SCHEIBE FLUGZEUGBAU GMBH

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Flight Manual and Maintenance Manual

SF 25 C - F A L K E

LIMBACH L 2000 EA / EA 1

maximum all-up weight 610 kg

June 1990 Edition

This handbook is to be kept on board

Serial no: 44181

Registration no: PH-1186

Owner: Dwarf Powered Gliders
Mr. Cees Quist
PAMPUS 13
1231SP LOOSDRECHT

The translation is approved as for as it covers the original German text.

SF 25 C Falke (type sheet)

Serial no:

Registration no:

Engine	Limbach L 2000 EA						
	Limbach L 2000 EA 1						
Propeller	MT 150 L 90 - 1A						
	HO 11A - 150 B 90 L						
Max weight (kg)	**Kg**	**lbs**	**Kg**	**lbs**	**Kg**	**lbs**	
all-up	650	1433	610	1344	580	1278	
non-lifting components	490	1080	450	992	430	947	
Undercarriage	Single mainwheel, unsprung 8.00 x 4						
	Single mainwheel, sprung 6.00 x 6						
	Two wheel undercarriage 5.00 x 5 tailwheel: 210 x 65						
	Tricycle undercarriage 5.00 x 5 nosewheel: 5.00 x 4						
Wings	non-folding						
	folding (at aileron break)						
	fold-back						
Fuel tank	litres		gallons (Imp)		gallons (US)		
	80		17.6		21.1		
	55		12.1		14.5		
	44		9.6		11.6		

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MAINTENANCE MANUAL

Record of Changes to Manual

Change No.	Heading	Page see note	Date	Signature
1	Main wing assembly (AD 82-134/ SB 653-42	F 15 Op 2	14.10 1998	
2	Added Limbach SB 48,50,51,54, 53.1 (oil, fuel, spark plug)	F 7,8,13 Op 6,17	14.10. 1998	
3	Added AD 93-001/3 enclosure 2, AD 94-001/2 enclosure 1 (L'Hotellier connecting device)	F 15 Op 2	14.10. 1998	

N.B. F = Flight Manual, O = Operating Handbook

The pilot is responsible for ensuring that the aircraft is operated in accordance with the Flight Manual. The Falke is authorised to carry a maximum of two adults. The seating is side by side: the pilot sits on the port side. The Falke is authorised for training and the instructor may opt to sit to port or starboard. All regulations must be observed. The starboard control column may be removed for passenger flying.

1. Specifications and Limitations

1.1 Engine

Limbach L 2000 EA or
Limbach L 2000 EA1 with hub adapter
17.03.065 manufactured by Limbach

Max. rpm	3400
Max. continuous rpm	2700
Minimum continuous rpm	2300
Static rpm approx.	2500 - 2700
Max. cylinder head temperature at any of the four cylinders (°C)	250

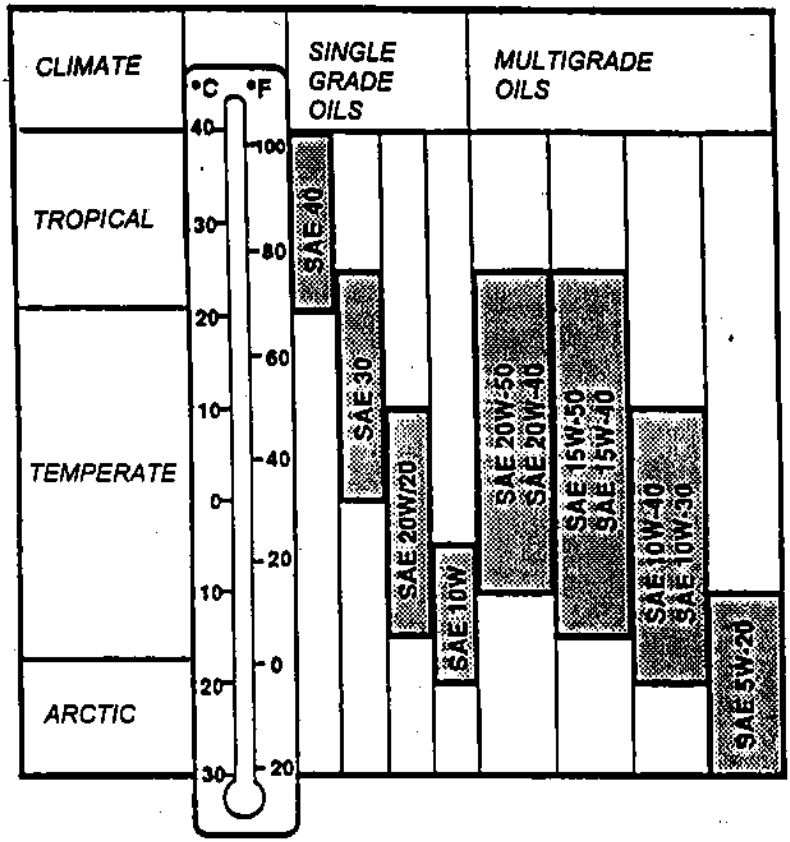
1.2 Fuel

AVGAS 100 LL or four star petrol (leaded auto gasoline) see Limbach TB 53.1 and 50
Fuel tank capacity 55 litres (55 litres usable) or optional version 44 litres (44 litres usable).

1.3 Lubricants

see Limbach TB48

Do not use detergent/non-detergent aircraft engine oils. Use good quality API SE oil for **petrol** engines.



Oil capacity	2.5 litres (0.55 Imperial / 0.66 US gallons)
Oil pressure range	1-4 bar (15-59 psi)
Min oil pressure at 2500 rpm	1 bar (15 lbs/psi)
Minimum oil temp before take-off	50 °C but 70 °C min if carburettor icing likely.
Maximum oil temp	120 °C
Crankcase oil capacity	2.5 litres
min oil capacity	1.5 litres (lower mark)

1.4 Propeller

Two blade wooden fixed-pitch propeller:
Hoffmann HO 11A-150B 90L or
MT-Propeller MT 150 L90-1A.

1.5 Engine Instrumentation

Rev counter

Starting range	0 - 700 rpm	(yellow sector)
Normal operating range	700 - 2700 rpm	(green sector)
Caution range	2700 - 3400 rpm	(yellow sector)
Max. revs	3400 rpm	(red line)
Static revs.	ca. 2500 - 2700 rpm	

Engine hours counter (Integral in rev counter)

This counts 2800 revolutions of the propeller as one minute of engine time and gives a five digit reading: the first three digits represent completed hours and the last two digits show values for 1/10 and 1/100 of an hour.

Oil Pressure Gauge

Operating range	1-4 bar (15-59 psi)	(green sector)
Minimum oil pressure	1 bar (15 psi)	(red line)
Maximum oil pressure	4 bar (59 psi)	(red line)

Oil temperature gauge

Operating range	50-120 °C	(green sector)
Minimum temperature	50 °C	(red line)
Maximum temperature	120 °C	(red line)

LIMBACH Flugmotoren

Technical Bulletin

48

Subject: Engine oils

Affected engine models: All-engines models

L 1700
L 2000
L 2400

Background information: The engine oil specification released to date in accordance with API-SE or higher has repeatedly given cause for complaint. When inexpensive engine oils have been used, there has sometimes been cracking of the engine oil between valve shaft and valve guide of the exhaust valve. In extreme cases, this could lead to the valve sticking in the guide.

Priority: At next scheduled oil change

Compliance: Only quality engine oils mineral based or partially synthetic oils that comply at least with API-SG or API-SH specification may be used. These oils must also comply with Volkswagen standards VW 501.01 or VW 500 00. These modified specifications are to be entered by hand in operating manuals. These specifications will be integrated in the next revision of the operating manuals.

Remarks: Oils of the large mineral oil companies such as Agip, Aral, BP, Castrol, Dea, Elf, Esso, Mobil, Shell, Texaco and Veedol are to be understood as quality engine oils (Trademarks property of respective owners).

This document has been translated to the best of our knowledge. In case of doubt however only the German original shall be considered authoritative.

The german original of this Technical Bulletin has been authorized by the german aviation authority (LBA) on August 07, 1995

LIMBACH Flugmotoren

Technical Bulletin

50

Subject: Fuel hoses

Affected engine models: All engines models

L 1700
L 2000
L 2400

Background information: The fuel hoses used to date are unsuitable for unleaded fuels

Priority: When using leaded fuels, none; when using unleaded fuels, at the next 50-hour check.

Compliance: The fuel hoses mounted by the manufacturer are supplied as of now in a quality which permits the use of unleaded fuels. Already supplied fuel hoses on engines which are operated with a mixture of AVGAS 100 LL and unleaded fuels must be replaced. In the case of engines which are operated exclusively with leaded fuels, a change in the fuel lines is not necessary. In addition, we recommend that information is obtained from the manufacturer of the airframe regarding suitability of the fuel hoses installed for unleaded fuel.

Remarks: The new hoses can be recognized externally by a crimped sleve (between hose and fire-protecting hose) at both ends of the hose.

This document has been translated to the best of our knowledge. In case of doubt however only the German original shall be considered authoritative.

The german original of this Technical Bulletin has been authorized by the german aviation authority (LBA) on August 08,1995

LIMBACH Flugmotoren

Technical Bulletin

53.1

Subject: Unleaded fuel

Affected engine models: All engine models:

L 1700
L 2000
L 2400

Background information: Production stop of leaded automotive fuel.

Priority: None

Compliance:

Series L 1700 and L 2400:

Engines of this series may be operated with immediate effect with unleaded fuel Super Plus unleaded, according to DIN EN 228. Other unleaded fuels may be used as long as they have a minimum octane rating of RON 98 and MON 88.

Series L 2000:

Engines of this series may be operated with immediate effect with unleaded fuel Super Plus unleaded according to DIN EN 228. Other unleaded fuels may be used as long as
- they have a minimum octane rating of RON 98 and MON 88 and
- the engines of this series have been adapted pursuant to Technical Bulletin 42

General Remarks (all engine models):

The following should be taken into account:
1. The engine's fuel lines must be suited for unleaded fuel. On this, please check Technical Bulletin 50.
2. The airplane's fuel lines and tank must be suited for unleaded fuel. On this matter, please contact the airplane manufacturer or follow his instructions in this context.
3. Use brand name fresh fuel only. Storage of unleaded fuel is limited. Prolonged storage of fuel in open tanks may cause evaporation of light volatile components and a change in the fuel's properties. On addition, fuel properties are affected by seasonal changes.
4. The engine's temperature should be kept at the lowest possible level. Ideal is less than 180 °C in a climb. In this context see Technical Bulletin 44.
5. Use of additional additives is not permitted.
6. Mixing of lead and unleaded fuels is not advisable.
7. References in the manuals are to be added in handwriting.

Note: Technical Bulletin 40 is herewith invalid.

Remarks: This document has been translated to the best of our knowledge. In case of doubt however only the German original shall be considered authoritative.

Approval: This Technical Bulletin is approved in accordance with the procedures of the LBA approved development organization I-EC 27.

LIMBACH Flugmotoren

Technical Bulletin

54

Subject: Oil- and Fuel hose assemblys

Affected engine models: All engine models:

L 1700
L 2000
L 2400

Background information: Change of material specification, improved quality of hoses.

Priority: None

Compliance: Fuel- and Oil hoses manufactured by Limbach Flugmotoren GmbH & Co. KG have an extended service life of 5 years. The expiration date is inscribed on the crimp-on clamp at the end of the hose. The markings have the format MM/YY. As an exemple the marking 04/02 would mean that the hose must be replaced until april 2002.

Note: Only the expiration date engraved on the clamp is valid. Old hoses are not affected by this bulletin. Correct the operating manual accordingly in handwriting.

This document has been translated to the best of our knowledge. In case of doubt however only the German original shall be considered authoritative.

Approval: This Technical Bulletin is approved in accordance with the procedures of the LBA approved development organization I-EC 27.

1.6 Master Switch

The master switch isolates the battery from the aircraft electrical system. It is switched on before flying and off after the flight is completed. It may also be switched off whilst soaring engine-off. With engine running only switch off in case of emergency (e.g. short circuit, jammed starter relay or similar).

1.7 Circuit Breakers

The electrical system (excluding the starter circuit) is protected against overload and short circuit by circuit breakers.

Circuit breaker for battery	25A
Circuit breaker for generator	20A

A short circuit or overload will trip the button of the circuit breaker affected. After correction of the fault the button is pressed to restore the circuit. If the battery charge is low (e.g. after repeated attempts at starting in winter) the button of the generator circuit breaker (20A) may trip whilst the engine is running (in flight). If this occurs it should be pressed again after about two minutes or the battery will not be charged.

1.8 Ammeter

With a well charged battery the ammeter indicates no current flow with the engine running. With a discharged battery the ammeter will give a positive (+) reading whilst the battery is recharged with the engine running. With a number of extra heavy auxiliary loads or if the engine is stopped and assuming that there is a load on the battery, it will indicate battery discharge (-). Continuous heavy charging (approx. 10 A) when the engine is running indicates that the battery is no longer able to hold a charge (i.e. is too old) or that the regulator is faulty.

1.9 Antenna Connection

A top loaded antenna for radio communication is located within the fin. The coaxial cable runs from the antenna to a point beneath the luggage locker where the remainder of the cable is coiled and secured. From there it can be routed to the radio (if fitted). When fitting a radio the appropriate regulations are to be observed.

1.10 Connections for other electrical equipment

Fuses and connections for other electrical equipment (e.g. radio, ACL, position lamps etc.) are located on the fire-proof bulkhead. The fuses should be appropriate to the current load of the specific equipment installed. The on-board supply is 12 VDC negative earth (ground). When fitting additional equipment the appropriate regulations are to be observed.

1.11 Airspeeds

Maximum airspeed	102 knots (118 mph)	190 km/h
Maximum manoeuvring speed	81 knots (93 mph)	150 km/h
Maximum rough air speed	81 knots (93 mph)	150 km/h
Maximum airspeed with spoilers extended	102 knots (118 mph)	190 km/h

Airspeed indicator markings

Red line	102 knots (118 mph).	190 km/h
Yellow sector	81-102 knots (93-118 mph) (Caution)	150 - 190 km/h
Green sector	38-81 knots (~~44~~-93 mph).	70 - 150 km/h

1.12 Weights

Empty weight	410 kg approx.
Max. permissible load including fuel	200 kg approx.
Max. permissible AUW (all up weight)	610 kg
Max. weight of non-lifting components	450 kg

For an overview of actual weights measured see Maintenance Manual page *.

1.13 Centre of gravity at flying weights

Aircraft attitude	Wing chord rib 6 (2.20m = 86.59") from centre line (horizontal).
Datum point:	2.00m (78.72") in front of the leading edge of the root rib 0 (0.52m = 20.5" from the centre line).
Forward limit of CG:	2.143m (84.3") aft of datum
Rearward limit of CG:	2.334m (91.9") aft of datum

1.14 Placards and warnings

In addition to the fireproof type plate and the usual placards, the following signs must be appropriately displayed:-

1. Port side of cockpit by the levers:
   "Spoilers -full travel operates wheel brake"

2. On the instrument panel, by the controls:

   "Choke - pull for rich"
   "Ignition - on - off"
   "Fuel - off - on"
   "Master switch - on - off"
   "Throttle"
   "Ventilation"
   "Starter"
   "Propeller brake"
   "Cockpit heater - pull"
   "Carburettor heating"
   "open - cooling vents - closed"

3. By the canopy emergency jettison handle:
   "Canopy Jettison: Pull on front and top handles, throw clear to the right"

4. On the rear wall of the luggage locker:
   "Luggage - max. 10 kg (22 lbs)"

5. Between the seats by the trimmer lever:
   "Nose down - Trimmer - Nose Up"

6. On the fuselage near the fuel tank filler cap:
   "AVGAS 100 LL or 4 star leaded petrol (gasoline) see Limbach TB 53.1 and 50
   Fuel tank capacity: 44 litres" (gallons: 9,7 imperial/ 11,6 US) or, depending on size fitted:
   Fuel tank capacity: 55 litres (gallons: 12.1 imperial/14.5 US),

7. On the fuselage adjacent to the:
   - mainwheels (2 wheel u/c) "2.1 bar"
   - mainwheel (sprung single wheel u/c) "2.1 bar"
   - mainwheel (fixed single wheel u/c) "1.8 bar".

8. Above the tailwheel "2.5 bar" and on the nose-wheel "1.5 bar".

9. By the oil filler: "Oil 2.5 l"

10. On the instrument panel:
"Caution - Wet Wings - see Flight Manual"
"Engine running - Cowling flap open"
"No smoking"
"Pre-take-off checks":
folding wings secured, (if applicable) safety harness securely fastened, trimmer set, spoilers closed and locked, canopy locked, full and free movement of controls, fuel cock open, fuel level, cowling flap open.

1.15 Aerobatic manoeuvres, cloud flying

Aerobatics and cloud flying are not permitted.

2. Operating Instructions

2.1 General

The Falke is a self launching motor glider. It may be flown with an MGPPL (Motor Glider Private Pilot's Licence).

It is of course necessary for the pilot to have a thorough understanding of motor gliders and the operations of the engine. He must become thoroughly acquainted with the Flight Manual and the Operating Handbook and master the essential details of the airframe and engine.

2.2 Daily Inspection

Before commencing the day's flying or after unfolding the wings or rigging the aircraft, it is necessary to inspect the airframe, the engine and the propeller for airworthiness. The following checks should be made:

2.2.1 Airframe

During the inspection everything should be checked carefully (no cracks or deformations), with particular attention paid to safety pins, pulleys and cables, as well as play in the controls.

See AD 82-134/SB 653-42

1 Main rigging points. Check the four wing attachment points. Check that the main bolt is fully home and secured, and check that the two rear wing attachment points are secured.

2 Check that the aileron controls in the fuselage are connected and secured.

3 Check that the spoiler controls in the fuselage are connected.

See AD 94-001/2 enclosure 1 and AD 93-001/3 enclosure 2

4 Check the controls from the cockpit for full and free movement and that the starboard column is secure.

5 Check rudder pedals and nosewheel steering if applicable.

6 Check pulleys, fairleads and cables for wear and kinking.

7 Check operation of spoilers from the cockpit.

8 Check correct operation and effectiveness of the brake.

9 Check the instruments and radio.

10 There is a facility for draining the pitot: remove the drain plug which is accessible through the hand hole under the tailplane. Check especially after exposure to rain and road transport and drain as necessary.

11 Check that the safety harnesses and their fittings are in proper condition and secure.

12 Any luggage should be secured by the straps provided.

13 Check for foreign objects.

14 Check the canopy, canopy lock, canopy jettison system and direct vision window.

15 Check the spar/fuselage fairings cover plates on the underside, both sides of the fuselage.

16 Check that both outriggers are in good condition and correctly attached (only applies in the case of single mainwheel undercarriage).

17 Check both pushrods at the aileron.

17a Check the wing folding attachments are secured and also the aileron drives at the folding points (if applicable); check that the wing joint fairings are secure.

18 Check that both ailerons are attached and secured.

19 Tailplane - check that the front connection is tight and secured.

20 Check that the elevator is connected to the pushrod in the fuselage and secured.

21 Check the trimmer on the elevator.

22 Rudder - check rudder bearings, fixing and cable attachments, and security. After rigging check that the rudder moves in the correct sense.

23 Check the tailwheel assembly bearings and axle for full and free movement (also nosewheel if applicable).

24 Check the condition and tyre pressure of mainwheel(s), tailwheel (or nosewheel) and outrigger wheels if fitted.

25 Check the underside of the fuselage for damage or oil (hot exhaust).

26 Check the general condition of the ply, fabric and paint finish of the aircraft for damage.

27 Check that the ground handling yoke has been removed from the nosewheel.

2.2.2 Engine (see also Engine Handbook)

1. Check the engine thoroughly for missing or loose nuts, bolts, screws etc. Check fuses, cooling ducts, ignition leads and V-belt for condition and beware of chafing.

2. Check that the following operate freely: throttle, choke, engine cooling flap, propeller brake, heating, ventilation and carburettor heating.

3. Check the oil level and top up if necessary. The oil level should be checked after every hour or

two and after every longer flight, with topping up if necessary.

4. Check there is no leakage or chafing in oil or fuel lines.
5. Inspect the fuel filter and empty/clean if necessary. Open the fuel drain valve briefly (press to open, on the outer surface of the fuselage under the tank).
6. Check the battery acid level, battery mounting and vents.
7. Check the engine mountings for security.
8. Check the cooling duct panels for cracks and ensure they are securely attached.
9. Check the engine bay for foreign bodies.
10. Examine the cowling components for cracks. Replace cowling and ensure that all fasteners function correctly.
11. Check the fuel tank level.
12. Check that the fuel tank vent is not blocked. Use only the original filler cap with vent (bearing the words "Patent blau").

2.2.3 Propeller (see also Propeller Handbook)

1. Examine the propeller for indentations, splits and other damage. The propeller should be cleaned frequently to remove any accretion of insects and grass.
2. All bolts must be tight.
3. Check the spinner for cracks and ensure that the bolts are tight.

2.3 Pre take-off checks

It is essential to check the following points before each flight.

- Folding wings secured (if applicable)
- Canopy closed and locked
- Safety harnesses secure
- Trimmer set
- Spoilers closed and locked
- Full and free movement of controls
- Fuel on
- Fuel in tank
- Cowling flap open

2.4 Starting the Motor Glider

Before a cold start, especially in chilly weather, switch off the ignition then turn the propeller in the normal direction a few turns. Check whether you can hear the click of the magneto (essential!). Is any unusual resistance felt when turning the propeller? After these checks have been carried out, the motor glider is ready for service.

2.4.1 Starting the engine (see also Engine Handbook)

Before starting, ensure that someone is standing to the left at the front of the machine to make sure that no-one is near the propeller. All club members and also any spectators must be instructed regarding the dangers of rotating propellers: contact with a rotating propeller can be fatal. Close the canopy before starting. Before pressing the starter the pilot calls from the cockpit "Clear prop" and the observer confirms by repeating "Clear prop" that the area around the propeller is clear. Then, and only then, proceed to start the engine.

Starting procedure:

- Apply parking brake
- Open engine cooling vent
- Open fuel cock
- Pull choke if engine is cold
- Move the throttle approximately 2 cm from the tick over position
- Master switch on
- Switch off any sensitive electrical equipment (radio etc.)
- Ignition on
- Is the propeller clear?
- Press starter button

As soon as the engine starts release the starter button, push in the choke and set the throttle so that the engine ticks over at about 1,000 rpm. The oil pressure should increase within 10 seconds.

When cold the engine will usually start within 2 - 3 seconds. Then return the choke immediately or the engine will flood and stop. If the motor fails to start after two attempts, push in the choke, open the throttle completely or almost completely and try starting again. If the engine does not start after five more attempts it is probably flooded. Ignition off, full throttle, choke closed. Turn over the engine by hand backwards about eight to a dozen times. Then try starting again with full throttle, reducing the throttle setting as soon as the engine starts. A warm engine is best started with the choke pushed in and with the throttle at a tickover setting.

2.4.2 Hand starting the Engine

The engine can also be started by turning the propeller, the pilot remaining in the cockpit of course. The same comments apply with regard to

choke and throttle as when starting using the electric starter. **Never hand start without chocks** in front of the mainwheel(s). Take up a good, firm position, facing the propeller call "Switch off" to the person in the cockpit who checks that the ignition switch is really in the "off " position before answering "off". Pull the propeller past the ignition point once or twice. The impulse click of the magneto will be heard. Ensure that your hands are clear of the propeller when it starts.

After confirmation from the cockpit that it is off first pull the propeller over several times. "Ignition on" followed by shouted confirmation from the cockpit of "on". Continue as for starting with electric starter.

2.4.3 Warming up, static rpm check (see also Engine Manual)

Warm up the engine by first running it at 1,000 rpm for about two minutes then at 1,500 rpm for five to 10 minutes (depending upon the ambient temperature) until the oil temperature reaches its operating point of 50 °C. The temperature gauge is relatively slow to respond so that at an indicated 50 °C the engine is already sufficiently hot. If the take-off point is some distance away, the engine may be warmed up whilst taxiing. As soon as the operating temperature is reached, apply the brake, hold the control column fully back and run up the engine. Gradually open the throttle, check oil pressure and temperature and run for about 20 - 30 seconds, then check the carburettor heating. The revs should reduce by approximately 150 rpm when carburettor heating is applied. (Do not start with carburettor heating pulled). Then turn off carburettor heating and return to tickover.

2.4.4 Taxiing

The Falke can taxi unaided and is steered on the ground with the tailwheel (or nosewheel), with a turning circle of 12 - 15 m (with nosewheel this is reduced to approximately 3 m). The mainwheel brakes will stop the motor glider effectively. In the two wheel undercarriage version the port seat also has heelbrakes and the turning circle can be reduced by their judicious use.

When the Falke is being moved (e.g. ground handling, hangar packing) it is helpful if an assistant steers the aircraft by moving the rudder - and hence the tailwheel. A ground handling steering bar is useful for the nosewheel version,.

2.5 Take-off and climb

(Caution: See also 2.12 Wet wings - warning).
Pre-flight check list (see 2.3 or the placard in the cockpit).

- Trim neutral, spoilers closed and locked, control column central (do not push the column forwards).
- Apply full throttle
- For normal take-off run see section 3.1.
- Check engine revs, allow ground speed to increase to 46-49 knots (53-56 mph) then climb with the airspeed not less than 46 knots (53 mph), with rpm at 2600 - 2700 rpm. Continue climbing to about 650-1000 ft such that the airfield is within reach in case of engine failure. After reaching about 150 - 250 feet the engine revs may be reduced. 85-90 km/h 85 km/h
- Check that the oil pressure and oil temperature are in the green sector. The limits must not be exceeded.

- Ensure that the airspeed when climbing is sufficient to cool the engine, so preferably keep the airspeed a little higher, especially in hot weather.
- During a prolonged climb in hot weather, monitor the oil temperature carefully: if it approaches the upper limit then fly faster and reduce engine revs. i.e. accept a shallower climb on reduced power.

2.6 Level Flight

The minimum airspeed for level flight is 43 knots (50 mph). Best cruising speed is about 70 knots (81 mph) at 2,500 rpm. Maximum cruising speed 81 knots (93 mph) at 2,700 rpm.

2.7 Landing

The aircraft can be landed with the engine either running or stopped. Approach at about 49 knots (56 mph), flying a normal gliding type circuit. Control the glide path with the spoilers. As the spoilers are effective it is not usually necessary to slip the aircraft. With spoilers extended the rate of sink at 49 knots (56 mph) is approximately 3.7 m/s (12 feet per second). At minimum touch down speed (38 knots / 44 mph) the Falke touches down with the tailwheel then with the mainwheel (in the case of the nosewheel version first with the mainwheels then with the nosewheel). The landing run of about 300 feet can be reduced effectively using the mainwheel brakes. The brake is operated by the spoiler control on the last part of its travel when it is pulled fully back, so never touch down with the spoiler lever pulled fully back. The tail dragger version of the Falke also features heelbrakes, operated from the port pilot seat. If the heelbrakes are applied to reduce speed after landing they must be operated evenly to avoid the Falke swerving.

2.8 Stopping and starting the engine in flight

Before switching off allow the engine to cool down by gliding on tick-over or flying level with the engine throttle back for a minute or two then return the throttle to tick-over, switch off all sensitive electronic equipment and finally switch off the ignition. Reduce airspeed to no more than 43-46 knots (50-53 mph) 80-85 km/h to reduce windmilling so that the propeller brake may be applied if desired in the final stages. If the engine has not been allowed to cool there may be a tendency for it to continue firing spasmodically. If this occurs, apply full throttle, during the last stage of the engine turning. Should it be necessary, the propeller can be aligned horizontally with quick blips on the starter.

Before restarting in the air open the cowling flap, switch off all sensitive electronic equipment, switch on the ignition, fly at about 43-49 knots (50-56 mph). 80-90 km/h Set choke and throttle settings for hot or cold engine as on the ground. The engine is very easy to start if the pilot is familiar with its operation.

If the engine is cold do not use full throttle until the oil temperature reading has returned to the green sector. At airspeeds of about 70-80 knots (81- 130-150 km/h 93 mph) a quick blip on the starter will start the propeller turning and the engine will start immediately (depending on engine temperature). Choke in, about one third throttle, ignition on. Height loss is in the order of 500 - 600 feet.

2.9 Flying with the engine stopped

The aircraft handles very well at 43-51 knots (50- 80-95 km/h 59 mph) with a sink rate of about 1.2 m/s (3.94 ft/s) in straight flight.

Close the cowling flap to reduce drag when the engine is off. Open the cowling flap again before restarting the engine. The Falke, being a low wing monoplane, has to be flown cleanly. When skidding or flying at less than 43 knots (50 mph) the airflow breaks away from the wing/fuselage fillet area and performance is lost. When gliding and especially when turning, fly the aircraft as cleanly as possible and avoid skidding in turns. The traditional solution of a length of string mounted on a 10 cm (4") piano wire mast, about 20 cm (8") ahead of the canopy in front of each seat, is still a highly cost-effective aid to accurate flying. With a little practice the pilot will be flying accurately and climbing well in thermals even when compared with pure gliders.

80 km/h

2.10 Slow flying and stall characteristics

At maximum flying weight the stalling speed is about 35 knots (40 mph) with the engine running or stationary. At this speed the airflow over the wing roots begins to break away; ailerons and rudder are still fully effective. With a forward CG position the Falke simply lowers it's nose if the control column is pulled right back. With rearward CG positions it is possible to fly on, fully stalled in still air conditions with the control column right back whilst retaining full aileron and rudder effectiveness. In both CG positions immediate recovery is effected by easing the control column gently forward. Needless to say, in rough air conditions stalling will cause a wing to drop. When the aircraft is stalled with high engine revs the propeller slipstream tends to produce false ASI readings from the tail mounted pitot. If this occurs a stalled condition is still recognisable by the fact that the ASI needle flicks vigorously between 27 knots (31 mph) and 54 knots (62 mph). If stalled in a 30º turn, the Falke gradually drops the outer wing such that normal flying speed may be regained

65-70 km/h

50 km/h

100 km/h

when both wings are level. Stalling characteristics are the same engine on or engine off.

2.11 Spinning

Except with rearward CG positions it is very difficult, if not impossible, to make the Falke spin. If no corrective action, such as releasing the backward control column pressure, is taken the incipient spin becomes a spiral dive, from which a transition to normal flight is easy. Use of spoilers is recommended in the spiral dive. Even with rearward CG positions a continuous spin is impossible. A spin may be induced by gradually easing back the control column and crossing the controls but it will come out of the spin within five turns of its own accord even if controls are held crossed: the spin becomes a slipping manoeuvre from which normal flight is easily resumed. Pro spin aileron will cause spin to become a spiral dive from which the pilot should pull out gradually but without delay to avoid overstressing the aircraft (see above).

A spin can of course be corrected in the normal manner, this taking about half a turn. When rotation stops pull out of the resulting dive gently and do not hesitate to use the spoilers to prevent the speed building up excessively. **The Falke is not approved for aerobatics.**

2.12 Wet wings - warning

The Falke wing has a glider airfoil which is sensitive to rain. Drops of rain on the wings disturb the air flow and reduce the lift. Whereas minimum airspeed with dry wings is about 38 knots (44 mph) with wet wings it is 43-46 knots (50-53 mph). Wet wings change the stalling characteristics. Whereas the Falke is positively docile with dry wings it will drop a wing when wet. When flying in rain keep the airspeed

70 km/h
80-85 km/h

above 46 knots (53 mph). Do not attempt to take-off at less than 46 knots (53 mph). Fly at about 57 knots (65 mph) when climbing and on the approach. Avoid steep turns and other manoeuvres involving high G-forces. If there is snow or ice on the wing it must be cleaned off completely before take-off. Do not forget the tailplane.

2.13 Cold weather flying and risk of carburettor icing

Especially when flying in the winter it is important to check that the oil temperature does not drop below 70 °C whilst the engine is running. The carburettor and intake are warmed by the hot recirculating engine oil.

By installing a cylinder head thermometer (optional extra) the supply of cooling air to the engine can be accurately regulated by controlling the cowling flap. The cylinder head temperature must be monitored carefully: under no circumstances must the temperature be allowed to exceed the maximum of 250 °C.

Carburettor icing can occur when humidity is high (especially near clouds) and where the air temperature is between -10 °C & +18 °C. The pilot will recognise the rough engine note and reduced rpm. Carburettor heating control should be pulled immediately.

Carburettor icing can also occur when the engine is idling for long periods whilst gliding. Pull carburettor heat from the start but remember to cancel carburettor heat when you require full engine performance again.

Operation of the carburettor heater (when there is no icing in the carburettor) results in a drop in revs of

approximately 150 rpm. In warm dry air carburettor heat should be fully off (pushed fully home).

2.14 Operating without the outrigger wheels (single wheel undercarriage)

The Falke can also be operated without the outrigger wheels fitted. Taxiing is possible with a wing tip holder. Take-off is then like a normal glider launch - someone runs with the wing until the pilot has aileron control. After touchdown the Falke can be held level with the ailerons virtually until the aircraft stops.

2.15 Safety factors and engine reliability

It should always be borne in mind that the motor glider engine is not designed to such stringent specifications as that of a light aircraft (e.g. single ignition system instead of dual); it is simpler and cheaper. This must be taken into account when flying, by observing safety heights and flying in such a way that suitable fields are always at hand should it be necessary to land out.

2.16 Attachment points for parachute static release

These are to be found marked red on the tubular member above the back-rest, port for the port seat and starboard for the starboard seat.

2.17 Emergency canopy release

Pull the canopy lock knob above and the emergency knob (painted red) in front and throw off the canopy to starboard.

2.18 Type conversion

Before flying the Falke study the Manuals for the motor glider, the engine and the propeller. Complete a few type conversion flights with someone who is thoroughly acquainted with the aircraft.

A good number of solo flights should be completed before taking off with a passenger. Glider pilots without previous experience of light aircraft should particularly study the servicing and maintenance of the engine and propeller, and also the take-off procedure.

2.19 Crosswind

The Falke has been flight-tested for take-offs and landings in crosswinds up to 13 knots (15 mph). 25 km/h

2.20 Field landings

Flight-testing of the tricycle undercarriage SF 25 C Falke included field landings on unprepared soft earth (a potato field) along the rows. Other factors to take into account include wind strength and direction, length of landing area, obstruction free approach, gradient etc.

3. Performance data

Section 3 is based on two propellers only, namely the HO 11A - 150B 90L and MT 150 L90 - 1A

3.1 Take-off performance

These performance figures have been obtained from type test results and can be reproduced provided that the motor glider and engine are in good condition and that the pilot is of average ability and skill.

Maximum all up weight (AUW): 610 kg (1344 lbs)
Level airfield with short well kept grass. Wings dry, wing surface clean. No wind. Air pressure standard for height of airfield above sea level.

Lift-off speed: approx. 38 knots (44 mph). 70 km/h

	Airfield height a.s.l.		Air temperature °C							
			-15°		0°		+15°		+30°	
	m	ft	m	ft	m	ft	m	ft	m	ft
Take-off run	0	0	90	295	101	331	112	367	124	407
	250	820	95	312	107	351	119	390	131	430
	500	1640	101	331	113	371	126	413	139	456
	750	2460	107	351	120	394	134	440	148	486
	1000	3280	114	374	128	420	142	466	158	518
Distance req. to clear 15 metre (49 ft) obstacle	0	0	233	764	261	856	291	955	322	1056
	250	820	247	810	277	909	308	1010	341	1119
	500	1640	263	863	294	965	327	1073	362	1188
	750	2460	279	915	312	1024	348	1142	385	1263
	1000	3280	296	971	332	1089	369	1211	409	1342

3.2 Rate of climb

Maximum all up weight at sea level
Rate of climb: 2.9 m/s
Climb speed: approx. 46 knots (53 mph) 85 km/h

3.3 Airspeeds

Level flight from 40 knots (47 mph), throttled back 75 km/h

Cruising speed:
ca 70 knots (80 mph) at 2500 rpm 130 km/h

Maximum cruise speed:
81 knots (93 mph) at 2700 rpm 150 km/h

Speed on approach:
49 knots (56 mph) 90 km/h

Touchdown speed:
38 knots (44 mph) 70 km/h

3.4 Range and endurance (zero wind conditions)

Range & endurance (zero wind conditions)							44 litre fuel tank (gallons: imperial 9,67 US 11,61			55 litre fuel tank (gallons: imperial 12.1 US 14.5		
rpm	fuel consumption litres	gallons imp	US	airspeed kph	knots	mph	duration hrs mins	range kms	miles	duration hrs mins	range kms	miles
2500	10,3	2,26	2,72	130	70	81	4 16	555	347	5 20	690	431
2600	11,6	2,55	3,06	140	76	87	3 47	530	331	4 45	660	412
2700	13,1	2,88	3,46	150	81	93	3 20	500	312	4 10	625	391

N.B. Endurance and range do not allow for any fuel reserve

3.5 Gliding performance

Engine off, cowling flap closed:

Min sink: 1.09 m/s (3.58 ft/s) at 40 knots (47 mph) 75km/h
(single wheel undercarriage)
1.15m/s (3.77 ft/s) at 40 knots (47 mph) 75km/h
(two wheel undercarriage)

Glide ratio: ca 1:22 at 49 knots (56 mph) 90km/h

4. Centre of gravity and weight limits

It is the responsibility of the pilot (P1) to see that the weight limits are not exceeded.

4.1 Empty weight centre of gravity

Make sure that the empty weight CG is still within the permitted limits after repairs, respray or the installation of new equipment etc. Add balance weights if necessary. This work has to have the approval of an authorised inspector.

Centre of gravity limits for various empty weights are stated in Section 7 of the Maintenance Manual.

If the empty weight CG position is within the limits prescribed then the centre of gravity in flight will be within the permitted limits.

4.2 Centre of gravity at flying weights

In flight the centre of gravity has a considerable influence on the handling qualities of the aircraft. For this reason it is of vital importance that the prescribed CG limits are scrupulously observed.

The following limits of CG flying weights have been tested and approved:

The centre of gravity for all flying weights must be within the limits 2.143 m (84.35") and 2.334 m (91.87") aft of the datum point.

4.3 Weight placard

Cockpit weight limits (including parachute(s), both seats combined)
Max: 180 kg
Min: 60 kg
Luggage: 10 kg max.

It is important to ensure that the cockpit load (including fuel and possible luggage) does not exceed the maximum cockpit load. Allow 0.73 kg per litre of fuel (1.61lbs), i.e. a full 44 litre tank represents 32 kg (71 lbs) and a 55 litre tank 40 kg (88lbs). The luggage in the luggage compartment has no significant effect on the centre of gravity position.

5 Minimum equipment

1 Airspeed indicator (ASI) (up to 108 knots/124 mph) 200 km/h
2 Altimeter
3 Magnetic compass
4 Rev counter
5 Oil temperature gauge
6 Oil pressure gauge
7 Ammeter
8 Fuel gauge
9 Engine hours counter
10 two four-element safety harnesses
11 two back support cushions, to be used in the absence of parachutes.
12 Flight Manual, approved by the LBA, to be carried on board
13 Cylinder head temperature indicator (Italy only)

6 Additional electrical fuel pump (option)

An electrical fuel pump can be fitted as a special option. *It provides additional safety (switch on, check light goes on or the pump can be heard)*:

a) Before starting the engine
b) Before take-off
c) On the approach (if doing a touch and go)
d) In flight if there are fuel problems (e.g. air bubbles at high altitude, when it is hot or if the fuel is below specifications or when climbing very steeply).

In normal flight the additional pump should be switched off (switch off, light off).

AIRWORTHINESS DIRECTIVE

82-134 Scheibe-Flugzeugbau

Date of issue:
July 27, 1982

Affected motorglider:
Scheibe-Flugzeugbau SF25 B, C, D "Falke" and SF25 E "Super Falke".
All serial numbers.

Subject:
Main wing assembly.

Reason:
Inspection of proper engagement of the main rigging pin in the main wing fittings.

Action and compliance:
Before next flight and upon each wing assembly action the inspection in accordance with "Technische Mitteilung" has to be accomplished.

Technical publications of the manufacturer:
Scheibe-Flugzeugbau "Technische Mitteilung" No. 653-42 of 7-12-1982,
which becomes herewith part of this AD and may be obtained from Messrs.
Scheibe-Flugzeugbau, August-Pfalz-Straße, P.O.box 1829
D-8060 Dachau.

Accomplishment and log book entry:
Action to be accomplished by a skilled person.
TM and AD to be included in the flight and operating manual until a final regulation has been made.

	Technical Note 653 - 42	Page: 1 No. of Pages: 2

Subject: Main wing assembly (fittings with main wing centre pin)

Effectivity: Motorglider SF 25 B "Falke" all serial numbers
Motorglider SF 25 C "Falke" all serial numbers
Motorglider SF 25 D "Falke" all serial numbers
Motorglider SF 25 E "Super-Falke" all serial numbers

Accomplishment: Before further flight, and upon each wing assembly

Reason: Inspection of proper engagement of the main rigging pin in the main wing fittings

Instructions: Before further instructions the following must be checked:

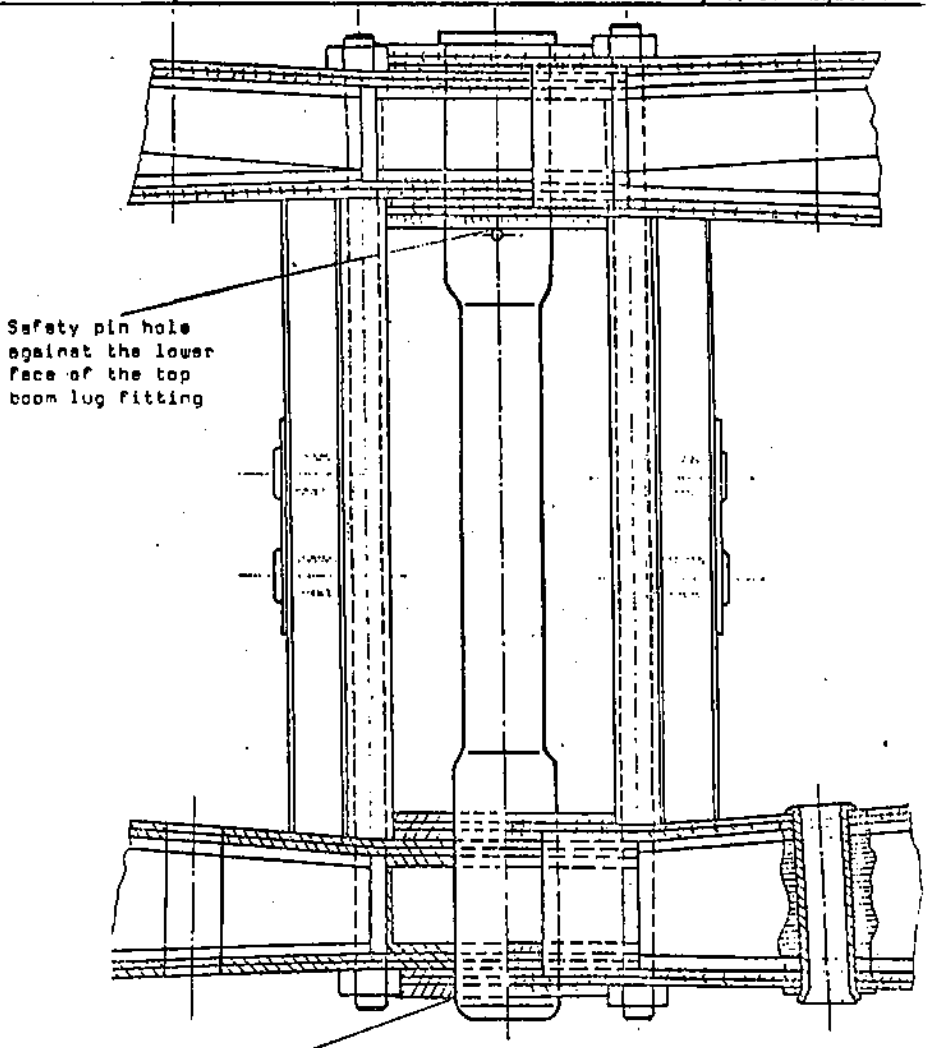
1. It must be checked that the main rigging pin is fully through the bottom lug fitting. With the main rigging pin pulled fully upwards by means of the top handle, such that the 2,5 mm safety pin is held against the lower face of the top boom lug fitting, inspect the amount of plain portion of main pin shank protruding below the port bottom boom lug fitting (Wings imburdened).If difficulty in the inspection is experienced when the Motorglider is assembled due to poor access, the wings must be removed and port wing inspected. Certainly upon the following assembly the inspection must be made again (when necessary, by help of a mirror and a handlamp).
   Should no plain shank be visible protruding below the port bottom lug fitting, according to 1., the aircraft shall not fly until the cause has been established, and rectified. For that, contact the manufacturer Fa. Scheibe Flugzeugbau.
2. Normally the main rigging pin has one safety pin hole. If more than one safety pin hole exists the aircraft must not be flown until the correct hole has been established, and the redundant hole made unusable (flush rivet)

If the inspection according to 1., shows that the main rigging pin is not fully through the bottom lug fitting with the plain portion, the first thing is to check that, with the main rigging pin fully down, another safety pin hole could be made, so that the plain portion is through the bottom lug fitting. Another thing to check is that the female lug fittings has not been splayed through a wrong assembly. In case the fittings must be straightened and a new inspection according to 1., must be made, contact Fa. Scheibe Flugzeugbau.

Important notice: Extreme care must be exercised when aligning the male/female lug fittings to ensure that female fittings are not splayed during mainplane rigging and derigging.
Do not use force by bringing in the main rigging pin (for example by means of a hammer or similar), but carefully insert by hand with the wings imburdened.

When there is doubt about the correct assembly, or any damage is determined which is likely to have a detrimental effect upon the airworthiness of the aircraft, contact Fa. Scheibe Flugzeugbau.

	Technical Note 653 - 42	SF 25 B/C/D/E
		Page: 1 No. of Pages: 2



SCHEIBE FLUGZEUGBAU GMBH
Dachau, Aug.-Pfaltz-Str.23
12. Juli 1993

Anlage zur Lufttüchtigkeitsanweisung Nr. 1993-001/3
L´Hotellier Schnellverschluß, Verriegelungskeil

Teil II

LBA-anerkannte Sicherungsverfahren

Das LBA hat folgende Sicherungsverfahren zur Sicherung von L´Hotellier Schnellverschlüsse anerkannt:
Uerlingshülse bzw. Hülsen nach dem Uerlingsprinzip (siehe Teil III), Sicherungsnadel (Abb. 2 und 2a), LS-Sicherungshülse (Abb. 3), Schempp-Hirth-Sicherungsfeder (Abb. 4) und Wedekind-Sicherung (Abb. 5).

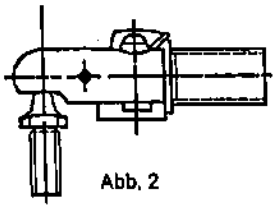
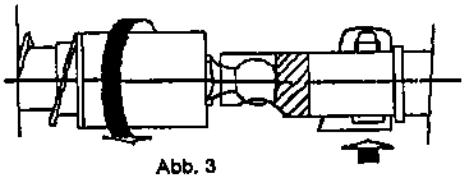


Abb. 2

Abb. 2a



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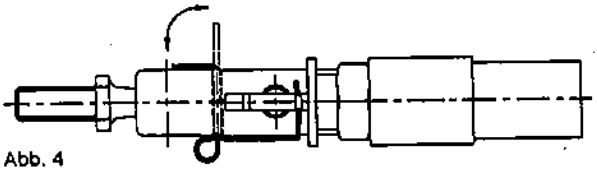
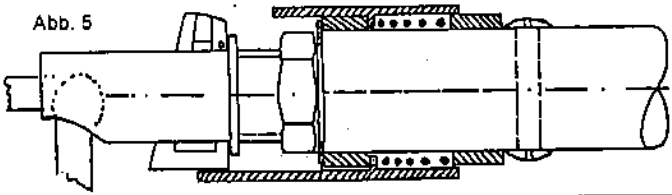


Abb. 4

Abb. 5



Anlage zur Lufttüchtigkeitsanweisung Nr. 1994-001/2
L'Hotellier-Schnellverschluß, Typ 45 -Ratsche-

Teil I

L'Hotellier Schnellverschlüsse

Mit der Funktion der Schnellverschlüsse sollte sich jeder schon vor der Montage vertraut machen.
Jeder Schnellverschluß wird mit zurückgezogenem Sicherungsexzenter vollständig über die Kugel an der Stoßstange geschoben. Beim Verriegeln geht der Sicherungsexzenter etwas zurück, so daß dann bei richtiger Verbindung die Bohrung auf der Kugel abgewandten Seite des Sicherungsexzenter sichtbar wird.

In diese Bohrung muß die Sicherungsnadel eingesteckt und damit der Schnellverschluß gesichert werden.

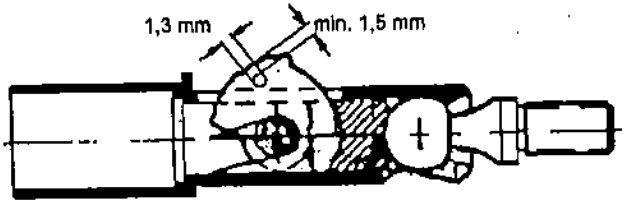
Achtung!
Durch nochmaliges Belasten der Steuerverbindung ist das vollständige Einkuppeln der Kugel zu überprüfen !

Warnung !
Nicht gesicherte Schnellverschlüsse können sich im Betrieb selbsttätig öffnen !!

Teil II

Arbeitsanleitung zur Anbringung der Bohrung

Beim Anbringen der Bohrung ist folgendermaßen vorzugehen:
Die Bohrung von 1,3 mm Durchmesser ist bei richtig eingesetzter Kugel so anzubringen, daß eine Seite der Bohrung am Hauptkörper des Verschlusses anliegt und auf der Rändel-Seite noch mindestens 1,5 mm Material stehen bleibt.



Warnung !
Beim Bohren ist darauf zu achten, daß keine Späne in den Verschluß bzw. zwischen Kugel und Pfanne gelangen.

MAINTENANCE MANUAL

1. Rigging and De-rigging

If the Falke is to be rigged and de-rigged often it is worthwhile obtaining support wheels for the fuselage so that the fuselage can be moved easily and if necessary even for short journeys on public roads. Every Falke fuselage has attachment points for fuselage support wheels. Simple supports without wheels are also available for parking the fuselage. (Not applicable in the case of the two wheel undercarriage version.)

1.1 Rigging

Before rigging, always clean and grease all fittings, especially after an open trailer journey:

1) Clean & grease front wing fittings (2 points)
2) Clean & grease rear wing fittings (2 points)
3) Clean & grease mainpins
4) Clean & grease tailplane fittings (3 points)
5) Clean & grease the pins at the wing folding point (if applicable) 3 pins per wing
6) Clean and grease the aileron drive at the wing fold position (if applicable).

It is best to begin with the port wing. A helper holds the fuselage on the starboard side, three further helpers offer up the port wing. Feed the spar through the fuselage carefully, being careful to avoid rudder cables, elevator pushrod and harness straps. Engage the rear fitting on to the lug on the fuselage. Bring the wing tip forwards to engage the root rib fitting on the forward lug on the fuselage.

The procedure for fitting the starboard wing is the same. Be careful to ensure that the fuselage is held vertical and not at an angle.

Bring the starboard wing tip forwards, correcting the height of the tips to allow the main spar fittings to slide into each other. It works best if one person climbs into the fuselage and gives instructions to the helpers at the tips, until the fittings are in line and the mainpin can be pushed home. The mainpin is secured under the upper part of the main spar fittings with the large safety pin provided.

See AD 82-134/SB653-42

The outrigger wheels (marked left and right) are pushed into the fittings under the wings and screwed tight (not applicable for two wheel undercarriage version).

The two aileron connections are made inside the fuselage and secured by safety pins and the spoiler control cables are connected by the two carabiners. Then the wing root/fuselage undersurface plates are added. Now fit the tailplane, preferably with two people to handle it. With the elevator in the up position the tailplane is offered up to the fixed lugs on the fuselage. Then the front tailplane fitting is screwed down onto the fuselage with the castellated nut which is secured with a safety pin. *)

The tailplane fairing (if applicable) is hooked under the fin and fixed with two patent fasteners. The elevator horn and pushrod are connected by a pin and secured with a safety pin. Finally connect the Bowden cable to the fittings on the elevator and trimmer, having first moved the cockpit trimmer lever fully forwards. After rigging, the aircraft will require a full Daily Inspection (Flight Manual p. 15).

*) See AD 94-001/2 enclosure 1 and AD 93-001/3 enclosure 2.

1.2 De-rigging

The de-rigging procedure is simply the reverse of the rigging procedure.

Start by removing the tailplane. Before attempting to remove the wings do ensure that controls (ailerons and spoilers) have been disconnected and that the underwing/fuselage fairing plates have been removed. Let the wing tip helpers take the weight off the main pin by gently raising the tips before withdrawing it. Then the wing tip holders ease gently tailwards to disengage the forward lug before moving the whole wing forward to free it from the rear lug.

During this operation avoid tilting the wings and fuselage and do not bring the wing tips too far back.

1.3 Folding the wings

The Falke is also available with folding wings for easier hangaring. These may fold either up or back. The folding wings are described in Appendix A and the fold-back wings in Appendix B.

1.4 Transporting the motor glider

The Falke can be transported on a special trailer. The supports for the wings must not be less than 4.5 metres apart. Otherwise the overhanging wing section can be damaged by road transport loads and when travelling off road. In the case of the version with folding wings the outer wing sections must be de-rigged and mounted in the hangar separately. It is only possible to trailer the Falke with the wing tip sections mounted on the wings over very short distances and on good roads. The propeller should be in its gliding position and mounted on the trailer

such that it cannot rotate in the slipstream whilst being towed. The canopy should be locked and held closed by the harness straps. If the aircraft is being towed on an open trailer without waterproof covers, ensure that water cannot enter the spoiler gap, pushrod openings, fuselage etc. If the wings do get wet en route dry them out immediately in a warm environment with the leading edge uppermost.

When moving the rigged motor glider across the airfield it is important to ensure that the control column is held fast by the harness straps to prevent the elevator bouncing.

1.5 Supports

(a) Two wheel undercarriage version
The Falke can be chocked directly under the GRP undercarriage leg housings or supported using the threaded holes provided at the side of the fuselage (the bolt thread is M10). On no account is the Falke to be chocked up on the fairing tubes in the undercarriage area.

(b) The Falke can be chocked at the stub tubes provided for the purpose (marked with a triangle) and in the older version at the steps or using the threaded holes provided in the side of the fuselage (the thread is M10). On no account is the Super Falke to be chocked up on the fairing tubes in the undercarriage area.

(c) The tail end of the fuselage may be supported only on the underside of the fuselage at the appropriate fitting or at the triangular cable deflector in front of the tailwheel, but not of course under the wooden stringer.

If the aircraft is to be left de-rigged, ensure that the wing halves are supported correctly as

described. This is particularly important in the case of the folding wing version.

At the very least the wing must be supported at the root and at about rib 19 (about 1.10 m outboard of the start of the aileron). It is essential to observe this support spacing when the wing is left vertical, or distortion of the trailing edge will occur.

If the motor glider is left in an enclosed space for a period of time it is essential to ensure adequate ventilation.

2. Fuelling up etc.

2.1 Fuelling up

see Limbach TB 53.1 and 50

The engine runs on normal filling station four star petrol (leaded) or AVGAS 100 LL. Before fuelling up at a fuel pump there must be an earth connection between the petrol pump and the fuselage metal structure. Use a chamois leather filter when fuelling up. Absolute cleanliness is essential. If fuelling up in rain protect the filler to prevent ingress of rain. No smoking or naked flame near the open tank or when the filler cap is off. Use only the original vented filler cap. (The filler cap is labelled "Patent blau" or "mit Lüftung").

2.2 Topping up with oil

The oil level is to be checked every one or two engine hours and after every long flight. The oil should be topped up to the upper dipstick mark. The oil filler position is accessible after removal of the engine cowling and is marked yellow. The Flight Manual lists approved oils on p. 8. Before checking the oil level the tailwheel is to be raised and chocked up 40 cm above level ground.

3. Maintenance, inspection and repairs

3.1 General

Reliability results from an aircraft being clean and well kept. This applies especially to the engine and propeller. The level of attention required will vary according to usage and weather conditions.

The aircraft is best cleaned with water or with soapy water. Do not clean painted surfaces with petrol (gasoline) or similar solvents as they attack the finish. The canopy should be washed carefully with fresh clean water and a sponge or washleather (float the dirt off or it will produce scratches). It can be given a final polish with perspex cleaner.

The aircraft has a synthetic finish and should be waxed regularly (once every few months). Only use waxes or polishes which do not contain silicones. Afterwards the aircraft should be rinsed off with water containing washing-up liquid to prevent the formation of water droplets on the wings in rain.

Whenever the aircraft gets wet it should be leathered off. Even the best finish deteriorates over time but care and protection can prolong its life and also the smoothness of the wing surface. If the aircraft is to be left in a confined space for a long time, adequate ventilation is essential.

3.2 Periodic Inspection and Maintenance

3.2.1 Daily Inspection

The normal Daily Inspection is of course required after work on it and before the start of flying. For details of the Daily Inspection see p. 15 of the Flight Manual.

3.2.2 Engine and Propeller Inspection

(see also Engine and Propeller Handbook).

The engine is to be serviced and checked every 25 engine hours (see Engine Handbook).

In addition the engine and propeller must be checked and serviced after every 50 engine hours. This work must be carried out in accordance with the Inspection and Maintenance List and recorded in the manufacturer's Motor Glider Log Book supplied with the aircraft.

3.2.3 Airframe Inspection

Airframe Inspection at 50 hours

This inspection includes a limited amount of lubrication work. For the sake of simplicity, we recommend that it should coincide with the 50 hour inspection of the engine:

1) Use a grease gun to grease the bearings of the steerable tailwheel (on later aircraft this is a sealed-for-life bearing). You can access the nipple with a grease gun through the hand hole in the fuselage. In the case of tricycle undercarriage aircraft, the steerable nosewheel (2 nipples) and the nosewheel drive (4 plain bearings) should be greased.

2) The rudder bottom bearings and rudder cable attachments.

3) In the case of the Falke with a sprung mainwheel: lubricate 2 nipples on the mainwheel suspension arms, accessible from underneath in the wheel box.

4) Folding wing Falke: clean and grease the wing folding locations (3 pins and locking). Clean and grease aileron drive at wing folding position.

Airframe inspection at 100 hours

The following is to be carried out after every 100 hours flying time and in any event at least twice a year. These jobs must be carried out in accordance with the Inspection and Maintenance List which are contained in the Motor Glider Log Book supplied by the Manufacturer.

3.3 Battery Servicing

At least every month check the electrolyte level and top up with distilled water as necessary. The correct level is individual cells with a battery hydrometer.

Specific gravity of electrolyte at 20°C (68°F)	State of battery charge
1.28 kg/litre	fully charged
1.19 - 1.21 kg/litre	half discharged
1.09 - 1.14 kg/litre	discharged

If necessary charge the battery (charge rate 1.5 amps).

If the battery is not in use it must be given a top up charge every month and every three months it must be discharged and then recharged.

Keep the battery clean and dry. Lightly grease the terminals with a non-acid, acid-resistant oil or grease, e.g. Vaseline. Oil and grease should not come into contact with the moulded top of the battery. Check the battery vents which are intended

to duct any inflammable battery gases safely out into the slipstream.

3.4 Undercarriage and brake

a) Two wheel undercarriage

The Falke has a maintenance-free GRP sprung two wheel undercarriage with 5.00 x 5 tyres, tyre pressure 2.1 bar (31 psi). The tailwheel is 210 x 65 mm, tyre pressure 2.5 bar (37 psi). The hubs of all wheels have sealed-for-life ball bearings. The two mainwheels are braked by the spoiler. Brakes are heel operated from the left pilot seat and also connected and operated by the spoiler control lever on the last part of its travel - so it is not advisable to land with spoilers fully extended. The Falke also has a parking brake which should always be applied before starting the engine. The procedure for applying the parking brake is as follows: pull the spoiler lever sideways adjacent to the first star, raise the parking brake lever and then release the spoiler control lever. You need both hands for this operation, but the brake may then be released with one hand by pulling the spoiler lever: the parking brake lever drops and releases the spoiler lever.

As brake wear takes place the brake will require adjusting. For brake adjustment: remove floor of cockpit (port side) and adjust the cable length at both adjusters at the pedals. Tighten the locknuts afterwards. Then adjust the handbrake at the spoiler lever. There are two adjusters (two per brake cable) ahead of the handbrake fair lead. The adjusters should be set such that when the aircraft is chocked up the wheels can just be turned when the left spoiler lever is applied to the limit just before the parking

position. This setting will produce an even braking effect and adequate braking for parking. The brake shoes must be replaced at the very latest when the brake lining is down to 1.5 mm (1/16") at its thinnest point. If the brake bearings are taken apart when the aircraft is dismantled, the position of the brake lever at the wheel must be marked for reassembly. The torque wrench setting for the spline brake lever attachment is 18/22 Nm (13-16 ft lbs).

The GRP sprung undercarriage should always be painted white to protect from UV and high temperatures.

b) Sprung Main Wheel Version

The Falke has a single mainwheel with 6.00 x 6 tyre. Recommended tyre pressure is 2.1 bar (31 psi), with maintenance free rubber cavity suspension. The tailwheel tyre is 210 x 65 mm, tyre pressure 2.5 bar (37 psi). The wing tip outrigger wheels have 200 x 50 mm tyres, tyre pressure 2.5 bar (37 psi).

All wheels run on sealed-for-life ball bearings. The wheel brake on the single mainwheel is a drum brake. The brake is connected to the spoiler lever and is applied in the final part of spoiler extension. For this reason it is important not to touch down with full spoiler. The Falke also has a parking brake which should always be applied before starting the engine. The procedure for applying the parking brake is as follows: pull the spoiler lever sideways adjacent to the first stop, raise the parking brake lever, release the spoiler control lever. You need both hands for this operation, but brake may then be released with one hand by pulling the spoiler

lever: the parking brake lever drops and releases the spoiler lever.

As brake wear takes place the brake will require adjusting. For brake adjustment: remove floor of cockpit (port side) and adjust the cable length at both adjusters at the pedals. Tighten the locknuts afterwards. Then adjust the handbrake at the spoiler lever. There are two adjusters (two per brake cable) ahead of the handbrake fair lead. The adjusters should be set such that when the aircraft is chocked up the wheels can just be turned when the left spoiler lever is applied to the limit just before the parking position. This setting will produce an even braking effect and adequate braking for parking. The brake shoes must be replaced at the very latest when the brake lining is down to 1.5 mm (1/16") at its thinnest point. If the brake bearings are taken apart when the aircraft is dismantled the position of the brake lever at the wheel must be marked for reassembly. The torque wrench setting for the spline brake lever attachment is 18-22 Nm (13-16 ft lbs).

c) **Unsprung single mainwheel version**

The Falke has an unsprung mainwheel 8.00 x 4, tyre pressure 1.8 bar (26 psi). In all respects this version is the same as the one with a single sprung mainwheel (see above).

d) **Tricycle undercarriage version**

Nosewheel 5.00 x 4, tyre pressure 1.5 bar (22 psi). Nosewheel suspension is provided by maintenance-free rubber cavity suspension. The nosewheel steering and drive should be greased at least once every 50 hours flying time. (see Maintenance List).

3.5 Propeller

(changing the propeller (see also Propeller Handbook))

The propeller is always to be fitted such that on the ground the blade is 15º before horizontal in the normal sense of rotation. This is important for starting by hand and also for landing with the engine off. When a propeller is removed the flange should always be marked before removal for ease of subsequent refitting. The propeller is bolted through the pressure plate to the propeller flange (6 bolts). The propeller flange is pressed on to the taper of the propeller shaft by a central nut and may only be removed by the engine manufacturer. To remove the propeller, remove the spinner, the six hexagonal bolts and withdraw the propeller from the hub. The reassembly torque setting for these nuts is 15 - 17 Nm (11 - 12 ft/lbs). The propeller tips have a maximum permitted discrepancy of 2 mm (5/64"). This discrepancy can be corrected by tightening individual bolts. All six bolts must be wired up in pairs.

Finally replace and secure the spinner.

3.6 Annual Inspection

As is the case with all gliders and aircraft, a motor glider requires annual inspection for renewal of its Certificate of Airworthiness. This must be carried out at the appropriate time by an authorised Inspector. The whole aircraft must be thoroughly overhauled before this annual inspection.

The work is detailed in the Inspection and Maintenance List in the Log Book supplied by the manufacturer. Fabric and paint work defects must

be made good. Control circuits are to be checked and replaced if worn. All control circuits are to be checked for adjustment and the control surface deflections checked.

Pay particular attention to the cables and the cable runs. Frayed cables (finger check painful but effectivel) are to be replaced using only cable to specification LN 9374. Worn pulleys and control cable guide bushes are to be replaced. Bushes must sit tightly in their fittings; a missing bush causes rapid cable wear. Keep cables with sliding contact clean and free from dirt. Oil but do not grease. Check also at each overhaul that there are no slight kinks or wear in the free lengths of cable.

Apart from cleaning and greasing the undercarriage assembly also renew the brake linings. The Propeller Handbook should be consulted regarding any necessary overhaul work on the propeller.

The Engine Handbook should be consulted regarding any necessary overhaul work on the engine. Check carefully the cowling, exhaust system, cabin heating, carburettor heating and ducts on the engine as vibration can cause fractures.

3.7 Non-periodic inspections, repairs

After any incident such as a trailer accident, a heavy landing or a field landing on a difficult surface the motor glider should be checked thoroughly for damage. In particular check all vital fittings for paint cracks which might indicate that the aircraft has been overloaded. Minor repairs can be carried out after discussion with an authorised inspector. Any such work must be carried out completely in accordance with manufacturer's drawings and other documentation and specifications. Spare parts (consumable) and materials are stocked by the

manufacturer and are available on immediate delivery. Special spare parts which might be required during the repair work will be manufactured and delivered as quickly as possible when the manufacturer is contacted. If the propeller is damaged, through contact with the ground or during transport for example, it must be returned to the propeller manufacturer.

If the propeller is damaged, the crank shaft or the hub may have been damaged so the engine manufacturer will need to dismantle the engine and check it.

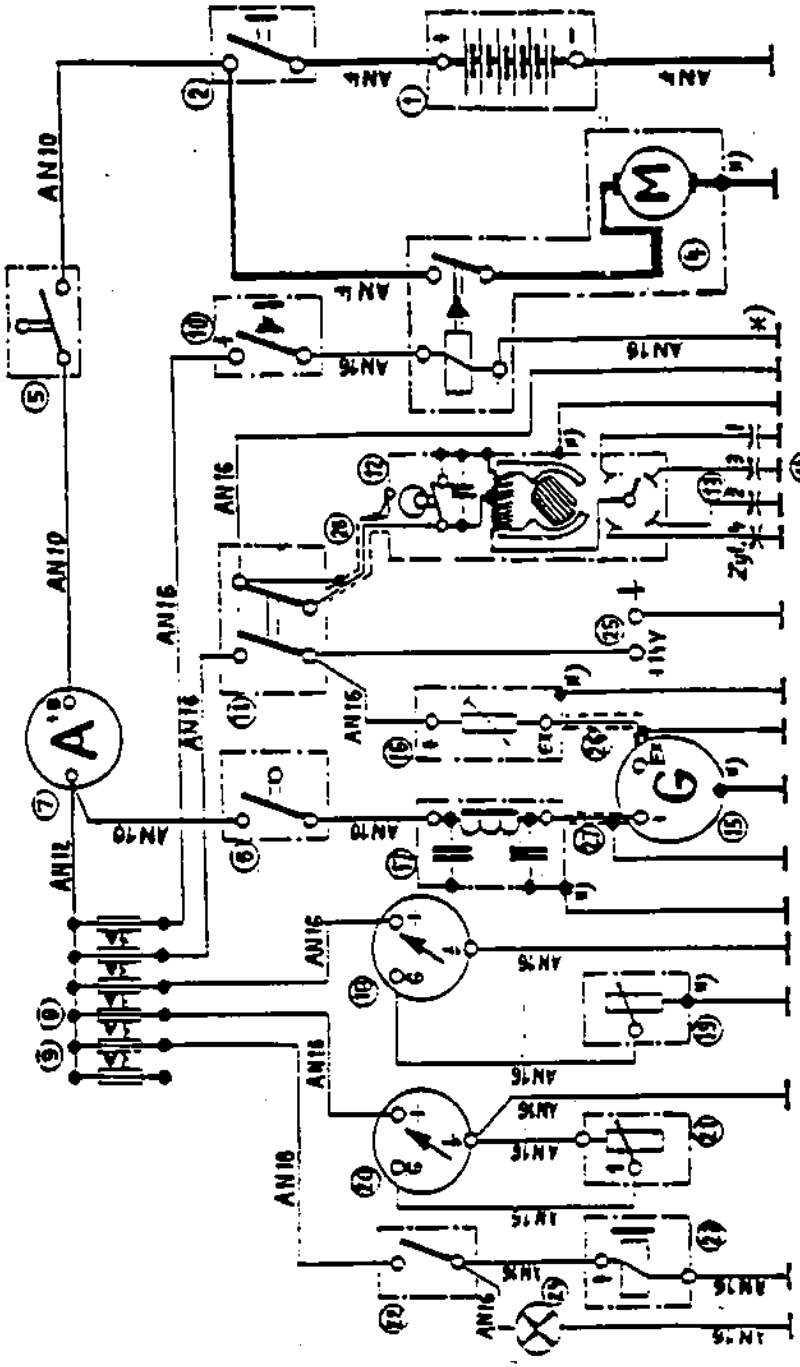
If major repairs to the structure of the motor glider are required (undercarriage, load carrying parts of the fuselage, wing fittings, spars) then they must be carried out by the manufacturer.

4. Equipment

Minimum equipment is listed in the Flight Manual on page 30. The complete set of equipment is listed in the Equipment List which is supplied in the Log Book with each Falke.

If the equipment is extended at a later date then all work must be in accordance with the drawings and documentation of the manufacturer. It may be necessary to establish the new centre of gravity. All regulations must be observed.

5. Electrical Wiring Diagram



Circuit Diagram for L2000 with
Bosch Starter 0.001.108.021
Revision 132

Diagram Details

1 Battery: Berga or Varta 51511; 51612 (new 51814)
2 Master switch: Bosch 0 341 001 001
3 ---
4 Starter motor: Bosch 0 001 108.021
5 Safety cut out (Battery): ETA 2-5700-K12 25 A
6 Safety cut out (Generator): ETA 2.5700-K12 20 A
7 Ammeter: Motometer 150.040.1008; 615.052.1011
8, 9 Fuse box: Bosch 0 354 041 001 with terminal bar
Bosch 1 351 090 000
Fuses 5A and above: Bosch DIN 72581 __ A
Fuses less than 5A: Wickmann 35101 quick blow __A or similar
Fuse holder: Schurter FEP 031.1001
Fuse insert : (5 x 20 mm): Schurter FSF 034.15.
10 Starter switch: Bosch 0 343 004 003
11 Ignition switch: APR Schaltronic 6-646 N; Amphenol T 215 N - S
12 Magneto: Slick 4230 or Bendix S4 RN 21 (new Slick 4330)
13 Ignition harness: Slick High Temperature Harness
14 Spark plugs: Bosch ~~WB 240 ERT~~ 1 see Limbach TB 51
15 Generator: Ducellier 14V 22/30 A
16 Regulator: Wehrle DU506 14V or Bosch 0 192 062 003 or Ducellier 8347
17 Filter: (Option): Hisonic Cessna S - 1629 - 1
18 Oil pressure gauge (option): Motometer 644.001.1002
19 Oil pressure sensor (option): Motometer 675.002.1001
20 Fuel gauge (option): VDO 301 252 24 3; 301.272/3/4 (for 55L tank)
21 Fuel sensor (option) (For 55L tank): VDO 21 85
22 Switch (option): APR Schaltronic 6 - 631 N
23 Fuel pump (option): Hardi 8812 HZPR
24 Indicator light (orange) (option): Bosch 0 310 152 005 with lamp (12 V 2W): Bosch/Osram 3898
25 Connection for Barograph (option)

Circuit Diagram for L2000 with Bosch Starter 0.001.108.021 Revision 132

26 Short circuit line: screened cable 1.2 mm^2 to LN9252 FYGPCP AN16

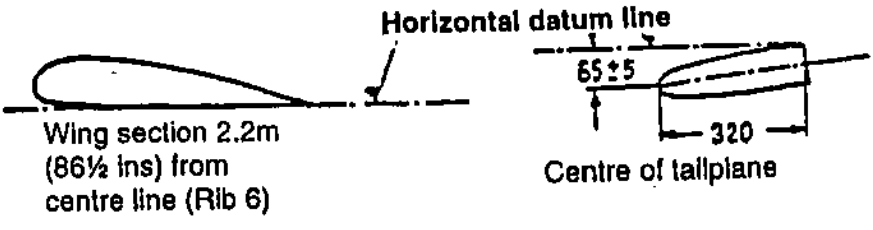
27 Screened cable: 5 mm^2 (option) LN9252 FYGPCP AN 10
Cable: LN9251 (to meet MIL-W-5086/2):
FYGP AN 16 1.2 mm^2, FYGP AN 10 5 mm^2
FYGP AN 12 3 mm^2, FYGP AN 4 22 mm^2

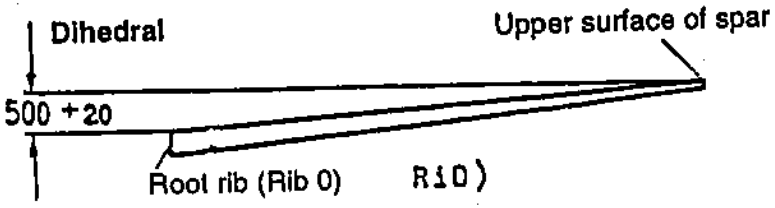
20 Fuel gauge (for 80L tank option) VDO 301 272 052 001

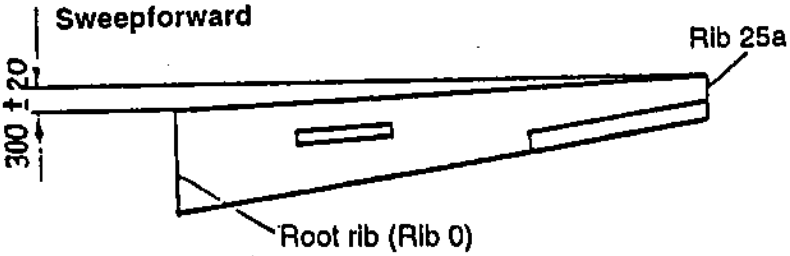
21 Fuel tank sensor (for 80L tank option) VDO EG 21/239, 224 082 007 013

20/21 Fuel gauge option (for 55 and 80L fuel tanks): Motometer 609.003.1012 only in association with Motometer 608.001.1055 fuel level sensor

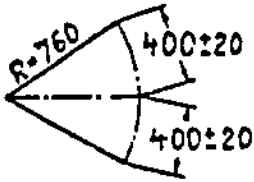
6. Adjustment of control deflections - Wing / fuselage / tailplane arrangement



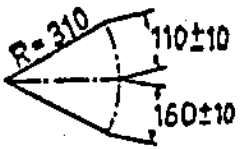




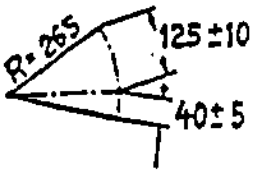
Control Surface Deflections



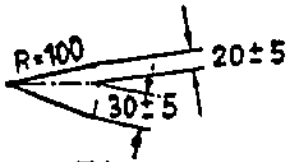
Rudder



Elevator



Allerons

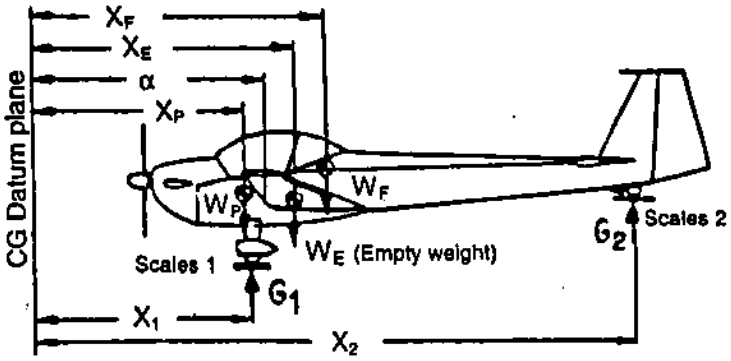


Trimmer

Dimensions in mm

The elevator and aileron stops are located under the seats. Adjustment is via a bolt with a lock nut. Trimmer deflection is adjusted by means of a stop at the very end of the trimmer cable. The rudder deflection stops are on the fuselage near the rudder horn. They are not adjustable as we have not found adjustment to be necessary. Adjustment to balance the spoiler opening angles is by means of two turnbuckles on the spoiler cables under the port seat. These must be secured with locking wire after adjustment.

7. Procedure for determining Centre of Gravity



To weigh the motor glider to establish the empty weight centre of gravity position, set up the aircraft on the scales such that the underside of the wing at Rib 6 (2.2 metres = 86.5") from the centre line is horizontal. With the aircraft at this attitude a plumb line is dropped from the leading edge of the wing at Rib 0 (0.52 metres = 20.46 inches) from the centre line. Two metres (78.72 inches) in front of this point is the CG datum plane from which are measured X_1 and X_2, the distance of the undercarriage axles. The wheels are supported on the scales which are used to determine weights W_1 and W_2.

The distance of the empty weight CG from the datum plane is determined by the formula:-

$$x_{\text{empty CG}} = \frac{W_1 \cdot x_1 + W_2 \cdot x_2 - W_F \cdot x_F}{W_1 + W_2 - W_F}$$

Use kg and cm for this calculation.

X_P = Pilot moment = 188 cm

X_F = Fuel moment = 205 cm

W_F = Weight of fuel: litres x 0.73 kg = weight in kg.

If the tank is empty then W_F and W_F X_F are omitted.

The empty weight CG must be within the following limits:

empty weight W_{empty} in kg *in lbs*	390 859	400 881	410 903	420 925	430 947
CG_{empty} in mm	2264 - 2347	2261 - 2347	2258 - 2347	2256 - 2346	2253 - 2346
in inches	89,13 - 92,40	89,02 - 92,40	88,90 - 92,40	88,82 - 92,36	88,70 - 92,36

The values given in the table for X_{empty} CG apply to motor gliders with an empty tank as calculated from the above formula for X_{empty} CG.

8. Weight and Centre of Gravity Chart

Date	Empty Weight	Maximum permissible load	Empty weight CG	Signature of Inspector
21.02. 2000	447 KG	163 KG	226,9 cm von BE	

Appendix A

Folding wings

Rigging the wings: If the outer wings have been separated totally from the inner wing (e.g. on a glider trailer) then first the upper fittings at the folding joint must be lined up and the top pin inserted from the front of the aircraft. Secure with a washer and split pin. It is essential to clean and grease the mating parts in advance. Then connect the aileron drive at the point of wing fold with a bolt, washer and lock nut.

The outer wings fold about the upper bolt (the centre line of the upper bolt is the fulcrum of the outer wing). The outer wings are to be folded sheltered from the wind e.g. in the hangar. To make the folding operation easier attach the outrigger wheels to the inner wings.

The control column and therefore the ailerons must be approximately in mid position. To open the outer wing one man slowly rotates the outer wing about the fulcrum and slowly lowers it in the extended position. A second person stands at the fulcrum and presses the inner wing down to prevent it tipping suddenly. If a second person is not available for this operation then an outrigger should be used to prevent the wing tipping and loss of control of the operation. Then, using the main pin handle, the lever for the pin separation drive is pushed fully from the front to the back. This inserts the lower front and rear pins. The securing pin locates automatically. Then check for correct operation of the aileron drive at the wing fold point. Replace the fairing and secure with the patented lock.

Closing the outer wings is the same procedure but in the opposite order. To operate the pin separation drive, the securing pin should be raised briefly.

Appendix B

1. Folding back the wings

On the SF 25 C Falke (single wheel undercarriage) first put the dolly under the fuselage so that the motor glider with its folded wings remains upright (in the case of the two wheel undercarriage this is not applicable).

After release of the control connections, the main pins and the wing rear connection on the fuselage, the wings are withdrawn from the fuselage on a guide. One man holds the wing at the trailing edge and one man holds the wing at the tip and pulls. Then the wing is rotated to vertical and is swung round towards the tail and put into a locator on the rudder. To keep the wing vertical a cable is connected from the trailing edge of the wing to the fuselage. The aircraft can then be moved, the tailwheel retaining approximately 30º steerability.

If greater manoeuvrability is required a 360º steerable dolly can be used. A mounting is available as an option.

To move the motor glider greater distances use a tail dolly with a car towbar connector so the motor glider can be towed gently. With practice two people can fold the wings. Initially it is safer to start with three.

2. Folding the wings

With two people, (A) and (B), the procedure is as follows:-

1. Fit fuselage support dolly (only applies to single mainwheel undercarriage).

2. Fit wing locator on the fin (insert and secure on the other side with a safety pin).

3. Helper (A) releases the small fairing plate under the wing roots and any electrical connections, aileron and spoiler connections in the fuselage and removes the safety pins from the main pins.

4. Helper (B) takes the weight of the **starboard** wing tip. (A) withdraws the main pin, goes to port trailing edge at the fuselage and releases the rear wingpin (release and move backwards).

5. (B) withdraws the wing on its guide right up to the stop. (A) holds the wing horizontal by the trailing edge.

6. (A) rotates the wing to vertical (lift wing trailing edge) and goes around the wing to the cockpit. (B) swings the wing tip towards the tail whilst (A) ensures that the wing root is free at the fuselage.

7. (B) pushes the wing on its guide forwards right up to the stops, (A) checks that the root is not touching the fuselage. (B) locates the wing hook in the eye on the fin, (A) secures the wing on the fuselage with the cable (with one wing folded the Falke is stable and will not tip).

8. The port wing is now folded in the same way. The wing is initially held horizontal by a strut in the fuselage and the wingtip is lifted to withdraw the wing.

The motor glider is now ready for parking in the hangar. If space is at a premium it is also possible to remove the tailplane.

3. Unfolding the wings

The procedure for unfolding the wings is as follows:-

1. (A) stands at the **port** wing root, unhooks the retaining cable from the fuselage and holds the wing vertical. (B) goes to the port wing tip, unhooks the wing from the fin and pulls the wing back against the stops. Then (B) walks forward with the wing, (A) goes behind the wing to the root and rotates the wing to horizontal.

2. Now (B) pushes the wing into the fuselage and inserts the spar root under the diagonal strut in the fuselage. (A) inserts the wing at the trailing edge into the rear wing connection, pushes the pin in from the rear and secures it with a safety pin. The wing is now secure in this position and can be released. A third person, if available, can watch whilst the wing is pushed into the fuselage to ensure that the wing root enters the centre of the fuselage correctly, the port spar under diagonal strut and the starboard spar into the fittings of the port spar.

3. Similarly the starboard wing is rotated forwards in the same way and inserted in the fuselage. The spar end is inserted in its mating opposite. A inserts the rear wingpin as in paragraph 2 above, secures it and inserts the main pin in the fuselage.

   (A) may find it convenient to push home the pin as soon as the holes are in line. Inserting the pin is easier if (B) waggles the wing tip gently.

4. (A) secures the main pin, connects the ailerons and spoilers and also any electrical connections, and then fixes the fairings under

the wing roots. (B) removes the wing locator from the fin.

5. In the case of single wheel undercarriage the fuselage supporting dolly is also removed.

6. Remove steerable tail dolly, if used

7. Checks after opening the wing:

- Seating and security of main pin
- Seating and security of the rear wing/fuselage connections
- Ailerons connected and secured
- Spoilers connected
- Any electrical connections restored
- Wing locator removed from the fin
- Supporting dolly removed (only applicable in the case of single wheel undercarriage)
- Insertable steerable tailwheel removed (if applicable)
- Check the full and free movement of the ailerons and spoilers and check the operation of the electrical circuits.

4. Maintenance on the folding mechanism

When the wings are folded, part of the folding mechanism is exposed so the motor glider should not be left out of doors in that configuration. If the folding wing mechanism is to give long service it is important that it is greased frequently and not abused. We recommend that the folding mechanism be greased after **every 20 folding operations** but in any case **not less than once a month** during the flying season and also at the start and finish of the season.

Lubrication routine when wings folded:

1. Grease front & rear wing/fuselage attachment points (4)
2. Grease front & rear fuselage/wing attachment points (4)
3. Grease mainpins and mainpin bores
4. Grease two guide rods in the fuselage
5. Grease guide rods in the wings (one on each)
6. Oil the two swivel joints on the guide rods

5. Rigging and de-rigging the Falke with folding wings

Before de-rigging the Falke with folding wings, release the swivel joints at the wing end (remove one locknut in each case). The wings can then be withdrawn totally from the guide rod and lifted from the swivel joint. For rigging, the wings are placed on the swivel joints again. Ensure that the swivel joints are in the correct position (match up colour codings). Secure the swivel joints with two new M8 lock nuts, then the wings can be inserted in the fuselage or folded back (see section on folding). If the folding mechanism section is removed, the Falke can be rigged and de-rigged as described in Section 1.

LIMBACH Flugmotoren

Technical Bulletin

51

Subject: Spark Plug BOSCH WB4A resp. WB 240 ERT 1

Affected engine models: All engines models

L 1700 E0, EA, EB, EC, ED
L 2000 E0, EA, EB, EC
L 2400 EB

Background information: Simplified product support. The abovementioned type of spark plug is no longer distributed by us and therefore does not recive any kind of inspection.

Priority: Immediatly

Compliance: Spark plugs type BOSCH WB4a resp. shall not be used anymore and must be replaced by type EYQUEM A 755 spark plugs at next forthcomming spark plug change after release of this document. References in the manuals are to be changed in handwriting.

Remarks: Engine specific data does not change. Technical Bulletin no. 41 becomes invalid.

This document has been translated to the best of our knowledge. In case of doubt however only the German original shall be considered authoritative.

Approval: This Technical Bulletin is approved in accordance with the procedures of the LBA approved development organization I-EC 27.