Thor 210
Hybrid Hexacopter

User Manual

V2.0 2023.05

FOXTECH

Description

Disclaimer

Thank you for purchasing this product. you can log in to the website for the latest product information, technical support and user manual. It is recommended that you download and use the latest version of the user manual. This manual is subject to change without notice.

You can also get product usage information or technical support through official customer service. Due to different production batches, the appearance or function parameters are slightly different and will not affect the normal use of the product.

Please read this statement carefully before using. Once used, it is deemed to be an endorsement and acceptance of the entire contents of this statement. Please read the instruction manual carefully and strictly follow the instructions in this manual to use this product. Foxtech will not be liable for any result or loss caused by improper use, installation, assembly or modification of users.

Intellectual Property

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Product Profile

Introduction

Foxtech Thor 210 Hybrid hexacopter is a long endurance heavy lift hexacopter equipped with 6kW gasoline-electric hybrid EFI power system and integrated propulsion system. The application of differential GPS technology ensures higher accuracy, attitude self-correction and no need for compass calibration. Its carbon fiber material and foldable arms make it easy to transport, store, and prepare for flight.

Highlighted Features

The heart of Thor 210 is the on board Halo-6000 generator, with which the max take-off weight can reach 56kg. This Halo-6000 generator consists of EFI engine and water-cooling system to ensure long endurance.

Using differential GPS technology, Thor 210 has superior positioning accuracy, anti-interference ability and flight stability.

Integrated propulsion system is simpler and easier for using. Foldable arm structure saves more space and makes this drone convenient for storage and transportation.

Assembled View

①	Integrated propulsion system
②	Radiator
③	Fuel Tank
④	Differential GPS
⑤	Halo-6000 Generator
⑥	Landing Gear
⑦	Cargo Suspending Area

Tab.1 Assembled View of Thor 210

Specification

Wheelbase	2000mm
Unfolded Dimensions	2100mm*1850mm*740mm
Folded Dimensions	1200mm*1100mm*740mm
Take-off Weight	≤56kg
RTF Weight	36kg(including battery, no fuel)
Generator weight	9.8kg
	Flying Speed: 5-10m/s
Fuel consumption	700g/kWh
Working Voltage	58V(14S)
Max generator output	6kW

Tab.2 Specification of Thor 210

No.	Items	Unit	Parameter Index	Remarks
1	Rated Voltage	VDC	58	
2	Rated Power	kW	6.0@ Sea Level	
3	Weight	kg	9.2	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	℃	-20 ~ 50	
10	Start Mode	-	One Key Starting	
11	Mixing Ratio of Lubricating Oil and Gasoline	-	1:25	Please use the oil suggested by the manufacturer.

Tab. 3　Main Technical Parameters of Halo-6000

Type	Double cylinder, two-stroke, EFI engine, water-cooling system
Displacement（mL）	124
Rated Power（kW）@7000 r/min	7.3
Rated Speed（r/min）	7000
Rated Max. Speed（r/min）	7500
Idle Speed r/min	5000
Oil	Jaso FC or iso-l-egc and higher 2T oil
Gasoline Label Number	95# gasoline is required

Tab.4 Main technical parameters of engine configuration

Generator

Over view

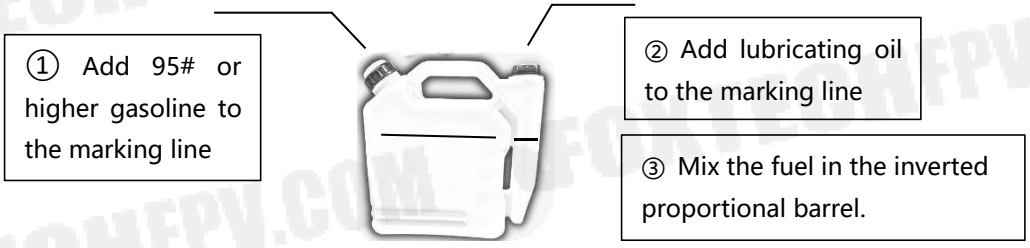
According to the requirements of multi-rotor UAV, the developed Halo-6000 is 58V (14S Li battery).

The engine uses two cylinder and two stroke gasoline as fuel. It adopts 32-bit MCU of vehicle gauge level, precise injection ignition, adaptive plateau correction, intelligent self-learning, and has passed the environment and EMC tests. Besides, it has the characteristics of high output power and low fuel consumption. The motor adopts the heuristic integrated external rotor motor, which is integrated with the engine, makes the hybrid system having the advantages of small volume, light weight, low noise and high power-mass ratio. The controller has the protection functions of over voltage, undervoltage, over temperature and overspeed.

Halo-6000 has excellent quality, strong power source, long-term high-power output, and long service life.

Fuel

Use 95# or higher grade gasoline, Jaso FC grade or iso-l-egc grade or higher 2T engine oil (Mott 710 is recommended), and use a fuel mixer to prepare according to the ratio of 1:40 (engine oil: gasoline). It is strictly prohibited to use vehicle 4-stroke engine oil.



Note:

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 oi). For everyday use, a ratio of 40:1(gasoline: engine oi)is suggested.

2. Please confirm that the technical parameters of UAV match the parameters of this hybrid system before use, so as to meet the operational performance of UAV, Prevent damage caused by improper configuration.

3. Failure to use the oil and engine-fuel ratio suggested by the manufacturer will cause engine damage. The manufacturer will not be liable for any consequences caused by using oil not suggested by the manufacturer.

Prepare

Inspection items before use

Check whether the connectors of the range extender and controller are connected and installed in place.

Make sure there is enough fuel in the fuel tank and the fuel pipe is installed correctly.

Spark plugs shall be checked before use. Spark plugs with excessive carbon and oil stains shall be replaced or cleaned.

Check the steering gear mechanism, check whether the steering gear rod ball head is flexible, and repair it if it is stuck.

Check the position of steering gear and throttle, and check whether the steering gear operates normally and whether the throttle position is correct.

Check the motor to see if it rotates normally.

Check the oil pipe. The oil pipe shall not directly contact with heat sources such as engine or motor. Meanwhile, excessive bending of oil pipe shall be avoided.

The ignition coil head should be pressed firmly to check whether the connector is loose.

There is no obvious bubble in the tubing.

Check the anti loosening mark of the connecting bolt, and there shall be

no dislocation.

⚠ Check whether the exhaust funnel is loose. In case of shaking, be sure to tighten the fixing bolts of the exhaust funnel.

Precautions for starting engine

Before starting the engine for the first time, the air in the oil inlet pipe needs to be discharged to make the oil inlet pipe full of oil and free of bubbles;

For the first using, the generator should be power on before adding coolant. After power on, the electrical water pump will continue to run for about 100s. If the water jacket is not full within 100s, the generator shall be re-powered on. Repeat until the air in the pipe line is drained. The pipe lines can be squeezed properly until there is no obvious bubble up welling in the water jacket; Generally, this operation is not needed during subsequent startup, just observe the liquid level of water jacket, and add coolant when it is too low.

After each power on, the steering gear will execute the self-learning program for about 8s. Operate the remote control to make the system indicator light normally on (the remote control needs to be unlocked).

The engine must be idle for 30 seconds after starting, so that the crankshaft, piston and connecting rod can be more fully lubricated.

Multiple start failures may cause the spark plug to be flooded. In this case, replace or dry the spark plug and try to start again.

Launch and stop

1. Move the yaw stick to far right and minimum the throttle
2. Switch the SA Lever up and down to unlock the generator.
3. After 5s, switch to the middle to start the generator.
4. Push the stick up to trun off the generator
5. After continuous flight, Halo-6000 needs to be cooled. Therefore, after

landing, maintain idle speed for 30s. After the engine is shut down, do not turn off the power supply and keep the water pump running for 3min.

Note:

1. In case of maneuver or gust during flight, the bus voltage will drop, which is a normal phenomenon.

2. If the drone voltage drops rapidly and continuously and is lower than 51V, special attention shall be paid, and it shall be immediately lowered for maintenance if necessary.

3. Running out of fuel will cause serious damage to Halo-6000. Please pay attention to the display of the liquid level sensor to monitor the remaining fuel to ensure that the operation is stopped before running out of fuel.

4. Gasoline is a volatile flammable and explosive liquid. At the end of the day or during long-distance transportation.The remaining fuel in the oil tank shall be drained and properly stored in the oil drum to avoid danger!

Maintenance

1. For routine maintenance items (after each operation), the warranty will not be given if the maintenance manual is not followed

1.1 Check whether the plug of the controller circuit is in good contact, and check whether the oil pipe and water pipe are loose or leaking.

1.2 Check if the controller is damp and keep it dry.

1.3 Check the motor for dirt and moisture, remove dirt and keep it clean and dry.

1.4 Check the air filter, remove the dirt, and keep clean（to prevent foreign matters or dust from entering the engine inlet）.

1.5 Check whether the fixing bolts are loose, and no loose bolts are allowed.

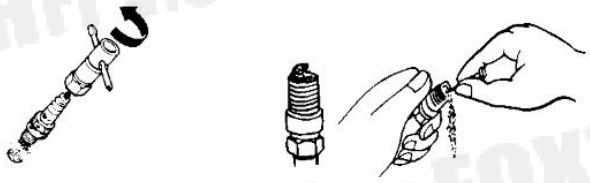
1.6 Check whether the steering gear rod ball is stuck. If it is stuck, oil can be applied temporarily and replaced later.

2. Regular Maintenance(Carry out regular maintenance and parts

replacement according to Appendix 2)

2.1 After the Halo-6000 running for 50h, check the carbon deposit on the spark plug. If the carbon deposit is serious, remove the carbon deposit or replace the spark plug.

⚠ Please power off the generator and cool down the generator to the indoor temperature before disassembling the spark plug and its cap. Hot plug is forbidden.



Remove the spark plug Remove carbon deposit

Fig. 8

2.2 Check whether the fuel pipe has aging, hardening and cracks. If so, be sure to replace it to avoid potential safety hazards.

2.3 Check the motor for dirt, remove sundries and keep it clean and dry.

3. Maintenance Before Long-Term Shutdown

it is necessary to carry out comprehensive maintenance for the Halo-6000 before storage, if the system is out of service and will not be used for a long time. This can avoid some parts failure caused by long-term shutdown and maintain the system performance.

⚠ Caution: The manufacturer shall not be responsible for the system damage caused by untimely maintenance.

Trouble Shooting

No.	Description	Check Item	Cause of Failure	Maintenance Method
1	System cannot be started.	Air filter	Under heavy working condition	Clean the filter with fuel
2		Oil Supply System	Wrong lubricating oil model	Use the suggested lubricating oil
3			Tubing bubble or no oil	Press the oil bubble several times to absorb oil
4		Wire Harness	Poor contact of connector	Check the circuit and connect it again
5		Spark Plug	yellow or weak light	Change the spark plug
6		Spark Plug	Loose of spark plug	Fasten the spark plug
7	Speed fluctuation, voltage fluctuation, heavy smoke	Fuel	Water in fuel or fuel quality Poor quality, fuel storage more than 2 months	Change the fuel
8		Lubricating Oil	Poor quality of lubricating oil	Change to the suggested lubricating oil
9		Oil Way	The oil supply is not smooth, there are bubbles in the yellow oil pipe, or the oil filter in the oil tank has not been replaced for more than 25 hours.	Drain the air from the oil inlet pipe. Open the filler cap to make the top of the fuel filter close to the top of the oil level. Power on and drain the air. In some cases, tilt the fuel tank properly.
10		Control Circuit	The control circuit or sensor is damaged.	Contact the manufacturer.
11	Insufficient Power Output	Carbon Deposition	It's time for maintenance.	Contact the manufacture.
12		Air Filter	The air filter element is too dirty.	Replace the air filter
13		Fuel Supply	Jam of the fuel filter or fuel injector	Replace the fuel filter or fuel injector
14	The voltage drops rapidly after take-off	Battery	Low battery voltage	Before takeoff, turn the three-position-switch to "run" and wait for about 1 minute.
15	miscellaneous		Mechanical parts are damaged.	Contact the manufacturer.

Caution: This system does not support low power consumption. When the system is not in use, please remove the battery or set a switch to cut off the electrical connection between the battery and the system. The system does not support hot plug. The controller will be damaged by hot plug in case of use and maintenance.

Maintenance List

Part Name	Unit Consumption	Before Start-Up	Every 25h	Every 50h	Every 100h
Air Filter Assembly	1	Check	Check/ Replace	Replace	
Oil Filter	1		Check/ Replace		
Servo Assembly	2	Check			Check/ Replace
Spark Plug	2			Check	Check/ Replace
Oil Pipe	1				Check/ Replace
Fuel Injector Quick-mount head	1			Check/ Replace	Replace
Servo Rod	2	Check			Check/ Replace
Loose of Silencer	/	Check			
Bolt torque mark	/	Check			

Big Maintenance List

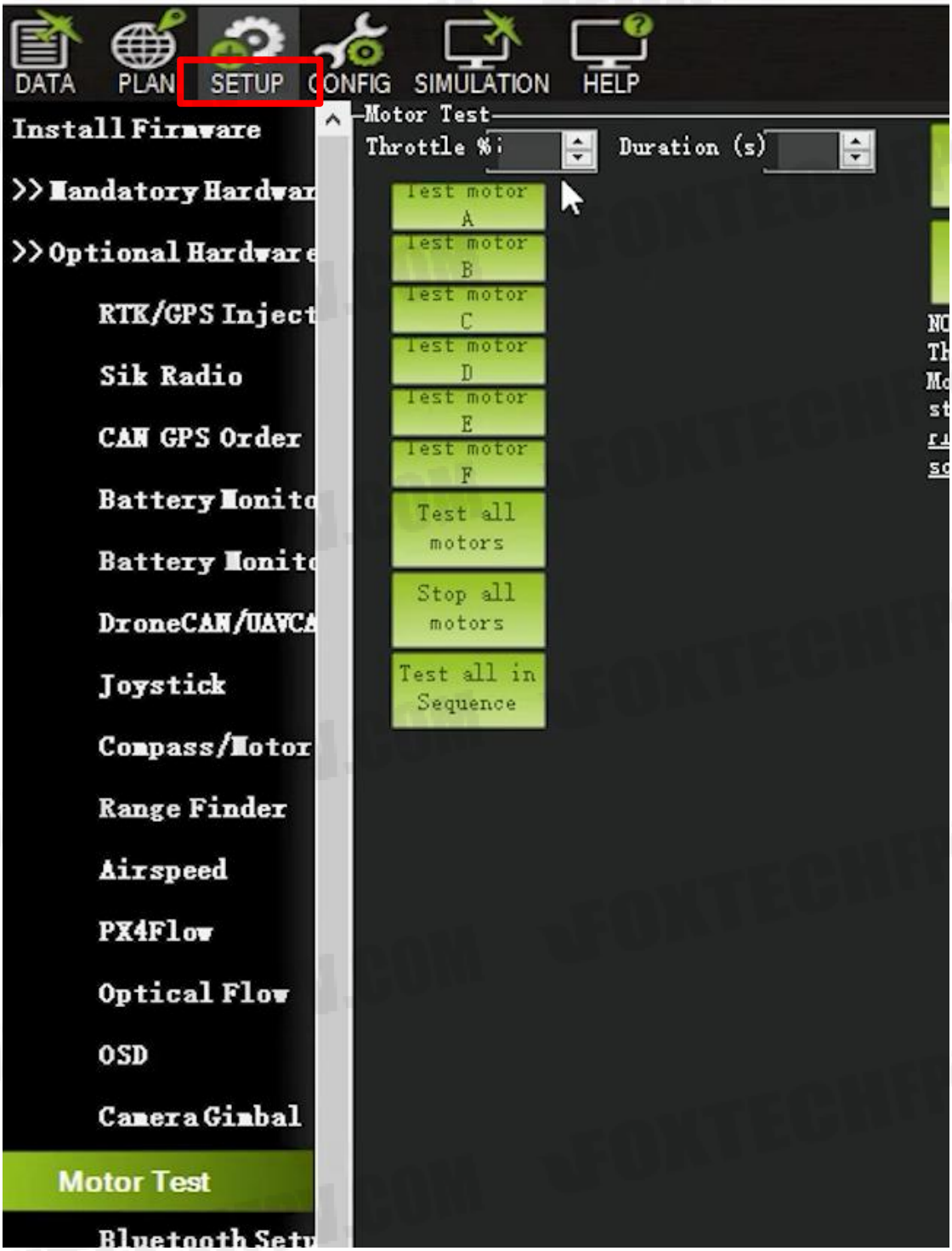
Part Name	Unit Consumption	Every 200h
Piston Assembly	2	Check/ Replace
Piston Ring	2	Check/ Replace
Piston Pin	2	Check/ Replace
Fuel Injector	1	Check/ Replace
Cylinder Head	2	Check/ Replace

Flight

Flight Environment

1. Do not use the aircraft in adverse weather conditions including rain, snow, fog, and strong wind.
2. Only fly in open areas. Tall buildings and steel structures may affect the accuracy of the GPS signal.
3. Avoid flying near obstacles, crowds, high voltage power lines, trees and water.
4. Avoid flying in areas with high levels of electromagnetism, including mobile phone base stations and radio transmission towers.
5. Aircraft and battery performance is subject to environmental factors such as air density and temperature.

Pre-Flight Checklist



Before each flight, fill in a number between 15%-20% under the catalogue SETUP>OPTIONAL HARDWARE>MOTOR TEST in the Software and then make sure:

1. Take-off weight is within limits.
2. There is enough fuel in the fuel tank.

3. Coolant is enough.

4. The remote controller, Batteries and your mobile device are fully charged.

5. The propeller is firmly installed in the right direction and unfolded.

6. Motors start properly and are functioning as normal(check on the ground station).

7. The remote controller is well connected and set to the correct channel and flight mode.

8. The data transmission is work fine.

9. The installation of the drone is firm.

10. The gasoline inlet is filled with oil(or push the primer pump several times until the fuel inlet pipe is filled with gasoline)

11. The speed of the generator is stable(fluctuate within a range of 1000) after starting and the temperature is normal.

12. The GPS satellite number is no less than 16, GPS HDOP is less than 1.0 and GPS2 is in the Fix mode.

13. The plane's direction displayed on the ground station is the same as the plane itself.

14. No operators is around the take-off area.

Takeoff and Landing

Takeoff

Follow the steps below to take off:

1. Unfold the arms and propellers.
2. Fasten the payloads.
3. Add gasoline and coolant.
4. Mount the batteries firmly.
5. Turn on the remote controller and connect it to the computer.
6. Connect the data transmission to the computer.
7. Power on the batteries.
8. Push the primer pump several times until the fuel inlet pipe is filled with gasoline.
9. Start the generator via remote controller.
10. Arm the plane in Q_LOITER mode.
11. Go through the pre-flight checklist.
12. Lift the accelerator channel and take off.

Landing

1. Back to the HOME position and lower the accelerator channel.

Note when flying

1. Monitor the open degree of air throttle via monitor software when flying, if the open degree is higher than 85%, then it’s recommended to land and reduce the payload weight or quantity of fuel and take off again.
2. Monitor the plane attitude in the monitor software. If the inclined angle is bigger than 15°, it should land and check the take-off weight, voltage and wind speed.
3. Monitor the location of the plane displayed in the ground station. If the

location is incorrect, it is recommended to land and check the GPS setting.

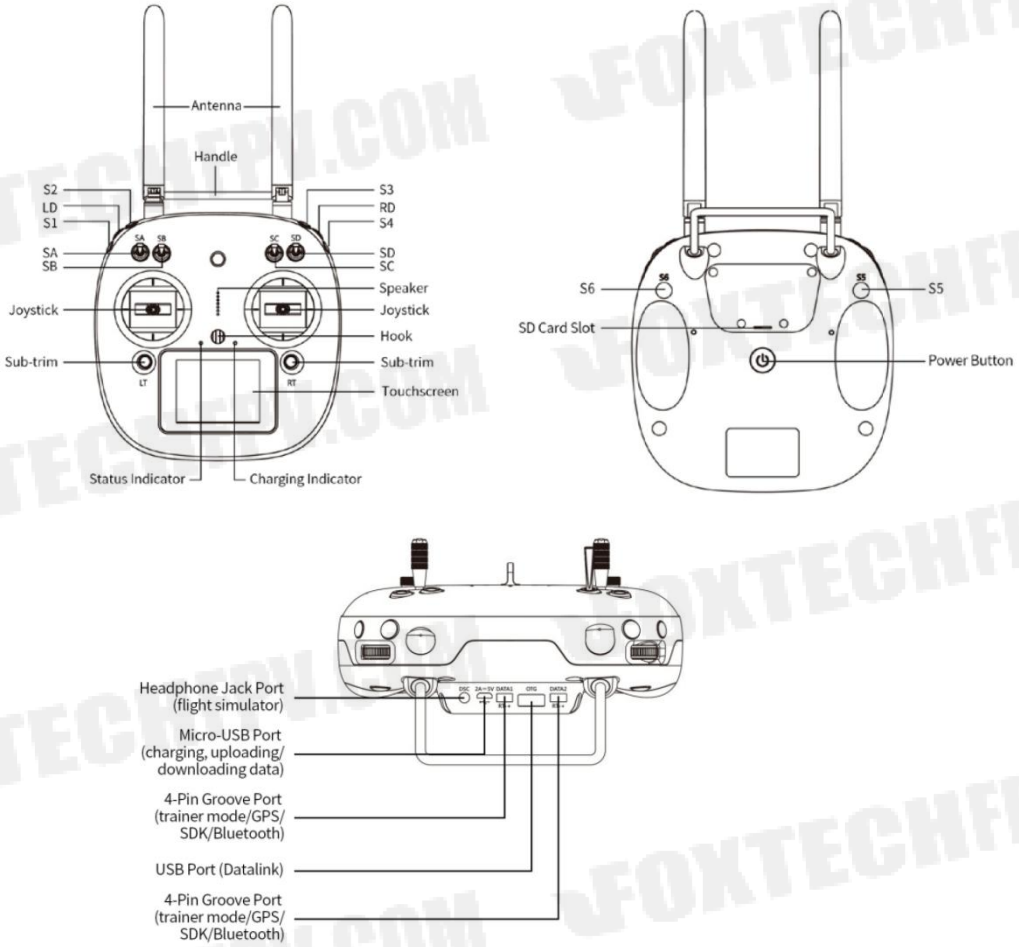
4. Monitor the voltage of the generator and plane. If the voltage drops rapidly below 51V, the drone should be landed and inspected when necessary. If the voltage difference between the generator and plane is too high, it is recommended to land and check the generator if it stop running.

⚠ For your safety, do not touch the radiator after landing, or the high temperature can cause burns.

Please take off within 15min after the generator starts, otherwise the generator will stop out of high temperature.

Appendix

DA16S+ Remote Controller



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