



***UL260***

***UL350***

***UL390***

***UL520***

# *Operating Manual*



# Preface

Thank you for choosing ULPower Aero Engines for your aircraft.

Before starting the engine, carefully read this manual. The Manual will provide you with basic information on the safe operation of the engine.

If you are unsure about the procedures mentioned in this manual, please contact a ULPower authorised service point.

We hope you will enjoy flying your ULPowered aircraft.

## Remarks

The diagrams and other pictures in this manual show the typical construction. They may not represent in full detail or the exact shape of the parts which have the same or similar function.

Specifications are given in the SI metric system with the USA equivalent in parenthesis. Where precise accuracy is not required, some conversions are rounded off for easier use.

In addition to this Operating Manual, please refer to the following:

- Installation Manual
- Maintenance Manual

Please make sure you have the latest version available of the applicable manual.

## Modifications

The information and components/system descriptions contained in this Operating Manual are correct at the time of publication. ULPower, however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on its products previously manufactured.

ULPower reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

## Engine serial number

On all enquiries or spare parts orders, always indicate the engine serial number, as the manufacturer makes modifications to the engine for further development.

## Repeating symbols

This manual uses the following symbols to emphasize particular information. These indications are important and must be respected.

- ✘ **WARNING** : Identifies an instruction which, if not followed, may cause serious injury including the possibility of death.
- ★ **Attention** : Denotes an instruction which, if not followed, may severely damage the engine or other components.
- Note** : Indicates supplementary information which may be needed to fully complete or understand an instruction.

## Safety information

- The engine should only be installed and operated by persons familiar with the use of the engine and informed with regard to possible hazards.
- Familiarize yourself with the installation, maintenance and operational limits of your ULPower engine. Failure to follow the instructions in this manual can result in a serious malfunction or loss of power in flight, with possible loss of life, injury or damage to the equipment. Limit yourself to the operations/ maintenance mentioned in ULPower manuals. If you are uncertain and in need of extra information please contact a ULPower authorized service centre.
- This engine is designed for possible application on aircraft used in VFR conditions which have the capabilities of controlled gliding without engine power.
- You should be aware that any engine may seize or stall at any time. This could lead to a crash landing and possible severe injury or death. For this reason, we recommend strict compliance with the maintenance and operation manuals and any additional information which may be given to you by your dealer.
- Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage.
- Make sure you know what engine you are using. Only engines UL260iSA /UL350iSA/ UL390iSA/UL520iSA are suited for acrobatics (inverted flight, etc.).
- It should be clear that the choice, selection and use of this particular engine on any aircraft is at the sole discretion and responsibility of the aircraft manufacturer, assembler and owner/user. ULPower makes no warranty or representation on the suitability of its engine's use on any particular aircraft. Furthermore, ULPower makes no warranty or representation of this engine's suitability with any other part, component or system which may be selected by the aircraft manufacturer, assembler or user for aircraft application.
- Never run the engine without a propeller or flywheel as this will inevitably cause engine damage and present a hazard of explosion.
- Propeller/flywheel and its attachment with a moment of inertia in excess of the specified value must not be used and releases engine manufacturer from any liability.
- Improper engine installation and use of unsuitable piping for fuel-, cooling- and lubrication system releases engine manufacturer from any liability.
- Unauthorized modifications of engine or aircraft will automatically exclude any liability of the manufacturer for direct, indirect and/or sequential damage.
- Spare parts must meet with the requirements defined by the engine manufacturer. This is only warranted by use of genuine ULPower spare parts and/or accessories. They are available at the authorized ULPower distribution- and service partners.
- The use of anything other than genuine ULPower spare parts and/or accessories will render any warranty relating to this engine null and void.
- Respect all government or local rules pertaining to flight operation in your flying area. Fly only when and where conditions, topography, and airspeeds are safe.
- Select and use proper and calibrated aircraft instrumentation. This instrumentation is not included with the basic ULPower engine.
- Before flight, ensure that all engine controls are operative. Make sure all controls can be reached in case of an emergency.
- Unless in a run up area, never run the engine with the propeller turning while on the ground. Do not operate engine if bystanders are close.

- In the interest of safety, the aircraft must not be left unattended while the engine is running.
- Keep an engine log and respect engine and aircraft maintenance schedules. Keep the engine in top operating condition at all times. Do not operate any aircraft which is not properly maintained or has engine operating irregularities which have not been corrected.
- To eliminate possible injury or damage, ensure any loose equipment or tools are properly secured before starting the engine.
- When in storage protect the engine, fuel, lubrication, induction and exhaust system from contamination and exposure.
- Never operate the engine without sufficient quantities of lubricating oil and cooling air.
- Allow the engine to cool at idle for several minutes before turning off the engine.

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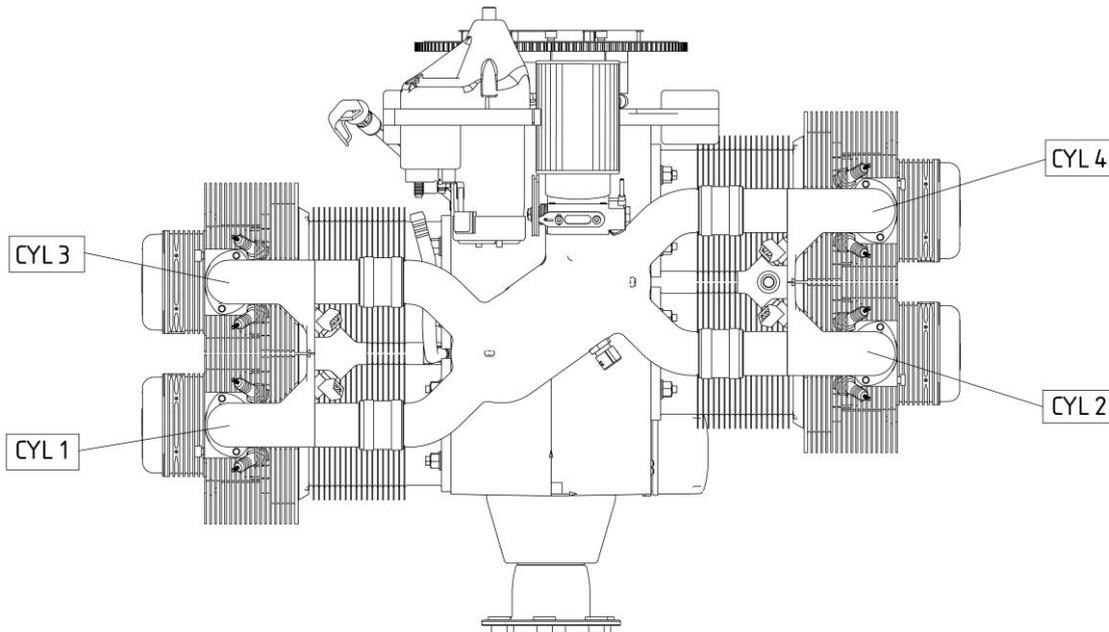
**Revision ..... 25**

## ***Engine description and engine views***

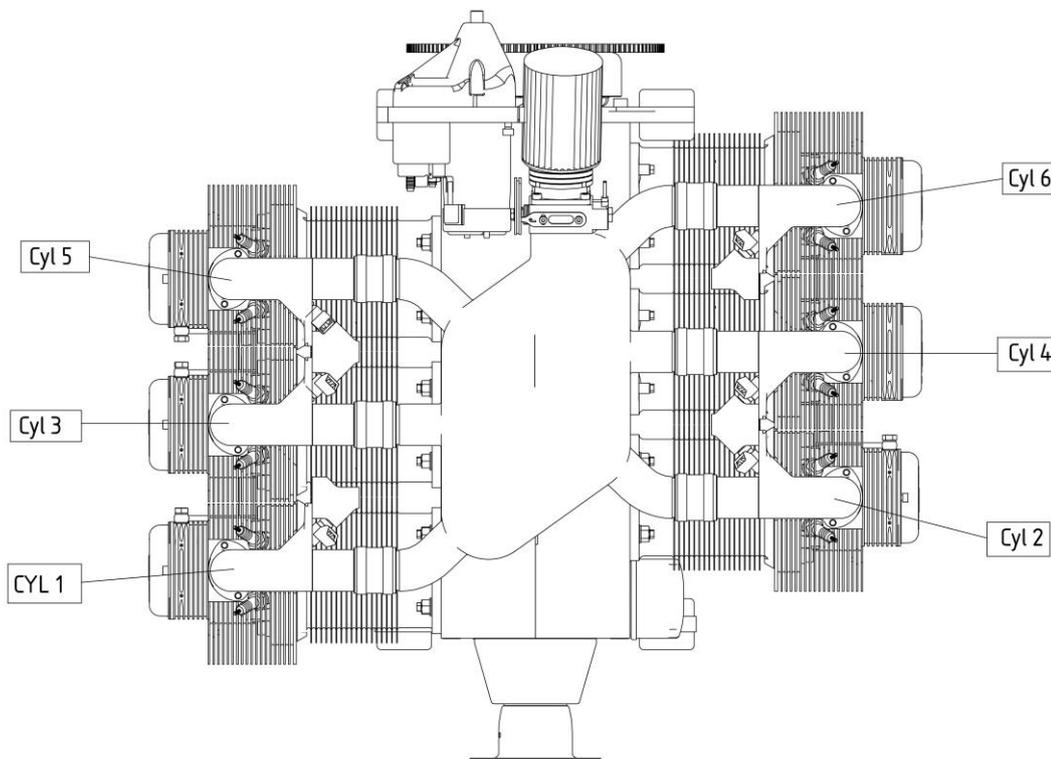
Please check our installation manual for a detailed engine description / engine view

# Denomination of cylinders

## UL260 / UL350



## UL390/ UL520



# Description of systems

## Lubricant system

The high volume oil pump, with integrated pressure release valve, takes up oil through a coarse filter on the oil pick up tube which is located in the wet oil sump.

An impressive amount of pressurized oil is pumped through the oil cooler (optional) and oil filter before it enters the main oil gallery where it lubricates the essential parts of the engine. Excessive oil accumulates back into the sump.

## Fuel system

Fuel from the tanks is guided through a coarse filter before reaching the electrical fuel pump. This high volume fuel pump (120l/h) creates a pressurized fuel flow and pumps fuel through a fuel fine filter towards the injectors and the integrated fuel pressure regulator. Afterwards excessive fuel is returned to the fuel tank.

## Electronic Engine Management system

All ULPower engines are equipped with an electronic injection and ignition system.

The ECU controls the mixture and timing from start-up to shut-down. As a result, in the cockpit, there is no choke, no primer, no carb heat, and no mixture; just a single lever - the throttle;

The ECU automatically sets the fuel mixture and ignition timing (multiple times per second!). It will even fine tune the fuel flow to compensate for changes in barometric pressure as well as inlet air temperature in the inlet manifold/airbox.

With timing corrections to avoid detonation and a built-in rev-limiter,(3,300rpm on most naturally aspirated engines or 2,700 RPM on turbo engines) the ECU not only ensures the most efficient power to fuel consumption at any given operating condition, but it also brings extra safety.

**Note:** *Since the engine is managed electronically and a current is needed to generate the sparks and operate the fuel pump, the engine cannot run without a working electrical system. The UL 260 / UL350 engine and fuel pump use maximum 15 Amps (12V DC) to operate  
The UL 390 / UL520 engine and fuel pump use maximum 21 Amps (12V DC) to operate*

**Note:** *The UL260/UL350 engine comes with an integrated AC generator with external rectifier/regulator that can supply up to 30 Amps. The UL390/UL520 generator can supply up to 50 amps This should be sufficient to charge the battery while the engine is operating and other electrical aircraft systems are in use.*

## Cooling system

All engines are air and oil cooled. Installing the ram air ducts that come with the engine, is mandatory. See installation manual for more info on this subject

The installation of an oil cooler is mandatory as the oil is not only used to lubricate but also to cool the engine. See installation manual for more info on this subject.

## Check light

The ECU contains a table of data, referred to as a '3-dimensional fuel map'. The map itself contains the mixture and timing control for operations up to 18.000 ft based on data received from five different senders

### 1.CPS -Crank Shaft Position Sensor/RPM ,

This sensor gives info on the crankshaft position, the RPM and position of each cylinder's piston and valves. This allows the ECU to calculate when to trigger the spark plugs/advance/retard the engine for smooth running.

### 2.TPS - Throttle Position Sensor

gives info on the %age power setting and also to know if 'accelerating'

### 3.OTS - Oil Temperature Sensor

This lets the ECU know whether it is a hot start or a cold start and to manage the engine accordingly with fuel to air ratio (rich or lean) and advance/retard. Based on this input, the ECU can automatically adjust the mixture to ensure easy starting and smooth running until the engine is at operating temperature

### 4.ATS - Airbox/inlet manifold Air temperature sensor

### 5.Build in pressure sensor ECU

#### Naturally aspirated engines :

#### 5.1 APS - Air Pressure Sensor

Air pressure is taken near the air filter/static port and linked via a hose to the ECU where the sensor is housed.

#### Turbo engines :

#### 5.2 TPS - Turbo Pressure Sensor

Turbo pressure is taken right before the throttle, a pressure line is connected from there to the ECU

By knowing the intake air (naturally aspirated engines) or turbo pressure (turbo engines) and temperature it is possible to calculate the air density to determine the correct amount of fuel to add for the 'right mixture'

If one of the above-mentioned sensors fails or becomes disconnected, the engine will continue to run, but not as efficiently as it will be using 'default values'. A warning light (checklight) will come on providing increased pilot awareness.

If the warning is intermittent, it may indicate a poor or loose connection or a break in a wire.

In the case of turbo engines, if the turbo pressure line between the ECU and throttle (see 5.2) is broken/disconnected, the TPS measures the ambient pressure instead of the turbo pressure. The ECU detects this issue, corrects the fuel map to run properly and activates the check light.

It is worth noting that if the ECU's goes into error mode you may find an increase in fuel burn.

When back on the ground, you can use the ULRead diagnostic software to find out what caused the check light to come up. Fix the problem before next flight.

### **Note**

It is very important that your check light is installed in accordance with the installation manual. You can test this by switching power "ON" to the ECU; If installed correctly the check light will come up for 2 seconds. You can do an additional test by disconnecting one of the sensors; if the installation is ok, the check light will come up.

## General operating limits

Engine	Naturally aspirated	Turbocharged/normalized
<b>Speed</b>		
Max. engine speed (RPM)	3300	2700
Recommended prop speed (RPM)	2200-2800	2200-2500
Normal idle speed (RPM)	850	850
Min. idle speed (RPM)	700	750
<b>Requirements about RPM settings</b>		
Min. static RPM at WOT (RPM)	2550	2400
Min. take OFF speed at WOT (RPM)	2800	2300
Min. speed WOT straight and level (RPM)	2900	2400

### Running in

#### a) Non aerobatic engine

- No need to use special run-in oil.
- To run in a new engine: It is important that the engine runs as much as possible at **operation temperature** (Oil temperature 80 à 100°C (212°F), CHT 110 à 140°C (284°F)) and at **± 80% of the max. power** during the **first 15 hours**.

This means: For the first 15 hours: Avoid continuous running at full power and make sure that the engine is loaded.

Do not run the engine for a long time at idle on the ground, but go flying( After take-off (full power) reduce the power to ±80%

#### b) Aerobatic engine<sup>1</sup>

- No need to use special run-in oil.
- To run in a new engine: It is important that the engine runs as much as possible at **operation temperature** (Oil temperature 80 à 100°C (212°F), CHT 110 à 140°C (284°F)) and at **± 80% of the max. power** during the **first 15 hours**.

This means: For the first 15hours: Avoid continuous running at full power and make sure that the engine is loaded.

Do not run the engine for a long time at idle on the ground, but go flying( After take-off (full power) reduce the power to ±80%

- Don't fly any aerobatic manoeuvres during the first 15 flying hours
- Follow maintenance manual and add Teflon additive (ULP Partnr. L0100120) every oil change starting from the first 15 hours oil change

<sup>1</sup> Only available for naturally aspirated engines

## Performance (ISA: International standard atmosphere)

Engine	Maximum HP (for 5 minutes)	Maximum Rpm (for 5 minutes)	Maximum HP (Continuous Power)	Maximum Rpm (Continuous Power)
UL 260i	97	3300	87	2800
UL 260iS(a)	107	3300	95	2800
UL 350i	118	3300	112	2800
UL 350iS(a)	130	3300	123	2800
UL 350iHPS	145	3500	131	3000
UL 390i	140	3300	125	2800
UL 390iS(a)	160	3300	143	2800
UL 520i	180	3300	170	2800
UL 520iS(a)	200	3300	180	2800
UL 520T	220	2700	200	2700

Table 1 : Performance

## Acceleration

Limit of engine operation at zero gravity and in negative "g" conditions

Max. .... 3 seconds at max. -0,5 g

## Oil pressure

Max. .... 8 bar (115,0 psi) (cold start)

Normal ..... 2-5 bar (30-75 psi) – above 2000 rpm

Min. .... 1 bar (14,5 psi) – below 2000 rpm/above 900 rpm

## Oil level

UL260 / UL350

I / iF / iS / IHPS: Max. .... 3,5 litres (3,7 quarts)

Min. .... 2,5 litres (2,6 quarts)

iSA: Max. .... 4,5 litres (4,7 quarts)

Min. .... 3,5 litres (3,7 quarts)

UL390 / UL520

I / iF / iS / T : Max. .... 4,5 litres (4,7 quarts)

Min. .... 3,5 litres (3,7 quarts)

iSA: Max. .... 5,5 litres (5,8 quarts)

Min. .... 4,5 litres (4,7 quarts)

**Attention :** The marks on the dipstick (min-max) are only valid in case the engine is level ! Installed in the plane, be sure the plane is level before checking the oil level.)

## Oil temperature

Max. .... 120° C (248F)

Min. .... 50° C (122F)

Normal ..... 80-100° C (175-212F)

## Cylinder head temperature

Max. .... 180°C (356F)  
 Max. continuous ..... 160°C (320F)  
 Min. .... 50°C (125F)

## EGT

Max. .... 880°C (1616F)  
 EGT varies upon delivered power.  
 Most important is that all EGT values are +/- equal

## ECU environment

Max. .... 65°C (149F)  
 Min. .... -40°C (-40F)

## Manifold air temperature

We advise to bring fresh air from outside the cowling to the inlet air filter/manifold.

We advise to install an suitable intercooler (see installation manual) for turbo engines.

Engine	Naturally aspirated	Turbocharged/normalized
Max. at start	60°C (150F)	75°C (140F)
Max. in flight	40°C (104F)	60°C (150F)

## Outside air temperature

Max. at start/ take off ..... 50°C (122°F)  
 Max. in flight ..... 40°C (90F)  
 Min. .... -25°C (-15F)

## Relative fuel pressure

Relative fuel pressure is the pressure above ambient pressure.

Engine	Naturally aspirated	Turbocharged/normalized
Max.	3.4 bar (49 psi)	3.4 bar (49 psi)
Min.	2.4 bar (35 psi)	2.4 bar (35 psi)
Normal	3 bar (43.5 psi)	3.3 bar (48 psi)

## Deviation from bank angle

Value to which the wet sump (normal oil level) lubrication system warrants lubrication in positive "g" flight situation

Max. .... 35°

## Electrical power

Min.: 12 VDC

Be sure the battery is completely loaded before **take-off** with an output voltage min = **12.7 VDC**

**Attention:** NEVER use a “booster” (quick battery charger) to start the engine.

**✘ WARNING:** Make sure operating limits are respected at all times. Running the engine outside of the limits set by the manufacturer may severely damage the engine and will render any warranty relating to this engine null and void.

## *Maintenance*

Maintenance should be performed at regular intervals to keep the engine in top operating condition. Please refer to the last published Maintenance Manual of the engine for maintenance schedule.

# *Engine performance*

For all UL-Power charts we refer to the website [www.ulpower.com](http://www.ulpower.com)

# Operating media

## Fuel

### UL260i / UL350i / UL390i / UL520i

Regular unleaded automotive fuel with a minimum of 95 octane RON (= 91 (ron+mon/2) in USA, 91(aki) in Canada) should be used to operate these engines.

AVGAS 100 LL and/ or AVGAS UL91 may be used if regular fuel is not available.

**Note:** Due to higher lead content in AVGAS, the wear of the valve and valve seats, the deposits in combustion chamber and lead sentiments in the lubrication system will increase.

### UL260iS / UL350iS / UL350iHPS / UL390iS / UL520iS / UL520T

Regular unleaded automotive fuel with a minimum of 98 octane RON(=93 (ron+mon/2) in USA, = 94 (AKI)in Canada), should be used to operate these engines.

AVGAS 100 LL and/ or AVGAS UL91 may be used if regular fuel is not available.

**Note:** Due to higher lead content in AVGAS, the wear of the valve and valve seats, the deposits in combustion chamber and lead sentiments in the lubrication system will increase.

**Attention:** When the engine hasn't run for over 2 months replace the old fuel.

## Lubricants

We recommend the use of Motul 300V (15W50) oil or Aeroshell SAE15W50 oil.

Do not use special brake-in oils.

**Note :** For Aerobatic engines : Add a bottle Teflon oil additive (part number : L0100120). This a an additive that was developed by ULPower and is not available on the general market.

DON'T ADD THIS DURING THE FIRST 15 HOURS. Only to be added after the first oil change

★ **Attention:** If AVGAS 100 LL is used frequently, we recommend to use only the semi synthetic oil "Aeroshell SAE15W50" and change oil more frequently (see maintenance manual)

# Standard operation

## Daily/Pre-flight checks

✘ **WARNING:** Conduct checks on cold engines only to avoid risk of burns and scalds!

Turn the propeller by hand in the direction of engine rotation several times and observe engine for odd noises or excessive resistance and normal compression. If irregular, first check tappet adjustment.

✘ **WARNING:** Make sure ignition is turned OFF when inspecting the engine. Have the cockpit occupied by a competent person.

Check that all spark plugs, leads and electrical connections are secure.

Verify the free movement of the throttle cable over the complete range. Check from cockpit.

Check for any oil and fuel leaks.

**Note:** Fuel pump must be switched on to ensure the fuel lines are under pressure.

Check oil level and replenish if necessary .

**Note:** Make sure the oil level is between the min. and max. marks. Before starting a long flight replenish up to max.level. Difference in oil quantity between min. and max. level is 0.8 litres.

Inspect exhaust system for damage, leakage and general condition.

✘ **WARNING:** Do not fly your aircraft if you noticed abnormal things during the daily/ pre flight checks. Always repair / rectify any possible problem.

## Engine start

✘ **WARNING:** Do not start the engine if a person is close to the aircraft.

1. Fuel tap ..... OPEN
2. Master switch ..... ON
3. ECU ..... ON
3. Ignition Coils ..... ON
4. Fuel pump ..... ON (if fuel pump relay is not installed)

★ **Attention:** Run the fuel pumps for a few seconds before starting the engine to avoid vapour lock and ensure fresh fuel from the tank is available. Fuel pressure must be stable and must be minimal 3 bar (3.0 - 3.2 bar).

5. Throttle lever ..... set to 10% position

6. Starter ..... ENGAGE

★ **Attention:** Activate starter for max. 5 seconds only (without interruption), followed by a cooling period of 15 seconds if restart is necessary. Do not engage starter as long as engine is turning. Wait until complete stop of engine.

As soon as engine is running adjust throttle to achieve smooth running at approximately 1200 rpm.

Check if oil pressure has risen within 5 seconds (if not: shut down). Verify pressure remains within the limits.

★ **Attention:** Increase of engine speed is only permitted when oil pressure reading remains below maximum.

Check fuel pressure (2.4 - 3.4 bar).

## Prior to take-off

### *Warming up period:*

Start warming up period with engine running between 1200 and 1500 rpm, duration depending on ambient temperature, until:

- oil temperature reaches at least 50°C (122°F)
- cylinder head temperatures are at least 50°C (125°F)

★ **Attention:** Always check temperatures and pressures are within limits.

### *Idle speed:*

When warm, engine can be set at idle speed.

**Note:** Although engine idle speeds of 700 rpm can be obtained, we recommend the ground idle to be at least 850 rpm for smooth running.

### *Throttle response:*

When ready for take-off do a short full throttle ground test. No irregularities may occur.

★ **Attention:** Turbo pressure must be 1.32 bar/19.14 PSI ( $\pm 0.2$  bar/ $\pm 2.9$  PSI) at WOT.

**Note:** Check with aircraft/propeller operating handbook, since engine speed depends on the propeller used.

### *Ignition test:*

The engine is equipped with double redundant ignition. Switch off one ignition coil at the time and verify that engine still operates normally on either of ignition coils separately.

★ **Attention:** RPM difference between running with coil 1, with coil 2 or both may not exceed 5% of nominal RPM

## Take-off and cruise

Climbing with the engine at maximum take-off power (see 'Table 1 : Performance' ) is permitted during a time period of max. 5 minutes.

In cruise, keep the engine power below the maximum continuous power settings (see 'Table 1 : Performance') for continuous operation.

★ **Attention:** Observe that all temperatures and pressures remain within limits at all times. If CHT's exceed maximum, reduce power.

Avoid flying your aircraft if the oil temperature has not reached normal operating values yet (50°C / 122°F). Low operating temperatures may not eliminate any accumulated water in the engine. The presence of condensation water in the lubrication system has a bad influence on the oil quality.

## Engine shut-down

★ **Attention:** For turbocharged engines ensure an adequate running cool-down period (2-5 min) to prevent deposits by choking of oil. Hard oil residues can obstruct parts of the oil system and lead to damage

Shut down the engine by switching off power to ECU before cutting off fuel/ignition.

Under normal circumstances, the descent and taxiing will have cooled down the engine sufficiently to shut it down (by switching of the ignition) immediately after the aircraft has stopped.

**Note:** *If temperatures are still at the high end of the limits, allow the engine to cool down by idling the engine for a few minutes before shut-down.*

## Engine storage

For long out-of-service periods we recommend the following to protect the engine against corrosion.

- Let engine run until warm, then change oil
- Remove the air inlet filter and insert approx. 30 cm<sup>3</sup> (1 Fl oz) of corrosion inhibiting oil into the inlet with the engine running at increased idle speed
- Shut off engine
- Close all openings on the cold engine, like exhaust end pipe, air intake (throttle), venting tube.
- Spray all steel external engine parts with corrosion inhibiting oil
- Store the engine as dry as possible

## Abnormal operation

✘ **WARNING:** At unusual engine behaviour, follow the guidelines below and perform the necessary maintenance and/or checks before next flight. All problems and maintenance/repairs/replacements carried out should be noted in the engine logbook.

### Abnormal running on ignition check

If you notice a substantial difference between running the engine on 1 ignition coil or on 2 ignition coils, please follow the procedure below .

Find out what ignition coil is causing the difference.

- If one cylinder stops firing : check ignition lead and sparkplug of the corresponding cylinder and coil.
- If two cylinders stop firing : check ignition coil, it's connection or wiring loom from ECU to the coil.
- If all cylinders stop firing : check ignition coil, it's connection or wiring loom from ECU to the coil.

★ **Attention:** The engine needs only one ignition system to function properly. The second system is used as an emergency backup. Operating the engine on one ignition system only reduces redundancy/safety, not the power output.

### Sudden engine stop

✘ **WARNING:** If prior to sudden engine stoppage no abnormal noise indicated internal damage to the engine, try to restart the engine, otherwise conduct power-off emergency landing.

Before restarting the engine, check the following:

- sufficient fuel level ?
- open fuel tap?
- master and ignition switch on?
- fuel pump switched on?
- fuel pressure?
- electrical system working ?
- sufficient battery voltage ( if necessary switch off all non essential electrical consumers)

If you had to do an emergency landing because the engine did not restart, or abnormal noise indicated possible internal damage to the engine, perform the daily/pre-flight checks (as stated before) carefully to pinpoint the problem. Check fuel for possible contamination. Rectify the problem if possible or send the engine for inspection/overhaul to a ULPower authorised service-centre.

Any sudden engine stop should be entered into the logbook, stating the possible reason.

### Reaching maximum engine speed

Engine is equipped with an electronic rpm limiter. When reaching maximum engine rpm, the engine will seem to hold back and slightly sputter. Throttle back to reduce engine speed.

## Exceeding of max. admissible cylinder head temperature

Reduce engine power setting to the required minimum and verify that CHT drops. Continue normal flight if the CHT drops within the temperature limits.

**✘ WARNING:** If temperature does not drop, carry out emergency/precautionary landing.

Any exceeding of the max. admissible CHT has to be entered into the logbook, stating duration and extent of over-temperature condition.

On the ground, verify that cooling ducts are still in place and air is free to flow over and through cylinder head cooling fins. If problem remains, the engine should be sent for inspection/overhaul to a ULPower authorised service-centre.

## Exceeding of max. admissible oil temperature

Reduce engine power setting to the required minimum and verify that oil temperature drops. Continue normal flight if the oil temperature drops within temperature limits.

**✘ WARNING:** If temperature does not drop, carry out emergency/precautionary landing.

Any exceeding of the max. admissible oil temperature has to be entered into the logbook, stating duration and extent of over-temperature condition.

On the ground, verify that oil level is sufficient and air is free to flow through oil cooler. If problem remains, the engine should be sent for inspection/overhaul to a ULPower authorised service-centre.

## Oil pressure below minimum

**✘ WARNING:** Oil pressure should be above minimum at all times. If not, shut down the engine immediately or as soon as possible.

In flight, reduce engine power setting and speed to the required minimum and carry out emergency/precautionary landing.

Any loss of pressure below the minimum required oil pressure has to be entered into the logbook, stating duration and extent of under-pressure condition.

On the ground, verify that oil level is sufficient and that no oil leaks are present. Check that oil lines to and from the oil cooler are not twisted/blocked or leaking. If oil cooler and oil lines are not blocked, oil filter should be inspected and changed. If problem remains, the engine should be sent for inspection/overhaul to a ULPower authorised service-centre.

## Exceeding of max. admissible oil pressure

**✘ WARNING:** Oil pressure should be below the maximum at all times. If not, shut down the engine immediately or as soon as possible.

**Note:** *At cold start, the oil pressure could be higher for several minutes as the oil is still cold and not as liquid, resulting in a higher pressure. Nevertheless, the maximum pressures of both warm and cold engines should not be exceeded as it indicates a problem with the pressure relief valve or oil lines/galleries and thus no/improper lubrication.*

Any exceeding of the max. admissible oil pressure has to be entered into the logbook, stating duration and extent of over-pressure condition.

On the ground, verify the oil level. Check pressure relief valve. If problem remains, the engine should be sent to a ULPower authorised service-centre for inspection/overhaul.

## Relative fuel pressure deviates from normal

✘ **WARNING:** Verify that fuel level and battery voltage are sufficient (min 12 VDC), and that the electrical system is working properly. If battery voltage is running low, switch off unnecessary electrical consumers. Carry out emergency/precautionary landing.

*Note:* A change in relative fuel pressure influences the air-fuel mixture. If pressure drops, the mixture becomes too lean; if pressure rises, the mixture becomes too rich. Any deviation in the correct air-fuel ratio can influence the power output of the engine.

★ **Attention:** A too lean fuel mixture can cause knocking, and severe damage to the engine.

While the engine is not running (ignition off, but master switch and fuel pump on) the same problems should show.

On the ground, check fuel or electrical system for possible cause. Replace filter(s), pump(s), lines, pressure regulator or sensor as necessary.

Test the fuel system with ignition off and master switch and fuel pump on.

## Derivation of turbo pressure (if applicable)

Once the turbo has spooled up, the turbo pressure will remain constant between 2000-2700 RPM and until the specified height (15.000 ft).

If the turbo pressure is too low, verify that the RPM is above 2000 RPM. Increase RPM (turbo spool up) to see if turbo pressure increases to normal value.

If the turbo pressure is too high, the over-boost protection will set in at 1,4 bar/20.3 PSI. Because of the over-boost protection, the engine will stutter. Lower the throttle/RPM immediately.

Any deviation of turbo pressure will influence the power output of the engine.

✘ **WARNING:** If the turbo pressure deviates (from normal conditions) , carry out emergency/precautionary landing.

Any deviation of the turbo pressure has to be entered into the logbook, stating duration and extent of deviation.

## Single CHT and/or EGT drop

Verify that both CHT and EGT of the same cylinder have dropped. If not, CHT or EGT probe or signal intake have a malfunction. Correct before next flight.

✘ **WARNING:** A large deviation of both CHT and EGT temperatures in one cylinder, when compared to the others, indicates that the particular cylinder is not firing properly or is not firing at all. Engine delivers reduced power. Carry out emergency/precautionary landing.

If it is not a sensor malfunction, send the engine to a ULPower authorised service-centre for inspection/overhaul.

## Knocking

Reduce engine power setting to the minimum needed and keep engine temperatures well below the maximum.

✘ **WARNING:** Carry out emergency/precautionary landing.

Be sure the right fuel type and octane rating have been used.

## Low battery voltage

Switch off all unnecessary electrical consumers, as the engine needs battery to operate.

**✘ WARNING:** Carry out emergency/precautionary landing.

To reduce electrical power consumption in flight even more, one ignition system can be turned off. Keep in mind that ignition backup system is not operating at that time, but in the event of an emergency, can be manually selected by switching second ignition system back on and switching first off.

On the ground, have generator, battery and electrical systems checked for any malfunction. Verify that no more than 15 Amps are being used by electrical devices other than the engine and fuel pump.

## Prop Strike

A propeller strike or sudden stoppage is an accident/incident in which an aircraft's propeller contacts any object and is forcibly slowed, stopped or damaged. Examples where this may occur include, but are not limited to, landing gear collapse, failure to extend the landing gear, nose-over, contact with parts of the aircraft (such as cowlings or tow bars), impact with a hangar door/building, impact with trees/fences/hedges, hitting water, running in long grass, collision with birds and other animals, etc. It should be noted that not all prop strikes result in visible damage.

After a prop strike or sudden stoppage, the incident must be entered in the engine logbook. The only known safe procedure is to remove and disassemble the engine and completely inspect the reciprocating and rotating parts. Experience has taught us that there may be hidden internal engine damage which may result in an in-flight engine failure including broken crankshaft or loss of propeller.

Therefore, ULPower have opted for a mandatory crankshaft replacement, along with any other parts that are found to be damaged, after a propeller strike or sudden stoppage. We have found that this results in a more reliable, quicker and cost effective solution than NDT or other inspection procedures.

In the event of a propeller strike/sudden stoppage, please contact your local ULPower dealer who will guide you through the required formalities before shipping the engine back to factory or to an officially approved ULPower Service Center.

Any decision to operate an engine which was involved in sudden stoppage, propeller strike or prop damage without disassembly and inspection will violate the warranty conditions. Any decision to fly an engine without complying with the ULPower prop strike directives is at the owner's responsibility and will immediately void all warranty conditions. As mentioned in the ULPower warranty conditions (available upon request) ULPower Aero Engines will under no circumstances be held responsible for any damage to and/or liability of customer/third party.

# Revision

## Revision 1 (2020- 07 - 01)

Pg 10: To run in a new Engine: ...

Pg 12: Deviation from bank Angle: 35°

Pg 16: Engine start => Fuel Pump => if fuel pump relay is not installed

## Revision 2 (2020- 11 - 01)

Pg 12: Fuel pressure values

Pg 16: Fuel pressure values

## Revision 3 (2021- 06 - 30)

Pg 9: Subdivision naturally aspirated engine and turbo engine

Pg 10: In the case of turbo engines ...

Pg 11: Speed and requirements about RPM settings : subdivision naturally aspirated engine and turbo engine

Pg 11: Aerobatic engines for naturally aspirated engines

Pg 12: Add UL520T in performance chart

Pg 13: Add turbo engine specifications at manifold air temperature and relative fuel pressure chart

Pg 15: Add UL520T

Pg 17: Add take-off RPM settings for turbo engine

Pg 18: Engine shut down procedure turbo engine

Pg 22: Derivation of turbo pressure (if applicable)