



Document	ULPower installation checklist
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Checked by	
Validity	This document DOES NOT replace nor overrule the official ULPower documentation, but merely acts a guideline as to items to check related to the installation procedure.
Reference documents used in the preparation of this document	ULPower engine installation, operation and maintenance manuals The latest documents available at the time of production of this document were used. ULPower reserves the right to change and update its manuals at any time. The latest manual contents will override any content references in this document, these are available via www.ulpower.com
Disclaimer	This document has been developed based on the authors experience. It is offered as guidance and assistance. It does not replace any official ULPower document. All users of this document do so of their own volition and at their own risk. Users should note that warranty of the engine may be voided by installation of any non-ULPower options

Reference information:

Checklist completed on (dd/mmm/yyyy) ____ / ____ / ____ by

Name	Address	Town	Post Code
Telephone	Alternative Telephone	e-mail	

Aircraft details for AIRCRAFT REGISTRATION _____

Type	Model	Serial Number	Installation type*
			New/Replacement
Propeller make/ type/blades	Accessories as applicable	EFIS or other engine data instrument installed	Battery type/V/Ah/CCA
Exhaust*	Air baffles*	Air Filter emplacement*	
ULPower exhaust	None	Free air inside cowling	
Non-ULPower	ULPower	Ducted air to free air inside cowling	
Modified ULPower	Non-ULPower	Ducted air to forced air chamber	



Fuel Pumps*	Oil Radiator	Oil Used	Fuel Tank(s) installed*
ULPower single ULPower dual Other (detail)	ULPower and mount ULPower other mount Other (detail)	Aeroshell 15W50 Motul 300V 15W50 Other (detail)	Single Dual wing Actual number 3 tanks
Header tank installed*	Fuel return to*	Additional senders fitted (qty if more than one)*	
Yes (if yes capacity __ litres) No	Header To feed tank Other (detail)	EGT _____ CHT _____	Fuel Pressure Oil Pressure

Engine Type/Options fitted to engine*

2 nd ECU	Fuel Pump Control Relay (FPCR)	Front engine mount plate
Swivel oil pick up	Forced cooling	
Aerobatic version	Reverse Rotation (RR) version	

*Delete/modify as applicable to the installation

Engine Data/Serial Numbers (where applicable) ENGINE TYPE

Engine Serial #	ECU serial #	Propeller serial #	Governor serial #

Installation checklists:

Engine Physical and engine mounting

Physical appearance (check for damage to pushrod tubes, potential mishandling during transport and installation). Note any anomalies	
Engine mount securely connected to the engine and airframe in a manner suitable for application	
Anti-vibration mounts fitted (with compression spacers if applicable)	
Suitable clearance from any mechanical damage during operation (e.g. rubbing/fretting)	
Check for sufficient oil	
Check for appropriate baffle fitting	
Check all hoses and connections for signs of damage, poor fitting or abuse	
Stand back and look around the engine from all angles, including BELOW and above. Note any anomalies.	
Move in and look over the engine at close quarters. Note any anomalies.	
Check throttle throw and free movement of cable connection at throttle body	
Check throttle cable is secure and has a 'flexible routing' (NOT straight!)	
Check coil and HT lead installation	
Check ECU security	
Visual check of wiring	
Fuel pump pre-filter(s) installed	
Fine filter installed between fuel pumps and engine	



Electrical Circuits/Wiring

For safety ensure that MASTER is OFF, ECU is OFF, FUEL PUMP(S) are OFF and that all possible other items are OFF before continuing.	
Are all wires, switches and other connections appropriate and in accordance with the manual/approvals/safety?	
Is Battery 12V and has installation considered sustainability and cranking	
If the battery is Lithium, does it have Battery Management System?	
Are battery cables appropriate dimensions, in line with latest recommendations?	
Is rectifier/regulator installed in a suitable 'cool' location (or ducted to keep cool). Ideally mounted on a suitable 'heat sink'.	
Check all wiring is clear of moving parts (esp starter ring gear)	
Are firewall transits suitably protected with glands, etc	
Check mounting of the ECU – If in the engine compartment it should be suitably located for protection from/away from heat and mechanical damage. It is normally mounted behind the firewall. The ECU must be isolated from the airframe vibrations, electrical system and heat. Ensure that the rubber mounts are fitted and that the body of the ECU is protected from mechanical damage (consider vibration at startup, etc.).	
Verify that both ECU connectors at the ECU are properly connected (if dual ECU check both)	
Check coils are secured and appropriately mounted. (ULP brackets on 4 cyl engine)	
Check that connections to coils from ECU are properly connected and secure	
Check all senders on the engine are connected and secure and unlikely to be affected by mechanical or vibration issues.	
Check that data ports (one per ECU connection loom) are secured and if connected protected from vibration and mechanical damage.	
Double check EGT senders with airframe/cowling/engine installation issues.	
Check ECU wiring to latest manual (suggest printout attached to this report)	
Engine frame ground wire installed, of a suitable section, with good continuity between engine block and airframe ground	
Check TPS (Throttle Position Sender)	

Oil Circuit/Routing

Are all oil lines secure and protected from mechanical damage, including fretting?	
Check oil lines to cylinder heads	
Confirm that oil level is between min/max	
Check for oil leaks and ensure that sump plug(s) is/are secure.	
Check oil lines for kinks, obstructions and appropriate radii.	
Ensure that oil cooler connectors are either both UP or one side UP. (avoid both DOWN to avoid air building up in the rad).	
Check oil thermostat and oil filter are secure and no leaks.	
Check oil breather line to oil/air separator and return installation and lines do not create traps	



Oil/air separator is clear of heat and 'active air flow' to the breather point	
Double check the dipstick is returned and locked	
Oil Radiator secure and isolated from vibration	

Fuel Circuit/Routing

Have fuel lines been flushed post make up and pre-connection to engine?	
Are all fuel lines secure and protected from mechanical damage, including fretting?	
Are the fuel tank and all related fuel system material(s) suitable for the fuel being used?	
IS the fuel supply line to the fuel pump at least 12mm ID (often 'blue line')?	
Are all connections suitable at the engine side (AN/JIC -6)	
Are all supply lines connected?	
Is the Fuel return line from engine at least 6mm I.D. (8mm suggested) (AN/JIC-6)?	
Is there a non-return valve fitted on the fuel return line to prevent fuel loss via a broken return line after shutdown IN THE CORRECT SENSE?	
Check for pre-filters (100 micron) BEFORE the fuel pump(s). Check security of filters.	
Fine fuel filter (15 micron) installed after the fuel pump(s) and BEFORE the engine. Check security of filter.	
Is there a fuel pressure sender installed between pumps and fine filter? (Optional)	
Is there a fuel pressure sender installed between filter and pressure regulator (if so note if on filter or fuel rail)	
Is there a warning to 'Wait for fuel pressure to subside before working on fuel rail' visible in the engine compartment?	
Are all fuel fittings secure, protected from mechanical damage (e.g. fretting) and appropriate?	
If header tank is fitted, does it exceed 2litres?	
If dual tanks (without header) is the fuel selector duplex (ensures return of fuel to tank fuel is taken from)?	
In all cases, is the fuel return such as to reduce immediate pick-up of 'hot and vapour rich' returned fuel?	
Are fuel lines protected with fire-sleeve or other mechanical protection, where appropriate?	
Are fuel pumps fitted with fire-protection/mechanical protection cover (especially if fitted fire-wall forward)? [note this is not a ULP requirement]	
Double-check firewall passage of fuel lines for security and protection	
Check pressure regulator line to the airbox is secured and without signs of damage	
Confirm that the return line CANNOT be 'shut off' or restricted	
Is the fuel system compliant with the latest ULPower Installation manual?	



Exhaust

Exhaust suitable for the engine?*	
Is exhaust tail-pipe secured to reduce vibration and load?	
Are the exhaust muffler brackets installed and secure? (drop down supports)*	
All EGTs at roughly the same distance from the cylinder head?	
All EGTs are fitted with to ensure not 'pointed upwards'	
All springs fitted and wire-locked as appropriate?	
All manifold bolts tightened appropriately?	
All joints 'anti-seized'?	
Heat protection present in areas where needed close to exhaust? (pay particular attention to the engine mounting rubbers on lower mounts)	
Are the exhaust gaskets fitted ?*	

Other

Is the ECU air pressure port routed to a suitable location? *	
Are RAM-AIR ducts secure and appropriate?	
Auxiliary equipment installed and secured correctly	
All torque values declared as respected by builder (prop, engine, etc). Cross check if at all unsure.	
If VP or CS prop, check installation of pick-ups for security and protection.	
Check cowling does not fret or rub on engine	
Check idle stop on engine is secured	
Is the ULP capacitor installed?	
Are EGT senders fitted?	
Are CHT senders fitted?	
Have EGT/CHT senders been calibrated (checked when dipped in boiling water)	

LED installation and function

The ULPower engine ECU supports/Recommends the following	Colour	Present	Functioning
ECU ON (normally GREEN)			
LOW-POWER to ECU (normally RED)			
SENSOR FAULT (normally RED) (can be triggered by sensor disconn.)			
LEDs MAY be installed to note Fuel Pump 'on' (NB: both pumps should not be on for extended periods – and should be placarded)			
MAIN fuel pump (normally GREEN)			
AUX fuel pump (normally GREEN)			

***Not applicable to turbo engines**



For turbo – engines only

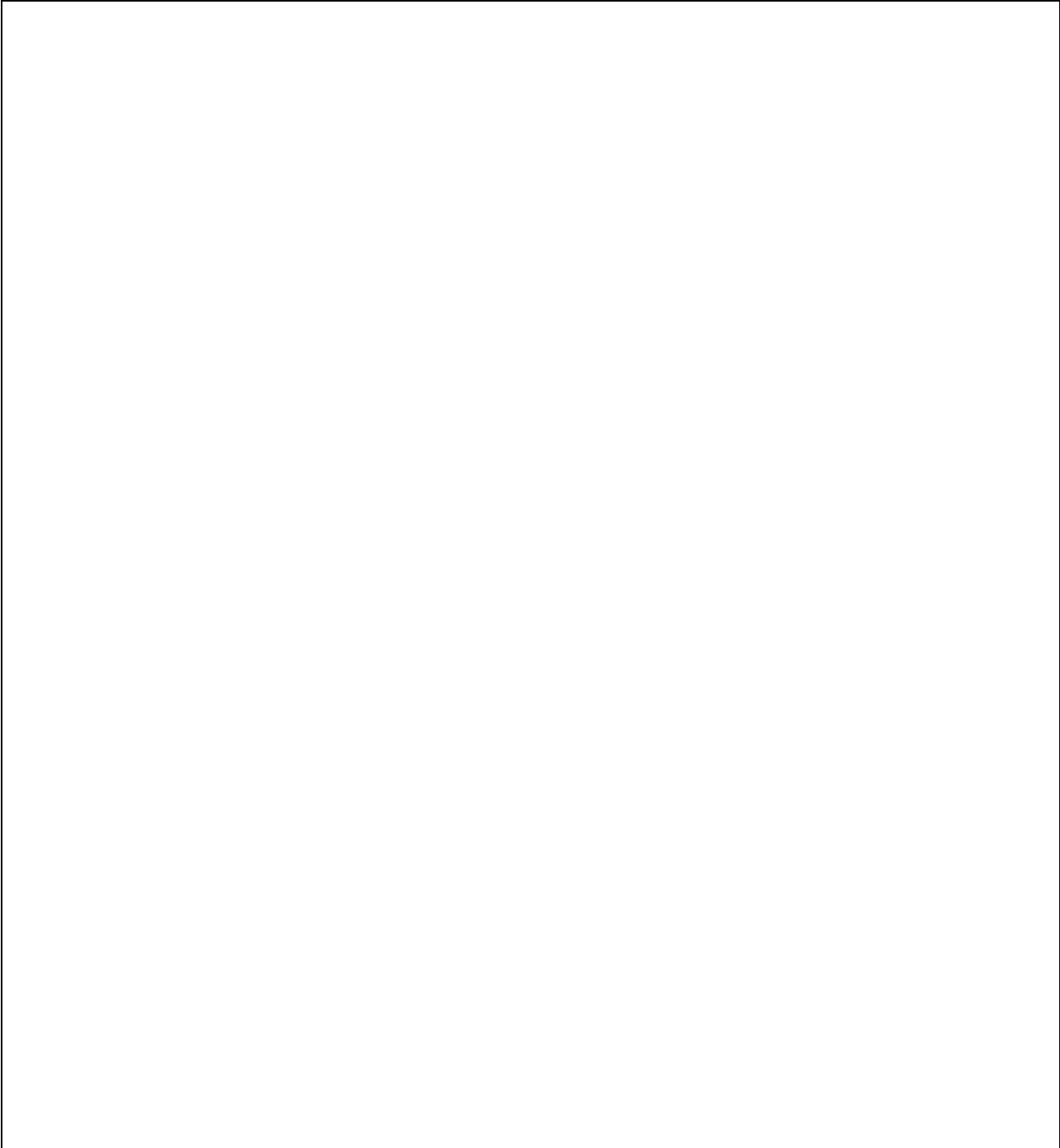
Check pneumatic connection : Turbo pressure to ECU (away from heat !)	
Check pneumatic connection : Turbo pressure to Boost control valve	
Check pneumatic connection : Boost control valve to Wastegate	
All pneumatic + electric connections must be routed away from heat	
Filter wastegate not obstructed ?	
Boost control valve electrically connected ?	
Boost control valve venting (filter) to ambient air ?	
Heat protection in areas near turbocharger ?	
Check connection induction system	
Suitable intercooler according to min. requirements ULPower ? (see IM)	
Intercooler mounted with anti-vibration mounts ?	

Other Comments



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TEST RUN

Prior to test running any engine, please ensure that all personnel are briefed on the procedure, and that the test run area is clear of FOD, personnel, animals and other risks. The aircraft should be suitably restrained from unintended movement (chocks, etc), in a suitable location, with a suitable fire extinguisher on hand, as well as material for clearing potential oil and fuel spillages. Emergency shutdown options for the ULPower engine range include switching off Ignition switches, switching off the ECU, switching off the fuel pumps and switching off the fuel tap, in order of speed of shut down potential. **DO NOT TEST RUN THE ENGINE UNLESS A SUITABLE PROP IS INSTALLED AND YOU ARE SUITABLY TRAINED IN STARTING UP AND SHUTTING DOWN THE ULPower ENGINE AND ITS OPERATION.**

Pre-TEST RUN

IF available, connect a ULRead cable and computer running ULRead and carry out parallel checks during at least part of the run.	
CHECK ECU:	
Check that ignition switches are OFF (ie 'closed circuit')	
Check that fuel pump switches are OFF (ie 'open circuit')	
Turn on Master power	
Turn on ECU – ECU LED lights should light up	
Switch off Master and ECU.	
CHECK FUEL FLOW:	
With Master power OFF and all circuits OFF...	
Remove the fuel connector from the RETURN side of the engine (after NRV if possible) and run to a suitable container to collect fuel (at least 5litres capacity)*	
Switch Master to ON	
Switch MAIN fuel pump ON until fuel flows without bubbles	
Turn OFF MAIN fuel pump, establishing fuel flow ceases.	
Repeat procedure for AUX fuel pump	
Proceed to measure fuel flow in litres over 1 minute from each of the fuel pumps individually, and both together, record in table below	
Switch OFF fuel pumps and Master power	

*NOTE: the fuel system UP TO the engine inlet MUST have been flushed before this operation – see check list above

MAIN fuel pump fuel flow over 1 minute		l/min	X 60 =		l/hr
AUX fuel pump fuel flow over 1 minute		l/min	X 60 =		l/hr
BOTH fuel pumps fuel flow over 1 minute		l/min	X 60 =		l/hr

If returning collected fuel to tanks, filter prior to returning.

Confirm fuel flow is equal to or exceeds 120 l/hr in all configurations	
Fuel rail pressure must be min. 3 bar AND stable (engine OFF).	
Reconnect fuel line and cross check	
If possible, with the engine switched off (with both fuel pumps switched on),	



measure the pressure on the output of the fuel pressure regulator (return line) – it must not exceed 1 bar (relative to ambient pressure).	
With the fuel system reconnected, switch ON the Master and Back-up power, and then ONE fuel pump. Allow the system to pressurize.	
If Fuel pump control relay is fitted, check for 15 second pump shut off.	
Check all circuits for signs of leakage.	
Check that fuel is returning to tank of pick up (header or selected tank, change selected tanks if necessary to confirm appropriate return.	
Switch OFF fuel pump, Back-up power and Master	
Make a final check for fuel/oil leaks before proceeding.	
With the propeller area clear, all loose items secured and with appropriate briefing of all concerned, ensure that the aircraft is in a 'ready to start' configuration.	

TEST RUN

<p>Start up procedure: after appropriate pre-start checks (Throttle full and free, Trim set to T/O, Fuel on and to the correct tank, flaps full free movement, symmetrical, and away, full and free on all controls in all directions, gyros and gauges in good condition, hatches and harness, clearances as required, comms as required, safety lookout, security x-check, etc – or as appropriate, proceed as follows (unless indicated otherwise in the POH)</p> <ol style="list-style-type: none"> 1. Master ON 2. Relevant power on to enable EMU/EFIS (to be able to monitor engine) 3. EMU ON (wait for it to boot) 4. ECU ON (LED witness) 5. IGNITION switch ON FOR IGNITION COIL 1 ONLY (Coil 2 OFF) 6. MAIN FUEL PUMP ON (it should energize, and off in 15 seconds if Fuel Pump relay is fitted) 7. Simultaneously, listen for fuel pump to energize, pressure to build and stabilize, possibly hearing return fuel to the tank 8. Final look out, and Shout CLEAR as appropriate 9. Set throttle to idle + 10% 10. Press START (max 5 seconds, if necessary wait 15 seconds then retry) 11. Set to approx. 1200 rpm 12. Check oil pressure – if not present/rising in 5 secs shut down immediately 13. Check Fuel Pressure (2.4 to 3.8 bar) 14. Monitor engine and if possible note the electrical output 15. Check all temps and pressures – if out of range SHUT DOWN 16. Repeat above steps with ignition coil 2 ON, ignition coil 2 OFF 17. Repeat again with both coils (1 +2) ON. 	
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<p>IGNITION AND PUMPS CHECK – this replaces Mag checks on this type of engine. NOTE there are no magnetos, and there is NO mixture control, it is managed automatically by the ECU.</p> <p>With the engine warm, and engine running smoothly at around 1,500 rpm and both ignition coils ON, there should be no warning lights or other out of range conditions.</p> <ol style="list-style-type: none"> 1. Switch OFF one of the ignition switches and check/note rpm drop 2. After a few seconds, switch back to ON. Max. 5% drop of RPM. 3. Switch OFF the second ignition switch and check/note rpm drop. Max. 5% drop of RPM. Switch back to ON. 4. Switch ON the AUX fuel pump, ensuring that there is no noticeable difference in engine output (if there is, there may be a fuel pressure/volume issue) 5. Allow the engine to run on both pumps for around thirty seconds 6. Switch OFF the MAIN fuel pump, ensuring that there is no noticeable difference in engine output (if there is, there may be a fuel pressure/volume issue) 7. Switch ON the MAIN fuel pump and switch OFF the AUX fuel pump. <p>The above is for ground checking and is not a complete 'flight-check', albeit the basis thereof. Refer to the POH for more details.</p>	
<p>Without increasing engine revs over 1,500, and having run the engine for around 5 minutes, shut down the engine</p>	
<p>Shutting down procedure option B</p> <ol style="list-style-type: none"> 1. Idle (approx. 850 rpm) the engine 2. Switch off unnecessary electronics 3. Switch off ECU - engine should stop immediately. NB IF FCPR is fitted to running fuel pump it should shut off also. 4. Switch off fuel pump(s) switch(es) 5. Switch off master, etc. 	
<p>CHECK ALL SYSTEMS – especially for oil/fuel leaks and items coming loose/vibrating/fretting etc.</p>	
<p>IF all is good, you may start the engine up again. It should start much easier the second time (warm).</p>	



RPM / Stops check

You may now check the RPM range for your prop, and also establish the idle setting. Refer to the airframe manufacturer for the desired setting. NOTE the setting set before completing this checklist.

During these checks you MUST monitor temps and pressures. This is a new installation. If temps or pressures rise suddenly or error lights come on– shut down, unless you know WHY and are prepared to take the risks associated with continued running.

If a VP/CP prop it is prudent to test possible on the ground. It should be noted that installations will NOT be able to reach full power on the ground unless suitably restrained and located away from areas where damage to aircraft, persons or other property may occur. If it has not been possible to reach full power on the inspection, please not max RPM reached on tests.

This inspection was carried out by _____ Inspector number _____

Signed _____ Date ____ / ____ / ____

We suggest that each check item above is noted and signed by the person carrying out the installation check, stamped if appropriate with their inspection stamp.

Other checks may be carried out as appropriate, in accordance with the installation and operation manuals or your respective OEM/association/authority.

Most aircraft EMUs will record the data from the test run, which can be printed out and attached to this document. Likewise, a ULREAD screenshot may be a useful addition.

Remember: Safety is NO accident!