User Manual
EOS 150

Introduction

Thank you for having purchased an **EOS 150** engine! It can proudly be said that most probably the EOS engines, all models, are the ones with best weight to performance ratio on the market today. Extensive development done by enthusiastic engineers being pilots themselves together with the use of only highest quality materials and best workmanship of every single component have led to this outstanding state-of-the-art product. EOS engines are made in Austria, assembled with care by experts.

- EOS engine - light weight and reliable power -

General Description

The **EOS 150** is a one cylinder 2-stroke engine, forced air cooled, with Carbon housing, diaphragm carburetor, manual start, belt drive reduction, centrifugal clutch and chromium exhaust with Aluminum silencer. It has been designed to fit the Paramotor, light single seat Paratrike, Nano Trike with Hangglider and various other special applications for Paraglider and Hangglider motorized flight craft.

Picture / Overview

EOS 150

(picture may diversify due to small changes by continuous development)

Technical Data

EOS 150

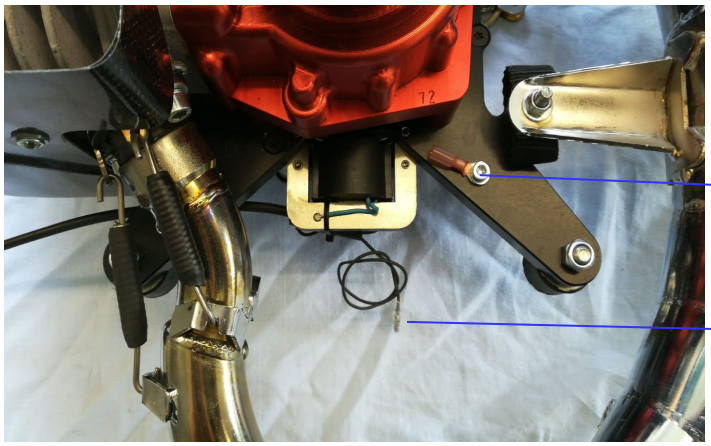
engine	one cylinder 2 stroke
displacement	154cc
stroke	52,5mm
bore	61mm
compression ratio	1:10,5
gear ratio of belt drive	1:3,5
carburetor	membrane Walbro WB37
spark plug	NGK BR9HS, B9HS, BR10HS, B10HS
power	25,7HP (18,9KW) at 9000RPM
thrust	>66kg / >70kg 125cm / 130cm prop
starter	rope hand starter / EASY-STARTER
cooling	fan cooling
average consumption	3,3 - 4l/h
fuel inlet	membrane, fiber Reed valve
air inlet	HIFLOW-SHOT air box
fuel recommendation	unleaded 98 Octane (min. 95 ROZ)
fuel mixture	2%
2-stroke oil	full synthetic
weight (w.o. exhaust)	9,85kg
weight (with exhaust - all complete)	12,2kg
exhaust	Nickel plated
max. build-in length	21cm
dimensions	57x34x25cm
propeller recommendation (rotation anti clockwise) diameters 125cm or 130cm	EOS P&T Carbon 2 blade

Build Engine to Frame

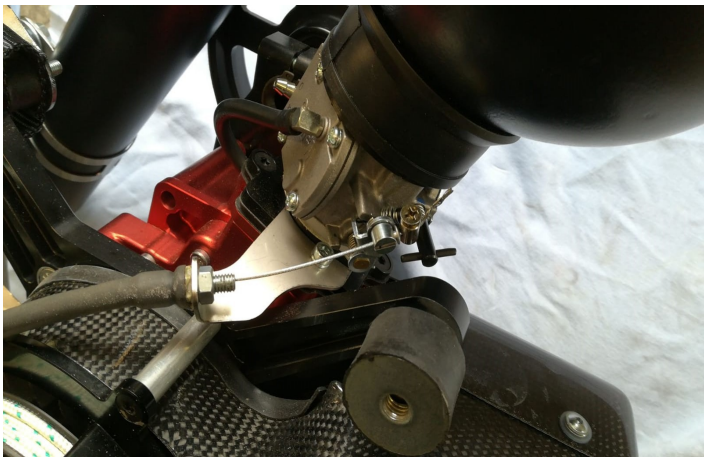
It varies depending on frame and craft design. But generally, engine should be mounted by using the four attachment points of the main support bracket and using the four rubber

dampeners which come along with the engine as standard supply.

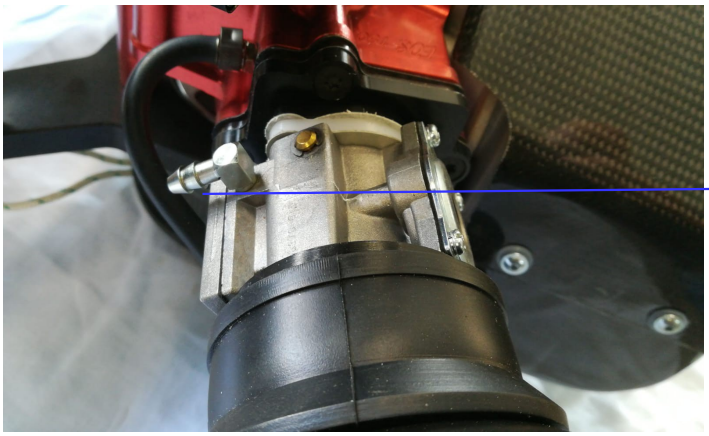
Connect engine ignition kill wires to throttle cable (see picture);



Connect throttle cable to carburetor (see picture);



Important note! - connect fuel line with appropriate inner diameter 6mm (see picture), put tube over nipple only, no extra additional fitting needed. Check for a proper air-tight fit.



Place air box to carburetor adapter and well tighten connection with hose clamp while turning air inlet in direction of cylinder or further backwards (not facing to the propeller).

Starter rope to place in right position and with correct tension (see picture);

remove cable binding
after starter rope installation

Place propeller centering hub to drive wheel (see picture) when mounting the propeller;

Important note! - use the proper bolts (not coming with the engine) with proper lengths (metric M6, Inbus type with washer, min. 8.8 quality) where the thread of the bolt goes min. 15mm and max. 25mm into the thread of the drive wheel.

Propeller

Please use only appropriate propeller types fitting the engine's parameters. Despite of the diameter in use, the max. RPM should not go much higher and not much lower than the mentioned data in the tech. data listing. Wrong propellers may lead to damage of the engine and will for sure not grant the desired power and thrust. Therefore, we recommend to use the propellers as per our accessories offers. The use of other / wrong type of propellers will result in invalidity of the warranty for the engine!
If a propeller gets damaged and out of balance causing the engine starting to shake and vibrate more than normal, we strongly advise to change it to new as serious damage may occur to engine and especially to engine mount, drive shaft and bearings.

Spark Plug

Install the appropriate spark plug type what comes along with the engine delivery.

Fuel, 2-stroke Oil and Fuel Mix

Use fuel with min. 95 ROZ (unleaded or leaded) or higher only.
Recommended 2-stroke oil quality is either half synthetic or full synthetic with the following specifications; API-TC (TSC-3); JASO FC or JASO FD

fuel mix

run-in procedure, first 3 hours operation	approx. 2.5% / 1:40
regular operation	2% / 1:50

Please note! - every engine has been test run and carburetor settings have been pre-adjusted properly (standard setting) prior delivery. Nevertheless, further individual adjustments of the jets (H jet and L jet) may be necessary. See closer descriptions later on.

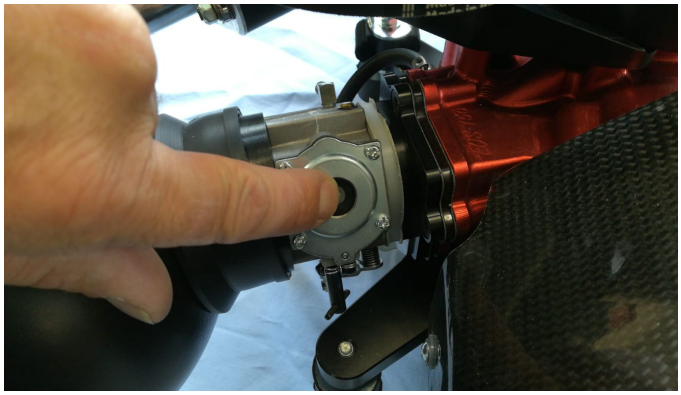
Starting the Engine

The carburetor is pre-adjusted right and the setting should work in general as it comes.

cold engine
Press the membrane on the carburetor (gentle!) and with the in the fuel system installed rubber hand pump bring up fuel in the fuel line until you can see the fuel entering the nipple on the carburetor (transparent fuel lines are recommended therefore). Do not pump more/any further. Then release the membrane. Press the rubber hand pump once more to build up fuel pressure in the fuel lines. Then after that press the membrane on the carburetor again one time what results in filling the chambers of the carburetor with sufficient fuel but not flooding the engine.
Start the engine by pulling on the starter until the engine starts, no throttle. In case there should be insufficient fuel in the system you can try with 10% throttle.

warm engine
Start the engine by pulling on the starter until the engine starts, no throttle. In case there should be insufficient fuel in the system you can try with 10% throttle.

Important note! - never press the membrane with to much force.
Important note! - do not over-float the carburetor as in consequence the engine gets floated and then it will be very difficult to start it.



press membrane

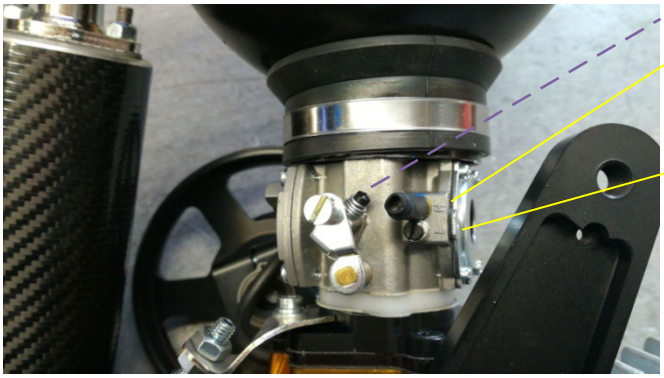
Stopping the Engine

Release throttle, press ignition kill switch. As an emergency procedure, if any failure with the ignition kill switch or wiring, close the air inlet of the air box with your hand and engine will stop quickly. **Caution!** - well take care of the propeller.

Adjustment of the Carburetor

The **EOS 150** is equipped with the type Walbro WB 37 (modified), no choke.

Standart settings;
L jet adjuster screw: 1 1/4 turns out (anti clockwise) - 1 turn and 15 minutes
H jet adjuster screw: 1 1/4 turns out (anti clockwise) - 1 turn and 15 minutes
Pop Off pressure: 11 PSI
Lever distance: 1mm



idle adjuster screw
H jet adjuster screw (sealed with shrink tube or laquer)

L jet adjuster screw

For general understanding;
The engines come pre-adjusted from the factory in Austria with above mentioned standard settings. These are "safe" settings rather on the rich side, for a rich combustion. These resulting in a spark plug picture being on the rather "black" side - please see figure at the end of this chapter - picture from #14 "best" in direction to left/up/rich. The Austrian factory being on a certain area in a certain altitude MSL (mean sea level), but also in changing conditions of air temperature and humidity. Therefore whenever the engine being operated at another location / in other conditions there is practically need of doing re-adjustments of L jet and H jet screws. As a general rule please note;
- combustion getting richer when;
- - engine operated in higher altitudes above MSL
- - engine operated in warmer air temperatures
- - engine operated in more dry (less humidity) air conditions
- combustion getting leaner when;
- - engine operated in lower altitudes
- - engine operated in colder air temperatures
- - engine operated in more humid air conditions
A slightly to rich engine setting is no problem and safe (spark plug pictures #9-#13 / figure end of this chapter). A far too rich setting resulting in rough engine run, not reaching max. RPM and has lesser power, dying at idle. Worse start up then normal. Impurifying the engine, excessive oil may come out from the exhaust. Higher to even excessive fuel consumption. Debris building inside the combustion chamber (piston, head). BUT; no damage to the engine can occur!

CAUTION(!); - In opposite, a too lean setting will lead to a soon or even instant(!) engine overheat and damage (hole in piston head, seizing). All onward pictures #21-#29 / figure end of this chapter indicate a to lean up to a way to far to lean setting.
We recommend to aim to reach a spark plug appearance as per pictures #11-#14 by adjusting the H jet accordingly!

If you have any problems or doubth for a correct engine setting, go back to the standard H-jet and L-jet setting as above described and consult with an expertised person and/or your dealer!

Please note; - With a wrong setting of the L jet adjuster screw the engine cannot get damaged. Hovever, with a wrong setting of the H jet adjuster screw very quick (only in case too lean)! The setting of the L jet will not influence the spark plug picture!

<u>spark plug pictures - steps from rich to best;</u>
(H jet adjuster screw only!)
- in 5min. turn steps (clockwise) - each of this step will "jump" about over about 4 pictures

<u>spark plug pictures - steps from best to hot / lean;</u>
- in 1min. turn steps (clockwise) - each of this step will "jump" about over 1-2 pictures
CAUTION(!); - do not proceed with 5min. turn steps(!). Do not exceed a 3min. turn clockwise from the optimum spark plug picture towards lean as here already the engines starts to run too hot with danger of damage!

=> turning the jet adjuster screw clockwise will go from rich to lean (H and L)
=> turning the jet adjuster screw anti clockwise will go from lean to rich (H and L)

=> the L jet influencing idle to low/medium RPM combustion
=> the H jet influencing medium to high and full RPM combustion

Remark; - To get indication from the spark plug there is need to run the engine at full power from 3min. constant run onward. Engine runs in low or medium RPM will not considerably change the spark plug picture and/or bring a usable result. But also do not run the engine excessively at full power as 3min. or 3-5min. is enough!
CAUTION(!) - run the engine safely fixed on ground with appropriate distance to the propeller! Or run it on your back only.

If you feel your engine starting and runing fine, idles well then stay with the standard factory settings. In case you have problems with idle run, bad acceleration, low power and not reaching max. RPM, seeing a wrong spark plug picture then proceed with adjustements of the L or H jet or both. Also make sure you have a correct setting of the idle adjuster screw!

Remark; - Make sure you have a correct and a from EOS engine recommended propeller installed! A not with the engine matching propeller will never allow a correct engine run!
Make sure you have a correct fuel/oil mix! A too oily mix will not allow a correct engine run.
CAUTION(!) - A to poor oil percentage will make the engine seize! Make sure you have a fresh good working and correct type of spark plug!
For adjustments proceed as follows;
- adjustment of the idle screw
- adjustment of the L jet screw
- adjustment of the H jet screw

starting from the factory settings; L jet adjuster screw 1 1/4 turns out (anti clockwise) and H jet adjuster screw 1 1/4 turns out (anti clockwise)

To start the tuning procedure;
After having checked and/or set the jets to standard settings, start and run the engine in low RPM until warm. Check idle run and if needed ajust the idle adjuster screw until you reach a smooth constant running with about 2000 RPM.

1st step - L jet
Activate throttle by quickly accelerating the engine and quick releasing the throttle therafter, watch how it comes back to idle each time …

… acceleration is fast and even, engine run comes down to idle quick and stays at proper idle	no adjustment needed
… engine run comes down to idle quick but engine kills	to rich setting, turn in clockwise the adjuster screw
… engine run comes down to idle to slow but then stays at idle (and/or idle run is unstable and "dancing"), and acceleration is not fast enough	to lean setting, turn out anti clockwise the adjuster screw (mostly from that point a 5min. turn out anti clockwise then is the right setting)

Make changes of the adjuster screw in 5min. turn steps only and re-try procedure until finding the right setting. There may be need to also re-adjust the idle adjsuter screw after having made to big adjustments on the L screw! Both settings have to be balanced together.

2nd step - H jet
Go to max RPM / full throttle for 3min. (3-5min.) and afterwards stop the engine. Check the spark plug for color …

… compare to the sample spark plug pictures below	if matching a picture from #11 - #14 no adjustment needed
… spark plug pictures like #10 or #9 or lower	too rich setting, turn in clockwise the adjuster screw

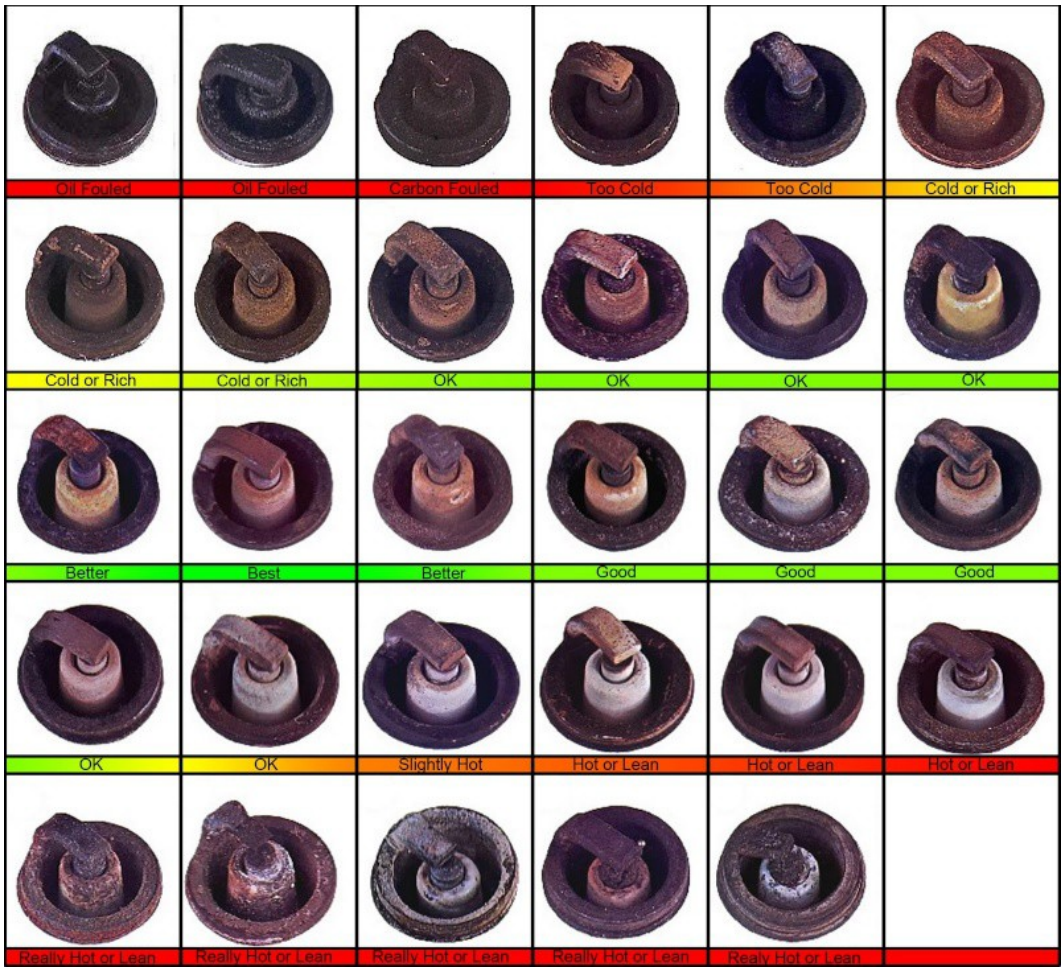
Make 5min. turn steps (clockwise) - each of this step will "jump" about over about 4 pictures
And again …
Go to max RPM / full throttle for 3min. (3-5min.) and afterwards stop the engine. Check the spark plug for color …
(see advices written before)

… compare to the sample spark plug pictures below	if matching a picture from #11 - #14 no adjustment needed
… spark plug pictures still "to black"	to rich setting, turn in clockwise the adjuster screw

Continue until you have the perfect result.
Please note; - Starting with the standard setting of the L jet should never show a too lean spark plug picture but good or too rich only. In case nevertheless you see a too lean spark plug picture …

… compare to the sample spark plug pictures below	if matching a picture #15 to higher, then as a fist step turn out anti clockwise the adjuster screw for 5min.

Continue until you have the perfect result.



first picture up left is #1, last picture down right is #29, "best" is #14

Clutch and Propeller

Even if the idle is set correct and RPM is low (under 2.500 RPM, or even under 2.000) and clutch is not engaged the propeller still may turn slowly. Particularly this happens when;

- engine is very new
- propeller is especially light weight

The reason is the friction of the bearings from the clutch bell, sitting on the turning crank shaft. The more the bearings get used and loosing friction, the lesser the propeller will turn at idle.

Break-in Procedure on a new engine

If no beak-in procedure will be conducted generally the engine should not get damaged or fail but this procedure may improve the performance and durability of the engine though.
CAUTION! - an operation in max. RPM for a longer period of time on any new and/or cold engine however may lead to engine damages!
Therefore we recommend to follow the procedure as described.

Any new engine should be treated with special care within the very first approx. 5 hours of operation, say until the first about 20 Liters of fuel are burned. It is recommended to use a fuel mixture ratio of 2,5% (1:40) during the break-in procedure.

Warm-up (general advice for a procedure before any flight operation of an engine);
Start the engine and accelerate gently until about 20-30% throttle and let it run in this range for about 1-2 minutes, then after that go several times to idle to check if it is set right else make the necessary adjustments to have a perfect idle run (see chapter how to set the carburetor in the manual). Finally accelerate the engine up to full throttle, about 5-10 seconds, go back to idle, full throttle again for about 10-20 seconds.
Warm-up procedure is completed.

CAUTION! - the break-in procedure should be conducted with factory jet settings (L-jet and H-jet in positions as the engine comes new, as described in the manual). Well take care that the fuel tank is filled with sufficient quantity and will never ran out within the duration of the break-in procedure!

Break-in;
For the corrt break-in procedure you need a proper installed and working RPM tachometer and a watch to check each duration of the suggested sequences.
After warm-up, operated on the ground;
Step 1 -
4.000 – 5.000 RPM – 5 minutes, after that back to idle for 1 minute
6.000 RPM – 3 minutes, after that back to idle for 1 minute
7.000 RPM – 2 minutes, after that back to idle for 1 minute
8.000 RPM – 1 minute, after that back to idle for 1 minute
about 9.000 RPM = full throttle – ½ minute
After that stop the engine and let it cool down between 10-20 minutes and repeat the Step 1 procedure again for a second and thereafter for a third time. After all is completed, make a general check of the engine, check all componets and bolts and fuel system for air tightness. Remove spark plug and check the condition and color (we refer to the chapter carburetor setting in the manual and the different spark plug pictures).
Step 2 -
Start to use the engine in flight by always gently accelerating, avoid full throttle operations over a longer period else than ½ minute. Try to operte the engine in various RPM runs and not using staedily same RPM ranges. Never make flights longer than about ½ hour and carefully check the engine after every flight for loose bolts, general check of the components, check for possible oil leaking on cylinder. Check fuel system and filter.
The Step-2 operation and in consequence the whole break-in procedure is completed once you have reached about 5 hours of opertation and/or about 20 Liters of fuel burn. Go back to 20% (1:50) fuel mix ratio.
REMARKS! - We assume that the engine installation has been made properly by experts and fuel system as well as wiring system is without failure. Fuel tank to be double checked for proper ventilation that under no circumstances vaccum can occur. Only quality fuel with enough Octane and only quality 2-stroke oil as per recommened specifications to be used. All bolts fastened and no loose items. Correct propeller installed, hub bolts tight. Only persons with proper knowledge to conduct the break-in procedure and the unit should be well under control during ground operation (Step 1). If the unit cannot be properly secured on ground it is recommended to conduct Step 1 by having the unit on the back of the person/pilot. If any other person(s) present during ground operation of Step 1 to be warned about the danger of the propeller!

Engine operation

Whenever you begin to operate the engine at a new time, well take care of;

- pre-flight check (according to the Paramotor unit or other aircraft manufacturer's advice)
- check for proper fuel quality and fuel mix
- never run the engine without propeller
- well warm up the engine before flight – **respect the propeller!**
- check before flight if warm engine running well in all RPM's – **respect the propeller!**
- check before flight if engine well running at idle with proper low RPM
- listen to any possible strange noise what may predict a fault whatsoever
- never run the engine under full power excessively

Have pleasant flights with your new EOS engine! - Fly safe and respect the propeller!

Maintenance

maintenance table

	before every new use	after first 5 hours	every 25 hours	every 100 hours or every year	after 200 hours
rubber mounts	check			replace	
screws and nuts	check				
throttle cable function	check				
ignition kill switch function	check				
fuel system	check				
air box rubber fitting	check			replace	
drive belt	check		replace		
spark plug cap fitting	check				
carburetion and combustion / spark plug image		check	check		
spark plug		check	replace		
muffler springs			replace		
carburetor membranes and gaskets			check	replace	
starter rope / or complete starter				replace	
fuel lines				replace	
Reed valve				replace	
exhaust silencer dampening material				replace	
piston and rings					replace
crankshaft bearings					replace

Combustion and Spark Plug Image

The way the spark plug looks like showing you the quality of combustion. With a correct combustion the engine is giving best performance and life span of the engine will be longest. Generally speaking, a too rich setting will never kill the engine but making it perform improperly, causing a rough run and making the engine shake in low and medium RPM's. Exhaust will smoke extensively and oil dropping out. In long term spark plug getting soiled making it fail and accumulation will affect piston and cylinder head.
A too lean setting will result in increased abrasion of piston, rings and cylinder and giving insufficient lubrication to bearings. Engine temperature increases resulting in a generally too hot engine run and damages may occur soon. A far too lean running engine will fail quickly or even instantly (piston head surface getting burned and forming a hole, resulting in instant loss of compression and engine stops, or piston and rings start to scratch cylinder surface and seize).

If the spark plug of your engine showing a far too rich or far too lean combustion;
– check for proper fuel/oil mix
– check your fuel lines and filter (no kink in fuel line, no leaking, no air coming into the line system, no air bubbles, no dirt in filter blocking fuel flow)
– check fuel tank vent (no vacuum)

– check if spark plug type is the right one
– check for correct settings of the L-jet and H-jet adjuster screws
– original air box with original air inlet installed to engine (tight fit of collar)

If all above correct but still improper combustion, then there may be a general fail function of the carburetor. Change membranes and gaskets. If still improper combustion, consult with your dealer/Paramotor/aircraft manufacturer for assistance (or EOS engine if the agent cannot help).

(See chapter Adjustment of the Carburetor)

Troubleshooting

problem	possible reason	solution
the engine does not start	lack of fuel	add fuel
	fuel does not reach the carburetor	check the fuel lines, connections, filter, bulb pump, remove air inside the fuel system open tank ventilation valve
	flooded engine	remove spark plug, dry and clean it, pull starter several times (no throttle) and re-install spark plug
	no spark	replace spark plug, check spark plug cap fit, check wiring for possible short circuit
	sufficient fuel, fuel reached carburetor, no flooded engine, spark plug working - but still no start	follow advice in the beginning of the manual - in case of still no start - check carburetor for proper function and eventually replace membranes and gaskets
no idle run	improper setting of idle adjuster screw and/or low jet adjuster screw	follow advice in the beginning of the manual
	defective spark plug	replace
no stable idle run	wrong adjusted low jet	follow advice in the beginning of the manual
	air through the gaskets	tighten screws and bolts, eventually replace gaskets
engine does not reach maximum RPM	propeller does not fit engine parameters	replace by correct propeller
	defective spark plug	replace
	to rich setting of H jet	adjust according to instructions
	to oily fuel mix	replace by correct fuel
	failure in fuel system	check fuel lines for kink, check connection for air tightness (bubbles in the fuel lines), check filter, check if tank vent open
	defective carburetor	check function, check for dirt, possibly replace membranes and gaskets
	defective Reed valve	replace

Main Torques Catalogue

- in NM (Newton meter)

M4 bolt sizes	8
M5 bolt sizes	12
M6 bolt sizes	14
M7 bolt sizes	16
M8 bolt sizes	22

Important note! - Any screw or bolt or nut what may get unscrewed, removed and re-installed needs to get secured – as a general advice – by screw glue Loctite 243 (blue).

Repairs

Any small repairs whatsoever what can be fixed by common sense and without expertise may be conducted by the owner. Any other repairs may need extensive knowledge about high performance 2-stroke engines and Paramotor engines in general (most mechanics for normal 2-stroke engines may not have the sufficient experience) and therefore we strongly recommend to consult with your dealer/Paramotor/aircraft manufacturer for assistance (or EOS engine if the agent cannot help).

Parts Lists

We refer to our web site *www.eos-engine.com* where the up-to-date lists can be found. In any case, consult with your agent for your spare part needs.

Storage of the Engine

If you would like to store away the engine for a longer period of time for proper preservation we recommend to do the following;

- empty the fuel tank and all fuel lines, also the carburetor
- remove the spark plug and fill in about a tea spoon quantity of pure 2-stroke oil
- slowly pull on the starter rope for several strokes/turns
- re-install the spark plug
- plug the hole of the exhaust / silencer
- plug the hole of the air inlet
- spray the engine outside with WD40 oil spray, you can spray all parts whatsoever (except do not spray the pulley and the drive wheel / inside of the belt area)
- store away at a dry(!) place
- cover engine with blanket

Warranty

EOS engine grants warranty for the period of 1 year onward the exact date the engine has been delivered out and left EOS engine Austria. The warranty includes engine, spare parts and labor involved for any upgrades and repairs. No refund for shipping forth and back. Warranty is void under the following circumstances;

- any changes or modifications made which were not conducted by EOS engine
- use of non-genuine parts
- improper maintenance
- operation without propellers
- operation with not suitable propellers
- electrolysis and corrosion
- fire or crash or improper operation
- corrosion, rust, wear through entered water, sand, stones
- damages caused by maintenance through unqualified persons

Caution

Despite it is a high quality product, the EOS engine may fail any time due to any reason whatsoever, it is in the nature of 2-stroke engines in general that they can fail. Such failures may lead to emergency landings and in the following to serious injury or death. Therefore never fly your Paramotor / trike / aircraft whatsoever equipped with the EOS engine in regions and/or altitudes where safe landings with a sudden engine stop are not possible at any time, not hurting yourself or other persons, nor cause any damages to third parties.

The EOS engine is neither certified nor does it meet the requirements for certified aircraft engines, it is not tested for safety and reliability according to airworthiness standards. It should only be used in not certified Paramotor devices, Experimental- or other non certified aircraft and only in such cases where sudden failures do not interfere safety. Aircraft equipped with this engine are only to be used under VFR daylight conditions. The engine is not designed for acrobatics.

The engine will be a part of a craft (Paramotor, Trike, special flying craft) only and the builder of the aircraft where the engine at the end is installed needs to take own responsibility for possible failures due to improper installation or not to the engine fitting components.

Inadvertence during the use of the engine with propeller may lead to serious injuries or death and at any time, during ground operation and/or flight operation, the user or pilot has to pay best possible attention being fully aware of the consequences what may result from improper operation of the engine and propeller.

For the sake of maximum safety we refer to the maintenance regulations and advice of both, the aircraft manufacturer where this engine is built in and the one valid for this engine.

Liability Disclaimer

EOS engine, the owners and all distributors will decline any claims from engine owner and/or engine user or from any related or effected third party for damages or injuries what may arise directly or indirectly by the use of the EOS 150 engine. The owner and/or engine user accepts to take full responsibility by himself and declares to indemnify and hold harmless EOS engine, the owners and vendor.

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EOS 150 — LIGHTWEIGHT & RELIABLE POWER —

by

EOS — ENGINE —

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