.

1. Flügel	Wing
Außenlaminat	Outer laminate
1 Lage 92 110 längs	1 Layer 92 110 lengths
1 Lage 92 125 längs	1 Layer 92 125 lengths
Kern	Core
Conticell 60 8 mm	Conticell 60 8 mm
Innenlaminat	Inner laminate
1 Lage 92 125 diagonal	1 Layer 92 125 diagonal



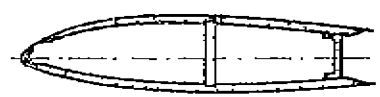
2. Rumpf	Fuselage
Von außen nach Innen	From outside to inside
1 Lage 92 110 längs	1 Layer 92 110 lengths
1 Lage 92 146 längs	1 Layer 92 146 lengths
3 Lagen 92 140 diagonal	3 Layers 92 140 diagonal

3. Ruder	Controls
Höhenruder oben	Elevator above
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
2 Lagen 92 125 diagonal	2 Layers 92 125 diagonal
Querruder oben	**Aileron above**
2 Lagen 92 110 längs	2 Layers 92 110 lengths
Kern Conticell 60, 4 mm	Core Conticell 60, 4 mm
1 Lage 92 110 diagonal	1 Layer 92 110 diagonal
Querruder unten	**Aileron below**
2 Lagen 92 110 diagonal	2 Layers 92 110 diagonal
Kern Depron 4 mm	Core Depron 4 mm
Seitenruder rechts und links	**Rudder left and right**
2 Lagen 92 110 diagonal	2 Layers 92 110 diagonal
Kern Depron 4 mm	Core Depron 4 mm
1 Lage 92 110 diagonal	1 Layer 92 110 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



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 remain 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 creating flutter conditions.

5. Damage to section of 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 approximate 20 mm ratio laminate thickness 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.Damage of Spars

The spar caps are produced out of glass-fibre rovings. At a wing span of 6,65 m begin a glass-fibre labe. If a spar cup is broken, you need a major repair (see point 12).

Retaining roving thickness: splice ratio is 1:50.

9. 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 foreign 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 (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.

10. 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 fittings (push rods) consist 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 (4 × in the fuselage) 6 steel balls (ø 7 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.

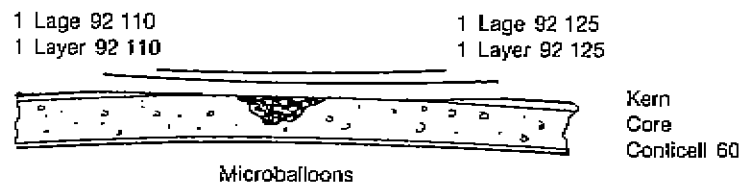


Abb. 1
Fig. 1

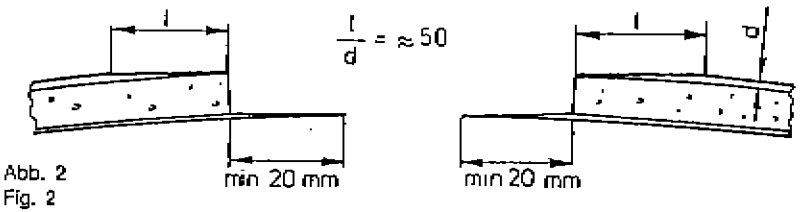


Abb. 2
Fig. 2

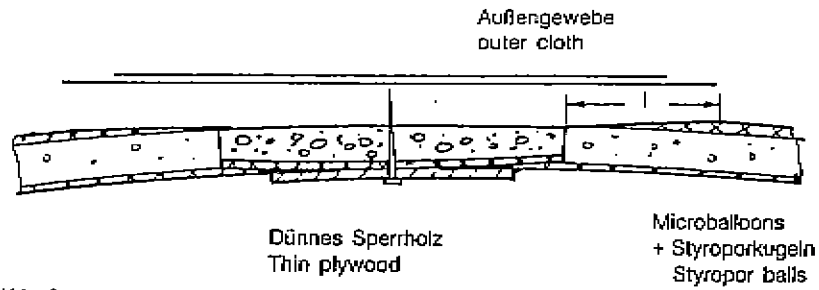


Abb. 3
Fig. 3

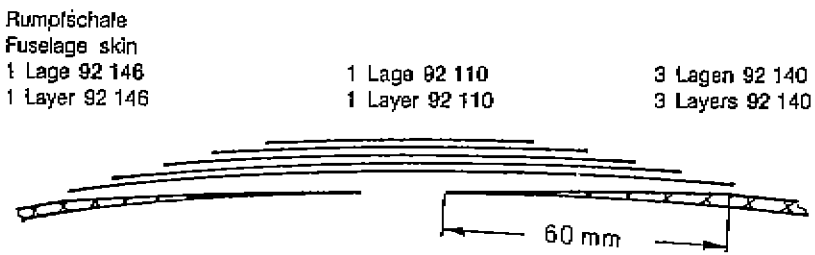


Abb. 4
Fig. 4

11. Maintenance of Breaksystem

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

Changing of breakshoes

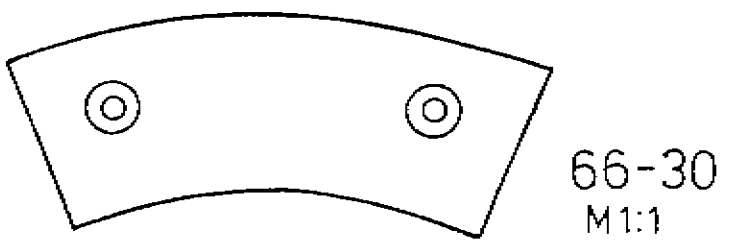
a) Remove the wheelcover.

b) Loosen 1/4 inch screws (spanner size 11 mm) to take out break. Do not remove breakpipe or you have to bleed again.

c) Take off the two parts, on which the breaklining are riveted on.

d) Mount new breaklining with rivets, assemble in reverse order.

e) Shape of breaklining.



Bleeding of breaksystem

a) Mount transparent plasticpipe on bleedingscrew put other end of pipe in a container with breakfluid.

b) Loosen bleading screw, when break via leaver and breakzylinder pushes breakfluid trough the brake.

c) Bleeding is complete when no more airbubbles can be seen in transparent plastic pipe.

Remarks:

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

The mainbreakzylinder with reservoir, is under the baggage compartment.

12. Major repairs

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

- Broken off wing, fuselage, tailplane, control surface, spar stumps (spar caps)
- Ripped or torn-out - Main fittings (in fuselage ø 55 x 3, Fitting of the tailplane in fin. In the wing, aileron securing both ø 24 mm, joining bearing GE 25. Spar cap bolts ø 25 mm).
- Destruction of main rib (vertical frame)
- Damage of the GFK laminate (tear, splits, cracks immediately near the main fittings).

13. 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)

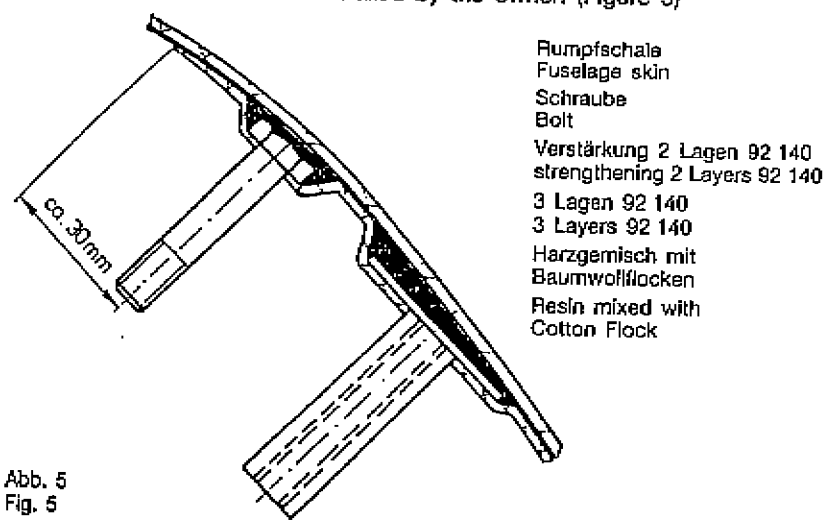


Abb. 5
Fig. 5

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 manufacturer.