

Subject: Replacement of engine GROB 2500 E1/D1 by engine LIMBACH L 2400 EB1.AA

Affected Aircraft: Motor glider GROB G 109 (B)

Aircraft: Type G 109 (B) Registration \_\_\_\_\_

Propeller: Type MTV-1-AL160-03 Serial no.: \_\_\_\_\_

Engine: Type LIMBACH L 2400 EB1.AA Serial no.: \_\_\_\_\_

Operating time:

Engine	_____	hours
Propeller	_____	hours
Airframe	_____	hours

Operator: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Place of conversion: \_\_\_\_\_

Date: \_\_\_\_\_

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List of required parts:

Pos.	Description	No. of parts	Limbach Part Number
1	Aircraft engine type LIMBACH L 2400 EB1.AA complete with: generator, starter, magneto, ignition mounting, mechanical fuel pump, fuel pipes, carburetors and air filters	1	244.000.001.000
	Operating and maintenance manual	1	241.253.900.000
2	Propeller with spinner type MÜHLBAUER MTV-1-A/L 160-03 Operating and assembly instructions E-148	1	241.353.001.000
3	Control unit P-120-U (automatical adjustment) completely with wiring	1	241.353.110.000
	or		
	Control unit P-120-U (automatical and manual adjustment), with wiring	1	241.353.120.000
4	Carbon brush support (propeller pitch-adjustment)	1	244.353.010.000
5	Circuit breaker 4 Amp.	1	733.161.005.000
6	Manifold pressure indicator	1	240.215.700.000
7	Hose pipe (manifold pressure)	1	244.215.010.000
8	T-fitting	1	207.215.635.000
9	Oil pressure indicator 0-10 bar	1	240.215.140.000
10	Tachometer (electronic)	1	241.215.495.000
	or		
	Tachometer (mechanical) with operating time counter, only in connection with	1	240.215.510.000
	angular gear	1	241.119.200.000
	tachometer drive cable	1	
11	Baffles; set	1	244.163.001.000
12	Sealing rubber profile	4,5 m	170.163.500.000
13	Muffler, complete with heating shroud	1	244.173.010.000
14	Spacer	4	244.155.010.000
15	Sleeve 12*1*80	4	244.155.020.000
16	Replacement piece, fiberglass	1	
17	Fuel pipe	1	244.097.060.000

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Pos.	Bezeichnung	Menge	Limbach T/N
18	Pushrod, carburetor pre-heating	2	244.105.010.000
19	Pushrod, throttle	2	244.105.020.000
20	Pushrod, starting carburetor	2	244.105.030.000
21	Operating and flight manual, pages with changes	1	
22	Gasket, carburetor, engine side	4	170.131.025.000
23	Gasket, carburetor, air filter side	4	170.107.005.000
24	Nut M8, self-locking	4	520.003.008.000
25	Screw, hexagon, M10*170	4	501.012.421.000
26	Castle nut M10	4	520.007.010.000
27	Split-pin 2,5*40	4	595.010.091.000
28	Cable, starter	1	244.143.010.000

**DISASSEMBLY:**

- 1 Unmount cowling upper and lower side.
- 2 Unscrew ground connection of battery. Disconnect cable between positive pole of battery and starter.
- 3 Unscrew high tension leads of spark plugs.
- 4 Close fuel shut-off.
- 5 Dismount propeller with spinner completely.
- 6.1 Dismount engine Grob 2500 E1/D1 with engine mount, muffler and bafflers.
- 6.2 Dismount engine mount.
- 7 Dismount air filter and carburetor preheating boxes with torsion rods.
- 8 Dismount tachometer.
- 9 Dismount complete control unit of mechanical propeller adjustment in the cockpit.

**MODIFICATIONS:**

- 1 Cut out lower engine cowling, bond replacement piece with resin, coat with fire proofing and repaint.
- 2 Modify engine mount and connection tube between the two upper fastening flanges (engine side) according to sketch, repaint.

## MOUNTING AND ASSEMBLY

Remark: Check items must be confirmed by initials on the according line. In case of a negative result (defect) or in case of items which have not yet been checked the appropriate line must be marked with a continuous number and explained at the end of the maintenance instruction under "defects and comments".

### A) Preparation

- 1 Check condition and completeness of delivered materials according to delivery note. \_\_\_\_\_
- 2 Compare airworthiness documents. \_\_\_\_\_
- 3 Check condition of engine cowling, upper and lower part (fire proofing, cracks, fit, missing fasteners). \_\_\_\_\_
- 4 Check condition of engine mount (corrosion, cracks, ena-melling, absorbing rubber parts, deformations and brittle-ness). \_\_\_\_\_
- 5 Check condition of firewall bulkhead holes checked (leaks). \_\_\_\_\_
- 6 Check condition of carburetor pre-heatings (repair if necessary). \_\_\_\_\_
- 7 Check condition of torsion rods with beddings. \_\_\_\_\_
- 8 Fuel filter cleaned. \_\_\_\_\_
- 9 Check battery support and acid level, top-up if necessary. \_\_\_\_\_
- 10 Check condition of heating hoses. \_\_\_\_\_
- 11 Check condition and expiration date of remaining hoses. \_\_\_\_\_

### B) Mounting and assembly in cockpit

- 1 Oil pressure indicator mounted. \_\_\_\_\_
- 2 Control unit of propeller mounted (to the remote mechanical propeller adjustment). Connection made according to the modified circuit diagram. \_\_\_\_\_
- 3 Over-current release mounted near to control unit device. \_\_\_\_\_
- 4.1 Tachometer (electronical) mounted. Connected to the ignition switch, available connection cable used. \_\_\_\_\_
- 4.2 Tachometer (mechanical) mounted with tachometer wave. \_\_\_\_\_
- 5 Ignition key removed. \_\_\_\_\_

**C) Preliminary work at engine**

- 1 Left and right carburetor dismounted from inlet manifolds, closed provisionally, baffles mounted.  
**Note: The baffles must fit closely to the cylinders and cylinder heads.**  
Provisional plug removed from inlet manifolds and carburetor fitted with new gaskets and nuts. \_\_\_\_\_
- 2 Carburetor pre-heating mounted with torsion rods. New gaskets used. Carburetor linkage installed and synchronized, lock nuts secured with safety enamel after tightening, ball sockets secured with new safety pins. \_\_\_\_\_
- 3 Air filter mounted with new gaskets. \_\_\_\_\_
- 4 Supports for torsion rods mounted. \_\_\_\_\_
- 5 Carbon brush support mounted. \_\_\_\_\_
- 6 Carbon brush with speed sensor mounted.  
**Note: Carbon brushes are protected against damage with mas-king tape, remove tape before mounting the propeller.** \_\_\_\_\_
- 7 Engine mount attached to the engine. \_\_\_\_\_
- 8 Cover (protection) removed from magneto, ignition harness fitted to the magneto.  
**Note: Do not yet connect ignition harness to the spark plugs for safety reasons (accidental starting of engine).** \_\_\_\_\_

**D) Mounting of engine**

- 1 Engine with engine mount and extension of engine mount assembled to firewall. \_\_\_\_\_
- 2 Muffler with new gaskets mounted. \_\_\_\_\_
- 3 Fuel pipes connected and secured with safety enamel. \_\_\_\_\_
- 4 Generator connected. \_\_\_\_\_
- 5 Starter connected. \_\_\_\_\_
- 6 Oil pressure indicator connected. \_\_\_\_\_
- 7 Oil temperature indicator connected. \_\_\_\_\_
- 8 Indicator for cylinder head temperature connected. \_\_\_\_\_
- 9 Carburetor actuation connected, ball sockets mounted with new safety pins. \_\_\_\_\_
- 10 Short-circuit lead connected to magneto and secured.  
**Note: Torque is very low, if tightened too much, this could result in destruction of the condensator and failure of the engine.** \_\_\_\_\_
- 11 Plug removed from the crankcase breather and hose.  
**Note: Use only textile reinforced hoses and take care of a sufficient radius while routing; thermoplastic material may buckle and close when the engine is heated, which could result in engine damage.** \_\_\_\_\_

- 12 Carbon brush and speed sensor mounted according to the manufacturer's instruction. \_\_\_\_\_
- 13 Battery connected. \_\_\_\_\_
- 14 Engine oil topped-up (quantity according to manual). \_\_\_\_\_
- 15 Upper and lower part of engine cowling mounted without sealing rubber profile, perfect seat of spoilers checked. The distance of the spoilers to the cowling is about 10 mm. \_\_\_\_\_
- 16 Clearance of muffler checked (minimum distance to cowling 10 mm). \_\_\_\_\_
- 17 Cowling dismantled, sealing profile mounted with lip pointing in flight direction (the rubber profile should firmly press to the cowling by means of the air pressure in flight). \_\_\_\_\_

**E) Mounting of Propeller**

**Note: The slip rings of the propeller, the tightening flange of the propeller and the propeller flange of the crankshaft must be clean, dry and fat free (if necessary, clean with appropriate material).**

- 1 Slip rings of propeller and tightening flanges cleaned. \_\_\_\_\_
- 2 Crankshaft of engine turned so that the ignition marking of the propeller flange is aligned with the partition line of the crankcase top. \_\_\_\_\_
- 3 Masking tape carefully removed from carbon brush. \_\_\_\_\_
- 4 Propeller installed vertically with 30° offset counter-clockwise (viewed facing the engine). Propeller was carefully inserted into holes. Washers installed, nuts installed by hand until sluggish, nuts torqued with torque wrench (cross pattern). \_\_\_\_\_
- 5 Seating of carbon brush and speed sensor checked resp. adjusted according to the manufacturer's instructions. \_\_\_\_\_
- 6 Propeller tracking checked according to manufacturer's in-struction. \_\_\_\_\_
- 7 Operation of variable-pitch propeller checked. \_\_\_\_\_

**F) Checking**

- 1 Complete assembly of engine checked according to check list. \_\_\_\_\_

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**TORQUES**

Propeller	45 Nm
Spark plugs	25 Nm
Short-circuit lead of magneto	1,5 Nm
Engine mount - crankcase	45 Nm
Engine mount - firewall	32 Nm
Nut M8 valve rocker arm	25 Nm

All other bolts with metric thread (coarse-pitch) are torqued according to VDI 2230, page 1 (coefficient of friction 0,10; screws zinc plated).

Dimension	Property class	Torque Nm
M4	8.8	2,5
	10.9	3,7
	12.9	4,3
M5	8.8	4,9
	10.9	7,3
	12.9	8,5
M6	8.8	8,5
	10.9	12,5
	12.9	14,5
M8	8.8	20,5
	10.9	30
	12.9	35
M10	8.8	41
	10.9	60
	12.9	71



**CHECKLIST FOR ENGINE ASSEMBLY**

WIRING

**Note: Please take special care of the routing and connection of the wiring, vibrating leads must be tied. Consider movement of engine concerning connections to the firewall and the cowling. Use only wire terminals with strain relief.**

Short-circuit lead of magneto tightened and secured. \_\_\_\_\_

Battery lead to generator connected and tightened. \_\_\_\_\_

Charge lamp lead of generator connected and tightened. \_\_\_\_\_

Starter terminals connected and tightened. \_\_\_\_\_

Oil pressure sender connected and tightened. \_\_\_\_\_

Oil temperature sender connected and tightened. \_\_\_\_\_

Thermocouple(s) for cylinder head temperature connected. \_\_\_\_\_

Verkabelung Kohlenblock und Drehzahlsensor angeschlossen. \_\_\_\_\_

Carbon brush with speed sensor correctly adjusted to the slip rings. \_\_\_\_\_

Wiring of carbon brush and speed sensor connected. \_\_\_\_\_

MECHANICS

Slip rings of propeller clean, dry and fat free. \_\_\_\_\_

Engine mount tightened and secured to engine. \_\_\_\_\_

Engine mount tightened and secured to firewall. \_\_\_\_\_

Muffler connected and tightened. \_\_\_\_\_

Heater actuating lever connected and tightened. \_\_\_\_\_

Heating hose and hose clips tightened. \_\_\_\_\_

Carburetor pre-heating hose left side and hose clips tightened. \_\_\_\_\_

Carburetor pre-heating hose right side and hose clips tightened. \_\_\_\_\_

Tachometer drive cable (if existing) connected and tightened. \_\_\_\_\_

Oil hoses tightened and secured. \_\_\_\_\_

Fuel hoses and banjo bolts tightened and secured with approved safety wire. Banjo bolts checked for leaks. \_\_\_\_\_

Flared fittings tightened and secured with safety point and checked for leaks. \_\_\_\_\_

Pushrods (carburetor pre-heating, throttle valve and starter carburetor) from firewall to engine tightened and secured. \_\_\_\_\_

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Pushrods (carburetor pre-heating, throttle valve and starter carburetor) from torsion tubes to carburetor resp. carburetor pre-heating left and right side tightened and secured. \_\_\_\_\_

Idle stop left and right side checked and in good condition. \_\_\_\_\_

Full throttle stop left and right side checked and in good condition. \_\_\_\_\_

Choke stop left and right side checked and in good condition. \_\_\_\_\_

Level of motor oil checked and okay. \_\_\_\_\_

Level of damper oil in carburetors checked and okay. \_\_\_\_\_

V-belt tension checked and okay. \_\_\_\_\_

Torque of propeller tightening nuts checked and okay. \_\_\_\_\_

Propeller blades checked for damage and okay. \_\_\_\_\_

Propeller spinner tightened, checked for damage and okay. \_\_\_\_\_

Foreign object check ok. \_\_\_\_\_

Engine cowling mounted, all fasteners available and tightened. \_\_\_\_\_

## TESTRUN

It makes sense to run this test with two persons, one of them should observe the test run from outside the aircraft with an operable fire extinguisher.

Manifold pressure indicates in advance of test run \_\_\_\_\_ InHg.

Tighten brakes, pull elevator, check if propeller is clear, open fuel shut-off valve, turn on main switch, turn off radio and avionics, put propeller controller into starting position, turn on electrical fuel pump and ignition.

Start engine, then turn off the electrical fuel pump.

Check indicators for oil pressure, engine speed, check charging voltage and charging current.

Adjust engine speed to 1500 min.<sup>-1</sup> until engine is running true without choke.

Adjust lever to idle running position, engine speed about 800 min.<sup>-1</sup>.

Read and note the following values:

Oil pressure	_____	bar
Oil temperature	_____	°C
Engine speed	_____	min. <sup>-1</sup>
cylinder head temp.	_____	°C

Warm up engine until the oil temperature is higher than 60°C. Then read and note the following values:

Oil pressure at 1000 min <sup>-1</sup>	_____	bar
Oil pressure at 2500 min <sup>-1</sup>	_____	bar
Oil temperature at 2500 min <sup>-1</sup>	_____	°C
Cylinder head temperature	cyl. 1 _____	°C
	cyl. 2 _____	°C
	cyl. 3 _____	°C
	cyl. 4 _____	°C

Check speed indicator with calibrated revolution counter.

Speed indication	
at motor glider	at calibrating instrument
1500 min <sup>-1</sup>	_____ min <sup>-1</sup>
2500 min <sup>-1</sup>	_____ min <sup>-1</sup>
2800 min <sup>-1</sup>	_____ min <sup>-1</sup>
Full throttle _____ min <sup>-1</sup>	_____ min <sup>-1</sup>

Manifold pressure at full throttle indicates \_\_\_\_\_ InHg.

Idle running speed is \_\_\_\_\_ min<sup>-1</sup>

Cool down engine (about 2 minutes at a speed of 1500 min.<sup>-1</sup>).

Turn off engine - turn off ignition and main switch.

Remove engine cowling, check engine for leaks and mount engine cowling.

Compensate compass and construct a compensation table.

Effect new aircraft weight according to the manufacturer's instruction.

Old useful load \_\_\_\_\_ kg

New useful load \_\_\_\_\_ kg

Make test flight.

Motor oil used \_\_\_\_\_

Viscosity class \_\_\_\_\_

Fuel used \_\_\_\_\_

Indicated temperatures at:

	Engine speed	Manifold pressure	Cylinder head	Engine Oil
Take-Off Power				
Climb				
Cruise				

The maximum allowed temperatures of 250 °C for the cylinder head and 120 °C for engine oil may not be exceeded. The optimum cylinder head temperature for take-off and climb is approximately 200 °C, in cruise it is appr. 170 °C. The optimum oil temperature is 80 °C.

It is confirmed that the test run has been effected according to the above specifications.

Place \_\_\_\_\_ Date \_\_\_\_\_

Name of mechanic \_\_\_\_\_

Signature \_\_\_\_\_

**OBJECTIONS, TECHNICAL NOTES AND COMMENTS**

Pos.-no.	Description	Defect eliminated

The inspector signing below with the appropriate authorization confirms that the part certificates resp. the test certificates are available, that engine and propeller as well as the result of the weight have been logged in the log book, and that the Great Modification - Assembly of engine LIMBACH L 2400 EB1.AA and assembly of propeller MÜHLBAUER MTV-1-AL160-03 has been effected according to the maintenance instruction no. 23.

The airworthiness approval certificate with no.: \_\_\_\_\_ has been issued

The motorglider is airworthy.

Perform next annual check until \_\_\_\_\_

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Seal:

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