

LIMBACH

Flugmotoren

Operating and Maintenance Manual

**Limbach L 2400 EF/DF
ET/DT
DX/DS**

**Engine for Powered Gliders and
Very Light Aircraft**

Edition: 20.08.2021

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Approval and translation has been done by best knowledge and judgement. - In any case the original text (P/N 250.253.500.000) in german language is authoritative.

Limbach Flugmotoren GmbH
Kotthausener Str. 5
53639 Königswinter, Germany
Tel. ++49-2244-9201-0
Fax ++49-2244-9201-30
www.limflug.de

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1.1 Change Index

This Edition replaces the Operating and Maintenance Manual from 20.06.2018.

This manual has 53 pages and is issued per 20.08.2021

This edition replaces:

Date	Description
02/98	New edition
04.03.2001	Replaces edition from 02/98
01.12.2005	Replaces edition from 04.03.2001
15.01.2014	Replaces edition from 01.12.2005
19.02.2016	Replaces edition from 15.01.2014
20.06.2018	Replaces edition from 19.02.2016
20.08.2021	Replaces edition from 20.06.2018

1.2 Release

Released and approved on: 20.08.2021

B.Eng. Sven Simmerkuss

2 Introduction

This manual is meant to instruction for proper operation and maintenance of the aircraft engine.

Modifications to the engine are only permitted with the approval of our development department.



Caution:

The specially identifies safety notes must be observed to prevent accidents with personal injuries and to prevent damage to the engine.

Please also observe the instructions of the aircraft manufacturer. They are specially adapted for operation of the engine in the aircraft.



Caution:

Familiarize yourself with the layout of the engine controls in your aircraft according to the instructions of the aircraft manufacturer. Pay special attention to those controls needed to master an emergency situation.

The aircraft manufacturer must ensure that the operating limits specified by us are monitored, not exceeded and made understandable to the user by using display instruments. This concerns performance data, speed limits, pressure and temperature data.



Caution:

The specified operating limits are only permissible for short periods. Continuous operation at the operating limit can reduce the engine lifetime and lead to engine failure.

3 Engine Description

- Horizontally Opposed 4-Cylinder 4-Stroke Reciprocating Engine
- Combined Liquid Cooling for the Cylinder Heads
- Ram Air Cooling for the Cylinders
- Wet Sump Forced Lubrication
- Single Electronic Engine Management System Providing Spark and Fuel
- Direct Propeller Drive
- Electrical Starter
- Alternator

3.1 Model Designation

L 2400 E F 1 . X X

1. 2. 3. 4. 5. 6. 7.

1. LIMBACH (Manufacturer)
2. Displacement Class in cm³
3. (E) Single Ignition
(D) Dual Ignition
4. Equipment - Basic Type of Construction

F/S = Tractor Propeller
Electronic engine management
Liquid cooling for cylinder heads
Ram air cooling for cylinders
Generator rear
Starter rear

T/X = Tractor Propeller
Turbocharger, Intercooler
Electronic engine management
Liquid cooling for cylinder heads
Ram air cooling for cylinders
Generator rear
Starter rear

5. Type of Propeller Flange

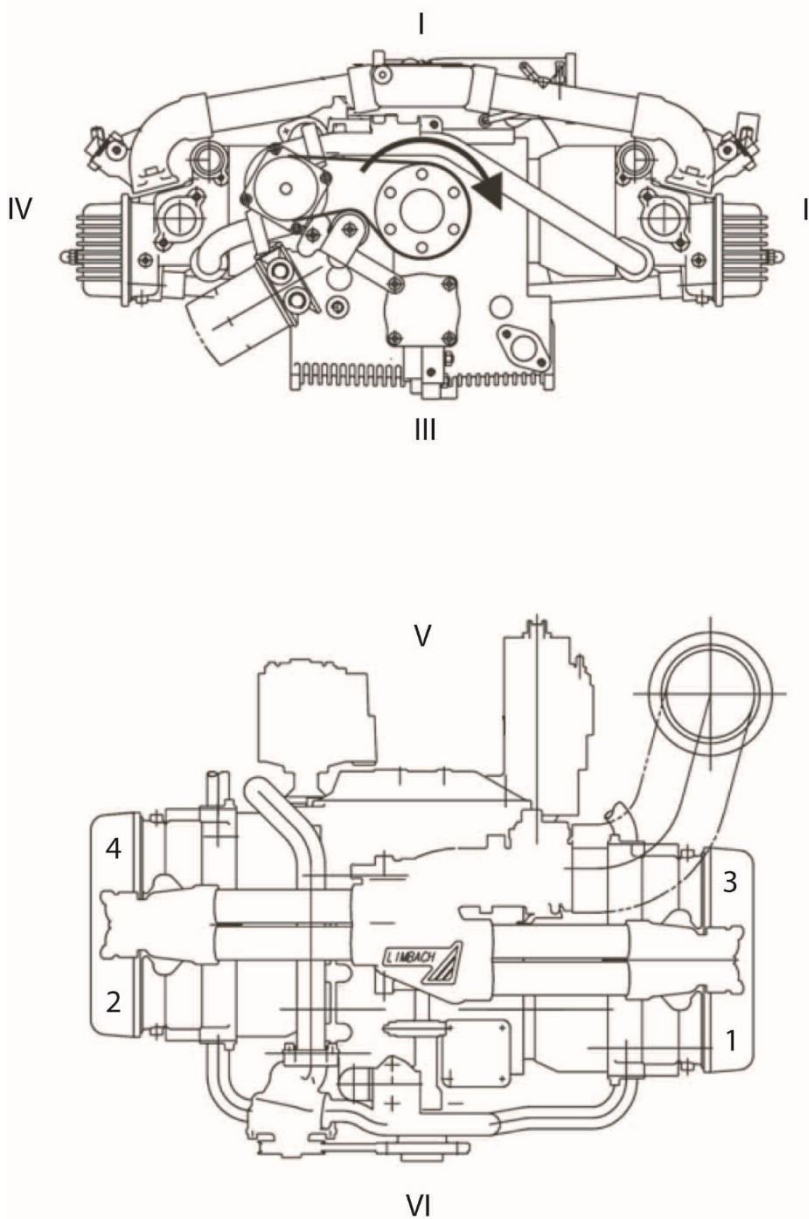
- 1 = Flange for Variable-Pitch Propeller
- 2 = Flange for Fixed-Pitch Propeller
- 3 = Flange for Fixed-Pitch Propeller (SAE 1)

- 6 + 7. Installation

Type Differences with regard to installation related changes

X = Experimental Engine without Certification

3.2 Cylinder Designation



- I** = top
- II** = left
- III** = bottom
- IV** = right
- V** = rear = accessory mounting side
- VI** = front = propeller side
- 1** = cylinder 1
- 2** = cylinder 2
- 3** = cylinder 3
- 4** = cylinder 4
- arrow** = crankshaft rotation

4 Technical Data

4.1 LIMBACH L 2400 EF/DF

Dimensions

Bore	97 mm
Stroke	82 mm
Displacement per Cyl.	606 cm ³
Total Displacement	2424 cm ³
Compression Ratio	9.5 : 1
Crankshaft Rotation	counterclockwise
Ignition Timing	variable mapped
Firing Order	1-3-2-4

Equipment

Engine management system	Weber Alpha PI 38 Weber Alpha PI 48 trijekt bee
Spark Plugs	NGK DCPR7E
Ignition Cable	LIMBACH
Ignition Harness	LIMBACH
Injectors	IWP 43
Fuel Pump	PIERBURG
Alternator	BOSCH 14V-33A BOSCH 14V-55A BRISE 14V-55A, P/N: 250.113.065
Starter	MAGNETON 1 kW, P/N: 250.143.010
Oil Pump	Geared Pump
Oil Filter	241.083.001
Propeller Flange	250.031.301*) 250.031.302**)

Engine Ratings

Max. Take-Off Power	74 kW / 100 HP at 3000 rpm 30 inHg
Max. Continuous Power	62 kW / 84.5 HP at 3000 rpm 28 inHg

Engine Rotational Speeds

Max. permissible speed	3200 rpm
Max. speed for cruise	See flight and maintenance manual of airframe manufacturer.
Min. continuous speed	2400 rpm
Idle speed	800 ±100 rpm

Fuel and Oil

Fuel	see section 10
Engine Oil	see section 10
Coolant	see section 10

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*) With crankshaft 241.031.013

***) With crankshaft 241.031.001

Pressures and Temperatures

Fuel Pressure	2.5 bar / 14.6 psi (measured relative to the manifold pressure)
Engine Oil Pressure max.*)	7 bar / 101.5 psi
min.	1 bar / 14.5 psi at 2500 rpm
Engine Oil Temperature max.*)	120 °C
min	50 °C (indicated)
opt.	approx. 80 °C
Water Temperature max.*)	110 °C
opt.	70 to 90 °C (at cruise)

Liquid quantities

Engine Oil Charge max.	3.5 ltrs
min.	2.75 ltrs
Coolant	approx. 3.5 ltrs

*) Operating limit - only permissible for a short period!
Continuous operation at the operating limit can reduce the engine lifetime.

4.2 LIMBACH L 2400 ET/DT

Dimensions

Bore	97 mm
Stroke	82 mm
Displacement per Cyl.	606 cm ³
Total Displacement	2424 cm ³
Compression Ratio	8.0 : 1
Crankshaft Rotation	counterclockwise
Ignition Timing	variable mapped
Firing Order	1-3-2-4

Equipment

Engine management system	Weber Alpha PI 38 Weber Alpha PI 48 trijekt bee
Spark Plugs	NGK DCPR7E
Ignition Cable	LIMBACH
Ignition Harness	LIMBACH
Injectors	IWP 43
Fuel Pump	PIERBURG
Alternator	BOSCH 14V-33A BOSCH 14V-55A BRISE 14V-55A, P/N: 250.113.065
Starter	MAGNETON 1 kW, P/N: 250.143.010
Oil Pump	Geared Pump
Oil Filter	241.083.001
Turbocharger	250.173.100*) 250.173.105**) 250.173.106***)
Propeller Flange	250.031.301 (For crankshaft 241.031.013) 250.031.302 (For crankshaft 241.031.001)

Engine Ratings

Max. Take-Off Power	96 kW / 130 HP at 3000 rpm 40 inHg****) 41 inHg*****)
Max. Continuous Power	85 kW / 115 HP at 3000 rpm 38 inHg****) 39 inHg*****)

Engine Rotational Speeds

Max. permissible speed	3200 rpm
Max. speed for cruise	See flight and maintenance manual of airframe manufacturer.
Min. continuous speed	2400 rpm
Idle speed	800 ±100 rpm

Fuel and Oil

Fuel	see section 10
Engine Oil	see section 10
Coolant	see section 10

- *) In conjunction with Weber Alpha PI 38
 **) In conjunction with Weber Alpha PI 48 and boost control valve 250.173.111 (identification 432340-68)
 ***) In conjunction with trijekt bee and boost control valve 250.173.115 (identification 432340-16)
 ****) For turbocharger 250.173.100
 *****) For turbocharger 250.173.105 and for turbocharger 250.173.106

Pressures and Temperatures

Fuel Pressure	2.5 bar / 14.6 psi (measured relative to the manifold pressure)
Engine Oil Pressure max.*)	7 bar / 101.5 psi
min.	1 bar / 14.5 psi at 2500 rpm
Engine Oil Temperature max.*)	120 °C
min.	50 °C ((indicated)
opt.	approx. 80 °C
Water Temperature max.*)	110 °C
opt.	70 to 90 °C (at cruise)

Liquid quantities

Engine Oil Charge max.	3.5 ltrs
min.	2.75 ltrs
Coolant	approx. 3.5 ltrs

*) Operating limit - only permissible for a short period!
Continuous operation at the operating limit can reduce the engine lifetime.

4.3 LIMBACH L 2400 DX

Dimensions

Bore	97 mm
Stroke	82 mm
Displacement per Cyl.	606 cm ³
Total Displacement	2424 cm ³
Compression Ratio	8.0 : 1
Crankshaft Rotation	counterclockwise
Ignition Timing	variable mapped
Firing Order	1-3-2-4

Equipment

Engine management system	trijekt bee
Spark Plugs	NGK DCPR7E
Ignition Cable	LIMBACH
Injectors	IWP 43
Fuel Pump	PIERBURG
Alternator	BRISE 14V-55A, P/N: 250.113.065
Starter	MAGNETON 1 kW, P/N: 250.143.010
Oil Pump	Geared Pump
Oil Filter	241.083.001
Turbocharger	250.173.105
Propeller Flange	250.031.304*)

Engine Ratings

Max. Take-Off Power	118 kW / 160 HP at 3000 rpm 48 inHg
Max. Continuous Power	103 kW / 140 HP at 3000 rpm 44 inHg

Engine Rotational Speeds

Max. permissible speed	3100 rpm
Max. speed for cruise	See flight and maintenance manual of airframe manufacturer.
Min. continuous speed	2200 rpm
Idle speed	800 ±100 rpm

Fuel and Oil

Fuel	see section 10
Engine Oil	see section 10
Coolant	see section 10

*) With crankshaft 250.031.013

Pressures and Temperatures

Fuel Pressure	2.5 bar / 14.6 psi (measured relative to the manifold pressure)
Engine Oil Pressure max.*)	7 bar / 101.5 psi
min.	1 bar / 14.5 psi at 2500 rpm
Engine Oil Temperature max.*)	120 °C
min.	50 °C (indicated)
opt.	approx. 80 °C
Water Temperature max.*)	110 °C
opt.	70 to 90 °C (at cruise)

Liquid quantities

Engine Oil Charge max.	3.5 ltrs
min.	2.75 ltrs
Coolant	approx. 3.5 ltrs

*) Operating limit - only permissible for a short period!
Continuous operation at the operating limit can reduce the engine lifetime.

4.4 LIMBACH L 2400 DS

Dimensions

Bore	97 mm
Stroke	82 mm
Displacement per Cyl.	606 cm ³
Total Displacement	2424 cm ³
Compression Ratio	9.5 : 1
Crankshaft Rotation	counterclockwise
Ignition Timing	variable mapped
Firing Order	1-3-2-4

Equipment

Engine management system	trijekt bee
Spark Plugs	NGK DCPR7E
Ignition Cable	LIMBACH
Ignition Harness	LIMBACH
Injectors	IWP 43
Fuel Pump	PIERBURG
Alternator	BRISE 14V-55A, P/N: 250.113.100
Starter	MAGNETON 1 kW, P/N: 250.143.010
Oil Pump	Geared Pump
Oil Filter	241.083.001
Propeller Flange	250.031.301*) 250.031.302**)

Engine Ratings

Max. Take-Off Power	85 kW / 116 HP at 3400 rpm 29 inHg
Max. Continuous Power	78 kW / 106 HP at 3400 rpm 28 inHg

Engine Rotational Speeds

Max. permissible speed	3400 rpm
Max. speed for cruise	See flight and maintenance manual of airframe manufacturer.
Min. continuous speed	2300 rpm
Idle speed	800 ±100 rpm

Fuel and Oil

Fuel	see section 10
Engine Oil	see section 10
Coolant	see section 10

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*) With crankshaft 241.031.013

***) With crankshaft 241.031.001

Pressures and Temperatures

Fuel Pressure	2.5 bar / 14.6 psi (measured relative to the manifold pressure)
Engine Oil Pressure max.*)	7 bar / 101.5 psi
min.	1 bar / 14.5 psi at 2500 rpm
Engine Oil Temperature max.*)	120 °C
min	50 °C (indicated)
opt.	approx. 80 °C
Water Temperature max.*)	110 °C
opt.	70 to 90 °C (at cruise)

Liquid quantities

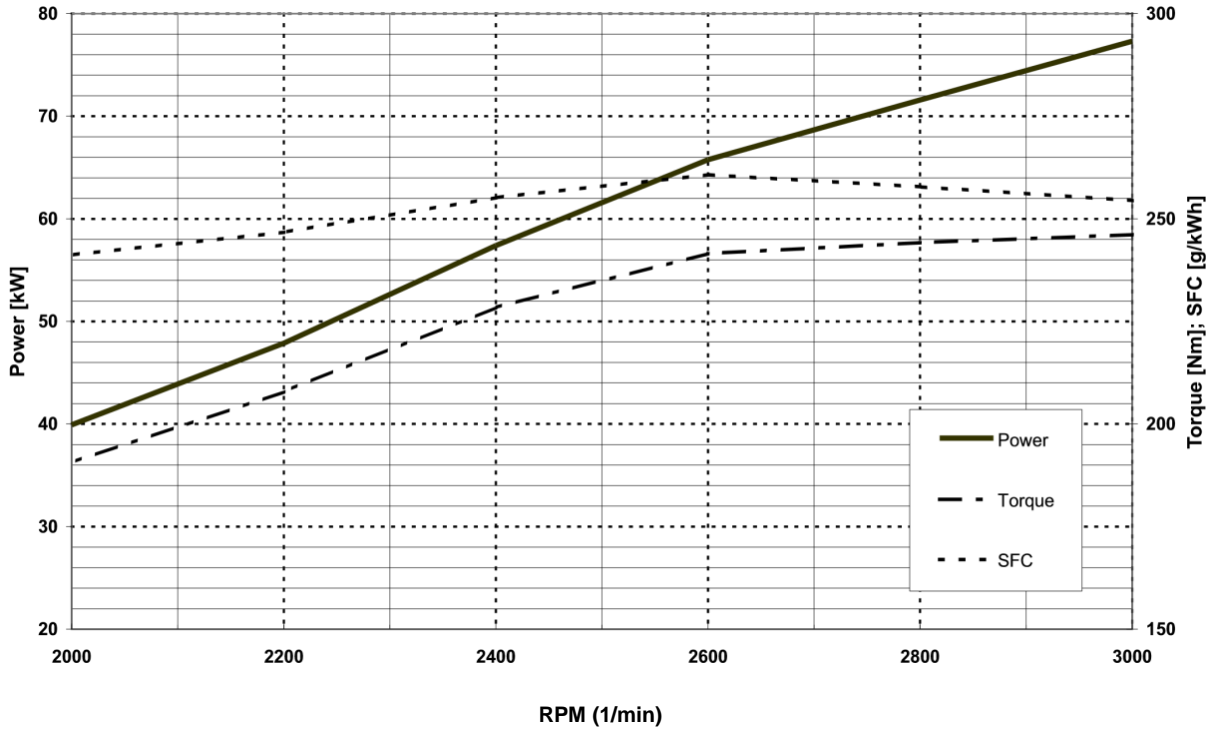
Engine Oil Charge max.	3.5 ltrs
min.	2.75 ltrs
Coolant	approx. 3.5 ltrs

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*) Operating limit - only permissible for a short period!
Continuous operation at the operating limit can reduce the engine lifetime.

5 Performance

5.1 Performance Graph LIMBACH L 2400 EF/DF



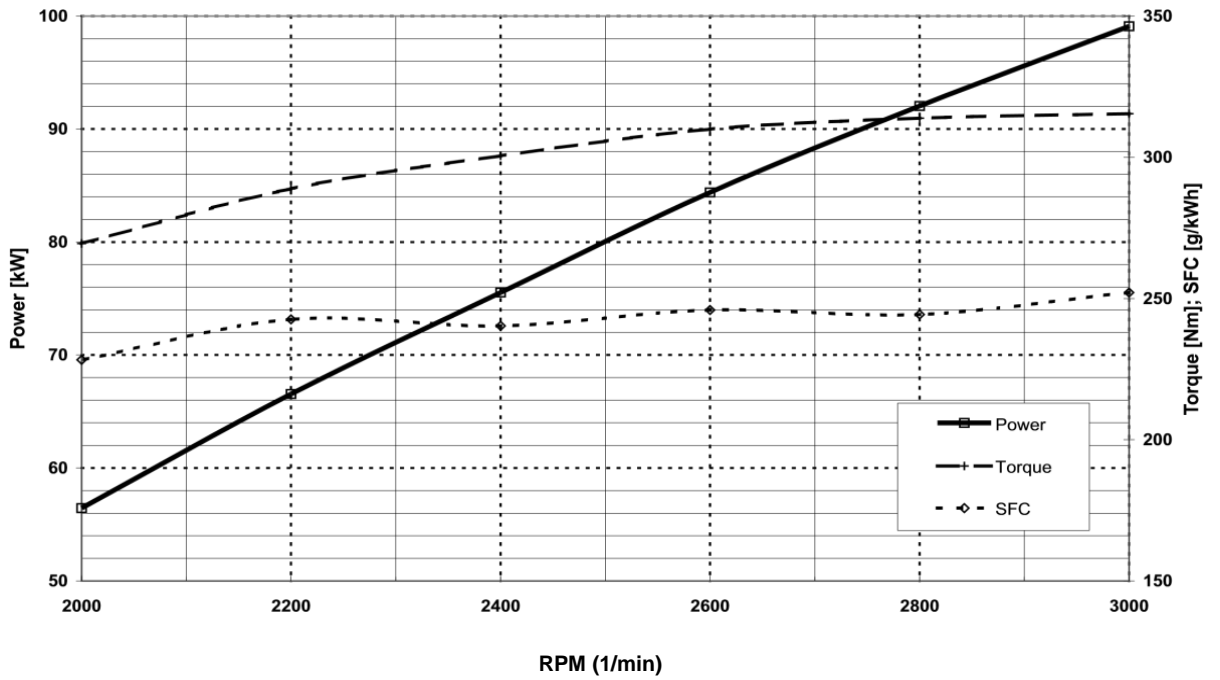
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5.1.1 Performance Data L 2400 EF/DF

Power values in kW (HP values in parentheses)

Manifold Pressure (inHg)	2400 rpm	2500 rpm	2600 rpm	2700 rpm	2800 rpm	2900 rpm	3000 rpm
20	28 (38)						
21		33 (45)					
22	34 (46)		37.5 (51)				
23		38 (52)		42 (57)			
24			42.5 (58)		46 (63)		
25		44 (60)		48 (65)		55 (75)	
26			48.5 (66)		53 (72)		
27				54.5 (74)		58 (79)	
28					60 (82)		62.5 (85)
29						67 (91)	
30	56 (76)	60 (81)	64 (87)	68 (92)	70 (95)	72 (98)	74 (100)

5.2 Performance Graph LIMBACH L 2400 ET/DT



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5.2.1 Performance Data L 2400 ET/DT

Power values in kW (HP values in parentheses)

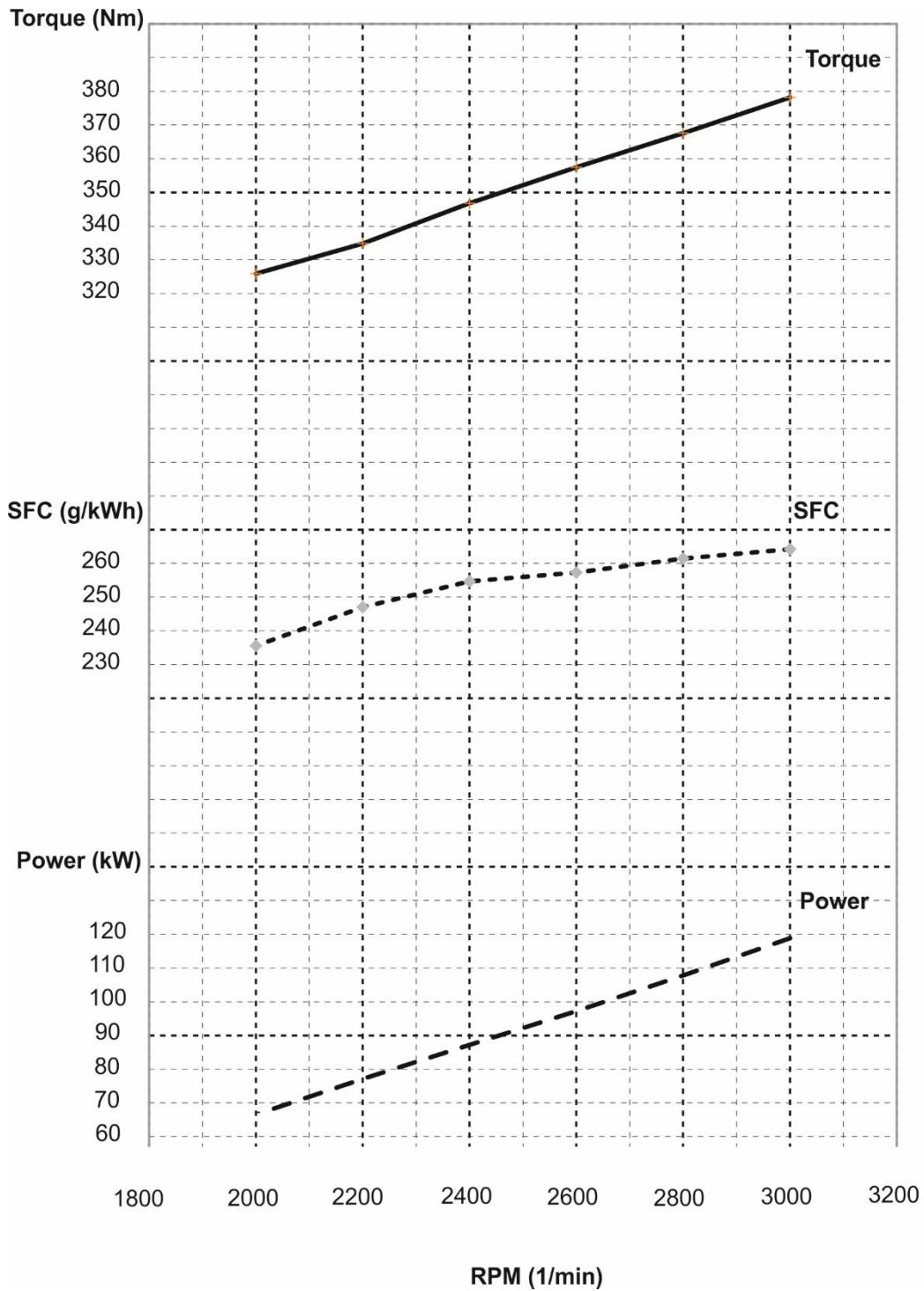
Manifold Pressure (inHg)		2200 rpm	2400 rpm	2600 rpm	2800 rpm	3000 rpm
*)	**)					
23	24	29 (40)	34.5 (47)	37 (50)	40 (54)	42 (57)
24	25	31.5 (43)	37 (50)	39 (53)	42 (57)	44 (60)
25	26	34 (46)	38 (52)	40.5 (55)	44 (60)	46 (63)
26	27	36 (49)	40 (54)	42 (57)	46 (63)	48.5 (66)
27	28	38 (52)	42 (57)	43.5 (59)	49 (67)	51.5 (70)
28	29	40.5 (55)	44 (60)	45.5 (62)	51.5 (70)	54.5 (74)
29	30	42 (57)	45.5 (62)	49 (67)	53.5 (73)	57.5 (78)
30	31	44 (60)	48 (65)	53 (72)	57 (77)	61 (83)
31	32	45.5 (62)	50 (68)	57 (77)	60 (81)	64 (87)
32	33	48.5 (66)	52 (71)	60 (82)	63 (86)	67 (91)
33	34	51 (69)	55 (75)	62 (84)	67 (91)	71 (96)
34	35	53 (72)	57.5 (78)	63 (87)	69 (94)	73.5 (100)
35	36	55 (75)	60 (81)	66 (90)	71.5 (97)	76 (103)
36	37	57.5 (78)	62.5 (85)	68.5 (93)	74 (101)	79.5 (108)
37	38	60 (82)	65.5 (89)	71 (97)	78 (106)	82.5 (112)
38	39	62.5 (85)	69 (94)	75 (102)	82 (111)	86 (117)
39	40		73 (99)	79 (107)	85 (116)	90 (122)
40	41			84 (114)	90.5 (123)	96 (131)

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*) Applies to turbocharger 250.173.100

***) Applies to turbocharger 250.173.105 and for turbocharger 250.173.106

5.3 Performance Graph LIMBACH L 2400 DX



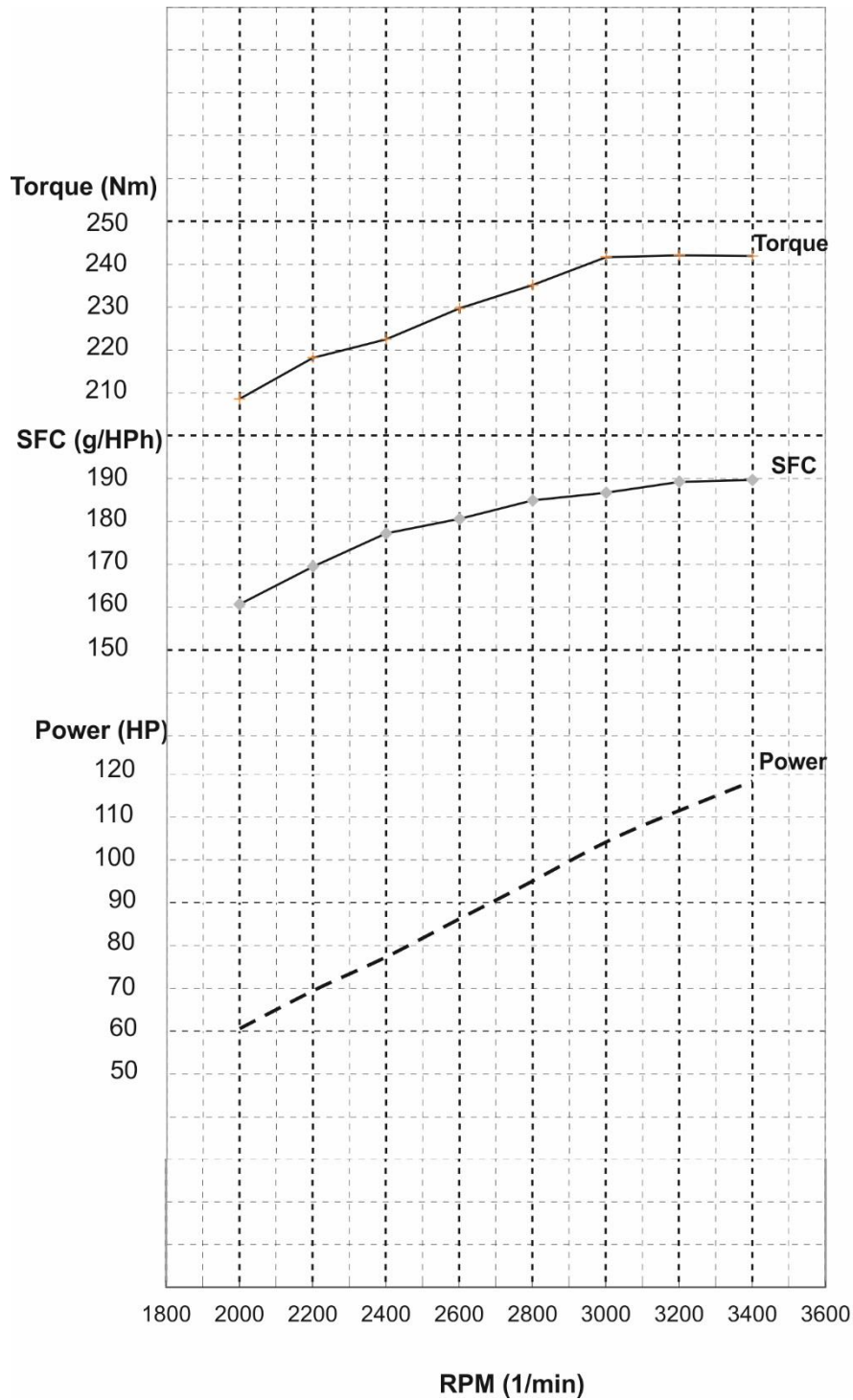
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5.3.1 Performance Data L 2400 DX

Power values in kW (HP values in parentheses)

Manifold Pressure (inHg)	2000 min ⁻¹	2200 min ⁻¹	2400 min ⁻¹	2600 min ⁻¹	2800 min ⁻¹	3000 min ⁻¹
24	23 (31)	24 (33)	28 (38)	30 (41)	32,5 (44)	37,5 (51)
26	28 (38)	30 (41)	33 (45)	35.5 (48)	37.5 (51)	41 (56)
28	31.5 (43)	34 (46)	37 (50)	41 (56)	43.5 (59)	48 (65)
30	35.5 (48)	38.5 (52)	42.5 (58)	46.5 (63)	50 (68)	55 (75)
32	38 (52)	44 (60)	48.5 (66)	51.5 (70)	58 (79)	63 (86)
34	42 (57)	48 (65)	53.5 (73)	59 (80)	64 (87)	70 (95)
36	46.5 (63)	52 (71)	58 (79)	65 (88)	72 (98)	77.5 (105)
38	50 (68)	58 (79)	63.5 (86)	70.5 (96)	77.5 (105)	83 (113)
40	54.5 (74)	62 (84)	68.5 (93)	76.5 (104)	84 (114)	89 (121)
42	60.5 (82)	68.5 (93)	76 (103)	82.5 (112)	91 (124)	96.5 (131)
44		75 (102)	82.5 (112)	89 (121)	97 (132)	104.5 (142)
46				94 (128)	103 (140)	110.5 (150)
48					109 (148)	119 (162)

5.4 Performance Graph LIMBACH L 2400 DS



250.253.501.000

5.4.1 Performance Data L 2400 DS

Power values in kW (HP values in parentheses)

Manifold Pres- sure (inHg)	2000 min ⁻¹	2200 min ⁻¹	2400 min ⁻¹	2600 min ⁻¹	2800 min ⁻¹	3000 min ⁻¹	3200 min ⁻¹	3400 min ⁻¹
22	30 (41)	32 (43)	33 (45)	34,5 (47)	35 (48)	38 (52)		
23	31 (42)	32,5 (44)	33 (45)	34,5 (47)	38 (52)	42 (57)	45,5 (62)	54,5 (74)
24	31 (42)	34,5 (47)	36 (49)	39 (53)	42 (57)	45,5 (62)	50 (68)	60 (82)
25	33 (45)	37 (50)	39 (53)	43,5 (59)	45,5 (62)	48 (65)	54,5 (74)	63 (86)
26	35 (48)	39 (53)	42 (57)	48 (65)	52 (71)	56 (76)	59 (80)	69 (94)
27	39 (53)	43,5 (59)	46 (63)	55 (75)	59 (80)	63 (86)	68 (92)	73 (99)
28	42 (57)	48 (65)	52 (71)	59 (80)	63 (86)	68,5 (93)	73,5 (100)	78,5 (107)
29	42,5 (58)	50 (68)	56 (76)	63 (86)	69 (94)	76 (103)	81,5 (111)	85 (116)

6 Operating Instructions

Strict adherence to the information contained in this operating manual is the basis for undisturbed operation of your engine.

6.1 Before Starting

Perform daily check (see section 7.1)

Move throttle lever to the full power position.

Check freedom of movement.

Check that the throttle lever on the throttle body reaches both the full power and idle position.

Switch ignition to „Off“

Disconnect the spark plug connectors.

Turn propeller a few times by hand.

Check for unnormal noises and indication of stiff movement.

Reinstall spark plug connectors.

Note:

Engines that are equipped with a vacuum pump may never be turned against the normal sense of engine rotation. Damage to the vacuum pump may occur.



Caution:

The propeller may only be turned by hand with the spark plug connectors removed.

6.2 Engine Start-Up



Caution:

When starting the engine, the propeller area must be clear. No persons may be present in the propeller area.

Open fuel shutoff valve.

Turn master switch and engine electrical system on.

Fuel pump starts and turns itself off after approximately 10 seconds.

Turn ignition off.

Turn emergency switch to emergency mode.

Turn ignition on.

- Fuel pump starts to operate and stops automatically after approx. 10 seconds*).
- At the same time the yellow indicating light in the engine emergency switch illuminates. In case of an electronic engine display the word “**Emergency**” is displayed.

*) Listen for operation noise.

Turn emergency switch to normal mode

The emergency indication disappears.

Move the throttle lever to 5-10 % power.

Check propeller clearance

Start engine.

When the engine is firing, release starter button and set engine speed to appr. 1300 rpm by means of the throttle lever.

Check oil pressure (must increase within 10 sec.).

6.3 Runup, Performance Check

Run the engine for approx. 2 min. at 1300 rpm. Then increase speed to 1500 rpm until oil temperature is 50 °C.

Due to the sluggish action of the indication, there will be sufficient effective operating temperature at 50 °C already.

6.3.1 Performance Check

Move throttle lever to full-throttle stop. Engine has to reach the full-throttle static speed published in the flight and maintenance manual of the aircraft manufacturer. Return throttle lever to idle.

6.3.2 Ignition Check L 2400 DF/DT/DX/DS

Using the throttle lever set the engine speed to 2000 rpm.

Check function of both ignition circuits starting from position „Ignition circuit 1+2“.

The engine must operate without misfiring in all operating modes of the ignition switch.

The engine speed may not drop more than 100 rpm using the position “Ignition circuit 1+2” as a reference.

Set the ignition switch to position “Ignition circuit 1+2”



Caution:

If full-throttle ground runs are made for a longer period, overheating of the engine is possible!

6.4 Hot Engine Start-Up

Hot engine starting is performed as described in Chapter 6.2, but without checking the emergency switch.

6.5 Take-Off

Increase engine speed steadily to full throttle and perform first part of climb with this setting, then reduce power.

Observe coolant, oil temperature and pressure. The limits may not be exceeded.



Caution:

With increasing ambient temperatures the engine power and the lift up of the wings will be reduced. This applies especially to situations in which the runway has been heated up by sunlight.

6.6 Engine Shut-Down

Shut engine down by switching ignition off.



Caution:

After taxiing for an extended period or at high power, run the engine at approx. 1300 rpm for 2 to 3 min.

Close fuel shutoff valve.

6.7 Inflight Shut-Down and Restarting

Set throttle to idle, let engine cool down and switch off ignition.

To avoid windmilling bring propeller into feathered position.

Starting engine is the same as on the ground.

It is not necessary to check emergency operation.

If the engine is cold, perform warm-up.

At low ambient temperatures and after prolonged soarings:

- the engine oil may have cooled so much, that the engine cannot be started anymore,
- the capacity of the starting battery may be reduced (see section 8.19)



Caution:

Make sure that you have sufficient altitude to restart the engine, especially at low ambient temperatures and prolonged soaring.

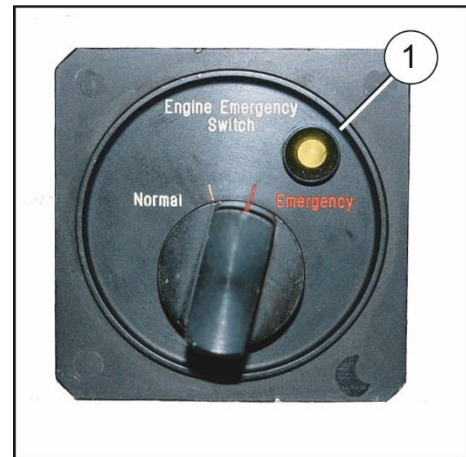
6.8 Emergency Procedures

If engine operation is disturbed, the emergency switch (S) should be set to emergency mode. When in emergency mode some engines sensors are deactivated resp. replaced with reserve sensors. Also a reserve fuel pump is selected.

6.8.1 Version with engine Emergency Switch

After activating Emergency Mode the yellow indicator (1) turns on.

During emergency operation the exhaust gas temperature (EGT) must be monitored. Adjust the power lever such that the exhaust gas temperature is in a range between 600 and 750 °C, depending on rpm. If the exhaust gas temperature exceeds the limit, the power must be reduced until the temperature comes between limits again. At low power settings the exhaust gas temperatures may be lower than stated. In such cases the power lever should be adjusted such that the engine runs as smooth as possible.

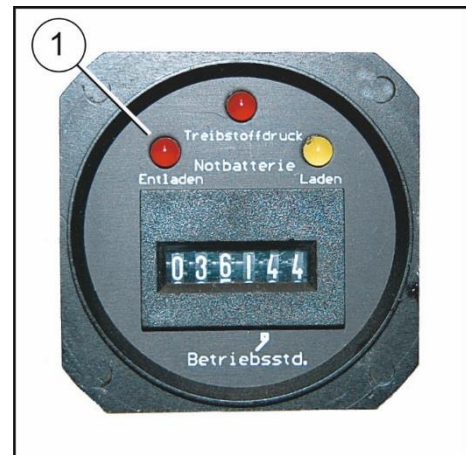


Note:

The engine may be restarted in emergency mode as long as the main battery is functional and the master switch is in the “ON” position.

If the red warning light (1) on the status indicator “Discharge” comes on, consider the following:

- The electrical system is disturbed.
- The operating time for the engine is limited. (Check the flight manual for the time remaining to fly).
- Take course to the next possible landing site. Adjust your flight attitude to a maximum range (climb at elevated speed), check the flight manual.
- The engine may not be restarted with the electric starter (Starting only possible by windmilling and considerable loss of altitude).



Caution:
If the lamp “Emergency Battery Discharge” comes on, the time available to operate the engine is limited.

6.8.2 Version with electronic engine display

After activating the emergency mode the message „**Emergency**“ comes on.

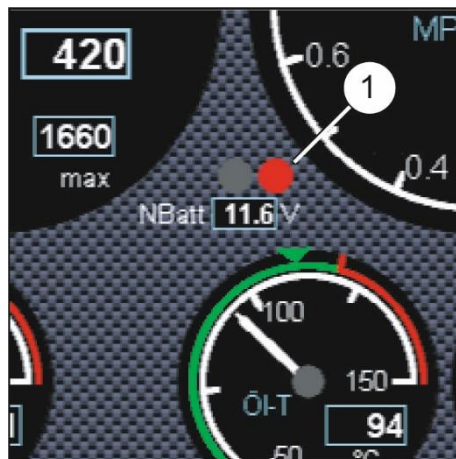


Note:

The engine may be restarted in emergency mode as long as the main battery is functional and the master switch is in the “ON” position.

If the red warning light (1) on the status indicator “Discharge” comes on, consider the following:

- The electrical system is disturbed.
- The operating time for the engine is limited. (Check the flight manual for the time remaining to fly).
- Take course to the next possible landing site. Adjust your flight attitude to a maximum range (climb at elevated speed), check the flight manual.
- The engine may not be restarted with the electric starter (Starting only possible by windmilling and considerable loss of altitude).



Note:

The voltage of the emergency battery „NBatt“.



Caution:

If the red indicator (1) lamp “Emergency Battery Discharge” comes on, the time available to operate the engine is limited. When the indicator is on an acoustic signal is issued. It may be turned off by pressing the alarm switch.

7 Maintenance Schedule

Maintenance at Limbach aircraft engines is to be performed after fixed time periods or when reaching a certain interval of operating hours. In addition, a “daily check” has to be performed before each flight. Repair activities during engine maintenance may only be performed by authorized persons. Therefore, the specifications together with the technical documents of Limbach Flugmotoren GmbH must be observed!

Note:

On turbocharged engines ET/DT/DX models the exhaust collector (pipes running from the engine to the turbocharger) are part of the engine.

7.1 Daily Check

- Remove engine cowling.
- Check bolted connections for obviously loose or missing fasteners.
- Check baffle assembly.
- Check all coolers and radiators for free passage of air – clean if necessary.
- Check harness.
- Check condition of drive belt.
- Check cowling for cracks and correct attachment.
- Check clearance of throttle pushrods and bowden cables.
- Check engine oil level and refill as necessary. Volume difference between max. and min. markings: 0.75 Ltr.
- Check coolant level and refill as necessary.*)
- Check oil, fuel and cooling system for leakage.
- Check acid level of batteries and refill as necessary.
- Perform test run (see section 8.17).

7.2 Periodical Checks

7.2.1 If the Engine is not Operated for more than 3 Months

Check capacity of emergency battery with a battery tester.

7.2.2 Every 2 Years

Replacement of emergency battery recommended (depending on battery type).

7.2.3 Every 5 Years after engine manufacture or major overhaul

Replace oil and fuel hoses (mounted to the engine). The oil and fuel hoses mounted to the engine are signed with an expiration date, e.g. 5.01 - i.e. to be replaced not later than May 2001.

*) After refilling the glycol content may have to be reestablished.

7.3 Operating Time related Inspections

	7.3.1	7.3.3	section 7.3.4	7.3.5	7.3.6
After 5 Operating hours	X				
After 25 Operating hours		X			
Every 50 Operating hours		X			
Every 100 Operating hours		X	X		
Every 200 Operating hours		X	X	X	
Every 500 Operating hours		X	X		X

7.3.1 After the first 5 Operating Hours

- Check valve clearance, replace cylinder head cover gasket as necessary.

7.3.2 After the first 25 Operating Hours

- Work as specified in section 7.3.3

7.3.3 Every 50 Operating Hours

- Check fuel, lubrication and cooling system for leaks.
- Clean engine.
- Check all coolers and radiators for free passage of air – clean if necessary.
- Check crankcase ventilation.
- Check routing of the turbocharger*) drain line (see section 8.13)
- Clean induction air filter or replace, if necessary.
- Check valve clearance, replace cylinder head cover gasket as necessary.
- Check compression.
- Clean and check spark plugs.
- Check drive belt tension of generator and coolant pump.
- Check the control cable and actuator rod for both the throttle and the boost limiter*) on the turbocharger for freedom of movement, range of travel – lubricate.
- Check emergency operation.
- Check seating of electrical connectors and wire boots.
- Check engine wiring for damage and proper routing.
- Check condition of emergency battery (see section 8.15)
- Check bolts, nuts, safety pins, and engine mounting frame for tight fit and proper condition.
- Perform engine test run.

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*) L 2400 ET/DT/DX only

7.3.4 Every 100 Operating Hours

- Change oil and replace oil filter.
- Change fuel filter.
- If there is still a permissible dimension of 23,8 mm, check valve shaft projection length for intake and exhaust valves.
. See Service Bulletin No. 13, current edition.
- Work as specified in section 7.3.3

7.3.5 Every 200 Operating Hours

- Replace spark plugs
- Work as specified in section 7.3.3
- Work as specified in section 7.3.4

7.3.6 Every 500 Operating Hours

- Check valve shaft projecting length.
- Work as specified in section 7.3.3
- Work as specified in section 7.3.4

8 Maintenance Instructions

This chapter describes the performance of maintenance work. In addition, the preservation of engines as well as winter and tropical operation is covered.



Caution:
Disconnect spark plug connectors before performing any work on the engine.



Caution:
When starting the engine, the propeller area must be clear. Secure the aircraft from rolling. No persons may be present in the propeller area.

Note:

Vacuum pump equipped aircraft engines must never be turned opposite to the engine rotation because the vacuum pump might be damaged.

Check with your airworthiness inspector if inspection is mandatory before starting work.

It is recommended to mark the position of parts to be removed before commencing disassembly work in order to facilitate assembly later on.

This is only applicable to parts which might be installed in different positions. During assembly, pay attention to markings provided by the manufacturer.

The spark plug connectors are marked with the cylinder numbers.

It is not important whether they are attached to the out- or inboard spark plugs.

Loosened screw connections must be secured! After loosening the screw connections, new locking elements (securing wire, split washer, spring washers, safety plates, etc.) must be inserted.

8.1 Oil Change

Warm up engine.

Drain oil.

Remove drain plug. After all oil is drained, install drain plug with a new gasket.

Change oil filter.

Remove oil filter. Slightly oil the rubber seal of the new filter before mounting and tighten filter manually.

Refill engine oil.

The oil charge is 3.5 l. Check oil level by means of the oil-measuring stick. The MAX marking must not be exceeded. The engine must be horizontally orientated. This is especially important for so called "taildragger" Aircraft.

See section 10.1 for oil specifications

8.2 Cleaning of Air Filter

Remove air filter.

Clean air filter, using compressed air, blowing from inside outwards.

Special filters are to be cleaned according to the aircraft manufacturer's instructions.

8.3 Adjust Idling Speed

The idling speed may be adjusted via the adjusting screw on the throttle body. The speed should be adjusted to 800 ±100 rpm. Turning the screw clockwise increases idling speed. Turning the screw counterclockwise reduces the idling speed.

8.4 Fuel Filter Cleaning

Draining and cleaning of fuel filter.

Refer to flight and maintenance manual of aircraft manufacturer.

8.5 Fuel, Lubrication and Cooling System Check

Check all hoses, hose connections, fittings, related equipment and engine casing joints for leaks, damage, proper attachment, installation and replacement periods. Check liquid levels.

Coolant and oil level should be between MIN and MAX markings.

Check the radiator, oil cooler and intercooler for obstruction, foreign objects and dirt.
Clean if necessary.

8.6 Crankcase Ventilation Check

Check visually for damages and clean breather line as necessary. Check suitability and installation of breather line - it has to be stable at engine operating temperatures (danger of buckling) and must be installed properly (no bucklings, no reduction in cross-sectional area, no suction effects at the end of the line).

8.7 Compression Check

Compression checks should be performed when the engine is “warm to touch”.

Remove spark plugs and the connectors from the injectors.

Measure compression by means of a compression pressure recorder.

Perform measurement with throttle full open. Record compression pressure at starting rpm for every cylinder until the pressure indicated on the recorder does not rise anymore.

Wear limit: 6 bar / 87 psi.

Permitted pressure difference: 2 bar / 29 psi

Reinstall spark plugs and injector connectors.

8.8 Check and Setting of Valve Clearance

Valve clearance must be checked or set only on a cold engine (ambient temperature).



Caution:
Remove spark plug connectors before starting to work.

Remove valve cover.

Valve clearance check.

Turn propeller according to engine rotation until the valves of the second cylinder are overlapping. Now, the valve clearance of the first cylinder may be checked (see cylinder designation at page 3.2).

Move thickness gauge between valve shaft and setscrew. The thickness gauge must be movable slightly “sucking”. It must not jam.

Valve clearance setting.

Untighten nut of setscrew and turn setscrew until thickness gauge can be moved slightly “sucking”. Tighten nut and check valve clearance again, readjust, if necessary.

Order of adjustment

The order of adjustment is: 1 - 3 - 2 - 4, i.e. the propeller has to be turned by 180° after the first cylinder has been set, in order to check the valve clearance of the third cylinder. After another 180° turn according to the engine rotation, the valve clearance of the second cylinder may be checked, etc.

Valve clearance:

Intake Valve 0.20 mm
Exhaust Valve 0.20 mm

Check cylinder head cover gaskets and replace, if necessary.

8.9 Check valve shaft projection length for intake and exhaust valves

Remove cylinder head covers.

Dismount rocker arm shafts.

Measurement of valve shaft projecting length by means of measuring device P/N: 803.001.130.
See Service Bulletin No. 13, current edition.



Caution:

With a still permissible dimension of 23,8 mm, the valve shaft projection length must be checked every 100 hours. When the wear limit of 23,3 mm is reached, the cylinder head must be replaced!

Install rocker arm shafts.

- Position rocker arm shaft assemblies on the studs in the cylinder head.
- Seat the pushrods in the sockets of the rocker arms.
- Pre-assemble spring washers and M8 nuts (strength class 10)
- Ensure that the pushrods are also seated in the camshaft followers.
- Torque nuts to 25 Nm

Note:

Turning the pushrods while tightening the bolts will prevent the pushrods from becoming unseated at the cam followers.



Caution:

An unseated pushrod may cause power loss and/or subsequent engine damage.

Check valve clearance and readjust, if necessary.

Mount cylinder head cover.

Check gaskets and replace as necessary.

8.10 Cleaning, Check and Setting of Spark Plugs

Removal of spark plugs.

Disconnect spark plug connectors.



Caution:

Do not unscrew spark plugs when the engine is hot.

Cleaning of spark plugs.

Clean spark plugs by means of a plastic brush in a degreasing solution. Do not use a steel brush for cleaning. Do not sandblast spark plugs.

Check electrode gap and adjust, if necessary.

Check electrode gap by means of a thickness gauge and adjust it by bending the ground electrode.

The electrode gap is 0.7 to 0.8 mm.

Reinstall spark plugs and connect spark plug connectors.

Grease spark plug thread with graphite grease P/N: 170.210.010.
Torque to 20 Nm.



Caution:

Electrodes must always be free from graphite grease! Do not use copper paste.

Use the following spark plugs:

NGK DCPR 7 E
P/N: 250.123.101

Change spark plugs every 200 operating hours.

Note:

The condition of the spark plugs removed from the engine discloses the following information:

Light grey:

Spark plug and engine adjustment o.k.

Velvet black:

Electrode gap too big
Mixture too rich
Lack of air (induction air filter contaminated)
Engine does not reach required temperature

Oillike glossy:

Interrupted spark plug operation
Excess oil in combustion chamber
Cylinder or piston rings worn out

Pearl formation:

Wrong spark plug
Loose spark plug
Mixture too lean ("false air")
Valves do not close properly
Induction air temperature too high

8.11 Drive Belt Check, Tensioning and Replacement

Drive belt check.

Check for wear, cracks and oil traces.

Drive belt tension check.

It must be possible to push the drive belt through with a strong thumb load by 5 to 10 mm.

Tensioning of drive belt.

Generator:

Unfasten mounting bolt of clamp at the accessory housing. Unfasten mounting nut of alternator with locking at the clamp. Tension drive belt by moving the alternator. Tighten and lock all bolts and nuts.

Coolant Pump:

Loosen fastening bolts of tensioner, tension belt and retorque bolts.

Replacement of drive belt.

Generator:

Unfasten mounting bolts of clamp and detach drive belt from pulley of alternator. Detach drive belt from crankshaft drive pulley. Attach new drive belt to crankshaft and alternator pulley and tension drive belt. Tighten all mounting bolts.

Coolant pump:

Remove propeller and propeller adapter. Loosen belt tensioner and remove belt. Install new belt, tension and tighten tensioner bolts. Mark all bolts with safety laquer after tightening. Install propeller adapter and propeller. Check propeller blade track.



Caution:

After propeller installation airworthiness inspection is mandatory.

New drive belts stretch more during the first time of operation. A check is required after 10 operating hours. Set belt tension as necessary.

8.12 Exhaust System Check

Check for damages, leaks and condition. Refer to flight and maintenance manual of aircraft manufacturer.

8.13 Turbocharger Check L 2400 ET/DT/DX

Check turbocharger for secure mounting. Check hose to boost pressure limiter for fit, tightness and damage. Check routing of turbocharger drain line (it must be routed with a constant declination towards the valve cover and have no bucklings, no reduction in cross-sectional area).

8.14 Bowden Cable Check

Check for condition, ease of motion and proper attachment. Refer to flight and maintenance manual of aircraft manufacturer.

8.15 Emergency Battery and Harness Check

Check emergency battery and warning lights. To do so disconnect the generator connector. Start engine and turn off the main switch. The engine must continue to run and the red light "Discharge" must be blinking. If installed the red generator warning lamp must be on.

Disconnect leads from the emergency battery and test loading capacity with a battery tester (similar to HAZET 4650-5). Reconnect leads.

Check proper installation, attachment and tight fit of electrical connections and terminals. Vibration of harness during operation must be avoided. Check connectors for corrosion. Check grounding leads.

8.16 Check of Bolted Connections

Check all accessible bolts and nuts for tight fit and check existing locks visually.

8.17 Engine Test Run

Check of starting performance.

At normal conditions (temperature, maintenance condition) the engine starts easily. If this is not the case check fuel supply and ignition system.



Caution:

Do not operate the starter a prolonged period of time (Risk of overheating).

Warming up.

Run the engine for approx. 2 min. at 1300 rpm. Then increase speed to 1500 rpm until the oil temperature is 50 °C.

Temperatures and pressures
See "Technical Data".

Check of throttle response.

Move power lever steadily to full throttle. Engine must show immediate response, engine speed must increase steadily.

Engine performance check

Move throttle lever to full-throttle stop. Engine has to reach the full-throttle static speed (refer to flight and maintenance manual of aircraft manufacturer). Set variable-pitch propellers to Take-off pitch.

8.18 Engine Preservation

Engines that are taken out of operation for more than 6 months shall be preserved.

Note:

At high humidity, it is recommended to close the exhaust muffler exit.

8.18.1 Compliance

Installed engine:

- Warm up engine and drain engine oil after engine shut-down. Change oil filter.
- Clean engine thoroughly.
- In any case, corrosion protection has to be performed by using fresh engine oil.
- Charge 3.5 l of engine oil and run engine for approx. half a minute with increased idle speed.
- Remove air filter and spray 25 to 30 cm³ of engine oil slowly into the intake opening of the running engine. Stop engine during spraying.
- Wet throttle linkage and boost pressure limiter linkage with engine oil.



Caution:

After corrosion protection, the engine must not run any more as this would disable corrosion protection.

Removed engine:

- Remove spark plugs and spray engine oil into the combustion chambers so that the upper part of the cylinder barrel is wetted, too.
- Crank engine manually or with starter for a few turns.
- Spray spark plugs with engine oil and install them again.
- Wet all linkages with engine oil.
- Close all openings to avoid entry of dirt or moisture
- Spray engine surface with engine oil. Take care of not exposing rubber parts and electrical connectors to engine oil.

8.19 Operation at low ambient Temperatures

In general, engine maintenance should be performed before the beginning of the cold season. Furthermore, the following hints for operation at extremely low ambient temperatures should be observed:

Electrical system

At low ambient temperatures, the capacity of the starting battery is reduced. This may lead to starting problems.

Check all wiring connections in the ignition system and clean as necessary, oxidized terminals cause voltage drops and thus starting problems.

Crankcase ventilation

At low ambient temperatures and high humidity, saponification of vent dome and breather line is possible. Make sure by means of special inspections that this cannot happen - a total lock might cause the engine oil to leak through the sealings due to overpressure. This would lead to high oil losses and possibly to the destruction of the engine.

Engine oil

For prolonged soaring (with stopped engine) please note that the viscosity of the engine oil increases extremely with the cooling down of the engine. In extreme cases the viscosity may have increased so much, that the starter cannot turn the engine anymore. When planning your flight, consider prolonged soaring and fill engine with appropriate oil. Eventually you should start the engine in between to warm up the engine oil again.

Coolant

For prolonged soaring (with stopped engine) take care that the coolant does not freeze. A content up to a maximum of 60% of anti-freeze and corrosion protection is necessary in any case. Eventually the radiator may have to be masked by suitable means.

8.20 Operation in Tropical Conditions

The following measures are necessary to protect the engine against heat and dust:

Air filter

If the engine is operated in areas of high dust accumulation install larger air filter (contact your aircraft manufacturer for details).

Oil-measuring stick

Seal oil-measuring stick by inserting a felt washer below the oil stick cap.
To achieve a tight fit of the oil stick in its guiding tube, bend stick as necessary.

Liquid cooling

If the engine is operated routinely at high ambient temperatures, a larger Radiator may be necessary (contact your aircraft manufacturer or the design organization).
The content of anti-freeze and corrosion protection may be reduced to 40 % to improve cooling performance

Dust protection of engines out of operation

Close exhaust pipe, crankcase ventilation, and induction air filter with a dustproof sealing.

Corrosion protection of engines out of operation

See section 8.18 for instructions.

Maintenance hints:

Air filter: Check daily and clean or replace as necessary.

Drive belts: Check drive belt tension daily. If wear is evident, replace drive belt.

Radiators: Check daily for erosion wear.

8.21 Miscellaneous

For further advice on maintenance and repair, refer to our maintenance instructions and technical bulletins.

9 Overhaul

9.1 Major Overhaul

Major overhaul must be performed by the manufacturer or overhaul shops, authorized by the manufacturer. Therefore, the engine has to be forwarded to the manufacturer or an authorized overhaul shop, after the operating time limit has been reached.

The permissible operating time (TBO) is determined by the latest issue of Technical Bulletin No. 9.

9.2 Major Repair

Major repair and major modifications must be performed only by the manufacturer or licensed fixed base operators, authorized by the manufacturer.

After ground or obstacle contact of the propeller, the engine has to be disassembled in any case and the crankshaft has to be checked outside the engine. Eccentricity measurement of crankshaft or propeller flange at installed conditions is inaccurate and not acceptable.

If ground or obstacle contact of the propeller has not been mentioned when ordering repair or major overhaul of an aero-engine, the liability of the owner for sequential damages will continue even after repair or major overhaul has been performed.

A change of the propeller hub has to be considered a major repair in any case.

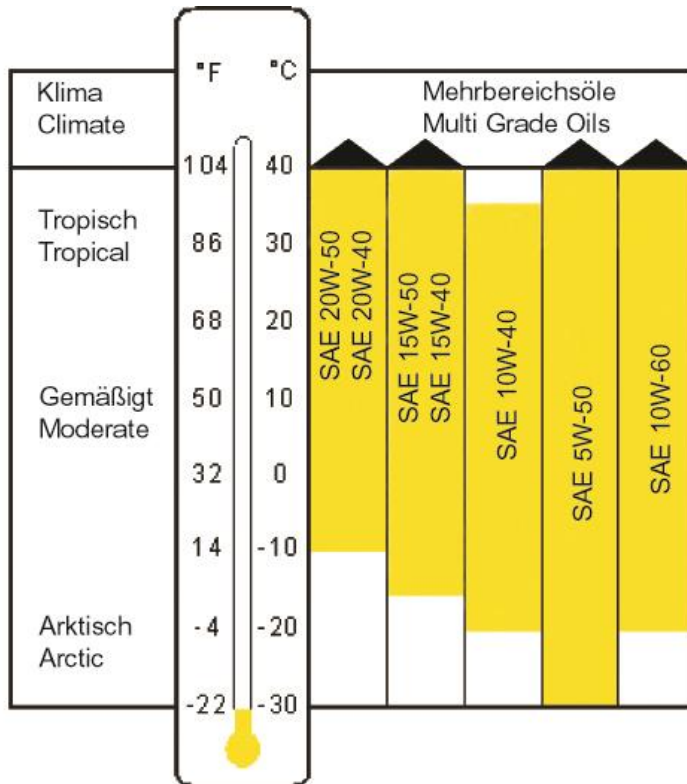
10 Lubricants, Coolants, Fuels

10.1 List of Lubricants

Do not use ash less dispersant or straight mineral aircraft engine oils!

Do not use fully synthetic oils!

Use only brand name oils according to specification API-SG, or higher. (eg. API-SH, SI, SJ, S...) as well as one of Volkswagen-specs VW 500 00, VW 501 01 or VW 502 00.



As the temperature ranges of adjacent SAE classes are overlapping, there is no need to change the oil for short time temperature variations.
See also information in the section 8.18

If low viscosity oils are used, the oil pressure may go below the lower limit at continuously high engine speeds and high loads. Such operating conditions should be avoided.

Lubricant additives - no matter what type - must not be added to the oil.

10.2 Coolant

The cooling system is filled with a mixture of water and anti-freeze and corrosion protection for all seasons. The amount of coolant is approximately 3.5 ltrs.

The mixing ratio may be varied between the following limits:

Frost protection down to	Percentage anti-freeze corrosion protection	Percentage water
-25 °C	40 % min.	60 %
-35 °C	50 %	50 %
-45 °C	60 % max.	40 %

Nitrite less and silicate less anti-freeze and corrosion protection may not be mixed. The antifreeze and corrosion protection liquids must comply with the VW specifications TL VW 774 C, D, F, J for coolant additives. If cooling liquids must be mixed, the miscibility must be checked previously - observe manufacturer's specifications! Nitrite less coolant additives are available in different colors. Silicate less coolant additives are usually red colored. A brownish color of the coolant may indicate mixing. When changing the coolant, rinse the engine and radiator with clear water.

10.3 Fuels

Following fuels are factory approved:

- Super Plus 98 fuel according to DIN EN 228,
- AVGAS 100 LL,
- or other unleaded fuels with a minimum octane rating of 98 RON and 87 MON.

Notes:

- Fuel hoses and lines must be suitable for fuel.*)
- Use fresh, brand name fuels only. Storage time for fuel is limited. If stored too long in ventilated containers, volatile components of the fuel may evaporate. That can change the properties of the fuel (reduced octane number). Also the fuel properties depend on the calendar season.
- Use of fuel additives is not permitted.
- Mixing of leaded and unleaded fuels is not recommended. Use mixed fuel only in case of need.



Caution:

Use of other fuels is not approved by the manufacturer.

*) Fuels may contain alcohol. Please consult the instructions of your aircraft manufacturer.

11 Recommended Nut Torques

Oil drainage screw to crankcase	20 Nm
Crankcase ventilation to case	10 Nm
Spark plug to cylinder head	20 Nm
Nut of valve clearance setscrew	15 Nm
Clamp to alternator (M6)	10 Nm
Clamp to alternator (M8)	20 Nm
Clamp to case	20 Nm
Alternator to case	45 Nm
Exhaust flange to cylinder head	20 Nm
Engine mount to case (M10)	45 Nm

12 Trouble Shooting

“Small”, apparently negligible causes are often responsible for a “big” effect, i.e. disturbance of engine operation. Detection of the causes is not always easy. The hints to possible trouble causes and their correction contained in this section serve as a guideline for the engine user, listing the most frequent faults. This list of causes, however, does not claim for completeness.

Repair work must be done only by persons authorized to perform the specific task.

12.1 Engine Starting Trouble

Possible Cause:	Remedy:
Battery discharged or defective.	Charge or replace battery.
Battery wiring not connected to starter motor or defective or possibly insufficient contact.	Clean connectors. Connect or replace wire.
Ground wire to engine not connected, defective, possibly insufficient contact.	Clean connectors. Connect or replace ground wire.
Starter motor defective.	Repair or replace starter motor.
Starter relay defective.	Replace starter relay.
Engine electrics not switched on.	Turn on engine electrics.
Ignition harness disengaged, mixed up or damaged.	Fasten ignition lead(s) or replace. Observe firing sequence 1-3-2-4. Check markings of connectors.
Fuse blown in relay box (MCU).	Check fuse, replace if necessary
Wiring harness or connector loose or defective, wire broken in wiring harness.	Check wiring harness and connectors, repair if necessary.
Throttle potentiometer defective.	Check throttle potentiometer. Replace if necessary. Try to run engine in emergency mode.
RPM sensor defective or not connected.	Check rpm sensor. Replace if necessary. Try to run engine in emergency mode.
ECU defective.	Replace ECU.

Possible Cause:	Remedy:
Ignition module defective.	Check ignition module(s). Replace if necessary.
Ignition coil defective.	Check ignition coil(s). Replace if necessary.
Spark plugs wet due to excess fuel.	Remove spark plugs, clean and dry. Determine and eliminate cause of excess fuel.
Electrode gap of spark plug too wide.	Correct electrode gap to 0.7 to 0.8 mm or replace spark plugs.
Fuel tank empty (faulty indication of fuel gauge).	Refuel, replace fuel gauge.
Fuel valve closed or filter blocked.	Open fuel valve, clean or replace filter.
Fuel line defective or not connected. Leaks in fuel system.	Replace or connect fuel line. Repair leaks.
Fuel pump defective or electrical connection to fuel pump interrupted.	Investigate electrical system and repair if necessary. Replace fuel pump. Try to run engine in emergency mode.
Fuel pressure regulator defective.	Check fuel pressure, replace if necessary.
	Note: Warning Light „Fuel Pressure“ is on.
Coolant temperature sensor defective.	Check sensor, replace if necessary.
Induction system leakage.	Check induction system for leakage and replace, if necessary, tighten joints.
Throttle fully closed.	Check throttle lever, check idle speed adjusting screw.
Insufficient compression (no valve clearance, leaky valves, engine overheated).	Adjust valve clearance, repair cylinder head, tighten cylinder heads according to specification. Investigate and remove cause of overheating.
Engine defective (blocked or worn out).	Overhaul engine.

12.2 Engine Operating Trouble

The following phenomena are considered to be engine operating trouble:

- uneven and irregular engine run
- temporary interruptions
- low power
- engine overheat
- rough engine run

Consider reasons as per section 12.1 besides the ones listed below.

12.2.1 Fuel Supply

Possible Cause:	Remedy:
Insufficient fuel flow (Fuel ventilation locked, lines blocked or defective, filter or screens blocked).	Check tank ventilation, lines, filter and screens and replace as necessary.
Insufficient fuel pump pressure.	Check fuel pump pressure and correct, if necessary.
Fuel injector defective.	Replace fuel injector.
Fuel pump defective.	Repair or replace fuel pump.
Fuel pressure regulator defective.	Check fuel pressure, replace if necessary.
Coolant temperature sensor defective.	Check sensor, replace if necessary.
Pressure sensor plugged, defective.	Check and clean hose to sensor, replace sensor if necessary.
Wrong idling speed.	Adjust idling speed.
Throttle does not open fully.	Repair throttle control.
Air filter dirty or blocked.	Clean or replace air filter.
Induction system leaking.	Check induction system for leaks and seal system if necessary.
Wrong fuel.	Refill fuel tank with specified fuel.


12.2.2 Ignition

Possible Cause:	Remedy:
Ignition module defective.	Check ignition module, replace if necessary.
Ignition coil defective.	Check ignition coil, replace if necessary.
Spark plug defective.	Replace spark plug.
Wrong spark plugs.	Use specified spark plugs.
Ignition harness disengaged or damaged.	Fasten ignition lead(s) or replace.
Connector on ignition coils mixed.	Check markings, change over if necessary.
Wiring harness or connector loose or defective wire broken in wiring harness.	Check wiring harness and connectors, repair if necessary.
Ignition switch defective.	Check wiring and switch and replace as necessary.
Fuse in MCU defective.	Replace fuse, determine cause (short circuit) and repair.

12.2.3 Cooling

Possible Cause:	Remedy:
Not enough coolant.	Fill coolant up to "MAX" marking, check for cause and repair if necessary.
Coolant system leaking.	Seal cooling system.
Coolant pump leaking, defective or drive belt missing.	Check coolant pump, replace if necessary or install drive belt.
Insufficient or damaged baffling and/or cooling system ducts.	Repair or complete baffling and ducts. Seal leakages.
Cooling air inlet disturbance (missing spinner, cross section too small).	Install spinner, check air inlets in cowling for foreign objects.
Fresh air and heating system ducts defective.	Replace ducts.
Cooling air outlet disturbance (Cross section too small or cowlfap does not open sufficiently).	Increase air outlet in cowling.

12.2.4 Lubrication

Possible Cause:	Remedy:
Bad engine oil quality.	Change oil. Use specified oil.
Oil filter or cooler blocked.	Change oil filter. Clean oil cooler, replace if necessary.
	<p>Note: At low ambient temperatures the oil may be overcooled in the oil cooler, thus causing blockage and high oil pressures. Mask oil cooler by suitable means to raise oil temperature.</p>
Oil thermostat or thermostat spring defective.	Check thermostat block, repair or replace if necessary.
Oil temperature sensor or indicator defective.	Check temperature sensor and indicator and replace as necessary.
Lack of oil in the oil sump.	Check oil level and refill oil as necessary.
	<p> Note: If the engine was accidentally operated without engine oil after performing an oil change – expect severe engine damage. A teardown inspection and repair is strongly recommended for safe operation.</p>
Oil pump defective.	Repair or replace oil pump.
Oil pressure regulating piston or spring defective.	Replace regulating piston or spring.
Oil loss due to blocked crankcase ventilation.	Clean ventilation, replace and properly install breather line (no bucklings or contractions).

12.3 Exhaust / Turbocharger System L 2400 ET/DT/DX

Possible Cause:	Remedy:
Induction system leaking.	Check seals, rubber boots and hose clamps, replace if necessary.
Intercooler leaking.	Replace intercooler.
Exhaust system leaking.	Check joints, replace springs if necessary.
Leaking exhaust gasket	Replace seal.
Thermal isolation missing around exhaust.	Repair /replace
Turbocharger defective.	Replace turbocharger.
Boost pressure limiter not working correctly.	Check linkage for corrosion, boost pressure hose for damage or leakage, replace if necessary.

12.4 Mechanical System

Possible Cause:	Remedy:
No valve clearance.	Set valve clearance.
	Note: This symptom may be indication of an over-heating engine, check cooling system, injection and ignition.
Leaking or sticking valve.	Repair cylinder head.
	Note: In some cases, fuel tanks made out of composite materials have been proven to be incompatible with the fuel, thus causing the tank material to dissolve. In such cases, the complete fuel system, pumps, filters, lines, injectors, fuel pressure regulator etc. must be cleaned or even be re placed.
Strong accumulation of deposit in the combustion chamber.	Demount cylinder heads, remove deposits.
Propeller unbalance.	Balance propeller. Check propeller blade track.
Engine suspension defective.	Replace engine suspension.
Excessive gas leakage at the piston.	Repair engine.
Bearing defective.	Repair engine.
Engine defective.	Repair engine.

12.5 Engine Operating Trouble in Normal Mode, no Trouble in Emergency Mode

The following phenomena are considered to be engine operating trouble:

- uneven and irregular engine run
- temporary interruptions
- low power
- engine overheat
- rough engine run

Possible Cause:

Remedy:

Speed sensor B1 (top mounted) defective.

Replace speed sensor, restore gap distance to pickup-pins on the flywheel.

Throttle potentiometer loose, maladjusted, disconnected or defective.

Check potentiometer fastening, adjust if necessary.

Note:

To adjust the throttle potentiometer a special tool is necessary P/N 803.002.015.000 (only for Weber Alpha).

Check wiring and/or connector repair or replace if necessary. Replace potentiometer if necessary.

Coolant temperature sensor defective.

Check sensor, replace if necessary.

Air temperature sensor defective.

Check sensor, replace if necessary.

Wiring harness or connector loose or defective, wire broken in wiring harness.

Check wiring harness and connectors, repair if necessary.