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D-MOTOR International © AIRCRAFT ENGINE

ENGINE OWNERS MANUAL

TYPE LF39 - 6 Cylinder Engine

Publication : LF39_2019_2

Succession Notice

This manual is a revision of the previous manual published in 2013 and any revisons there of. Information within this document replace the instructions of previous D-Motor International Publications – Engine Owners Manual.

Effective Changes for this manual / document

February 2019 V1	August 2019 (KGhekiere)		
March 2019 V2 (KGhekiere)			

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INTRODUCTION

D-MOTOR Engines

D-Motor LF 26 4 cylinder and LF39 6 cylinder engines are direct drive 100% water cooled boxer side valve engines. The engines incorporate multi-point fuel injection controlled by an advanced twin ECU control system which is performance mapped with Lambda sensing.

A 300W/25A generator is fully integrated as standard fitment; the oil and coolant pumps are directly driven by the camshaft. The fuel pressure is held at a constant level with a pressure regulator, which is connected to the fuel recirculating system. Air inlet preheating is not required and not installed.

The entire motor is controlled and monitored by the ECU (**E**lectronic **C**ontrol **U**nit). A second ECU is standard, battery and fuel pump can be installed as a redundant system.

D Motor aircraft engines are a Premium Quality European Product designed and produced in Belgium

https://www.d-motor.eu

SCOPE AND PURPOSE OF THIS DOCUMENT

This manual gives instruction and guidance for engine preparation, installation, and operation of the LF26 and LF39 aircraft engines. The installation instructions within this manual are basic guidelines. When installing the engine in the airframe, follow the airframe manufacturer's installation instructions. Refer to the D-Motor Engine Service and Installation manual for required maintenance (service information) such as: oil changes, oil top up, oil filter replacement, routine time limited-interval inspections, routine service, spark plug replacement/inspection procedures, cylinder inspection, fuel system inspection, and scheduled servicing procedures. For airworthiness limitations, guidelines to fault finding and for procedures to replace components, disassembley and re-assembley of the engine, refer to the D-Motor Engine Maintenance Manual. For spare parts information, refer to the D-Motor Illustrated Parts Catalog.

Warning

This is a non-certified aircraft engine ; the possibility of engine stoppage exists at all times. Do not operate this engine over densely populated areas. Do not operate this engine over terrain where a safe, power off landing cannot be performed.

The operation and maintenance instructions supplied with this engine must be followed at all times. Flying any aircraft involves the risk of injury or death, building and maintaining your own aircraft requires great personal responsibility.

Advisories

This document utilizes three types of advisories; defined as follows:

WARNING

A warning emphasizes information which, if disregarded, could result in severe injury to personnel or equipment failure.

CAUTION

Emphasizes certain information or instructions, which if disregarded, may result in damage to the engine or accessories.

NOTE

Provides special interest information, which may facilitate performance of a procedure or operation of equipment.

Warnings and cautions precede the steps to which they apply; notes are placed in the manner which provides the greatest clarity. Warnings, cautions, and notes do not impose undue restrictions. Failure to heed advisories will likely result in the undesirable or unsafe conditions the advisory was intended to prevent. Advisories are inserted to ensure maximum safety, efficiency, and performance. Abuse, misuse, or neglect of equipment can cause eventual engine malfunction or failure.

Order of Precedence

WARNING

The aircraft operator must use the airframe manufacturer's operating instructions found in the Airplane Flight Manual/ Pilot's Operating Handbook (AFM/POH) while operating the aircraft unless the AFM/POH directs otherwise.

Updates/Changes Distribution

Document updates are available from our web site upon notification of official document approval. Printed publication subscribers receive printed changes and revisions as they are released.

Document revisions are released if the update changes more than 50% of the contents of a publication. Revisions replace the previous version of a publication from cover to cover.
Minor corrections are released as change pages to the original publication, identified with a change number and effective change date in the page footer. Information on the page that changed from the previous edition is identified by a vertical, six-point black line referred to as a "change bar" in the outside margin of the page. A page change replaces only the previous edition of the affected page

Suggestions and corrections

D-Motor International solicits and encourages user comments regarding suggested changes to this manual. Direct recommended changes or questions to the attention of "Publications" at the address listed in this section, "Contact Information" or send comments via e-mail to info@d-motor.eu. Notify our Customer Service Department immediately, using our telephone number, if you discover incorrect information which adversely affects safety !! Thank you !!

Contact Information

D-Motor International factory representatives are available to answer technical questions and encourages suggestions regarding products, parts, or service. If customers have an inquiry or require technical assistance, they should contact their local D-Motor dealer/distributor or field representative. To contact a factory representative, refer to the contact information below:

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BELGIUM

Customer service department : +32 (0)56 498149

helpdesk@d-motor.eu https://www.d-motor.eu

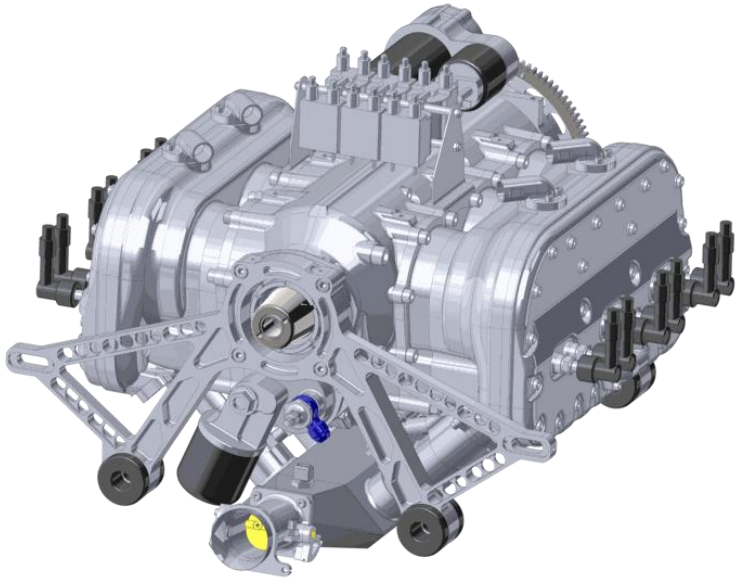
⚠ WARNING

Before starting the engine, read the Operators Manual, as it contains important safety relevant information. Failure to do so may result in personal injuries including death. Consult the original equipment manufacturers handbook for additional instructions!

TOA (Table of Amandments)

Current N°	Chapter	Page	Change date	Remark	Date aproval	Date inclusion	Signature
0 0	INTRO						

Before operating the engine, carefully read this Operators Manual. The Manual provides you with basic information on the safe operation of the engine. If any passages of the Manual are not clearly understood or in case of any questions, please contact an D-Motor International® authorized aircraft engines dealer/distributors or their independent service center. D-Motor International wishes you much pleasure and satisfaction flying your aircraft powered by this D-Motor®-Aircraft engine.



SAFETY INFORMATION

! WARNING : **Never operate the aircraft equipped with a D-Motor at locations, airspeeds, altitudes, Or other circumstances from which a succesful no-power landing cannot be made, after sudden engine failure (stoppage).**

- The D-Motor engine is not suitable for acrobatics.
- The selection and use of the D-Motor on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler and owner or user.
- Duet o different designs, equipment and types of aircraft, D-Motor will allow no warranty or representation on the suitability of its engine's use on any particular aircraft. Furthermore, D-Motor grants NO warranty or representation of its engine's suitability with any other part, component or system which may be selected by the aircraft manufacturer, assembler or user for aircraft application.
- Whether you are a certified pilot or a student, complete knowledge of the aircraft, its controls and operation is mandatory before flying solo. Flying any type of aircraft involves a certain risk! As user or owner of a D-Motor engine, be informed and prepared for any situation or hazard associated with flying.
- Make sure that you also obtain as much information as possible about your aircraft and engine (Service and Information Bulletins), their maintenance and operation from your dealer!
- Be aware that our engines may seize or stall at any time! This could lead to crash landing and possible severe injury or death. D-Motor recomments strict compliance with the maintenance and operation and any other information which may be given to you by your dealer or was published on the D-Motor website (https://www.d-motor.eu)
- Fly only when and where conditions, topography, and airspeeds are the safest !
- Use proper aircraft instrumentation. D-Motor does not deliver this instrumentation!
- Always ensure BEFORE FLIGHT that all engine controls are operative. Make sure that all control scan be reached in case of an emergency.
- Always run the engine and propellors in a bystander clear area !
- DO NOT leave the aircraft unattended with the D-Motor engine running !
- Keep a engine LOGBOOK and respect the engine and aircraft maintenance windows. KEEP YOUR D-MOTOR ENGINE IN TOP OPERATING CONDITIONS AT ALL TIMES.
- When in storage protect the engine and fuel system from contamination and exposure.
- NEVER operate the LF26/39 engine without OIL or Water, NEVER with insufficient OIL or WATER !
- Periodically verify level of coolant.
- Never exceed maximum rated RPM. Allow your D-Motor engine to coll at idle for several minutes before turning off the engine.

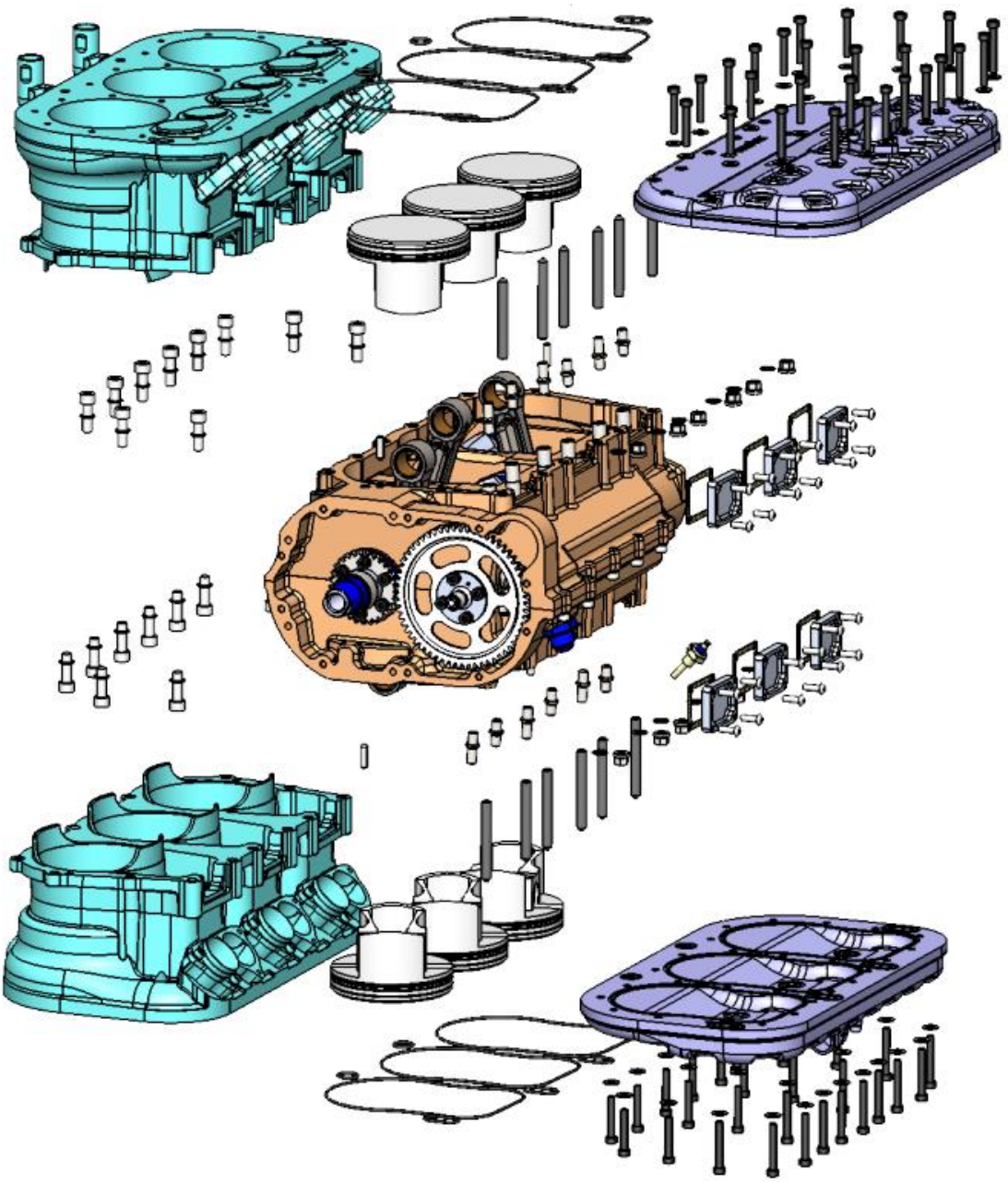
MAIN SECTION

Technical Sheet LF39 type D-Motor Engine

Producer	D-Motor, Belgium
Construction	6 cylinder boxer motor, 4 stroke
Reduction gear	Non
Cooling	fully liquid cooled
Control unit	ECU – 12 V
	8A for ECU and fuel pump required
Intake	Multipoint sequential fuel injection
Ignition	Double CDI, controlled by ECU
Generator	300 W/25A integrated
Bore	103.5 mm
Stroke	80 mm
Displacement	3.900 cc
Compression	8.1/1
Starter	12V - 1.1 KW integrated
Fuel pressure	2.5 – 3.0 bar (36.2 – 43.5 PSI)
Fuel regulator	2.5 bar (36.2 PSI) opening pressure, in the back flow
Fuel	MOGAS Super leadless 95 ROZ, or AVGAS
Fuel filter	P/N 107201
	Ultra-fine filter, pressure side operated
Fuel pump	Pressure 3.0 bar (43.5 PSI) 130 L/h flow
Power	125 HP at 3.100 RPM
Torque	283 Nm at 2.500 RPM
Rage of use	800 to 3100 RPM
	2100 u/min to 2800 u/min in Cruise
Lubrication	Dry sump
Oil pump	Pump driven by camshaft
Oil pressure	1.5 - 5.0 bar (21.7 – 72.5 PSI)

Oil specification	Synthetic 5W50 - 5W40 - 0W50 – 0W40
Oil quantity	3.5 Liters (0.91 US Gallons)
Oil filter	P/N 107001
Oil temperature	min 50° C to 120° C
	80°C to 100°C best range
Cooling liquid	Water with antifreeze and anticorrosive
	(for Aluminium motors)
Cooling liquid temperature	50°C to 100°C (opening pressure at 1.2 bar)
	See Service Bulletin 2019-015
Cooling liquid pump	pump driven by camshaft
Propeller flange	bolt-hole circle dia. 101.6 mm 6 x 13mm
Spark plug	P/N 106021
Ignition coil	P/N 106031
Plug	90° angled, rubberized
Lambda probe	P/N 185001

LF 39 type ENGINE (exploded)



Description

The D-Motor LF 39 is a 100% water cooled boxer motor with side steered valves for direct driven propellers. The motor has a lambda probe and performance map controlled multi field injection with double ignition. The 300W/25A generator is fully integrated; the oil and cooling liquid pumps are directly driven by the camshaft. The fuel pressure is hold at a constant level by a pressure regulator, which is connected to the back flow circuit. An intake air preheating is not required and not installed.

The entire motor is controlled and surveyed by the ECU (**E**lectronic **C**ontrol **U**nit). Standard is a redundant second ECU, battery and fuel pump and is installed as a redundant system.

During the use of the motor following data and information are constantly collected, analysed and interpreted by the ECU

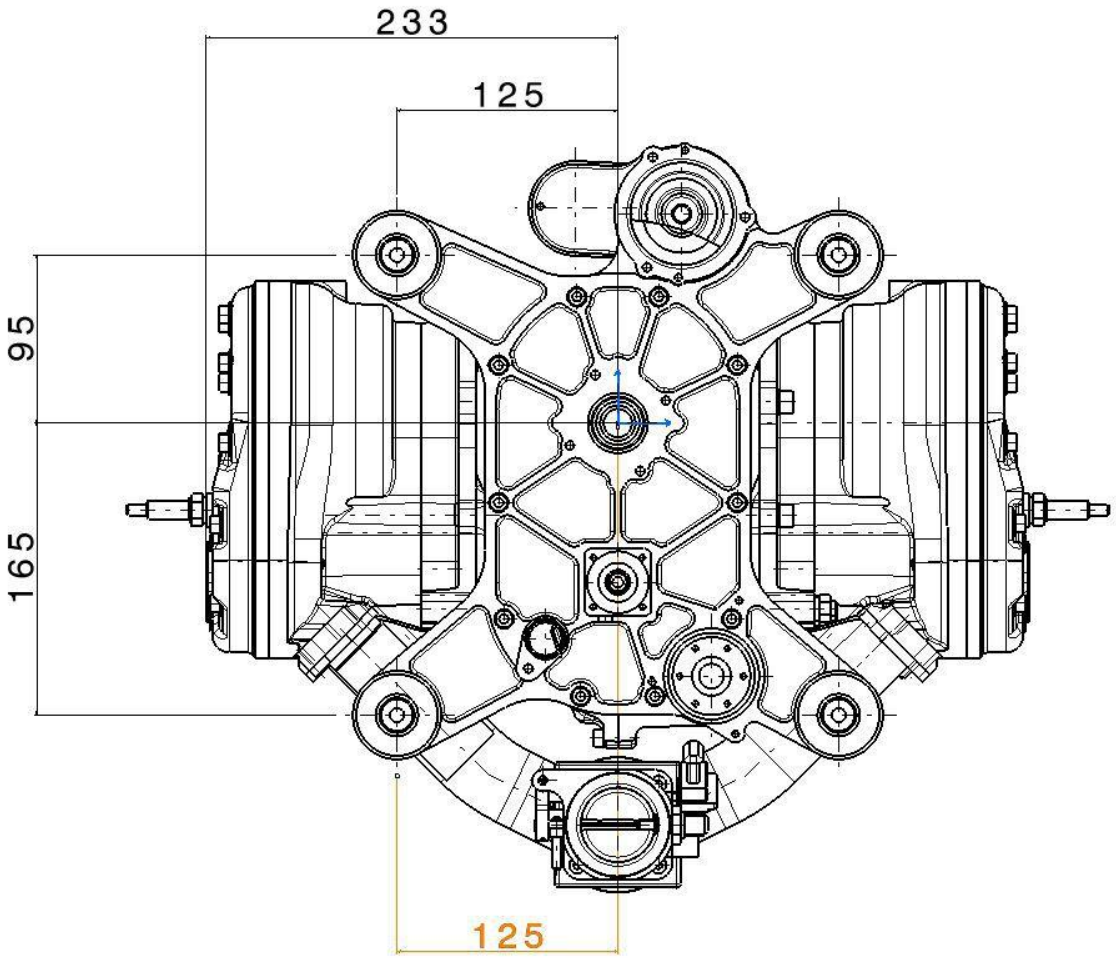
- Throttle valve position
- Intake air temperature
- Crankshaft position analogue
- Crankshaft position digital
- Air pressure
- Cooling liquid temperature
- On-board power supply voltage
- RPM
- Lambda probe values

If one of the sensors fails, the ECU change into a standard or emergency program, in which the motor continues to run, but eventually with less power and increased consumption. The ECU signalizes its status by means of LEDs on the ECU Casing, or optionally by means of a separate monitor.

As the option of a redundant system is installed by default(by the ECU, Battery and Fuel pump, etc.) the redundant systems controls themselves reciprocally. The full operation is still assured if one circuit fails totally.

Due to the sidesteered design of the motor, some motor failures (for example valve tearing) wouldn't stop the motor to work. Inflight even a loss of one or two cylinders can be compensated and the motor continues to run with less power, which enables to initialize a safety landing.

The power supply is very important for a safe operation of the motor. Should the generator fail and the battery is not charged sufficiently anymore, the motor continues to run only until the minimum power supply voltage of 8V is reached.



The above is one option, please contact our sales team for all possible options, incl. heli options.

Short specification list

- **Type**: D- motor LF39
- **Class**: Microlight aircrafts
- **Engine**: 6 cylinders, four stroke, liquid cooled
- **Displacement**: 3993 cc
- **Stroke**: 79 mm
- **Compression ratio**: 8/1
- ***Max power***: 125 Hp at 3000 RPM
- ***Max continuous power***: 112Hp hp at 2800 RPM
- **Used fuel**: 91, 93, 95 oct. 98 oct. or avgas
- **Fuel consumption**: 19 liter at 75% performance
- ***Maximum torque***: 285 Nm at 2500 RPM
- **Intake**: Multipoint sequential fuel injection
- **Alternator**: 25 Amp integrated
- **Electric starter**: 1.1 KW integrated
- **Ignition**: Double
- **Installed dry weight (liquids 7kg)**: 78 kg

Accessories

Delivered with standard engine package:

- The engine with integrated alternator, water pump, oil pump and electric starter.
- Rubber mounts (dimensions same as Jabiru and UL power).
- Fuel pump, fuel filter and injectors.
- 2 ignition coils, spark plugs and ignition leads.
- ECU and loom (standard redundant injection).
- 3 water temperature sensors (2 for ECU and one for instrument).
- Oil pressure and oil temperature sensor.
- Oil filter, oil tank with breather system.
- Exhaust pipes included and lambda probe, no mufflers are included.
- The liquid cooling system (radiator, hoses and expansion tank) are not included.

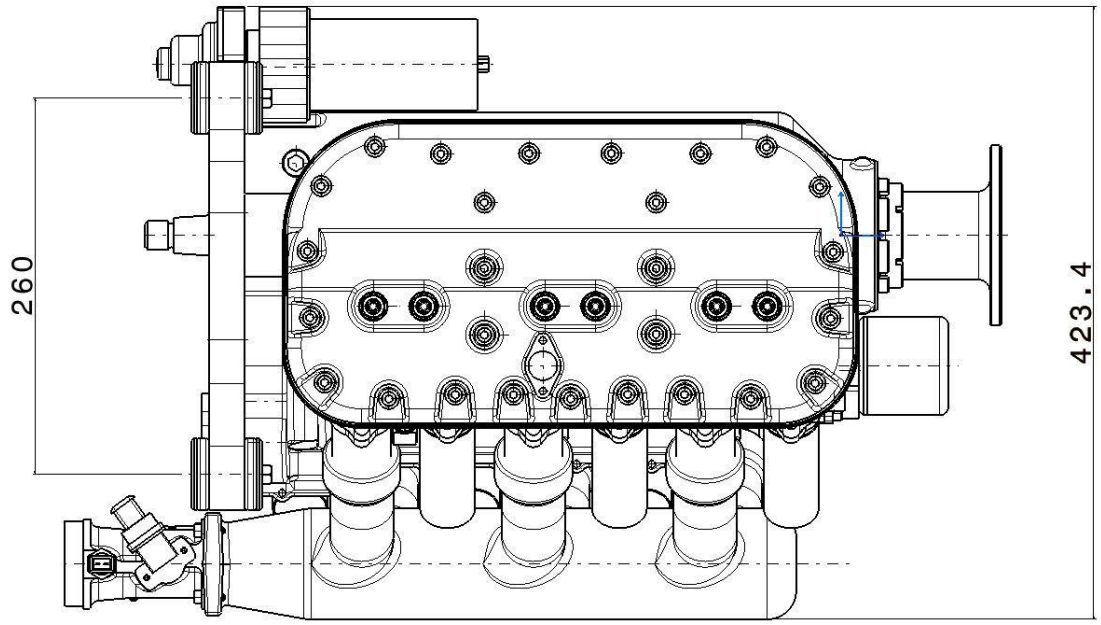
The different aircraft and helicopters, equipped, required different cooling configurations. It is difficult to anticipate a solution for every installation. Attempting to provide a universal solution would be both inefficient and overly expensive.

The weight of the engine completely installed with liquids is 85 and 88 kg depending on installation. This weight does not include the engine mount or propeller.

The TBO time is 1500 hours.

Options:

- Rajapack crate , packaging and handling
- Warranty: 2 year

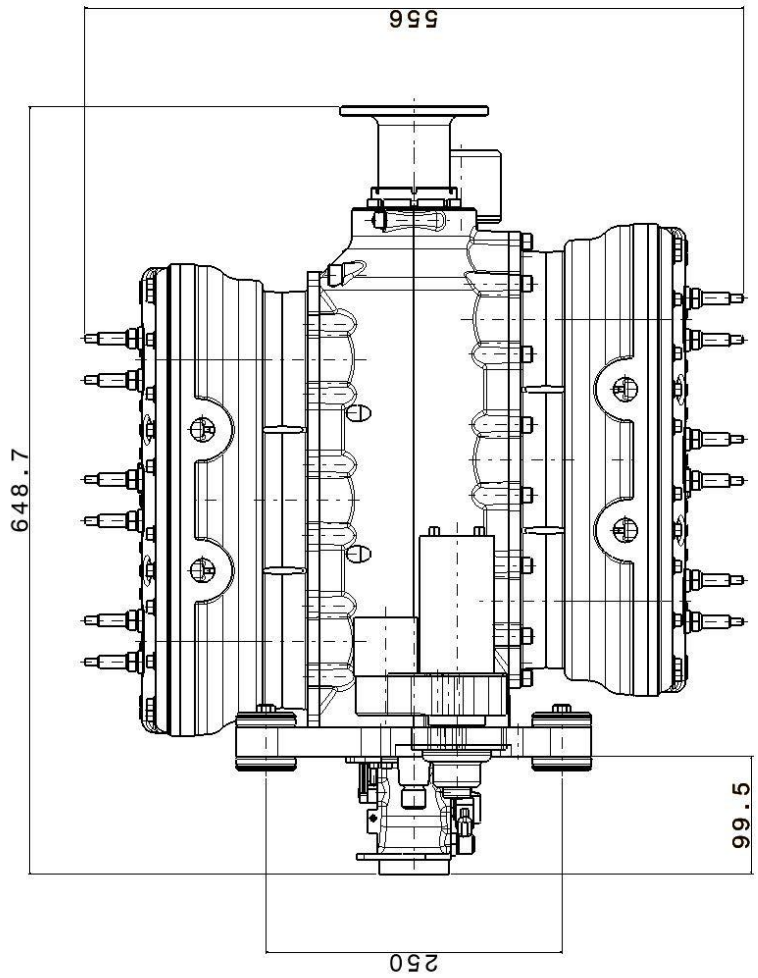


WARNING !!

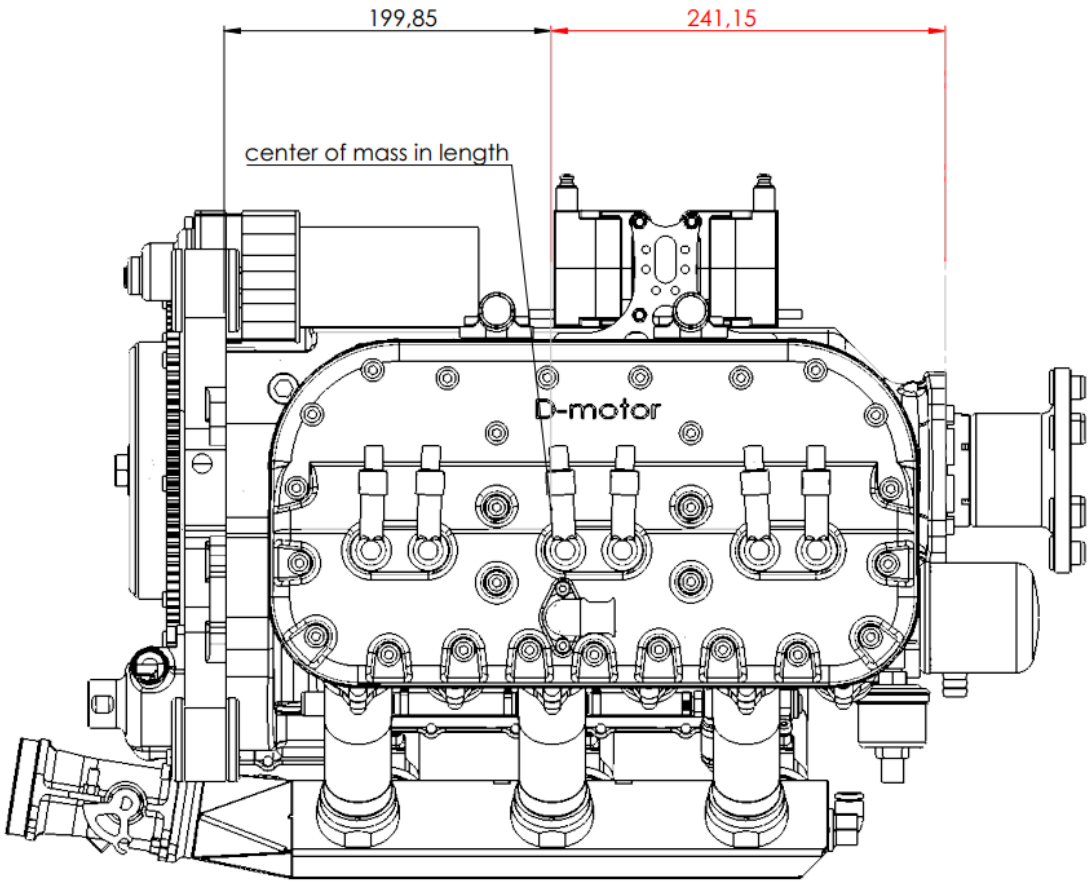
DUE TO THE PRECISION OF THE ECU CRANKSHAFT ROTATION MEASUREMENT

IT IS POSSIBLE TO HAND START THE LF39 BY ROTATING THE PROPELLER.

ALWAYS ENSURE ALL SWITCHES ARE OFF BEFORE WORKING ON THE LF39 type ENGINE.

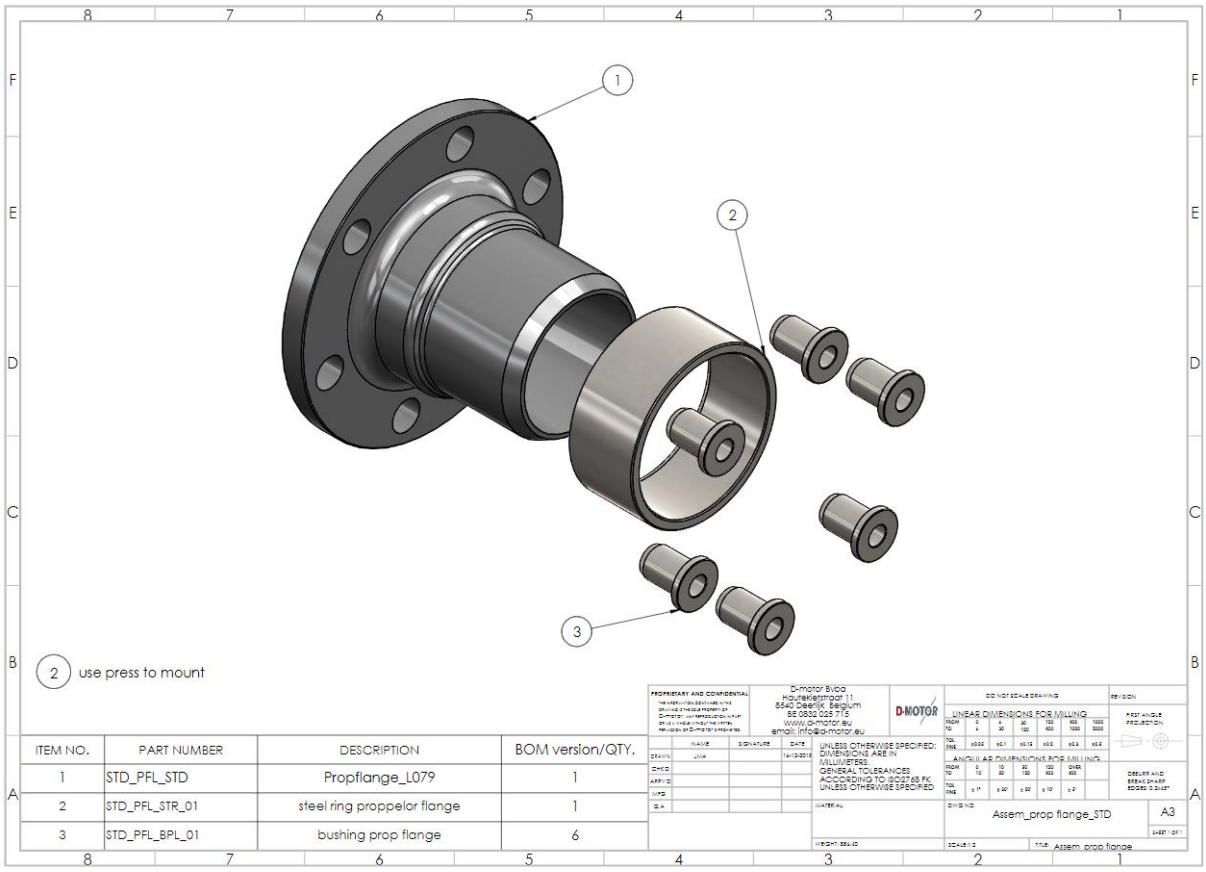

556
648.7
99.5
250

Center Of Mass (CG)



ASSEMBLY SHORT PROPELLOR FLANGE (Example)

D-Motor offers different types of propellor flanges – check our price list or contact our sales team.



ITEM NO.	PART NUMBER	DESCRIPTION	BOM version/QTY.
1	STD_PFL_STD	Propflange_L079	1
2	STD_PFL_STR_01	steel ring proppelor flange	1
3	STD_PFL_BPL_01	bushing prop flange	6

HANDLING OF THE ENGINE

Motor START

The LF 26 does not have a choke or an intake air heating. Thanks to the ECU and the injection system the motor may be started at any temperature without any special precaution.

The handling of the motor is based on following elements:

- Key Switch — Release to start
- Start Button — Activate the starter
- ECU Fuse/Switch — ON/OFF switch for the ECU with fuse function
- Fuel pump Fuse/Switch — ON/OFF switch for the fuel pump with fuse function
- Ignition circuit (2x) — ON/OFF switches of the ignition circuits
- ThrottleRegulate the power setting

⚠ CAUTION!

Never start the engine without prop installed. Otherwise the engine will be damaged.

After the pre-flight check and provided the propeller area is free the motor is started:

- Release the start with the key switch
- Fuel pump - ON
- Both ignition circuits - ON
- ECU – ON (if the outside air temperature is low the ECU may be switched 2 or 3 times ON and OFF in order to simplify the starting procedure.
- Throttle set on idle position, respectively control the idle position
- Push the starter button until the motor starts. Try for maximum 10 seconds, and then stop the starting process. Wait a few seconds and try again to start the motor.
- As soon as the motor runs increase the RPM after a few seconds
- Switch on the monitoring instruments and check the oil pressure
- Warm up with about 1200 RPM

If the oil pressure is insufficient or in case of an error message from the ECU, stop the engine and if necessary investigate for the problem.

If no error is reported and the oil pressure is sufficient warm-up the motor until the oil and water reach about 50°C.

Check both ignition circuits before take-off. To do so increase the power setting up to 2000 RPM and switch OFF circuit 1 for about 5 seconds, monitor the RPM which shouldn't change for more than 50 RPM. Proceed in the same way with circuit 2. The difference between the decreases while checking both circuits shouldn't exceed 30 RPM.

While checking both circuits, as soon as one circuit is switched OFF the ECU should report this error by means of the blinking LED or by the corresponding text message on the engine monitory instrument.

Motor STOP

If possible the engine should not be stopped when it is very hot. As the cooling liquid and the fuel are not pumped anymore it may create vapour lock problems due the residual heat.

Generally it is enough if the landing is made with reduced power setting and following taxiing to cool down the motor temperature sufficiently to enable an immediate stopping of the motor.

- Throttle set to idle
- Switch OFF all electrical consumers.
  If a NESIS is installed it should be switched OFF only after the motor has been stopped, in order to secure the safeguarding of the log book and the last flight.
- Switch OFF the fuel pump
  If the engine is still running for a few seconds, it reduces the remaining pressure in the fuel system.
- Switch OFF both ignition circuits, then the engine stops
- Switch OFF the ECU
- Turn OFF the start release key switch
- For parking maintain this status and if required remove the key

ENGINE Checking

If the last flight has been without any conspicuous behaviour, then the pre-flight check is limited to following:

- Control of cooling liquid — Sight control of the overflow reservoir
  Open maintenance trap
- Control of the oil level — Sight control of the oil reservoir
  Open maintenance trap

WARNING

As usual with all engines having dry sump lubrication, the highest level is reached only after the propeller has been turned a few times by hand until the typical gurgling noise is heard from the oil reservoir. This reservoir installed in your aircraft is normally equipped with a sight tube showing the oil level and therefore the control of the level is made visually.

MAKE SURE THAT ALL POWER SWITCHES ARE IN 'OFF' POSITION !!!

It is recommended to notice the level before and after turning the propeller in order to memorise the increase of the level. Once this is memorised one may not need to turn the propeller each time to control the oil level as the increase should be always the same.

Operation

Same as for all engines, the way to treat your engine will increase or decrease tremendously the life-time, the consumption, the maintenance costs and deterioration of your engine. Following a few recommendations for the right use of the D-Motor type LF39:

- The take-off or full power setting should be applied only once the engine, respectively the cooling liquid and oil has reached its minimum temperature of 50°C.
- It is recommended to reduce the power setting after the take-off and once you reached the safety altitude, and to fly instead a little bit faster. Even if the aircraft does not climb as fast as possible, in total you reach faster your destination, and the most important it means less consumption and deterioration. It is recommended not to hang the aircraft at the propeller, if it is not required to climb as fast as possible due to geographical obstacles.
- To fly fast does not always mean to gain a lot of time to reach your destination. By reducing the power setting speed is reduced only slightly, but the consumption is massively lower. Further your range is much higher. Please see therefore the consumption table under paragraph “7.5 Range and Fuel Consumption”.

- Avoid rapid changes of the power setting (except in case of emergency). It is better to increase or decrease the power setting slowly but constantly. Massive power setting changes in a short time does always means high stresses for the crankshaft, especially for direct driven engines.
- Each engine coming from serial production has its typical behaviour at different regimes. This is like a character of each individual engine. Even if the LF39 is an engine which runs extremely smoothly, it’s recommended to avoid regimes where your engine shows up with more vibrations. Often the RPMs of higher of fewer vibrations are nearby and only a few RPMs away from each other.
- In case your engine shows unexpectedly starting difficulties they may occur from impurities in the injectors or on the spark plugs. These impurities may be eliminated by using a special cleaning program. To start the cleaning program, set the throttle to full power setting, switch on the ignition and the ECU, and activate the starter for a few seconds. In this configuration the engine will not start, but initiate only the cleaning program.
  After running the cleaning program switch OFF the ECU, then switch the ECU ON again and try once more to start up the engine in the normal way.

Emergency Procedures

Normally the engines for Ultra-light or LSA aircraft are not certified, but also a certification does not protect from engine failures. Please bear in mind that for any existing aircraft or any existing engine a failure is possible. If sight of a failure is recognized before the take-off the flight has to be cancelled in any case. In case of a failure in flight the right reaction is very important:

- **Failures indicated by the ECU**
  Basically there are two kinds of failures, or indicated by a clear text message (if the monitor is installed) or by blinking, respectively constant glowing, of the LED. The first kinds of failures are those of the sensors or deviations of the measurements, but which is not an engine failure. For example, if the LED shows a constant glowing, the flight can continue until you reach the next airfield or an appropriated landing area. It does not mean an immediate danger. As for the second kind of failure, signalized by a fast blinking, this means that an emergency landing is to be initiated immediately.

- **Loss of cooling liquid**
  Should your engine loose its cooling liquid during the flight (for example due a broken pipe) the temperature will rise instantly and rapidly. An emergency landing has to be prepared immediately. The remaining running time of the motor without cooling liquid are a few minutes, this means that after the power setting has been reduced to idle, the remaining running time may be used just before landing.

- **Loss of power supply**
  In case the on-board voltage gets too low, for example if the generator fails, the battery is not loaded anymore. All consumers, also those required to run the engine are supplied by the battery only. Turn off all consumers which are not absolutely required and initiate immediately your landing on the nearest airfield. The remaining running time depends on the size and on the loading status of the battery. If two batteries are installed having together 4.5Ah the remaining running time will be between about 20 and 30 minutes.

- **Sensor failure**
  Some sensors are redundant; some values are in direct relation to other values. For example the cooling water is measured by two sensors, one to indicate the pilot the temperature, the second to supply the ECU. Now if the indicated temperature of the water is too high, but no warning coms from the ECU and the oil temperature shown is within the normal range, then for sure the sensor is damaged. Or if the oil temperature is extremely high but the water temperature and the oil pressure are normal then probably the sensor is damaged. If seems to be likely that a sensor failure occurred, it is not necessary to initiate an emergency landing. Land on the nearest airfield and repair the damage.

- **Redundant systems**

Some sensors or systems are redundant, for example the ignition, the crankshaft sensors, etc. Other systems are optionally available in redundancy, fuel pump, battery, generator or additional injectors. Redundant systems serve to increase the reliability of the motor and not to allow flying if one system fails. In no case it is allowed to take-off if one system failed on ground before take-off (for example one ignition circuit). Redundant systems allow continuing the flight until an airfield may be reached, a safe landing is secured and the failure may be fixed.

- **Unusual noises**
  If any unusual noises occur, maybe combined with a high volume, than it is possibly that the exhaust system or the intake air system which is damaged. A defective exhaust system could mean that the exhaust gases are not totally transported outside the cowling and may even penetrate into the cabin. Or some hot gazes may heat other parts and create further damages. This means high danger for the pilot or the aircraft and a landing of the next airfield is to be initiated immediately. Once landed the problem may be found and fixed.

  Unusual noise coming from the intake system points to problems coming from a defective or loose air filter system. This means danger for the motor, respectively the possibility of intake of additional air or worse, the suction of foreign particles into the engines combustion chamber, which may damage the engine seriously. This means to initiate the immediate landing on the next airfield as soon as possible and to fix the problem.

- **Heavy vibrations**
  Since the LF39 has an injection system carburator icing cannot occur and not be the reason for heavy vibrations. This means that in case heavy vibrations occurs, they must come from other sources, like the propeller, loss of counterweights on the propeller, loose bolt holding the propeller, loose spinner, etc.

  Heavy vibrations can also be a sign of beginning engine failure or indicate the loss of one cylinder, for example due to an injection failure or a damaged ignition.

  In any case set a power setting with lowest vibration, but which still allows a safe flight and land on the next airfield.

ECU ERROR MESSAGES

Possible error messages coming from internal diagnosis of the ECU:

Two leds are incorporated on the ECU housing, no LED lit = ALL OK !

All error diagnostic is logged. (See E.C.U. D-Motor Installation and troubleshooting manual)

Indicated errors from the diagnose means that or the sensor is damaged, or that the parameter is outside the expected range. For example, if the temperature is too high.

The error number 8 may be shown also directly after the start of a cold engine. In this case the required temperature of the probe to make a precise measurement is yet not reached. After warming up the error message should disappear.

Safety / Avoiding failures

Some failures are announced or get worse over the time. The recognition on time and the analysis of the causes may help to avoid failures of the motor or dangerous situations.

Loss of Cooling liquid

Loss of cooling liquid leads to an insufficient cooling of the engine, respectively too high temperatures and in most cases also to damages or operation malfunctions. For that reason the leak-tightness of the cooling system should be verified regularly. The normal through the maintenance trap is not sufficient for a complete check of the cooling system.

NOTE

A damaged sealing surface of the filling cap or a damaged head seal for example, cannot be recognized by controlling the level of the cooling liquid in the overflow reservoir. It is possible that when the motor gets warm, the cooling liquid is pressed into the reservoir, but during the engine get colder the liquid is not sucked back in the cooling system of the engine anymore. An indication to that is, for example, if the temperature of the motor is normal during the flight, but during or after the landing the temperature of the engine does not get down, or even gets higher.

For a full check of the cooling system the upper part of the cowling has to be dismounted. All parts and pipes of the cooling system should then be controlled visually for leakages, damages or signs of abrasion. Verify the hose clips of the pipes for tightness, open the cap of the ventilation tank (only if engine is cold) and verify if the ventilation tank is full of cooling liquid (level should be just below the sealing surface). Check if the sealing surfaces of the ventilation tank and of the cap are clean and without visible damages. If not please change the damaged parts and refill the cooling liquid if required.

Most ULTRA Light aircrafts are equipped with a heat exchanger. In the heat exchanger the oil interact, respectively exchange its heat with the cooling liquid. This means that the cold oil is heated and the hot oil cooled down by the cooling liquid. Once the engine is heated up to normal range and while it is operated normally (horizontal flight) the temperature of the oil and of the cooling liquid are tightly related to each other, whereat the temperature of the oil should be 10°C to 15°C higher than the cooling liquid.

NOTE

For example: Oil temperature is 90°C to 95°C and cooling liquid has about 80°C.

Should the difference of the temperature be higher or lower, the oil, the cooling liquid and the sensors needs to be checked.

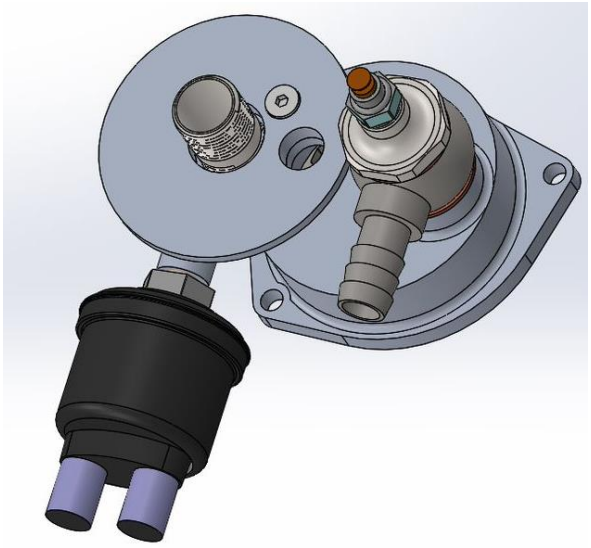
Oil Supply

The oil supply is secured by the oil pump and the dry sump system.

> ⚠ **CAUTION!**
>
> **(1) use only oil specified in this manual**
> **(2) don't use any additives.**

Mode of operation: The oil pump sucks trough the heat exchanger and the oil filter oil out of the reservoir and press the oil through the different channels toward the lubrication spots. A spring loaded ball valve regulates the oil pressure. The over pressure coming from the movement of the pistons press the oil back in reservoir.

Insufficient oil level may lead to heavy damages on the engine. The oil has basically two functions, the lubrication and the inner cooling of the motor. The control of the oil level is very easy and made by a visual control of the sight tube of the oil reservoir. Same as for the cooling system, also the oil supply system should be controlled regularly and completely.



For a complete and intense control of the oil supply system the upper cowling has to be dismounted. The system should be check visually for leakages, damages or unusual signs of use. Open the oil

reservoir cap and check if sign of water are visible, especially watch out for traces of foam, which is an indication that the oil has some water in it.

Verify the hose clips of the oil supply system for tightness and verify that the pipes are not bended.

A slightly low oil level does not automatically lead to engine damage, but may lead to higher temperature as there is not enough oil available for the inner cooling of the engine. In case the oil temperature increases slowly but continuously it is often an indication of a low oil level.

If the oil level is much too low in the oil tank, the pipes toward the gear pump may get empty and the gear pump may suck air instead of oil. In such case the required oil pressure is not reached at all or too late. If this happens, stop immediately the engine, refill the oil to necessary level and remove the air from the pipe toward the gear pump.

NOTE

Take care not to waste oil on the ground or inside the engine compartment.

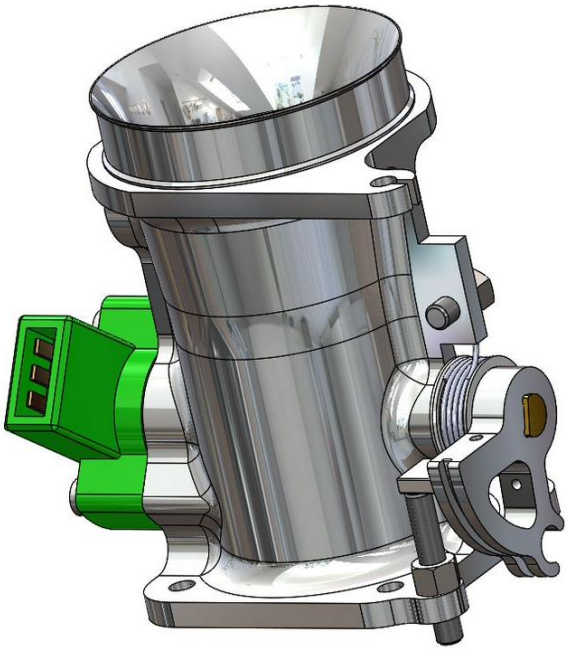
Throttle adjustments.

Adjust idle speed to 800 RPM using the idle screw on the throttle.

⚠ CAUTION!

The rotating propeller is extremely dangerous! Adjustments must be done with the utmost caution from behind the engine. The aircraft must be tied down or properly chocked. Do not perform this operations without a safety observer.

Confirm smooth running at idle. Run the engine at 1800 RPM and close the throttle to idle position. The engine should idle smoothly at 800 RPM for fix wings aircrafts. 1010 RPM for helicopters (depending on the choice of the fly wheel).



by increasing RPM to 1800 RPM and bring throttle back to idle. Engine must run smooth and continuously !

Fuel Supply

A safe operation of an engine with fuel injection is only given if the fuel supply is secured with sufficient pressure in the system. Carburator icing is impossible; vapour lock appears, due to the high pressure in the system, only under very special conditions. The fuel is sucked out of the fuel tank, trough the pre-filter with the water separator, toward the fuel pump. After the fuel pump the fuel is pressed through the fine-filter into the common rail system. The injectors gets the required quantity of fuel and the rest is pushed back again into the fuel tank. A pressure regulation valve in the back flow system keeps the pressure of the entire system constant. The permanent circulation in the system avoids an excessive heating of the fuel in the area of the engine and assure a permanent and autonomous ventilation of the system.

Troubles in the fuel supply may lead to less performance, unsteady running, higher consumption, and even to a total failure.

As prevention the fuel supply system should be inspected regularly for leakages, damages or abnormal signs of use. It is also very important to ensure that no fuel pipes are bended or porous and that all hose clips are tighten. Further it is important that all electric connections are well fixed.

If a fuel pressure indicator is installed, it may be used to recognize irregularities of the fuel system or of the fuel pressure.

NOTE

Strong indicators of upcoming problems or failures within the fuel supply system are unsteady or constantly low fuel pressure. Blocked filters, bended pipes or a damaged fuel pump could be the source of these problems.

Too high fuel pressure is an indication of a damaged regulating valve or a blocked back flow pipe.

Once these signs recognized it is mandatory not to take off again and if in flight to land as soon as possible on the nearest airfield.

Defective switches or fuses within the fuel supply system have to be replaced before next flight.

Important Information fuels and lubricants :

Fuel :	Automobile fuel, unleaded premium 95 Octane (RON) minimum.
Fuel pressure :	2,5 BAR
Oil type :	Fully synthetic branded automotive oil to API SJ standard as a minimum. Engine warranty is void if oil is used that is below this standard.
Oil volume:	3,5 Litres
Oil level is between	Ensure between max. & min. On standard oil tank 2 cm above middle of the tank.
Oil pressure:	1,5 Bar @ 2000 RPM 0,8 Bar @ idle RPM

Oil temperature (readings off of the feed line into engine):
Min. 50 Deg.C (122 Deg.F)

Max. 110 Deg.C (230 Deg. F)

Optimum oil temperature range :

80 – 100 Deg.C (170-212 F.)

⚠ CAUTION!

Don’t use any additives

Cooling system

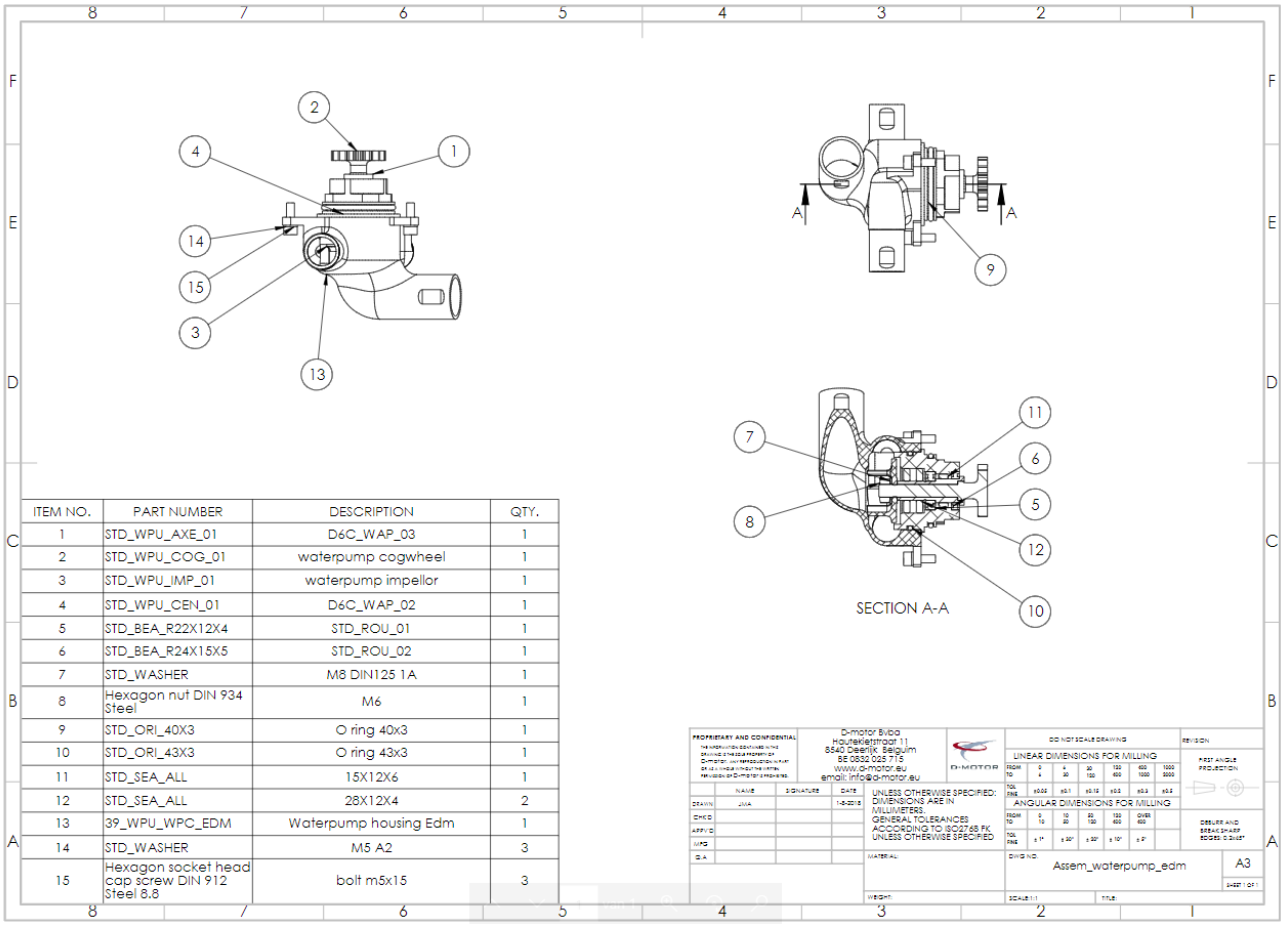
Liquid cooled (Max. water temperature 100 Deg. C)

Max. continuous power keep water temperature between min. 75 & max. 95 Deg. C.

50% coolant by volume.

Recommended coolants are: BP Procool and Shell Glyco Shell

Water Pump



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	STD_WPU_AXE_01	D6C_WAP_03	1
2	STD_WPU_COG_01	waterpump cogwheel	1
3	STD_WPU_IMP_01	waterpump impellor	1
4	STD_WPU_CEN_01	D6C_WAP_02	1
5	STD_BEA_R22X12X4	STD_ROU_01	1
6	STD_BEA_R24X15X5	STD_ROU_02	1
7	STD_WASHER	M8 DIN125 1A	1
8	Hexagon nut DIN 934 Steel	M6	1
9	STD_ORI_40X3	O ring 40x3	1
10	STD_ORI_43X3	O ring 43x3	1
11	STD_SEA_ALL	15X12X6	1
12	STD_SEA_ALL	28X12X4	2
13	39_WPU_WPC_EDM	Waterpump housing Edm	1
14	STD_WASHER	M5 A2	3
15	Hexagon socket head cap screw DIN 912 Steel 8.8	bolt m5x15	3

Power Supply

An engine with fuel injection requires for a safe operation a trouble-free power supply. The ECU receives all relevant data from the sensors, calculates the optimal ignition and injection time, as well as the required fuel quantity which needs to be injected and the injection duration.

Therefore the ECU, but also the fuel pump, required a continuous and trouble-free power supply. The ECU controls and provides the ignition coils and the injectors with the required electric power.

Any power supply interruption of the ECU leads to an immediate stop of the motor. A safe function of the switches and a correct connection of the cables is therefore extremely important.

Control and function test of the power supply

While the engine is running, the integrated generator produces an alternative current which is converted by means of a digital transformer into direct current in order to charge the 12V battery. The generator is able to produce at low RPM enough current to provide the required electrical power for the fuel pump, injectors, ECU and the ignition without discharging the battery, even at idle regime. The charge condition is surveyed by the digital transformer and limited to 14V. All consumers are power supplied by the battery and all circuits are separately secured.

The power supply on board is surveyed using the voltmeter and of the loading activities using the ammeter.

The average current consumption on board, when the engine is running, including the radio, transponder, glass cockpit and position lights amounts to approximately 10A if the battery is fully loaded.

NOTE

A decreasing voltage on board is an indication that the generator does not work properly or even has a total failure. If the generator has a failure all consumers are supplied only by the battery. If the on board voltage is lower than 8V the ECU stops working and the engine stops running. It is for that reason recommended to switch off all consumers and to land as soon as possible. The remaining flight time depends on the loading condition of the battery and of its capacity.

It is not allowed to operate the engine without battery connected to the generator. Aircrafts with more than one battery (Backup) at all-time one of the batteries must be connected via the transformer to the generator, while the engine is running.

Spark plugs

- Spark plugs should only be removed when engine is cold.
- Brush clean with a plastic bristle brush.
- Do not use a brass brush or a steel wire brush for cleaning.
- After 200 hours or at least annually. Replace spark plugs.
- Spark plug type: Beru UXT 1 / Beru Ultra R1-537
- The engine must be cold before the spark plugs are torque tightened..

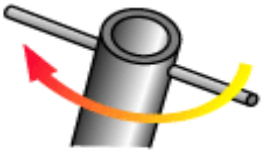
TABLE FOR TORQUE VALUES

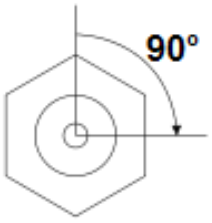
		Nm
Oil drain screw	M22	15
Oil pump screw (banjo)	M18	32
Crankcase screw small	M6	12
Crankcase medium *	M8	34
Crankcase screw big	M12	110
Crankcase screw front	M8	34
Rods	M8	42
Cylinder head	M6	12
Mounting plate	M6	14
Oil pump	M6	12
Flange	M20	240
Screw for starter	M5	7
Intake manifold screw	M5	7
Water pump housing	M5	7
Gear on camshaft	M6	18
Extension crankshaft	M6	18
Screw-nut alternator	M20	60
Bolts cylinders to crankcase	M8	34
Spark plugs	M14x1.25	22

If torque wrench is not available. Tighten as far as possible by hand with spark plug tool and then 90° for new spark plug and 30° for used spark plugs.

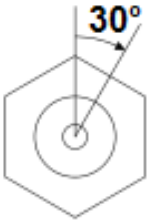
Fig 1

Fig 2





New flat sealing spark plug



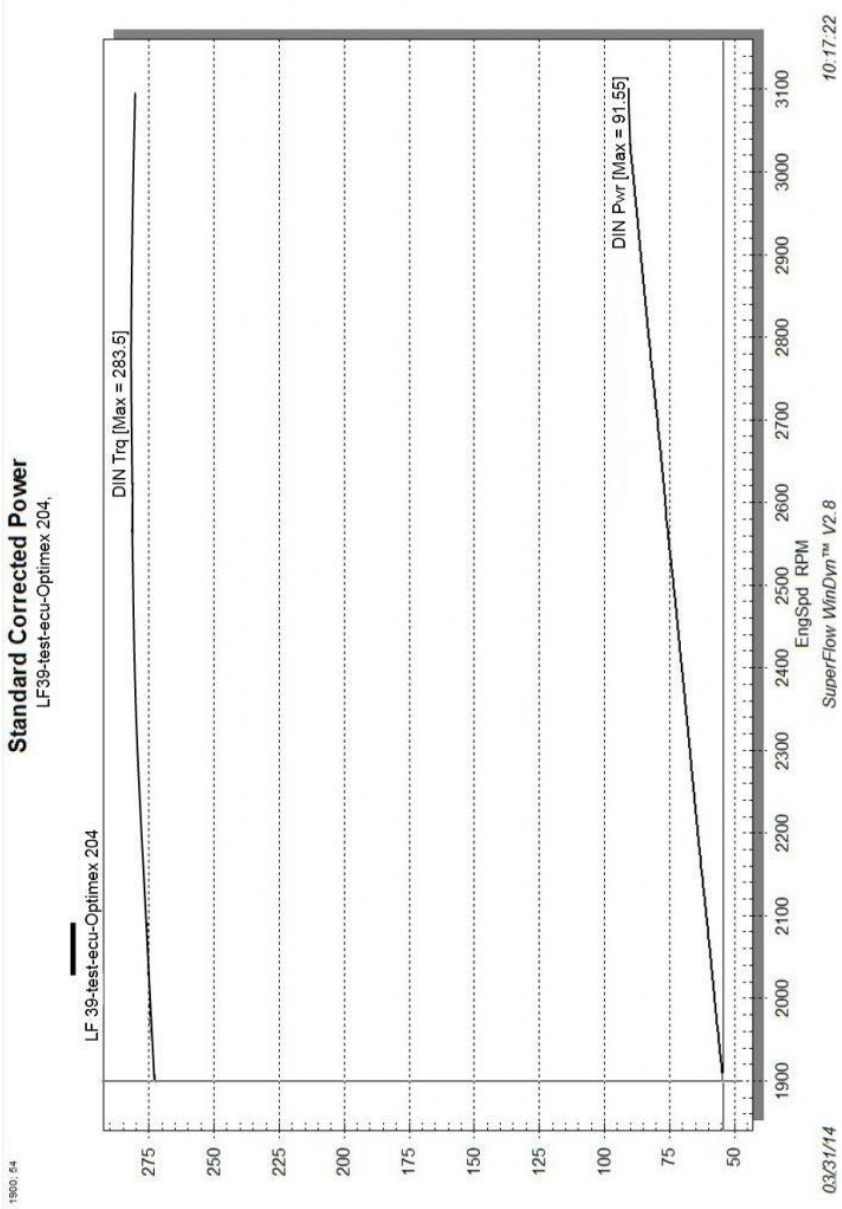
Used flat seal spark plug

When replacing used spark plugs, two points in particular are to be observed: Firstly, under no circumstances must contamination around plug hole fall into combustion chamber. Secondly, plugs must be tightened to the correct torque.

Excessive torque tightening can damage the plug, insufficient torque results in poor sealing and heat dissipation

(*) 1 internal and 1 external in the middle of crankcase

Performance Curve of the LF39 Engine



Periodic inspections

After the first 25 hours of operation the inspections listed in 6.2.1 are to be performed. The next inspection is due to at 50 hours and thereafter every 100 hours. The 100-hour inspection mentioned is to be performed every 100 hours but at least annually. The 200-hour inspection is to be performed every 200 hours.

First 25 & 50-hour-inspection

- Check condition of the throttle cables, choke cables.
- Engine mounts. Check for cracks, looseness of mounts, and looseness of engine to mounts.
- Check for looseness of bolts, nuts and pins.
- Check for oil leaks from hoses, the oil tank and fittings.
- Perform an oil change and send sample to constructor
- Change the oil filter.
- Fuel lines-check the standoffs, safeties, leaks and wear.
- Fuel filter-check, clean.
- Check the ignition harness for damage and tight connections at spark plug cap.
- Air filter-check, clean.
- Check the fuel lines.
- Check the general condition of the exhaust system; look for cracks, particularly at the welds.
- Check the muffler and attaching flanges at the exhaust ports on the cylinders for exhaust leaks.
- Check the ignition coils for wear and security of attachment.
- Check for leaks at the oil pressure and temperature sensors.
- Electrical wiring-check for wear, damage and security of attachment.
- Check the crankcase for leaks and cracks.
- Clean engine if dirty or oiled.
- Run up the engine .

100-hour-inspection or annually

- carry out the 50-hour-check.
- Perform a compression check.
- Change spark plugs.

200-hour-inspection

- carry out the 100-hour-inspection.
- Check the spark plug caps. Change if necessary.
- Change the fuel filter.
- Change the air filter.

Preservation of the engine for long term storage

For long out of operation periods and at extreme climatic conditions, we recommend the following instructions to protect against corrosion. Extra protection against corrosion beyond these recommendations is not necessary.

1. Change the engine oil in accordance with the section in this manual
2. Blank all openings, the exhaust tubes, the breather tube and air filters. Place in a large heavy duty plastic bag with a minimum of 4KG of desiccant bags. Take care not to puncture the plastic storage bag.
   Using a vacuum cleaner, draw all the air out of the storage bag and seal the neck of the bag by gathering the neck, folding it back on itself and clamping with a large ty-wrap. Re-activate the desiccant bags at least once a year by placing in a warm oven at 100 deg c for several hours.

Bringing the engine back operation

remove all the protections !!!

⚠ CAUTION!

For longer storage periods, the preservation procedures must be performed at least annually.

Winter operation

Care of the electrical system

Generally in the beginning of

the winter an engine inspection shall be performed.

- check all the connections of the ignition system and clean if necessary.
- Check the battery voltage.
- The battery poles and terminal connectors should be cleaned.

- Check the liquid coolant mix is suitable to cope with an outside air temperature of -36 deg C.

In Countries with extremely low temperatures it is recommended to protect the battery against freezing by keeping it in a warm location for storage between flights.

Cold starting procedures

Throttle OFF

Limit cranking the engine for periods longer than 10 sec. After the engine starts, keep the engine running but do not exceed 2000 RPM until the oil temperature reaches 50 deg C (122 deg F).

TROUBLE SHOOTING

Engine does not fire

Cause	Action
Ignitions OFF	ON.
Spark plug gap too big	Change plugs or re-gap plugs.
Fuel shutoff valve OFF or fuel filter blocked	Fuel shutoff valve ON, clean or replace fuel filter.
Lack of fuel	Fill fuel tank.
Ignition line loose or damaged	Check line connections. Replace if necessary.
Battery defective or discharged	Install charged battery or recharge.
Starting speed too low, start problems	Check battery.
Spark plugs wet from condensation	Dry plugs inside and outside.
Spark plugs wet with fuel (over-choked)	Dry spark plugs.
Inner mechanical defect	Contact engine manufacturer or approved service centre.

Warm engine shows irregular idling

Cause	Action
Intake manifold leaky	Tighten all intake connections. Replace any defective parts.

Engine runs erratic or misfires occasionally

Cause	Action
Spark plug failure	Clean plugs inside and outside. Replace if necessary.
Ignition wire breaks down	Check ignition wire and replace if necessary.
Ignition troubles	Check complete ignition system and replace parts if necessary.
Fuel filter blocked (fuel pressure indicator below 2,5 Bar)	Disassemble and replace the filter.

Engine overheats, Oil temperature over 100 Deg.C (212 deg.F)

Cause	Action
Too much oil remaining in the crankcase	Check the oil return line
Insufficient air-flow to the oil cooler	Check and clear the air passages.
Insufficient oil supply	Check oil level and fill if necessary.
Poor oil quality	Change oil. Use prescribed oil.
Oil filter blocked	Change the oil filter.
Defective oil temperature gauge	Replace the oil temperature gauge.
Excessive piston ring gas leakage (blow by)	Major overhaul is necessary.
Bearings defective	If there is metal contamination in the crankcase sump, a major overhaul is necessary.

The engine does not develop full power

Cause	Action
Ignition trouble	Tighten all connections.
Too much oil remaining in the crankcase	Check oil return line.
Fuel supply inadequate (less than 2,5 Bar)	Check fuel filter.
Incorrect fuel grade	Refuel with prescribed grade fuel.
Intake leaking	Tighten all connections. Replace defective parts.

Low oil pressure

Cause	Action
Insufficient oil in oil tank	Check oil level and fill if necessary
Oil remains in engine and doesn't circulate	Check oil return line to tank
High oil temperature	See higher
Pressure loss	Check the pressure control valve.
Air in suction line	Vent the oil line.
Defective oil pressure gauge	Replace the oil pressure gauge.
Bearings defective (no oil pressure)	A major overhaul is necessary.

The engine does not stop immediately

Cause	Action

Idle speed to high	Adjust proper idle speed (800 r/min) (1010 r/min for helicopters)
Ignition switch defective	Replace the switch.

Excessive oil consumption

Cause	Action
Piston rings or oil scraper rings worn	A major overhaul is necessary
Poor oil quality	Change oil. Use prescribed oil.
Worn valve guides or bad valve guide seals	A top overhaul is necessary.
External oil system leaky	Check for defects and correct as necessary.

Engine « knocks »

Cause	Action
Using fuel with a low octane rating	Use fuel with a higher octane rating.

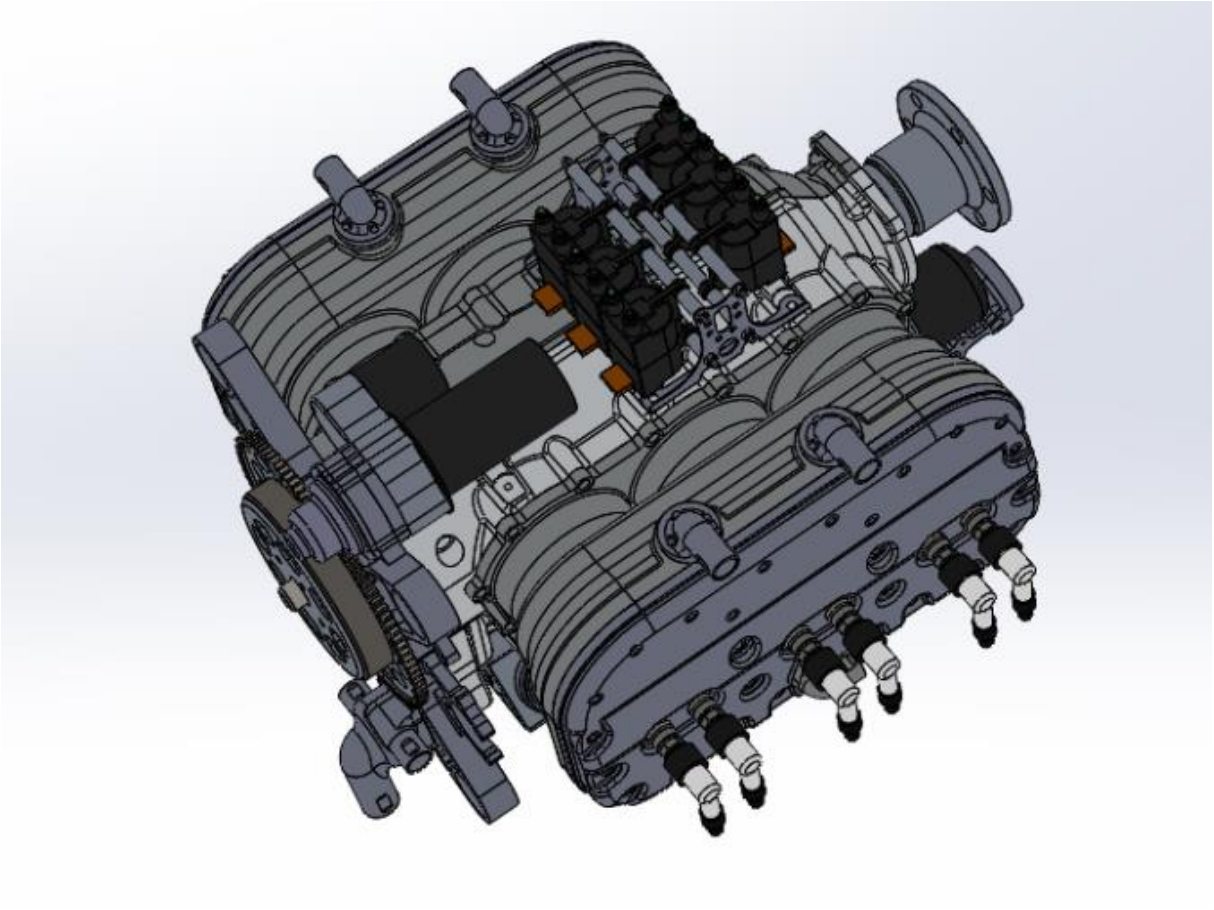
Engine hard to start at low temperatures

Cause	Action
Low battery charge	Replace battery or recharge.
High oil pressure	During a cold start a pressure reading up to 100 psi (7bar) is permissible

OVERHAULS

Major inspections at TBO is to be performed by the manufacturer or approved service centres only. For this purpose the engine is to be sent with its logbook to the manufacturer or the nearest approved service centre. The recommended time between overhaul (TBO) is at present 1500 hours of operation. An increase of TBO due to field experience will be published in the Service Bulletins of the manufacturer.

Major repairs and major modifications are also only to be performed by the manufacturer or by approved service centres, which are authorized by the manufacturer. In case of prop strikes or sudden stoppage, the engine must be disassembled and the crankshaft must be checked for cracks. This is considered a major repair and must be performed by the manufacturer or an approved service centre.



Water and Oil

Although hot weather is the most common cause of **overheating**, many other factors can cause the same problem. If **your** engine **overheats** in flight in normal weather, one of the following may be the culprit: The water and coolant level in the radiator is low. There's a leak in the cooling system, air bubbles appear in your closed water circuit, your cowling is not built to cool the engine enough !

D-Motor International builds solid engines.

The long life and safe life of our engines is linked directly with the operation temperature of the water, air and oil !

We would like to inform the OEM / Integrators of our engines to test the engine after integration thoroughly !

As engine manufacturer, we do not have a hand in the cowling or cooling system that is used!

Our Engine Control Unit (ECU) logs all active temperatures at a rate of 10/5 or 2 samples per second. (depending on the software version).

Water is **used to cool** down the **D-Motor engine**. it has high specific heat capacity. It can absorb a large amount of heat without a high increase in temperature.

Why cooling ?

Internal combustion **engines** remove waste heat through **cool** intake air, hot exhaust gases, and explicit **engine cooling**. ... Thus, all heat **engines need cooling** to operate. **Cooling is** also **needed** because high temperatures damage engine materials and lubricants and becomes even more important in hot climates.

The **cooling system** is composed of six main parts—an engine, a radiator, a water pump, a **cooling** fan, hoses, and a thermostat. During the combustion process, some of the fuel energy is converted into heat. This heat is transferred to the **coolant** being circulated through the engine by the water pump.

Our EOM (Engine operating Manual) defines the following recommendations :

Oil pressure	1.5 - 5.0 bar (21 – 72 psi)
Oil specification	Synthetic 5W60 - 5W40 – (0W60 – 0W40 cold regions)
Oil quantity	3.5 Liters (0.40 US Gal) NEEDED (different lengths of oil hoses,
	cooling radiator, etc. will need more oil then 3 or 3.5 litres) – See maintenance Information Bulletin !

Oil filter	P/N 107001
Oil temperature	min 50° C to max 100° C
	80°C to 95 °C best range
Coolant	Water with anticorrosive (50/50)
	(for Aluminium engines)
Coolant exit temperature	Not more than 10°C higher then inlet temperature. 75°C to 100°C (opening pressure at 1.2 bar at MSL)

There is a big difference between 'Ambiënt' temperature and 'effective' temperature.

Having a temperature monitoring sticker on the backplate indicating 105°C / 221 °F for example means that the engine has temperatures of over 130 – 140°C/266°F – 284°F

These temperatures are having a distructive influence on your engine !

EGT and CHT ?

An exhaust gas temperature gauge (**EGT** gauge) is a meter used to monitor the exhaust gas temperature of an internal combustion engine in conjunction with a thermocouple-type pyrometer. ... By monitoring **EGT**, the driver or pilot can get an idea of the vehicle's air-fuel ratio (AFR).

Cylinder Head Temperature (**CHT**) Gauge - Indicates the temperature of at least one of the cylinder heads. Used to set the fuel/air mixture.

D-Motor delivers optional a dashboard gauge with monitoring probes per cylinder. (P/N 500052)

As our engines are not operated by a carburetor, the display can be changed at customers demand. Basic idea is that the pilot has an overvieuw of all 4 or 6 cylinders, and can take action before the engine overheats.

The Water and Oil temperature is important !
D-Motor is cooling both cylinder head and cylinders. The red line for cylinder head temperature is the max. water temperature ! As D-Motor cools both head and cylinder body, it is obvious that the temperature difference between IN and OUT should not exceed 10°C.

Permanent monitoring of coolant temperature is necessary.

Water and Oil in your engine :

Water can get into the oil two ways. You generally don't have to worry about one of the ways if you fly your aircraft enough to burn off the water during normal flying. This drives off the moisture that simply comes from your engine breathing when it is not being used (cold air enters a hot engine and water condenses) and from combustion byproducts. The second more destructive route is through a coolant leak due to a bad gasket, an engine crack, etc.

The above facts usually are due to bad cooling engineering !!

This amount of moisture is generally going to cause serious engine issues including loss of power, oil sludging, etc. **Consult D-Motor when in doubt**.

Pilot Instructions water temperature :

The cooling system at 1.2 Bar does not have the same values as different pressure levels !!
D-Motor works with 1.2 bar water pressure.

	Water Temperature (°C/°F) press. at 1.2 Bar / 17.4 PSI Coolant exit temperature
NORMAL OPERATION	70 – 90 °C / 158°F – 194 °F
WARNING OPERATION	90°C – 100°C / 194 °F – 212 °F
DO NOT EXCEED TEMPERATURE	Above 100 °C / Above 212 °F

About water and oil temperature

The D-Motor engines are not high temperature engines. (some new cars are operating with a water temperature of 140°C). The optimal range is 80°C - 90°C for water and 90°C to 100°C for oil. In a perfect situation the oil should be 10°C warmer then the water temperature. At that point the engine is evenly warmed up. If the oil stays to cold, condensation can build up in the engine. This condensation water in the oil can only be removed from that oil if the oil temperature is high enough to evaporate the water and remove it.

If the cooling system is large enough to keep oil and water temperature within the limits, a thermostatic valve for water must always be installed. Reason is that the engine does not cool down to much during flight. The best practise is to have also a thermostatic valve for the oil circuit.

About the colour codes ?

The **green** area is between 70°C (158°F) and 90°C (194°F)
The **yellow** area is between 90°C (194°F) and 100°C (212°F)
The **red** area is from 100°C (212°F) on

If the airplane or helicopter cooling system is not dimensioned big enough to keep the temperature below 100°C (212°F) even at full throttle, then the temperature will continue to rise during climbing eg. Most pilots do not monitor the displays continiously, but only at certain intervals.

If the temperature rises above 95°C and the pilot notices, the performance most be reduced. However the cooling system is relatively slow and the changes are measured slowly. If the pilot reduces power shortly before 100°C (212°F), the temperature may still rise bove 100°C (212°F). In that case, when action has been taken by the pilot, no danger is to the engine.

Water boils at 100°C (212°F) ?

The above statement is right at MSL (sea level – 1013 hg). If the cooling system is without pressure, the water can boil at 90°C or 80°C depending on the altitude! If the pressure is increased in the cooling system, the water will only boil at higher temperatures. Clear water boils at 1.4 bar at just over 110°C. Frost protection (additives) in the water does not freeze at 0°C. The frost additives also ensure that the water does not boil until higher temperatures are reached. Depending on thge pressure (The D-Motor sealing rings are fit for maximum 1.2 Bar pressure) and the proportion of the frost additive, water will boil at 115°C to more then 130°C.

When the manual states 'water boils at 100°C (212°F), D-Motor means : common sense (taking altitude, duration, OAT, etc under consideration) !

Biggest risk for the D-Motor engines, bubbles or no bubbles …

The biggest risk for the D-Motor engines is not running 10°C higher then allowed. The D-Motor engine will not be damaged by this. The greatest risk to damage is caused by cavitation. The steam 'bubbles' in the water occur when the pressure drops to far and the temperature rises to high. Vibrations of components or housing walls intensify the effect. The pressure in the water also drops where the water flows at high speed, i.e. around corners or trough constrictions. In addition, there are 'hotspots' in the engine where the temperature can be a lttle higher locally. Eg. Near the exhaust valve.

Cavitation ? Even at to low temperatures cavitation may occur. If, for example, the engine gets warm while climbing, the water expands and goes into the overflow tank. At high altitudes (without a thermostat) and reduced power, the water cools down considerably. Perhaps even below 60°C. At that moment the pressure in the cooling system can drop below 1 bar and the water can boil at lower temperatures and form steam bubbles at the hot spots. So water temperature to low at high altitudes can be harmful.

What is the normal, warning and danger water temperature for the D-Motor engines ?

It is all about the difference between Temp IN and Temp OUT ! eg. Rotax and Lycomming only pushes its water trough the cilinder head chamber, they do not cool the cylinders, so comparing the water temperature of eg. Rotax with the D-Motor limits is of no use !

The best practise for cooling the D-Motor engines is to keep the Temp IN and Temp OUT close to each other (+/- 10°C). Temp IN is measured on a other place then Temp OUT ! When the three coulor code is installed in the cockpit, a pilot should see if the temperature rises above 90°C, and act! Eurocopter voids warranty if temperature is logged more then 15

seconds above 100°C … We at D-Motor call for the common sense, but ask the pilots to reduce power when reaching the yellow zone. The Engine Control Unit logs the action taken, and will be the only proof that a pilot overheated his engine or not. Flying at MSL, 100 ft or 5000 ft is not the same, again common sense and knowledge of the engine by the pilot !

Warranty VOID :

All engines that ran at 1.2 Bar water pressure at more then 105°C for more then 2 minutes will have Warranty VOID, except if the pilot has taken action at 95°C (see above).

(ECU Logfile will be abritary). The owner or operator may conduct a daily inspection, if so desired, but the pilot must perform a satisfactory preflight inspection before flight in order to determine that the aircraft is airworthy !

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