



GROB FLUGZEUGBAU
8939 Mattsies
Flugplatz Mindelheim-Mattsies
Telefon 0 82 68 / 4 11

Maintenance Handbook

This handbook must be carried on board at all times.

It refers to the TWIN ASTIR Sailplane.

Registration: N7813

Factory Serial Number: 3178

Owner: Utah Soaring Association



German edition of operating instructions are approved under § 12/2.
of LuftGerPO.

Published

Approval of translation has been done by best knowledge and judgement — In any case the
original text in German language is authoritative.

Index	page
Updates	2
I. Technical Data	3
II. Description of components	5
II. 1 Control Linkages	5
II. 2 Installation of Radio	11
II. 3 Installation of Oxygen	11
II. 4 Pressure tubing and connections to the instruments	12
III. Rigging Data and specifications	13
IV. Determination of the center of gravity	14
V. Weight and Moments of Inertia of the control surfaces	16
VI. Checks	17
VII. Regular Service	18
VIII. Lubrication	19
IX. Labels and Markings	20
X. General care	22
XI. Inspection procedure for increase of service time	23

Updates:

Rev.No.	Page	Reference	Date	Signature	LBA - approval
1	19a	TRAINER undercarriage	01.10.78		
2	2, 19	Maintenance of Hotellier-quick-connectors	04.05.81		
3	1, 2, 23	Inspection procedure for increase of service time	30.09.81		
4	2, 16, 22, 23	Extension of service life	11.10.91		
5	2, 21	Envelope limitations ASB315-64	30.06.2003		
6	2, 21	MSB 315-64/3 Revised Limits of Operation	14.09.2004		2. OKT. 2004 

I. Technical Data
Wings
Profile Eppler
E 603

Span	b	=	17,5 m	57.4 ft.
Area	F	=	17,8 m ²	191.6 sq. ft.
Aspect Ratio			17,1	

Ailerons

Span	b _{QR}	=	3,1 m	10.17 ft.
Chord inner	t _i	=	0,208 m	.68 ft.
outer	t _a	=	0,165 m	.54 ft.
Area	F _{QR}	=	1,16 m ²	12.486 sq. ft.
% of Wing area			6,45 %	

Fuselage

Length	l	=	8,12 m	26.6 ft.
Width of cockpit	b	=	0,736 m	29 inches
Height of cockpit	h	=	1,06 m	41.7 inches
Height of tailplane	h	=	1,68 m	5.51 ft.
Surface area ca.	F	=	13,3 m ²	143.16 sq. ft.

Fin

Height	h	=	1,4 m	4.59 ft.
Area	F	=	1,34 m ²	14.42 sq. ft.
Aspect Ratio			1,46	1.46
Chord bottom	t _u	=	1,2 m	3.94 ft.
top	t _o	=	0,8 m	2.62 ft.

Rudder

% of Fin			37,5 %	
Area	F	=	0,525 m ²	5.65 sq. ft.

Tailplane

Span	b	=	3,3 m	10.8 ft.
Area	F	=	2,112 m ²	22.7 sq. ft.
Aspect Ratio			5,16	5.16
Chord Inner	ti	=	0,815 m	2.67 ft.
Outer	ta	=	0,465 m	1.53

Elevator

Area	F	=	0,576 m ²	6.20 sq. ft.
% of Tailplane			27,3 %	

Airbrakes (Grob System)

Area (Each)	F _{BK}	=	0,504 m ²	5.425 sq. ft.
Span	b	=	1,4 m	4.59 ft.
Height	h	=	0,17 m	6,7 inches

Weights

Empty weight	ca.	400 kg	882 lbs.
Load Maximum with Waterballast		250 kg	551 lbs.
1. Seat		110 kg	242 lbs.
2. Seat		110 kg	242 lbs.
Ballast	ca.	110 kg	220 lbs.
Load Minimum (1. Seat)		70 kg	154 lbs.
Maximum Flying Weight		650 kg	1430 lbs.
Load% of Flying Weight		37 %	
Wing Loading	26,9 – 36,5 kg/m ²	5.51 – 7.48 lbs./sq. ft.	

Maximum weight of non-lifting parts 470 kg 1036 lbs.

II. Description of Components

II. 1 Control Linkages

The control of the TWIN ASTIR is designed as a push-rod system. The stick, bellcranks and horns are made from Aluminium, the pushrods are made of steel tubing with welded connections.

Elevator

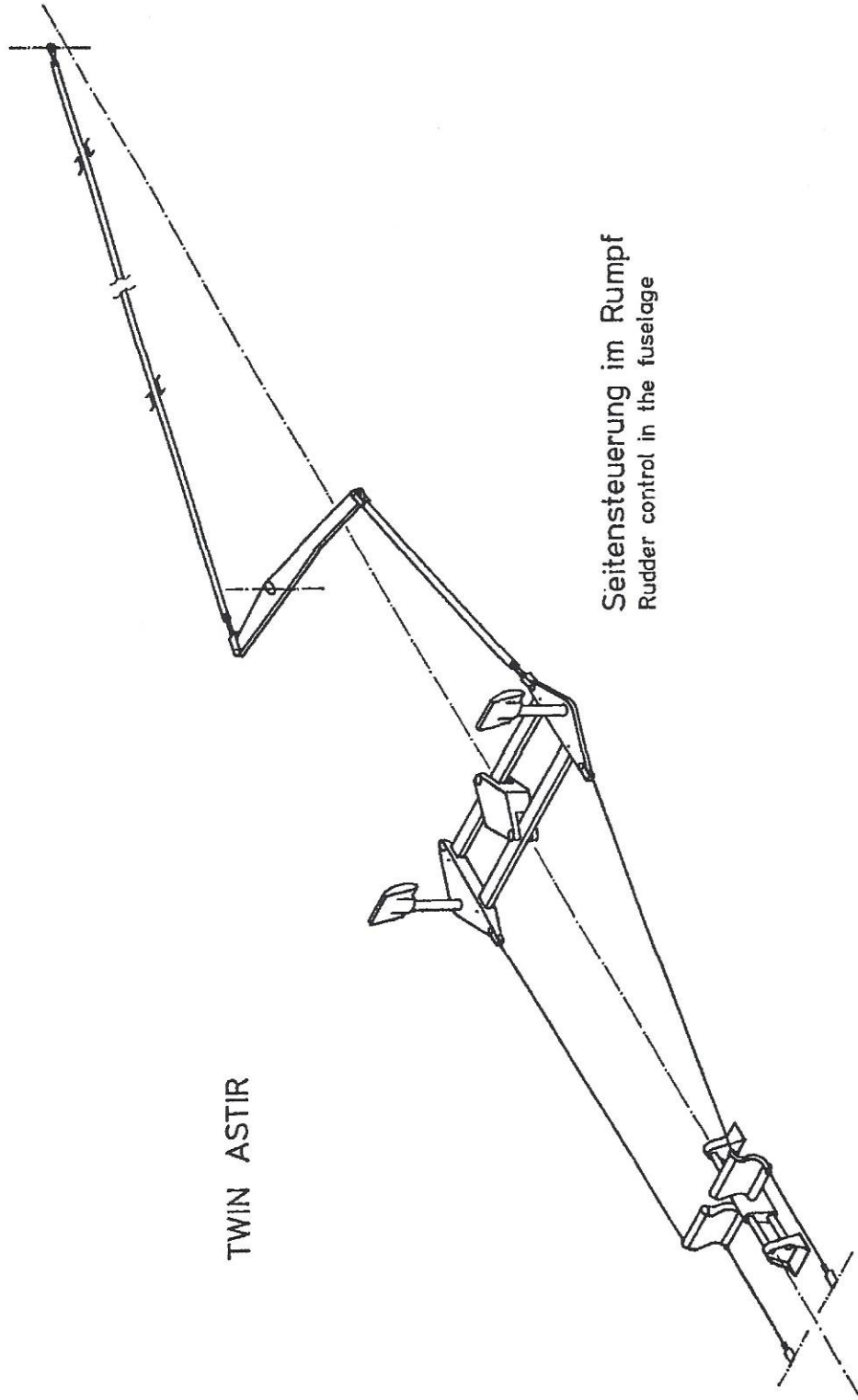
The control stick force is transferred from the control stick via the stick mounting frames to the elevator pushrod. The two control sticks are firmly connected. The rear control stick is detachable and held in place by a retaining nut. A single elevator pushrod leads from the rear stick to the elevator 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 transferred 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 a pushrod. Pushrods lead from the rear crank via an intermediate crank at the wheel box to the lower connection to the linkage assembly in the bottom of the fuselage. The aileron control connection and the pushrods in the wing are driven via the inner drive shaft of the linkage assembly and the upper crank. 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.

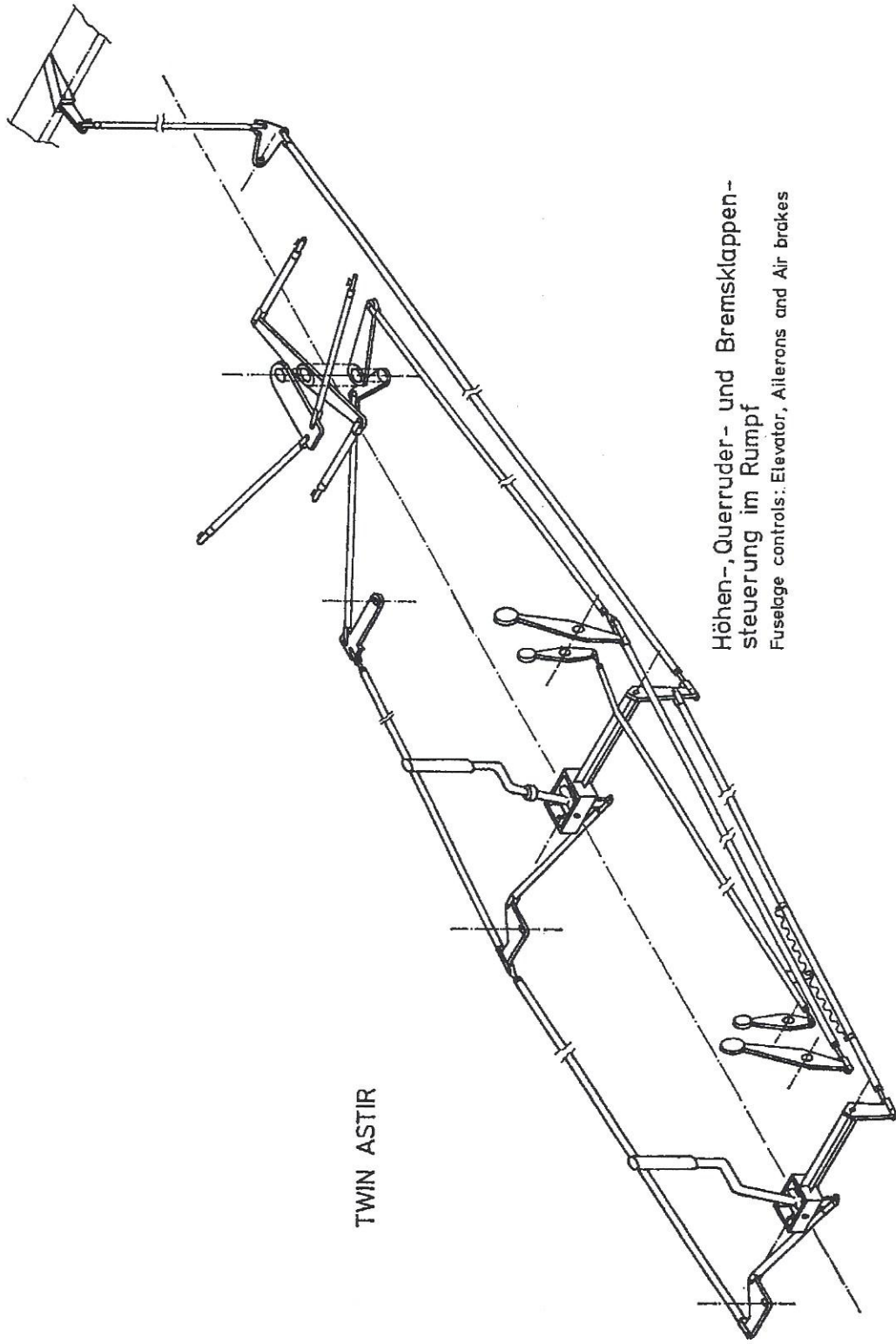
Rudder Linkages

Control cables lead from the front pedal mounting which can be adjusted in steps. The cables lie on the inside of the pedals and lead to the rear pedal controls. From there the main pushrod in the fuselage and the rudder are driven via the intermediate rudder pushrod and the rudder bellcrank at the wheel box. The whole of the rudder linkage system may be dismantled. The Stops for the rudder controls are located on the rear pedal support.



Seitensteuerung im Rumpf
Rudder control in the fuselage

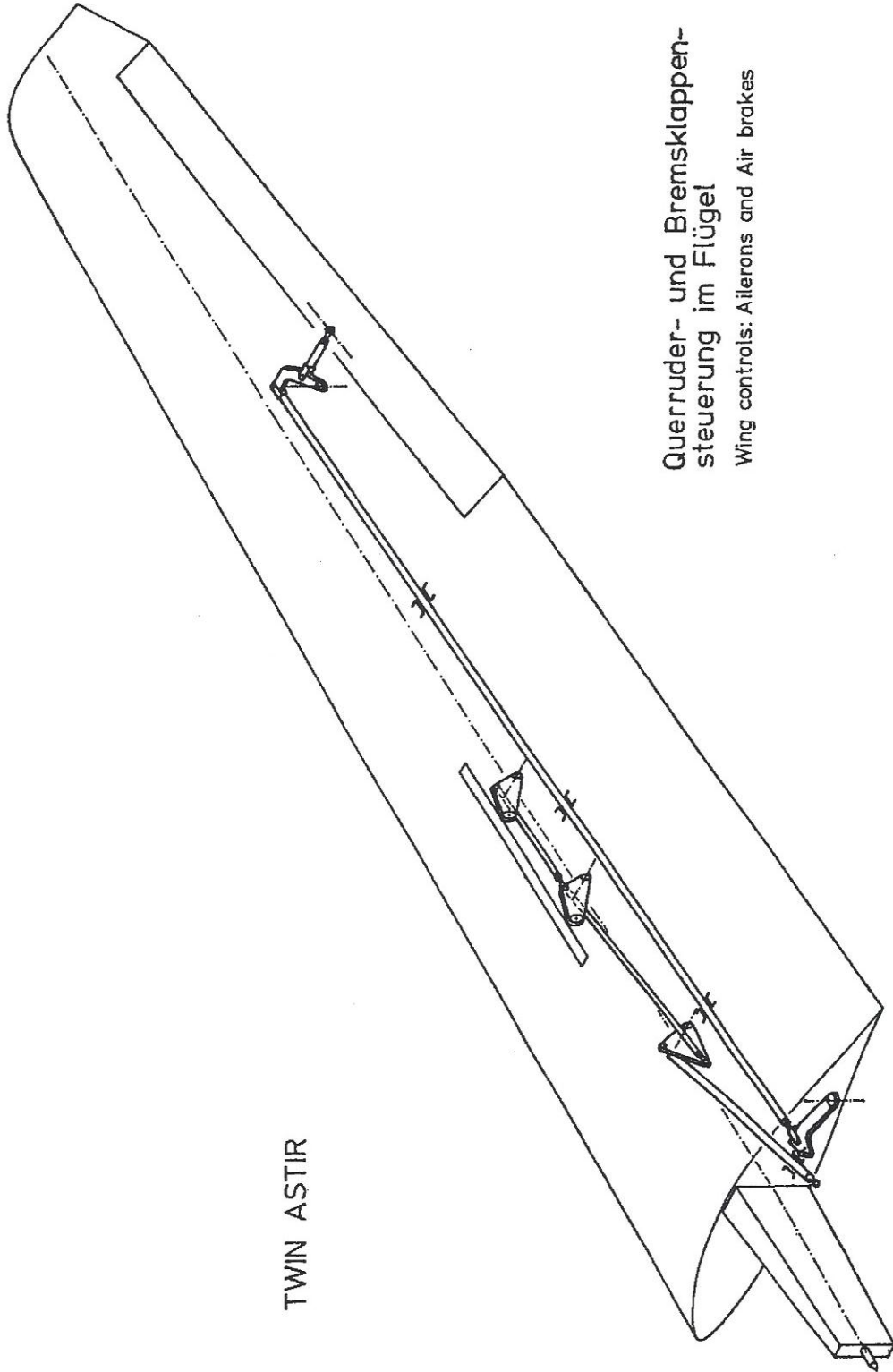
TWIN ASTIR



TWIN ASTIR

Höhen-, Querruder- und Bremsklappen-
steuerung im Rumpf
Fuselage controls: Elevator, Ailerons and Air brakes

TWIN ASTIR



Querruder- und Bremsklappen-
steuerung im Flügel

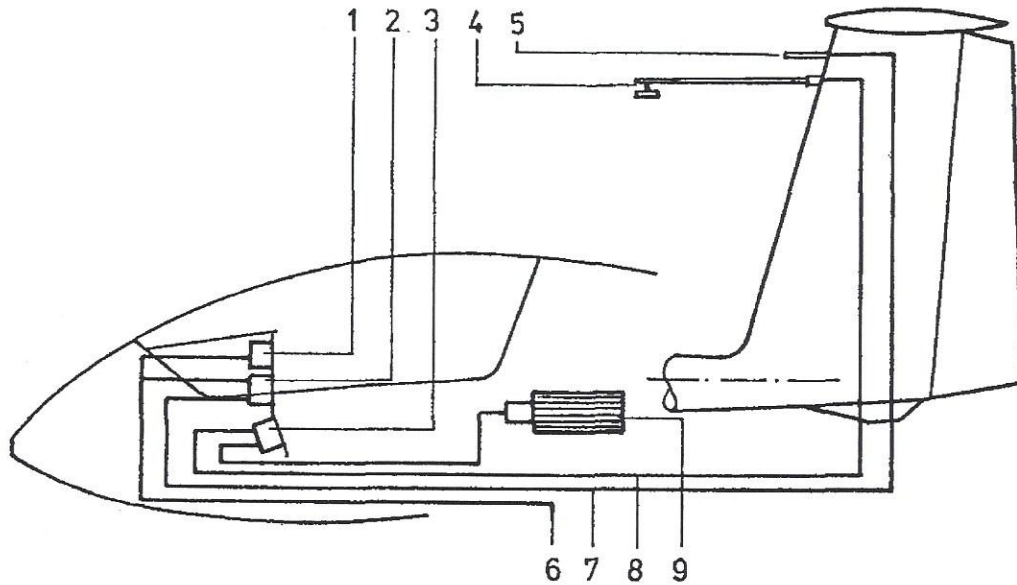
Wing controls: Ailerons and Air brakes

II. 2 Installation of Radio

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

II. 3 Installation of Oxygen

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

II. 4 Pressure tubing and connections to the Instruments

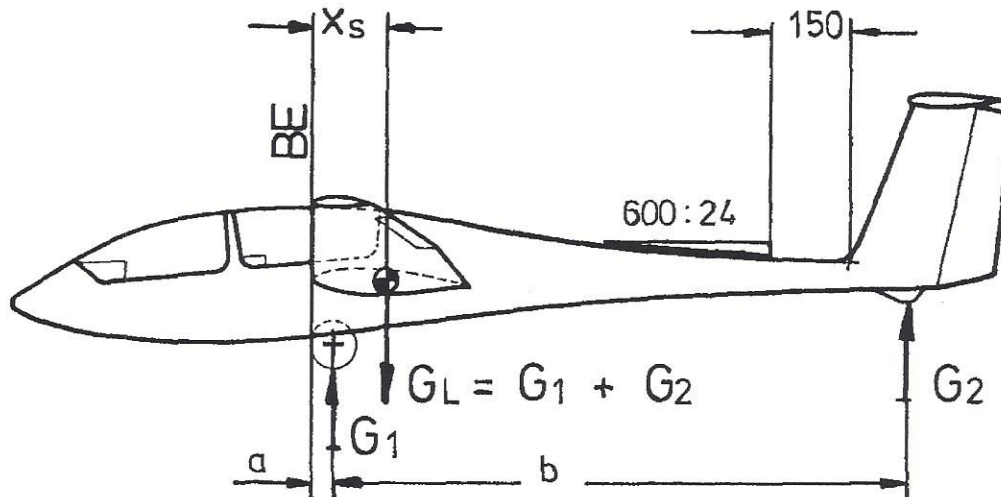
- 1 Höhenmesser (altimeter)
- 2 Fahrtmesser (air speed indicator)
- 3 Variometer (variometer)
- 4 Kompensationsdüse (total energy tube)
- 5 Staurohr (pitot tube)
- 6 Statischer Druck (static pressure) farblos (colourless)
- 7 Staudruck (pitot pressure) grün (green)
- 8 Düse (Totalenergy) rot (red)
-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

III. Rigging Data

Adjustment	Reference Line	Value	Tolerance
Wing — Incidence angle	Angle between the centre line of the wing and the longitudinal axis of the fuselage	2° 30'	± 15'
Wing — Sweep forward	Distance of line joining the wing tips from the reference line	0	± 40 mm (1.57 in)
Wing — Dihedral	Angle between the top surface of the wing and horizontal	3.5°	± 30'
Tailplane — Incidence angle	Angle between the chord of the tailplane and the longitudinal axis of the fuselage	0	± 15'
Reference line	Front of the wing at the root rib	QE 2980	(117.32 in.)
Control deflections	Upwards (right) Value Tolerance	Downwards (left) Value Tolerance	Measurement point from centre of rotation
Aileron Port	90 ± 10	45 ± 8	
Aileron Starboard	90 ± 10	45 ± 8	208 mm (8.19 in)
Elevator	91 ± 6	71 ± 5	222 mm (8.74 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)		

airbrakes extend: outward end 170 ± 10 mm above wing surface.

V. Measurement of Center of Gravity position



Datum Line: Front edge of the wing at the root

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

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

Empty weight C. of G.

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

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 of waterballast.

Conversion:	from	to	multiply with
	kg	lbs	
	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			
kg	lbs	Forward		Aft	
		mm	inches	mm	inches
390	860	725	28.54	747	29.41
395	871	719	28.31	744	29.29
400	882	713	28.07	740	29.13
405	893	708	27.87	737	29.02
410	904	702	26.64	733	28.86
415	915	697	27.44	730	28.74
420	926	692	27.24	727	28.62
425	937	687	27.05	724	28.50
430	948	682	26.85	720	28.35

It should be noted that to make use of the maximum load the maximum admissible 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 470 kgs (1036 lbs) or the maximum load permitted in the fuselage must be correspondingly decreased.

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

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

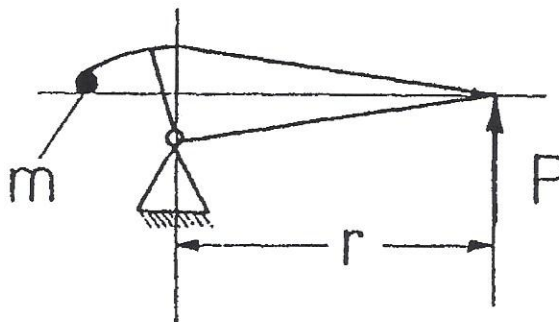
VI. Weights and moments of the control surfaces

Control Surface moments

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

Elevator	25.8 cm kg \pm 12%	5.2 kg \pm 12%
Rudder	24.9 cm kg \pm 12%	6.5 kg \pm 12%
Aileron	23.0 cm kg \pm 12%	5.7 kg \pm 12%

The moments must be measured with the control surfaces removed. To determine the moment $M = P \cdot r$ 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.



From Serialnumber 3073 the moments and weights of the control surfaces must not exceed the following values:

Elevator	25.8 cm kg \pm 12%	5.2 kg \pm 12%
Rudder	0-10 cm kg \pm 12%	max. 8 kg \pm 12%
Aileron	0-6 cm kg \pm 12%	max. 8 kg \pm 12%

An additional flutter calculation was performed. The results confirmed that the following values are acceptable:

Elevator	200 - 285 Ncm	3,10 - 4,40 kg (without mass balance)
----------	---------------	---------------------------------------



VII. Checks

Check Lists

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

Checks in specific cases.

After a heavy landing:

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

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

After a Ground loop:

Check the undercarriage mounting, check the rudder controls rods and bellcranks under the front seat.

Check the GFK tube at the base of the fin.

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

VIII. Regular service (100 hours and annual inspections)

The following schedule of service should be carried out every 100 hours or at the annual inspection, which 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 undercarriage should be inspected and the wheel and brake checked to be in good condition.
9. The two hooks should be treated in accordance with their appropriate maintenance manual.
10. Check the pitot for the ASI is clear and that the tubing to all instruments is in good condition and free of leaks or kinks.
11. The condition and calibration of all instruments should be checked and any other equipment inspected.
12. Equipment and instruments should be checked against the equipment list.
13. Check markings and placards.
14. After repair or change of equipment, the weight table should be updated with the new empty weight and center of Gravity by weighing or calculation.

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

IX. Lubrication

Ball Bearings

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

Sliding Bearings

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

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

Maintenance on Hotellier quick-locks must be conducted during each annual inspection or 500 hours which ever occurs first. They are installed at the control-connections of aileron and airbrakes at the wing-fuselage joint and at the elevator connection to the pushrod.

The diameter of the swivel has to be measured at different points by a micrometer with no differences in excess of 0.1 mm (0,004 in.) that means the swivel must still be spheric. If there are larger differences the swivels and the appropriate joints must be replaced.

Swivels and joints should be greased prior to each rigging.

The use of additional safety-pins guided through the holes of the wedge-type slides increases safety. (safety-pins No. 500 3771 from A. Würth, D - 7118 Künzelsau, W.-Germany or manufacturer)

TWIN-ASTIR TRAINER Undercarriage

1. Torque settings of the undercarriage attachment screws.

Torque to be applied at the side attachments:

at M 8 screws	—	1,2 kpm	=	8,7 lbs-ft
at M 10 screws	—	2,6 kpm	=	18,8 lbs-ft

2. Installed length of compression washer.

In order to keep to the design installed length of the compression washer, it is necessary to tighten the M 8. Hex nut at the upper mounting point of the wheel box. The correct installed length is automatically reached as a result. There are 106 compression washers.

3. Changing the brake shoes.

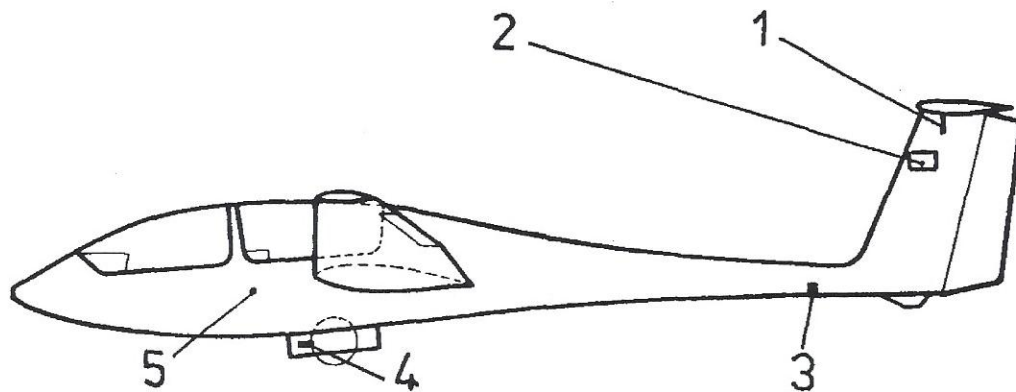
- a) Remove the wheel housing.
- b) Loosen the M 12 Allan key type screws in order to remove the brakes. The brake hose must not be taken off at the same time, otherwise it will be necessary to bleed the system.
- c) Remove the two split pins from outside and change the brake linings. The old brake linings can be used again after cleaning with steel brushes, if their dust grooves are still clearly visible.
- d) Re-install in reverse order.

4. Bleeding the brake system.

- a) Attach a clear plastic tube to the bleed screw, with the other end dipped in a container of brake fluid.
- b) While using the brake lever to force the fluid through the system via the brake cylinder, loosen the bleed screw.
- c) The bleeding process is completed when no more air bubbles are visible in the plastic tube.

Note

The brake fluid DOT 3 (amber) is available everywhere at garages. It is standardized within Europe.

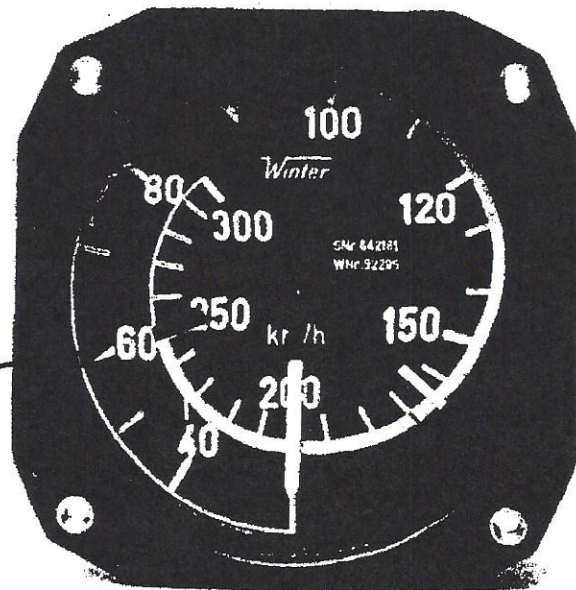
X. Labels and Markings

1. Marking controlling the correct rigging of the tailplane.
2. Label for the total energy tube.
3. Mark to locate the hole for the tail wheel.
4. Label for weak link strength and tyre pressure.
5. Red ring round the static hole.

ASI markings

Mph	Speed kts	km/h	Markierung	Bedeutung
51 - 105	44 - 92	82 - 170	Green Arc	Normal range of flying speed
105 - 155	92 - 135	170 - 250	Yellow Arc	Range of flying speeds to be used with care
155	135	250	Radial red line	Maximum speed (restored with MSB315-64/3)
64	55	102	Yellow triangle	Minimum recommended landing speed at full load

Red mark
At 250 km/h
(135 kts, 155 mph)



XI. General care

Dampness

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

Sunlight

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

Protection of the Finish

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

Cleaning the Canopy

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

Parking

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

XI. Inspection Procedures for Increase of Service Time

The original service life was established at 3000 operating hours. Within this period the prescribed 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-glidern and -motorglidern 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.



