Halo-6000

Usage Precaution

V1.0   2022.07

FOXTECH

Contents

Halo-6000 EFI generator features light weight, high output, stable and reliable. As a important part to the UAV propulsion system, Halo-6000 should be on the field after strict preparing and setting.

Please make sure that the use of Halo-6000 is strictly followed requirements below, in case improper use will cause damage to the equipment.

1. Specification

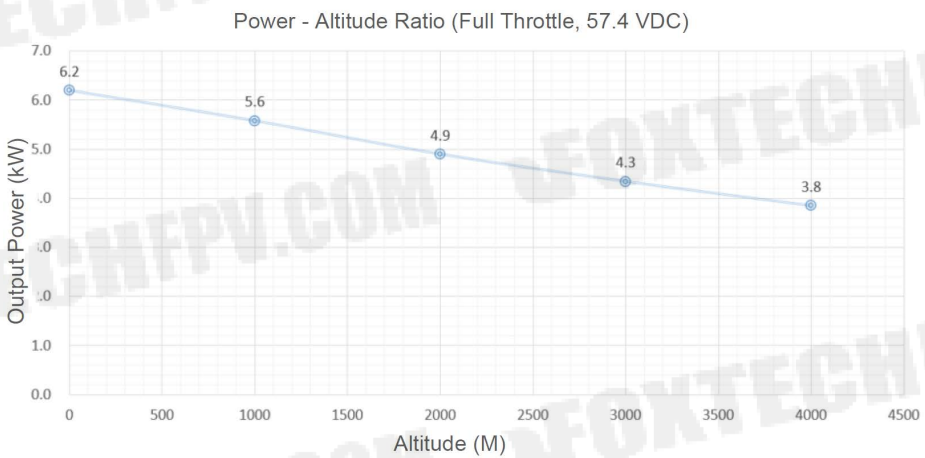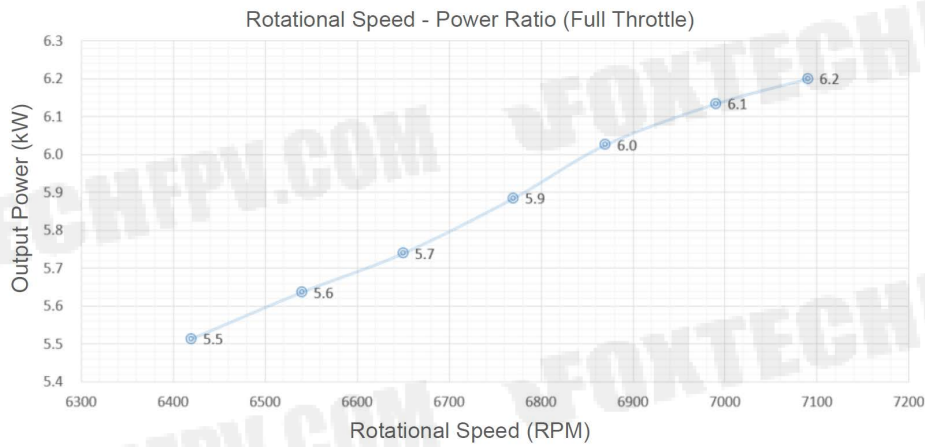| No.	Items	Unit	Parameter Index	Remarks
1	Rated Voltage	VDC	57.4	
2	Rated Power	kW	6.0@ Sea Level	
3	Weight	kg	9.5	Include: radiators, water pipe, water pump, fuel pump etc; Not include: coolant, gasoline, fuel tank
4	Dimension (L x W x H)	mm	312×288×206	
5	Average Fuel Consumption	L/h	5.7	
6	Applicable Models		Multi-rotor	
7	Applicable Power Voltage	VDC	multi-rotor UAV, VTOL fixed wing aircraft	
8	Altitude	m	≤2000	
9	Operating Ambient Temperature	°C	-20 ~ 50	
10	Start Mode	-	Remote Start	
11	Mixing Ratio of Lubricating Oil and Gasoline	-	1:25	Please use the brand oil suggested by the manufacturer.

⚠ **Caution:**

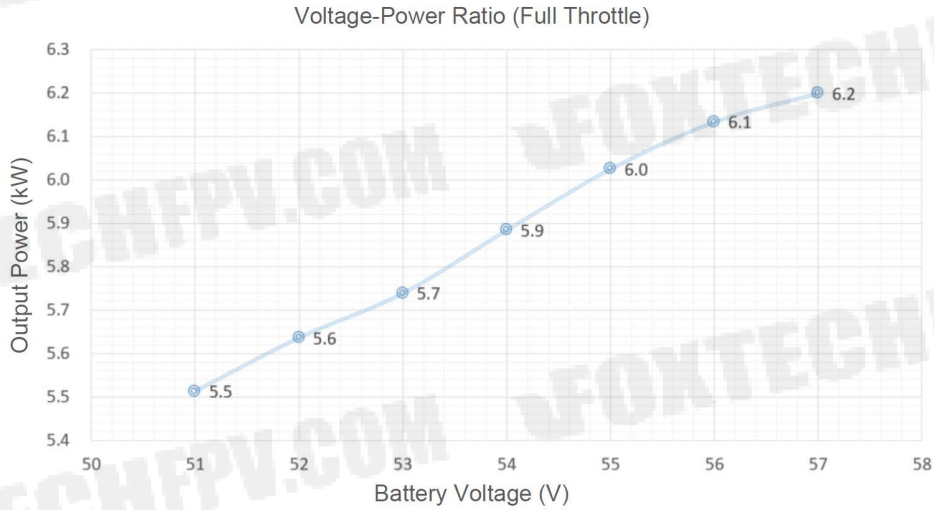**1. We suggest you to use 25L gasoline to run in the generator for the first time of using the Halo-6000 at the ratio of 25:1(gasoline:engine). For everyday use, a ratio of 40:1(gasoline: engine oil)is suggested.**

2.The engine oil used for Halo-6000 shouldbe MOTUL 710 2T, or appointed by Foxtech. If the damage is caused by the wrong use of engine oil, Foxtech will not be responsible for it.

To fit with your drone better, here we provide you several data that is key when using the generation. However, the test results is only of a single equipment, the standard specification is displayed as above.

Voltage-Power Ratio (Full Throttle)

Rotational Speed - Power Ratio (Full Throttle)

Power - Altitude Ratio (Full Throttle, 57.4 VDC)

2. Motor Oil Of Halo-6000

Halo-6000 equips a two-stroke EFI engine, whose gas-motor oil ratio is 40:1. Improper oil may cause serious damage, so please use the motor oil appointed by Foxtech. If the damage is caused by the wrong use of engine oil, Foxtech will not be responsible for it. The testing oil is unleaded 95 #, and we also recommended it to the operator.

1) The injector of EFI engine has a certain requirements of gas and motor oil, hence improper oil will cause jam of the injector nozzle. If so, the generator may stop in the air, even worse, the UAV with the malfunctioning generator won't be able to land safely.

2) Improper motor oil will make the cooling and lubricating of the generator harder, causing cylinder scoring.

3) Improper motor oil will accelerate the speed of carbon accumulation in the engine, or harden the block. The block will happen in lubricating nozzle and affect the rotation of the piston pin, lowering the generator efficiency or causing cylinder scoring.

3. Fuel System Of Halo-6000

During the actual use of the drone, the fuel supply system, including the fuel tank, needs to be cleaned regularly. The engine fuel tank cover should have a waterproof breather valve to ensure the correct pressure inside the tank to prevent the fuel tank from being sucked flat when the fuel volume drops causing difficulties in supplying fuel to the pump. The selection of the fuel filter is very important, too high fuel filter precision will cause the fuel filter frequently clogged, frequency replacement increase the cost, at the same time will cause the oil pressure drop, resulting in insufficient oil supply. Fuel filter selection accuracy is too low, will lead to particles blocking the injection nozzle, resulting in abnormal engine stop. Halo-6000 comes with a standard fuel filter, but considering different working environments, if the user wants a higher-precision fuel filter, you can contact us. It is suggested to install the fuel pump nearing to the fuel tank and engine to shorter the length of the fuel pipe and reduce pressure.

4. Radiator Of Halo-6000

The radiator can be mounted in different places to the generator, so after the installation, the operator should do the heat balance test of the UAV. When do the heat load testing of the generator, the temperature of the head should be kept between 70℃ to 9 0℃, and be care for temperature changing caused by season changing. Too low temperature for too long will accelerate the wear, and high temperature is easy to make the coolant boiling and cylinder scoring.

Halo-6000 has the function of monitoring the temperature of the engine and motor, when the water temperature is over 95℃, the generator will lower the throttle about 20%, when it's over 105℃, the generator will shut down for protection; when the motor temperature is over 135℃, the generator will lower the throttle about 20%, and when it's over 145℃, the generator will shut down for protection.

5. Cooling System Of Halo-6000

Halo-6000 applies water-cooling system, so if it is used in an environment that is under 0℃, an antifreeze should be added. For the first time use and refill, should exhaust the air. The air exhausting steps can be acquired from Foxtech. Air in the cooling pipe will make the coolant boiling, even worse, cylinder scoring. Please make sure that there is no air in the cooling pipe before each takeoff and check the sealing of the cooling system to ensure safety.

6. Air Filter Of Halo-6000

The engine's air filter system can filter out particles of a certain size, but long-term use or severe dust conditions can cause the air filter to clog, decreasing the engine air intake, which in turn reduces the engine output. If you find that the engine output decreases, please clean or replace the air filter in time.

7. Battery Of Halo-6000

Battery for Halo-6000 should meet these requirements:

1) The battery capacity meets the power demand for forced landing of the UAV in case of generator failure.

2) During the flight, the battery voltage can be maintained between 55 V-57.4 V, i.e. the Halo-6000 output power and the aircraft demand power are basically balanced. If the battery are used to provide auxiliary power for the aircraft, please make sure that the battery voltage can rise back to above 57 V before the aircraft lands. A continuous drop in battery voltage have two potential consequences; first, after the drone lands, the battery may charge at a large rate, which may cause a serious fire. Second, the lowered battery voltage will cause the generator output to be further reduced, resulting in insufficient system output power.

3) If the Halo-6000 can communicate with the flight control CAN bus, it can activate the ground charging protection strategy. When the system receives the command from the flight control indicating that the UAV is on the ground and the system voltage is below 56.4V, the power generation current of the Halo-6000 is limited to 25A or so to protect your starter battery. You can refer to this value to choose a battery of appropriate capacity and charging multiplier.

However, please note 1) Some of the flight controls sending the drone in the "air" or "ground" command depends on the drone is unlocked or locked propeller after landing, so there will be a delay with the actual drone load state. 2) The throttle has dynamic response time as well as control precision limitation, and each generator charging current on the ground will be different, so we suggest you try to choose high charging multiplier battery. 3) The drone should be locked in time after landing, do not use the generator to charge the battery charging at a large rate,which is easy to cause fire. If the battery voltage continues to rise, the generator will be protected in accordance with the following table. (14S battery as an example)

Num.	V of Each Unit	Fully Charged	Protect Voltage	Protect Time	Note
1	4.35V	58.5V	61.2V	10s	Once over the protection voltage or longer than the protection time, the system will shut down.
2	4.25V	57.4V	60V	10s	
3	4.2V	57.4V	59V	20s	

8. UAV using Halo-6000

Halo-6000 supports 14S battery, and it has voltage protection function, i. e. the system will automatically stop to protect when the voltage is continuously lower than 47.6V or higher than 61.6V. The hybrid system will have a certain voltage disturbance on the DC bus at the moment of generator startup. The equipment voltage level of the DC bus of the UAV should be above 70V to prevent disturbing your equipment at the moment of motor startup. It is recommended to add filtering capacitors to the DC bus to ensure the safety of the equipment. Figure 1 below shows the effect of adding 330uF/100V capacitors to the bus.
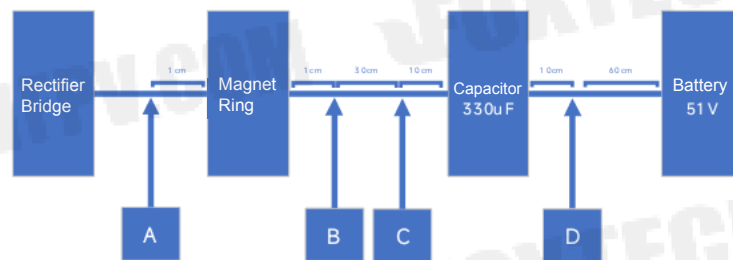
Measure Point	A	B	C	D
Without Capacitor	82 V	63 V	63V	63V
330uF Capacitor	74 V	61V	55 V	53 V

9. Start Method and CAN Bus Matching

Halo-6000 supports starting & stopping the engine with the CAN bus, receiver signal. When the customer's flight control does not support CAN, the customer can choose to start and stop the engine with the receiver, but in this case, all the generator status information will not be known to the customer, please fully evaluate the risk of such start method.

The CAN bus of the Halo-6000 control system has a 120Ω termination resistor and follows ISO11898-1/2, CAN2.0b Standard Frame communication specification, the communication rate includes 1Mbps/500Kbps, please contact us to determine your communication rate requirement.

10. Considerations when use the PMU for Water & Fuel Pump

Halo-6000 is equipped with a PMU module with input voltage range of 36-72V, output voltage of 12V and nominal power of 250W. If it is used to power other loads, the total additional load cannot exceed 60W.

This PMU module is a key power supply device for the ECU of the engine controller. It is not recommended that the customer use this module to supply power to other devices, The manufacturer will not be responsible for any abnormal system operation caused by the customer's non-standard use of this PMU module.

11. Wire Layout and Power Sequence

Halo-6000 doesn't have a low-power standby function, so the battery needs to be removed when the drone is not in use to avoid battery feed. When powering up the system, please strictly observe the powering up sequence, i.e. after all low-voltage connectors are connected, connect the negative cathode first and then the positive cathode. When disconnecting the power, disconnect the positive cathode first, then negative, incorrect operation will cause damage to the control equipment.

When the wire is arranged, the DC bus of high current should be far away from the signal alignment, if it can't be avoided, it needs to comply with the principle of crossover alignment to avoid interference. All generator connectors need to be fixed and tied to prevent poor contact or loose due to the vibration and cause the whole machine failure.