

HHO1500 Operations Manual

(Effective Date: 3/28/2024)





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PREFACE

Read this manual carefully before installing and/or using the equipment. Failure to follow instructions in this manual could result in personal injury, damage to the machine, damage to the customer's vehicle or some otherwise unforeseen damages. HHO Carbon Clean Systems (HHO CCS) will not be held responsible for any injury or damage caused by failure to follow the instructions herein. If you have questions, please contact HHO Carbon Clean Systems at info@hhoccs.com or call (800) 278-6343.

This manual describes the equipment, operating principles, procedures, maintenance, troubleshooting, and storage. It does not apply to all HHO CCS equipment.

Compare this manual with the actual product. If there are differences between the images and the actual machine, contact HHO CCS by phone or email to request updated information regarding the HHO1500's operation.

The operations manual may be updated. Subsequent procedures are subject to change without notice.

Of particular importance to hydrogen carbon cleaning services are NOTES, CAUTIONS, and WARNINGS found throughout the manual. They must be read closely and adhered to for the safe operation of the equipment.

WARNING

An operating procedure, practice or condition, that may result in injury if not carefully observed or followed.

CAUTION

An operating procedure, practice, or condition that may result in damage to equipment if not carefully observed or followed.

NOTE

An operating procedure, practice, or condition essential to emphasize.



WARRANTY STATEMENT

While HHO Carbon Clean Systems is confident our HHO1500 can reduce carbon buildup, HHO CCS does not guarantee any results. Many factors can cause reduced efficiency. Carbon cleaning is not an engine repair service. It is a non-invasive method to remove carbon buildup. It is designed to be added to routine maintenance schedules. It is not meant to replace oil changes or other general maintenance. Its effects may vary. An engine loses its efficiency gradually as it continues to see use. Carbon cleaning services with an HHO1500 are safe and will not harm vehicles if performed in accordance with this manual.

Warranty Coverage

HHO Carbon Clean Systems warrants the covered product to be free of all defects in material and workmanship for 12 months from the time of purchase. This warranty extends to the original buyers only and each successive buyer within the warranty period.

Within the period of this warranty, HHO Carbon Clean Systems will repair or replace, free of charge, any part proving defective in material or workmanship. All warranty repairs and service must be performed by an authorized technician, or at an authorized service facility.

Warranty Exclusions

This warranty does not apply to any costs, repairs, or services for the following:

1. Service calls to correct the installation of the covered product, or to explain the usage of the product to the buyer.
2. Repairs necessitated by use other than normal use.
3. Damage resulting from the misuse, abuse, accidents, alterations, or improper installation.
4. Corrective work necessitated by repairs made by anyone other than HHO Carbon Clean Systems.



ABOUT HHO CARBON CLEAN SYSTEMS

HHO Carbon Clean Systems is a mobile business that offers and sells gasoline and diesel engine carbon cleaning services, on-demand hydrogen equipment, and related products and services. The service removes carbon buildup on a wide range of engine components like combustion chambers, diesel particulate filters (DPFs), and turbochargers. Some of the benefits include:

- Removes carbon buildup from gas and diesel engines
- Restores fuel economy
- Lowers emissions
- Prevents damage to critical and expensive engine components
- Decreases downtime due to costly repairs

More information about HHO Carbon Clean Systems, its products and services, and franchise opportunities, can be found at hhocarboncleansystems.com.



FREQUENTLY ASKED QUESTIONS (FAQS)

Who do I call for customer support?

HHO Carbon Clean Systems may be reached through their website, email, or phone.

Website: <https://www.hhocarboncleansystems.com/contact-us/>

Email: Info@hhoccs.com

Phone: (800) 278-6343

Can you print out the HHO1500 Operations Manual and mail it to me?

At this time, HHO CCS does not print and mail manuals.

How do I receive my HHO1500 Operations Manual?

Manuals may be accessed and downloaded from the website.

Can I purchase HHO1500s wholesale?

HHO CCS's franchise network are distributor of HHO1500s. The devices are available for purchase from corporate and franchise network at retail prices.

What is HHO?

HHO is the atomic form of hydrogen (H₂) and oxygen (O) gases when water (H₂O) is separated. It goes by several names including HHO, Brown's gas, oxyhydrogen, and hydroxy. Or it can simply be referred to as hydrogen because when it is in this atomic structure, the atoms of hydrogen, hydrogen, and oxygen are not bonded. It is colorless, odorless, and lighter than air. Extracting the hydrogen from water is considered to be a possible long-term, renewable, recyclable, and non-polluting energy source.

[Here is an article](#) that amplifies on the properties of hydroxy gas.

How does HHO contribute to complete combustion?

The benefits attributed to hydrogen carbon cleaning are founded on the effectiveness of hydrogen during combustion. Hydrogen has highly combustible characteristics that make it effective for internal combustion engines, both gas and diesel.

[This article](#) explains how the addition of HHO contributes to complete combustion and its influence on engine performance.

Is carbon buildup a problem?

Carbon buildup has always existed in internal combustion engines. However, the maintenance issues caused by carbon buildup have been promulgated by the advancement of direct injection engines and emission control systems. This has increased the demand for a preventative maintenance service called "carbon cleaning."

[Here is an article](#) linking regulation and maintenance problems, a solution, and results.

Where can I get a carbon cleaning?

HHO has a network of independently owned locations around the United States. Those are visible on www.hhoccs.com.



Does carbon cleaning reduce a vehicle's carbon footprint?

Carbon cleaning has the potential to reduce a vehicle's carbon footprint. The purpose of carbon cleaning is to reduce carbon buildup inside an engine. The carbon buildup inside an engine is one of the factors that rob an engine of its efficiency. By reducing the buildup, an engine can have improved fuel economy. When a vehicle uses less fuel, it has a lower carbon footprint. In addition to this, an engine may have less downtime and lower maintenance costs with regular carbon cleaning.



EQUIPMENT DESCRIPTIONS

The equipment included with the HHO1500 is the HH1500 hydrogen generator, hose adaptors, Bluetooth Battery Sensor, and a key. Additional cold-weather equipment may be ordered. Below are descriptions of the components, controls, and indications.

HHO1500 HYDROGEN GENERATOR

The HHO1500 can be understood by its exterior and interior components. The exterior components consist of what is visible on the outside of the equipment whereas the interior components relate to the operational equipment that is housed inside of its compartments.

Exterior Components

The exterior structure of HHO1500 consists of the primary steel frame, power-in plug and cord, main power switch, Control Panel, Hydrogen Output Fitting, and adjustment knobs for hydrogen and moisture output.

- **Control Panel.** User's interface to control operations of the HHO1500. See the section on the Control Panel. It is a touch screen.
- **Water Adjustment Knob.** Controls the amount of moisture that flows through the Hydrogen Generator Hose. Turn clockwise to increase moisture. Turn counterclockwise to decrease moisture.
- **Hydrogen Output Fitting.** The output fitting is where the Auxiliary Water Tank extends from the HHO1500's exterior frame and connects with the Hydrogen Generator Hose.
- **Hydrogen Adjustment Knob.** This sets the flow rate of the oxyhydrogen gas from 0 to 1,500 liters per hour. Turn clockwise to increase the flow rate. Turn counter-clockwise to decrease the flow rate.
- **Hydrogen Generator Hose.** A 20-foot plastic 8 mm (5/16 in) hose that connects from the Hydrogen Output Fitting to the Graduated Fitting. Oxyhydrogen gas and moisture flows through the hose to the customer's vehicle.
- **Graduated Fitting.** The Graduated Fitting is a durable metal fitting connected to the end of the Hydrogen Generator Hose. It is used to connect various Hose Adaptors.
- **Main Power Switch.** A single-phase switch located on the back panel of the HHO1500 that turns on the device.
- **Power-In.** The device operates on 220 volts.



Image 1. Front of HHO1500

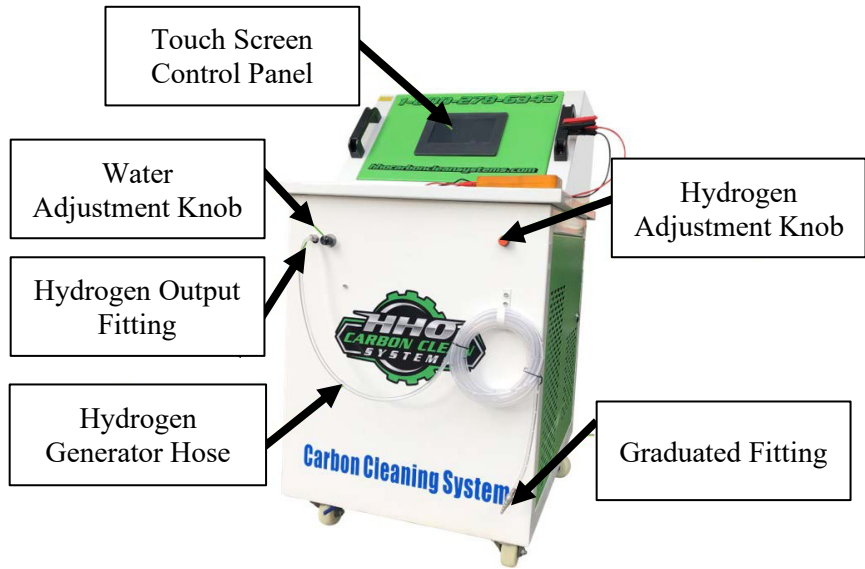


Image 2. Back of HHO1500

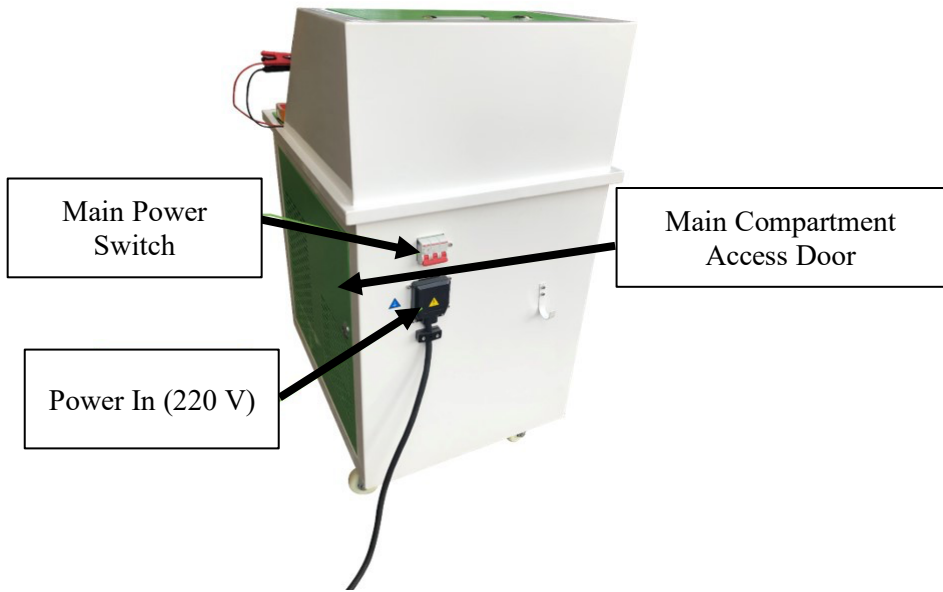
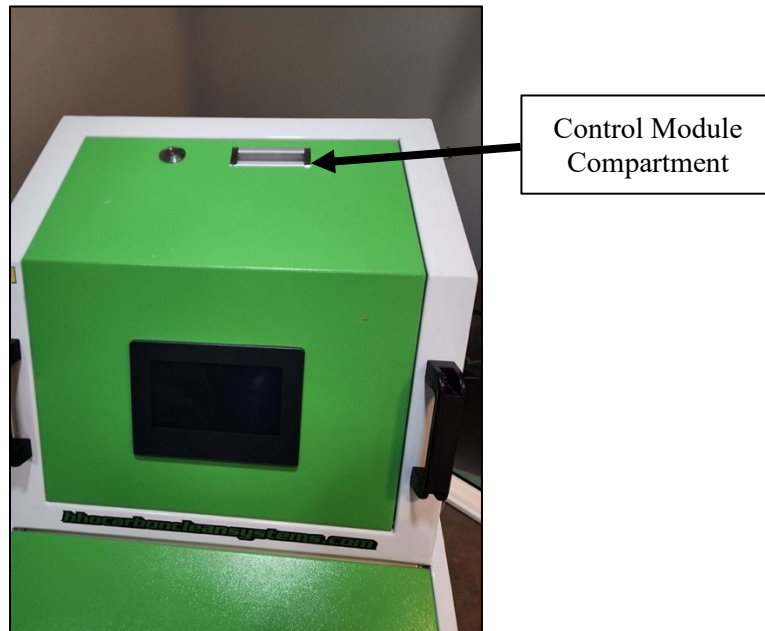




Image 3. Top of HHO1500



Interior Components

The interior of the HHO1500 holds the operational equipment that generates oxyhydrogen gas. The interior components should only be accessed when conducting routine maintenance to keep the equipment in clean, working order. It has three main compartments:

- **Refill Access Compartment**
- **Control Module Compartment**
- **Main Compartment**

Refill Access Compartment

The Refill Access Compartment is located on the front top section of the device. It provides access to the Electrolyte Cell in the center and the Auxiliary Water Tank on the left. A 17 mm wrench is stored here to open the Electrolyte Cell.

NOTE

Ensure that there is no standing water in the compartment to prevent corrosion.

- **Electrolyte Fill Cap.** The Electrolyte Fill Cap is the access point to fill the Electrolyte Cell. This requires a 17 mm wrench to tighten or loosen. The Electrolyte Fill Cap is located in the center of the Refill Access Compartment.
- **Water Fill Cap.** The access point for the Auxiliary Water Tank is the Water Fill Cap. This can be



tightened and loosened by hand. It is located on the left-hand side of the Refill Access Compartment.

Image 4. Refill Access Compartment



Control Module Compartment

The Control Module Compartment contains four components: Bluetooth Receiver, Circuit Control Module, Power Inverter, and the Control Panel. It is located on the top of the HHO1500 behind the Control Module Control Panel. The handle to open the compartment is located on the top of the machine along the back edge. It is secured with a key.

- **Bluetooth Receiver.** Receives the remote Bluetooth Battery Sensor signal. Under the face plate is the Bluetooth Receiver Dial Switch. See section on Bluetooth Battery Sensor to learn more.
- **Circuit Control Module.** The Circuit Control Module is the main circuit board that all other pieces plug into to create a cohesive unit. It adjusts the settings and interacts with each component of the device. For any issues concerning the Circuit Control Module, please contact HHO Carbon Clean Systems via phone or email.
- **Power Inverter.** This steps the 220 V power supply down to 12 V for safe operation of certain components like lights and sensors.
- **Control Panel.** The rear of the Touch Screen is visible when accessing the Control Module Compartment. It is connected to the Circuit Control Module.



Image 5. Bottom of Control Module Compartment

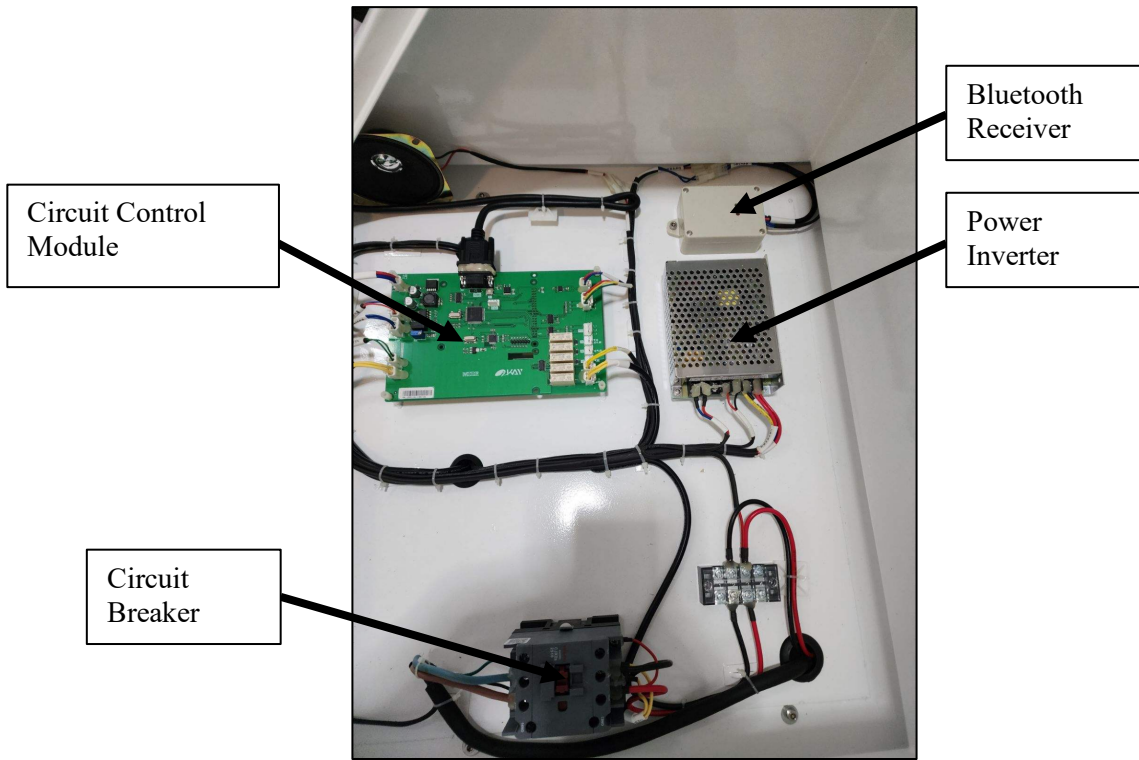


Image 6. Bluetooth Receiver Dial Switch

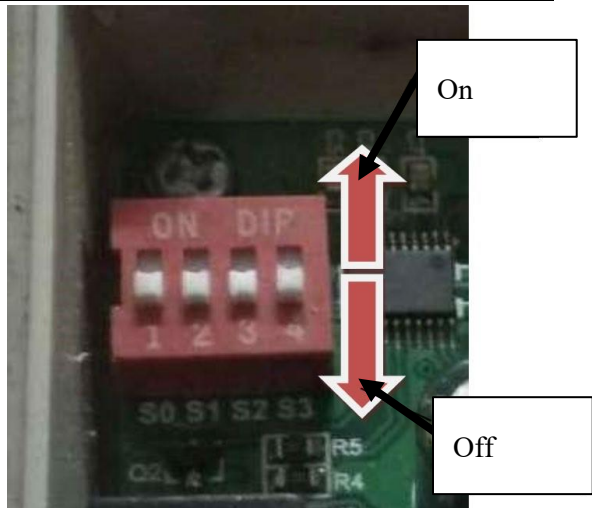
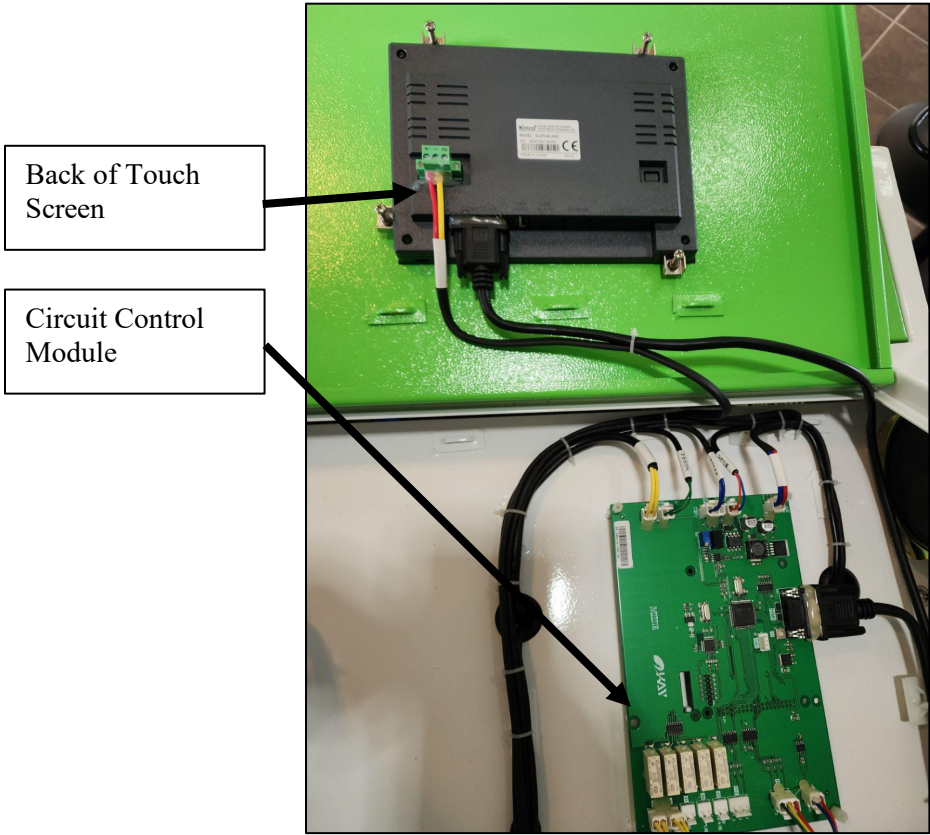


Image 7. Back of Control Module Compartment



Main Compartment

The main compartment is accessible from two sides. It is divided in half separating the electrolysis components from the power supply system. The wiring system uses a plug-and-play setup that is convenient for ease of maintenance and replacement of parts.

Electrolysis Components

- **Electrolyte Cell.** The 3.5-gallon Electrolyte Cell is wave-shaped to dissipate heat caused by electrolysis. It is accessed by the Electrolyte Fill Cap in the Refill Access Compartment. It holds the electrolyte solution. Electrolyte is the combination of distilled water and the catalyst, Potassium Hydroxide (KOH). The cell contains the anode and cathode which transfer the electricity through the electrolyte solution to generate the oxyhydrogen gas (HHO). The oxyhydrogen gas flows from the cell to the Auxiliary Water Tank. For cleaning, there is a drain at the bottom of the cell.
- **Electrolyte Anode and Cathode.** Anodes and cathodes are electrodes (substances that assist in the conduction of electricity wherein the electric current either enters or leaves the non-metallic part of a circuit). The electric current flows from the cathode (negative charge) to the anode (positive charge) through the electrolyte solution causing the water to go through a chemical change from molecular form (H₂O) to atomic form (Hydrogen, Hydrogen, and Oxygen). The



positively charged hydrogen atoms are attracted toward the cathode and negatively charged oxygen atoms to the anode.

- **Auxiliary Water Tank.** The oxyhydrogen gas flows from the Electrolyte Cell to the Auxiliary Water Tank before it flows out of the Hydrogen Generator Hose. Its function is to act as a safety guard against any form of flashback. The distilled water in this 1-quart tank may be added to the Hydrogen Generator Hose by the Water Adjustment Knob.
- **Cooling Fan.** An axial flow fan provides additional cooling to the Electrolyte Cell to prevent overheating.
- **Temperature Sensor.** Measures the temperature inside the Electrolyte Cell and reports this to the Circuit Control Module. If the device overheats, then a warning will be sent to the Control Screen and the device will stop producing oxyhydrogen gas.
- **Ground Connection.** The purpose of a ground wire is to transfer excess electrical charges in the system to the ground in a safe, direct, and controlled path where they can be discharged without the risk of electrical shock or fire.
- **Safety Valve.** The Safety Valve is used as a fail-safe for draining gas in the event of a Pressure Control Switch malfunction.
- **Electrolyte Level Detector.** Electrolyte Level Detector is connected to the Circuit Control Module to display the Electrolyte Cell level on the Control Panel.
- **Fuseable Link.** A safety feature that redirects excessive voltage. It is made of two metal bars that connects the Electrolytic Cathode to the ground connection. If excessive voltage goes through the fuseable link, the metal bars melt, cutting off the voltage, and turning off the machine.

Image 8. Electrolysis Components

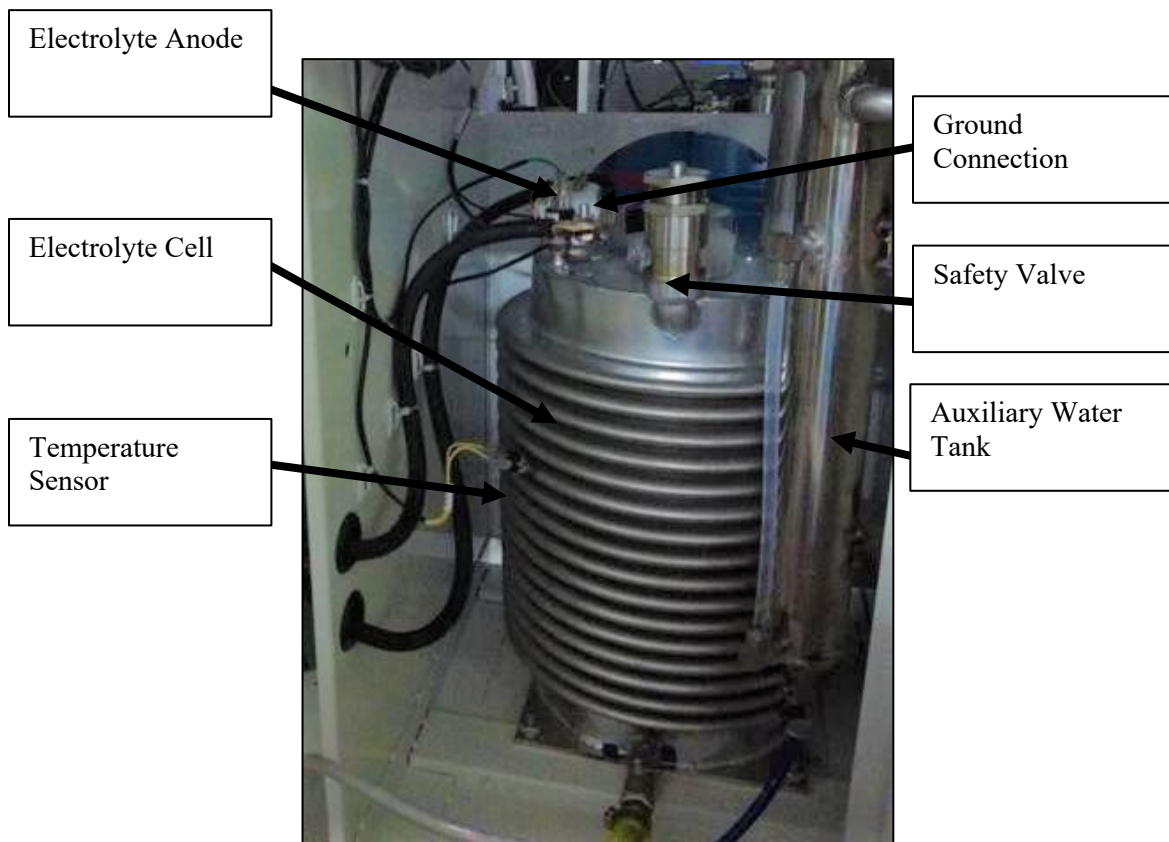


Image 9. Top View of Electrolyte Cell

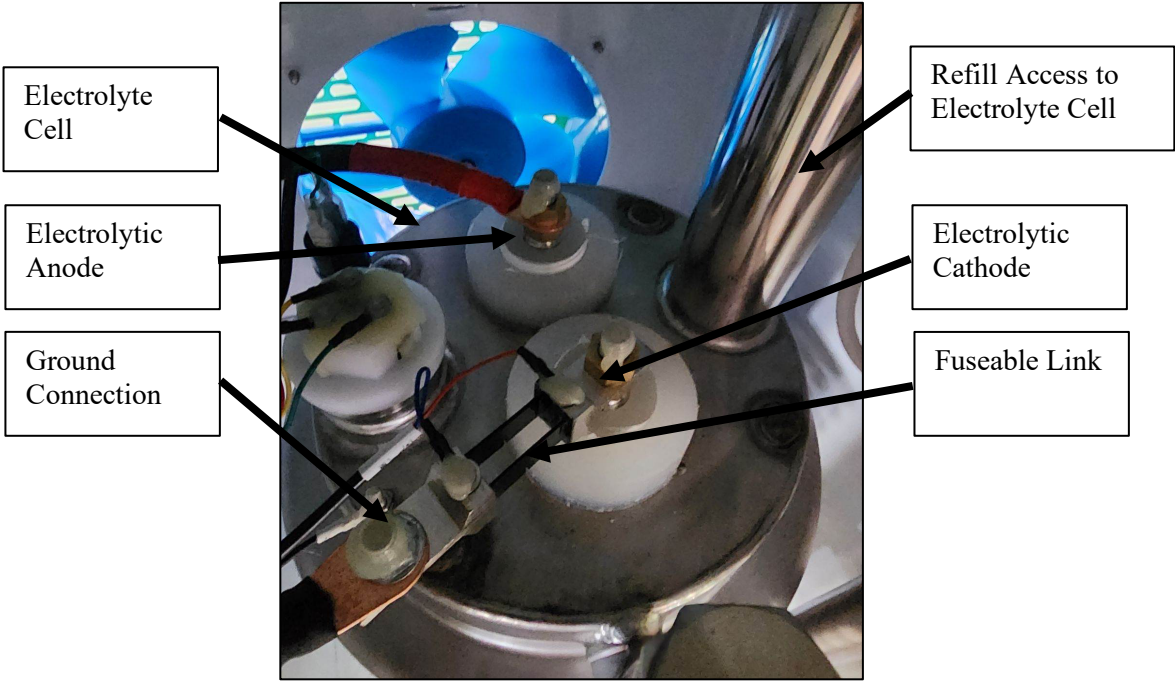
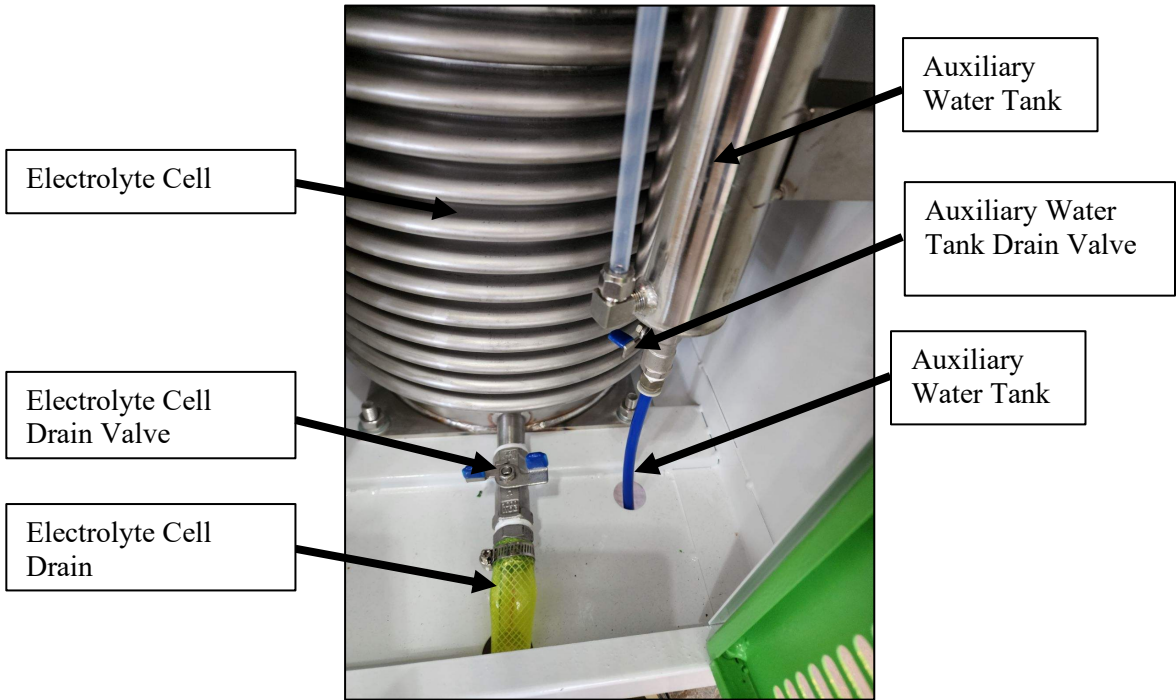


Image 10. Side View of Electrolysis Components





Power Supply Component

- **Power Supply.** The device is powered by a 220 V \pm 10 %, single-phase, 50/60 HZ, Max 16 Amp draw. It has 2 indicators:
 - **Power On.** Solid green when the machine is on.
 - **Fault light.** Amber light when the power supply has faulted.

NOTE

If power supply system malfunctions, please contact HHO Carbon Clean Systems and ship the complete Power Supply System. Do not under any circumstances attempt to disassemble or repair Power Supply System independently.

Image 11. Power Supply Components

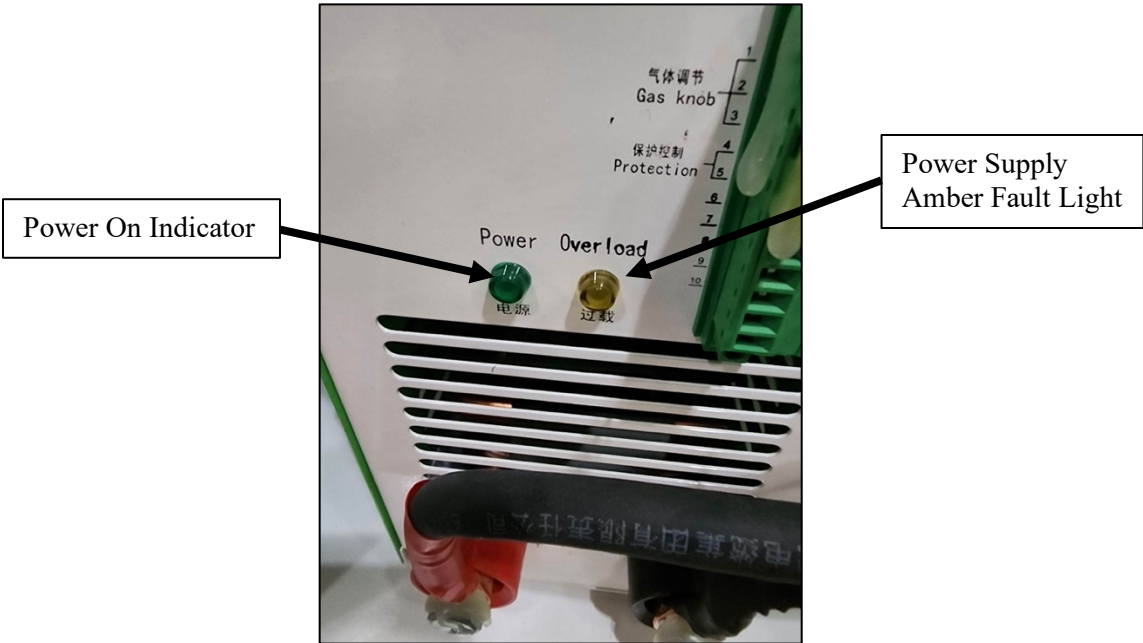


Cooling Fan

Power Supply



Image 12. Power Supply Indicators



Technical Parameters

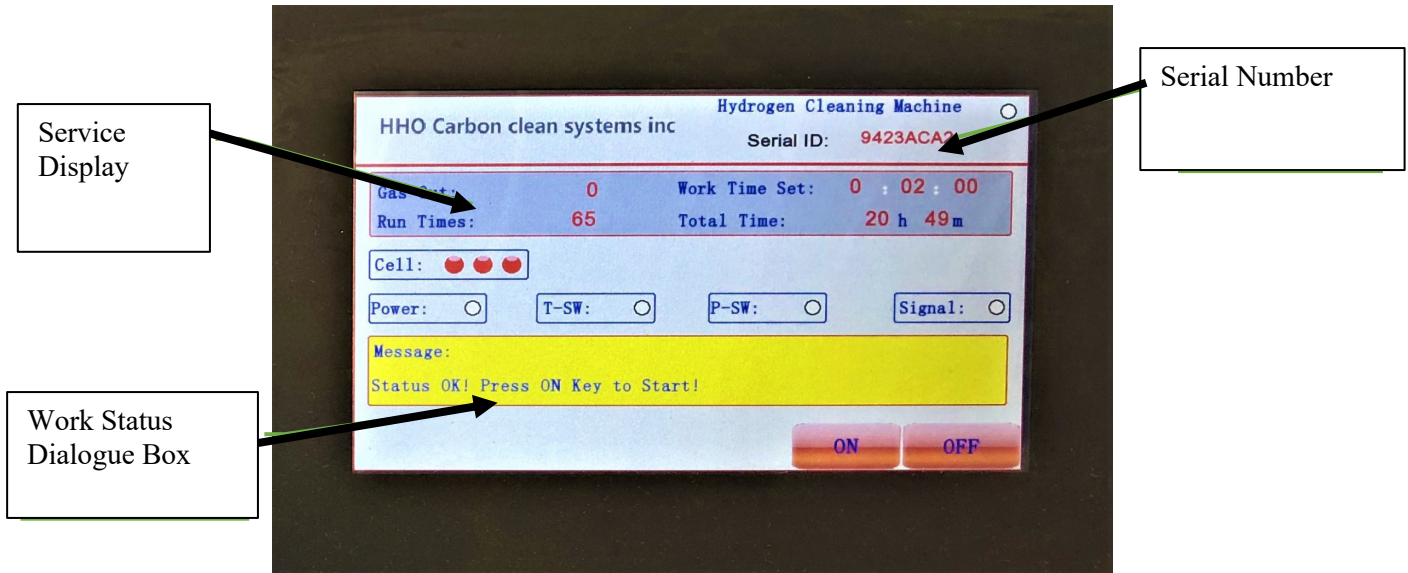
Table 1. Technical Parameters	
Model	HHO1500
Input Voltage (V)	220 V±10%, single-phase, 50/60 HZ, Max 16 Amp draw
Rated Capacity (KVA)	3.5
Actual Power Consumption (KW/h)	3.5
Working Pressure (Mpa)	≤0.09
Safe Pressure protect setting (Mpa)	≤0.19
Relative humidity (%)	≤90
Rated Gas Output (L/h)	1500±10%
Max. Water Consumption (L/h)	0.8
Cooling Method	Air cooling by fan
Insulation Grade	F
Protection Grade	IP21S
Requirement for Water	Distilled Water
Working Style	Continuously
Dimensions - L*W*H (mm)	590*740*1040
Net Weight (kg)	242 lbs



CONTROL PANEL

The Control Panel displays the current settings, overall status, work status, and error alarms. The top of the panel shows the company name and serial number. The service display portion of the panel provides information regarding the current service. Beneath that are indications regarding overall device health. On the bottom of the screen is a work status dialog box. The Control Panel is a touch screen.

Image 13. Control Panel Indications



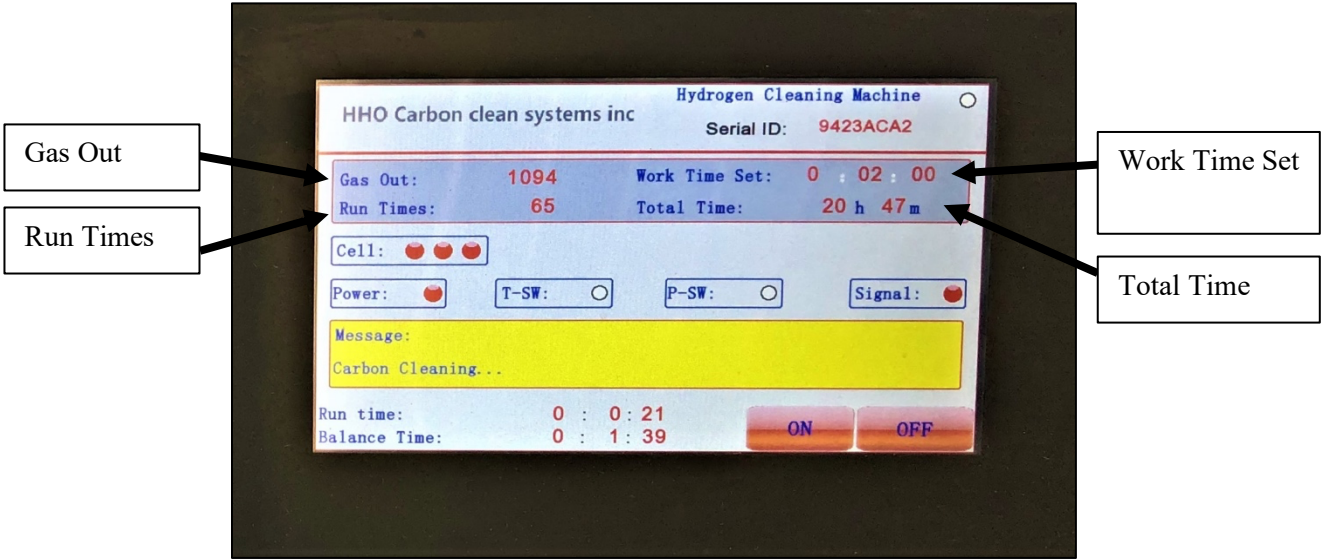
Service and Status Indicators

Service and status indicators display aspects related to the overall health of the equipment and its current operation:

- **Gas Out:** XXXX represents flow of oxyhydrogen in liters per hour. This is adjusted by the Hydrogen Adjustment Knob on the front of the device.
- **Work Time Set:** Shows the service time in a HH:MM:SS format. Press on “Work Time Set” to change work time. This does not count down. It displays the determined duration of the service.
- **Run Times:** Records the value of individual carbon cleaning services that have been performed in numerical format (XX).
- **Total Time:** HHO1500 records the total number of hours the device has operated.
- **Cell:** Displays water level in the Electrolyte Cell in increments of thirds as represented by red dots. 3 red dots is full.
- **Power:** It detects if the power supply for the electrolysis components is on or off. Red light means power is on and oxyhydrogen gas is flowing. White means there is no oxyhydrogen gas being generated.
- **T_SW:** Over-temperature indicator light. White means the temperature is within the operating range. A red light indicates when the Electrolyte Cell has overheated. The machine will stop producing gas.

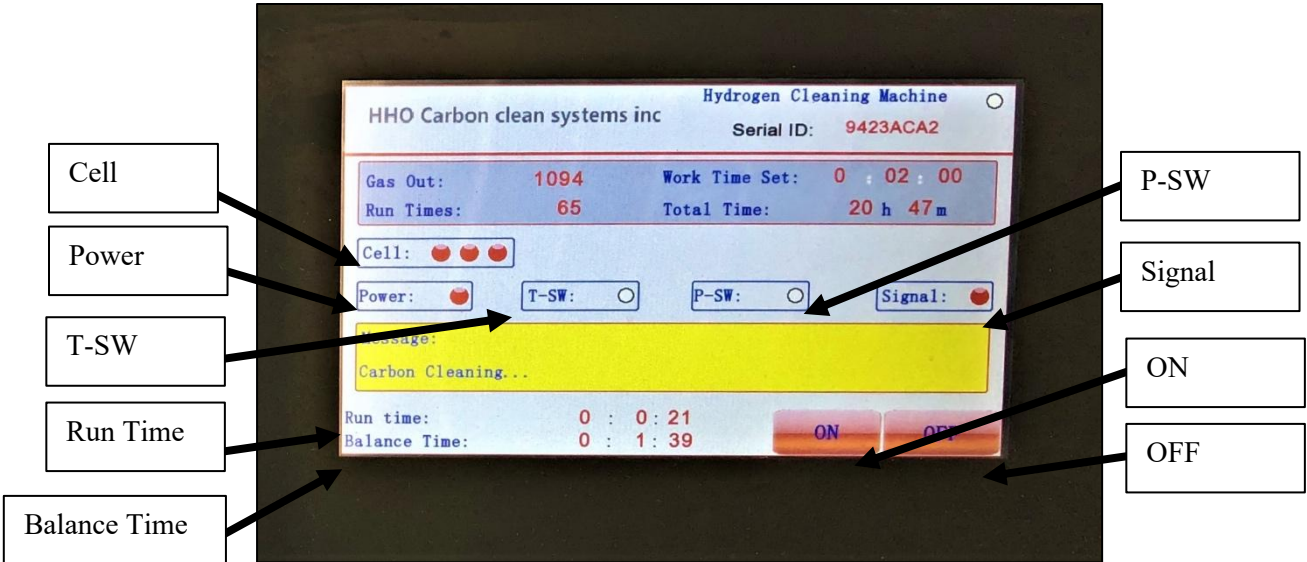


Image 14. Service Indicators



- **P_SW:** Over-pressure indicator light. A white indicator means operating normally. This will turn red when pressure exceeds safety limitations in the Electrolyte Cell. The machine will stop producing oxyhydrogen gas.
- **Signal:** When the machine receives a signal from Bluetooth Battery Sensor, the indicator will turn red. If there is no signal it will be white.
- **Run Time:** Displays the elapsed time during the service in HH:MM:SS format.
- **Balance Time:** The duration of time remaining from the set Work Time. It is the Work Time minus the Run Time.
- **ON:** Begins the generation of oxyhydrogen gas.
- **OFF:** Ends the generation of oxyhydrogen gas.

Image 15. Status Indicators





Work Status Dialog Box

The Work Status Dialog Box will display operational information concerning the current hydrogen carbon cleaning service and information that can be used to troubleshoot and maintain the HHO1500.

- **Self-Testing:** Self-testing is an automatic initial testing process on the machine to ensure operational safety and functionality.
- **Status OK! Press ON Key to Start!:** The machine has completed the pre-work and is ready to safely commence a oxyhydrogen generation.
- **Carbon Cleaning:** This indication indicates that the machine is operational and producing the oxyhydrogen gas.

Error Alarms

Several error alarms may populate in conjunction with indicator lights.

- **ERROR: Cell Too Hot!** Electrolyte Cell is at risk of overheating. The T_SW indicator light will also turn red. Follow on-screen prompts to troubleshoot and end the alarm using the ON Key.

CAUTION

Operating the HHO1500 with too hot of Electrolyte Cell can cause physical damage to the device.

- **ERROR: Car Engine Stop.** This alert indicates that the engine being serviced has breached the tolerance setting on the Battery Sensor. It is also possible that the HHO1500 machine is not receiving Bluetooth signal due to the placement or proximity of the Battery Sensor.

CAUTION

Operating the HHO1500 when an engine is off can cause hydrogen gas to “pool,” which, in turn may cause damage to the customer vehicle.

- **ERROR: Cell Lack of Water.** Indicates that the electrolyte solution (distilled water and KOH) level in the Electrolyte Cell is low and needs to be filled. The “Cell:” indicator will display the water level. Follow on-screen prompts, using the ON Key to end the alarm. To resolve, add electrolyte solution in one-quart measurements until 3 red dots appear beside the “Cell” indicator.

CAUTION

Operating the HHO1500 with lack of electrolyte can cause physical damage to the device.



CAUTION

Use the Control Panel to determine fill level. Determining fill level by viewing inside the cell will not determine the accurate level and can cause overfilling. If this tank overfills, then HHO1500 will push KOH solution through hose and into vehicles rather than oxyhydrogen gas. KOH can cause engine damage.

HOSE ADAPTORS

Each HHO1500 is equipped with several hose adaptors to connect to various engine types. They include a metal fitting and rubber hose. The metal end is designed for the connection points on engines while the rubber hose is designed to connect and seal with the Graduated Fitting.

Image 16. Hose Adaptors



ELECTROLYTE SOLUTION

For electrolysis to produce oxyhydrogen gas at 1,500 L/hr, an electrolyte is required. In the HHO1500's application, an electrolyte is a chemical catalyst that improves the conduction of electricity through distilled water. The electrolyte used by the HHO1500 is Potassium Hydroxide (KOH). The electrolyte solution is a mixture of KOH and distilled water.

During electrolysis, electric current flows from the cathode to the anode through the electrolyte solution. This results in the dissociation of positively and negatively charged particles which migrate towards the



cathode and anode. The H₂O molecules separate into two positively charged hydrogen atoms and one negatively charged oxygen atom. The hydrogen atoms are attracted toward the cathode and the oxygen atoms to the anode. While the oxyhydrogen gas is then transferred to the Auxiliary Water Tank, the KOH remains in the Electrolyte Cell. KOH Electrolyte Compound is to be filled upon installation and flushed and refilled annually or 1,000 hours, whichever is sooner. If the machine is to go longer than a month without use, then follow the long-term storage procedures.

Potassium Hydroxide (KOH)

WARNING

KOH is a hazardous material that can be harmful if swallowed, in contact with the skin or eyes, and may cause respiratory irritation.

Potassium Hydroxide (KOH) is an odorless, inorganic compound commonly called “caustic potash.” It is white or slightly yellow, and flakey or lumpy solid. It exhibits high thermal stability and has a low melting point. It is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200). Read the product manufacturer’s Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the mixture.

KOH is an acid that is reactive with water. Dilute with a base solution like white vinegar. Base solutions neutralize the acidity.

Corrosive to metals	Category 1
Acute Oral Toxicity	Category 4
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific Target Organ Toxicity (single exposure) Target Organs – Respiratory System	Category 3

KOH Hazard Statements

- It may be corrosive to metals (such as aluminum, zinc, tin, and lead) in moist air.
- It reacts violently with STRONG ACIDS (such as hydrochloric or sulfuric).
- It is harmful if swallowed.
- KOH causes severe skin burns and eye damage.
- KOH may cause respiratory irritation.

KOH Precautionary Statements

Prevention

- Wash face, hands, and any exposed skin thoroughly after handling.



- Do not eat, drink, or smoke when using this product.
- Do not breathe dust/fumes/gas/mist/vapors/spray.
- Wear protective gloves, protective clothing, eye protection, and face protection.
- Use only outdoors or in well-ventilated areas.
- Keep only in the original container.

Response

- Immediately call a poison center or doctor/physician.
- Dilute with a base solution like white vinegar.

Inhalation

- If inhaled: Move the victim to fresh air and keep at rest in a position comfortable for breathing.

Skin

- If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
- Wash contaminated clothing before reuse.

Eyes

- If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present, and easy to do. Continue rinsing.

Ingestion

- Rinse mouth.
- Do NOT induce vomiting.

Storage

- Store locked up.
- Store in a well-ventilated place. Keep the container tightly closed.
- Store in a corrosive-resistant polypropylene container with a resistant liner.
- Attacks some forms of plastics, rubber, and coatings.
- Store as a powder in dry conditions.

Disposal

- Dispose of contents/containers at an approved waste disposal plant.

BLUETOOTH BATTERY SENSOR

The Bluetooth Battery Sensor is critical to the safe operation of the HHO1500. Its purpose is to ensure that the customer's vehicle is on while the HHO1500 is producing oxyhydrogen gas. If a vehicle turns off or changes its operating condition beyond preset configurations, then the Battery Sensor will terminate the signal to the HHO1500. If the HHO1500 does not have a connection to the Battery Sensor, then it will not produce oxyhydrogen gas.

Several things impact a battery's voltage output:

- Alternator charging the battery
- Electrical load



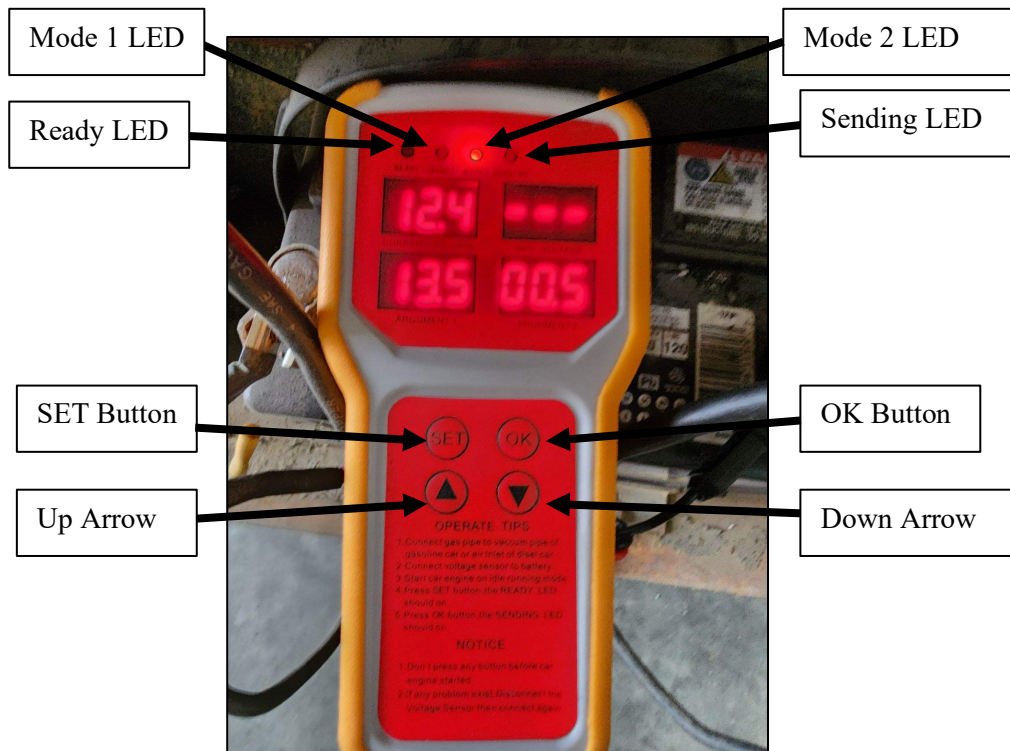
- Age of battery

A vehicle's battery is charged by the alternator when an engine is running. The alternator sends a higher voltage to the battery to charge it. A typical vehicle has a 12 V battery for example. When the vehicle is powered off, the battery voltage will measure about 12.6 volts. When the engine is running, the battery voltage will range anywhere between 12.6 to 14.4 volts because of the additional charge from the alternator. If an engine turns off, then the battery voltage would drop below the minimum voltage of the Battery Sensor and the Battery Sensor would terminate its signal to the HHO1500. The default minimum voltage is 13.0 V.

The load on the electrical system also impacts the voltage output. If a vehicle's headlights or air conditioning are powered on, then the battery may output higher voltage. Some vehicles are designed so that when the engine has lower demands, the alternator lowers the output power. If the voltage steps outside the preset voltage tolerances (0.5 V) on the Battery Sensor, then its signal to the HHO1500 will be terminated. To maintain a signal either adjust the voltage tolerance or turn on the air conditioning or headlights.

The Bluetooth Battery Sensor is powered on when connected to the vehicle's battery. It has no internal power supply.

Image 17. Bluetooth Battery Sensor Controls and Indications





Bluetooth Battery Sensor Indications

- **Mode 2 LED.** Illuminates when connected to the vehicle battery. This indicates the Battery Sensor is powered on.
- **Ready LED.** Indicates if the Set Voltage configuration is set. Illuminates green when the Battery Sensor is powered and the Set Voltage reading is configured (after the “SET” button is pressed). It is not illuminated before the Set Voltage is configured.
- **Sending LED.** Indicates if the Battery Sensor is communicating with the HHO1500. When flashing red, the Battery Sensor is connected to the HHO1500. If it is not illuminated, then the Battery Sensor is not connected to the HHO1500 and the HHO1500 will not produce oxyhydrogen gas. The connection is made after the device is “ready” (as indicated by the Ready LED) and the user hits “OK.” If the voltage goes below minimum voltage or outside the voltage tolerances, then this indicator will extinguish and the Battery Sensor will stop transmitting a signal to the HHO1500.

Bluetooth Battery Sensor Controls

- **SET Button.** Pressing once establishes the connected current battery’s voltage as the Set Voltage. Holding the SET button for 3 seconds changes the screen to a Setting Screen where alternative settings may be chosen.
- **OK Button.** Confirms selection.
- **Up Button.** Moves the selected number or setting up.
- **Down Button.** Moves the selected number or setting down.

Battery Sensor Argument Windows

- **Current Battery Voltage.** The top left argument window displays the current voltage output of the vehicle’s battery. This will change frequently based on the battery output. It is not a constant value.
- **Set Voltage.** The top right argument window displays the Set Voltage setting that is established when the user presses the SET Button. The Set Voltage is the expected power output of the operating vehicle which the voltage tolerance is applied to and the current battery voltage is measured against. For instance, a typical Set Voltage may be set at 13.5 volts for most cars. The voltage tolerance may be 0.5 volts. The allowable voltage range will be between 13.0 and 14.0 volts. The Battery Sensor will disconnect from the HHO1500 if the current battery voltage goes below 13.0 volts or over 14.0 volts (0.5 volts above or below the Set Voltage). The Battery Sensor pings the current battery voltage every few seconds to test. If the current battery voltage drops outside the voltage tolerances momentarily it will not terminate the signal to the HHO1500.
- **Minimum Voltage Required.** The bottom left argument window labeled “Argument 1” displays the configurable minimum voltage value. This minimum value is compared against the current battery voltage to determine if the alternator is operating. If the current battery voltage drops below this value, then the sensor assumes the vehicle has turned off, and the Battery Sensor will terminate its connection to the HHO1500.
- **Voltage Tolerance.** The bottom right argument window labeled “Argument 2” displays a configurable value (in volts) that the current battery voltage can range above or below the Set Voltage. Its default setting is half a volt (0.5 volts).
- **Settings Screen.** If the SET button is depressed for 3 seconds, then the argument window values can be adjusted. “Battery Sensor Command Structure” image (Image 18) walks through the



command structure to change the values.

- **Eight-bit Floating-Point (FP8).** An FP8 code is a combination or key so that the Battery Sensor pairs with an HHO1500. The Battery Sensor can change the FP8 setting from 0 to 5. Those correlate to dial switch receiver positions in the Bluetooth Receiver on the HHO1500.

Image 18. Battery Sensor Argument Windows

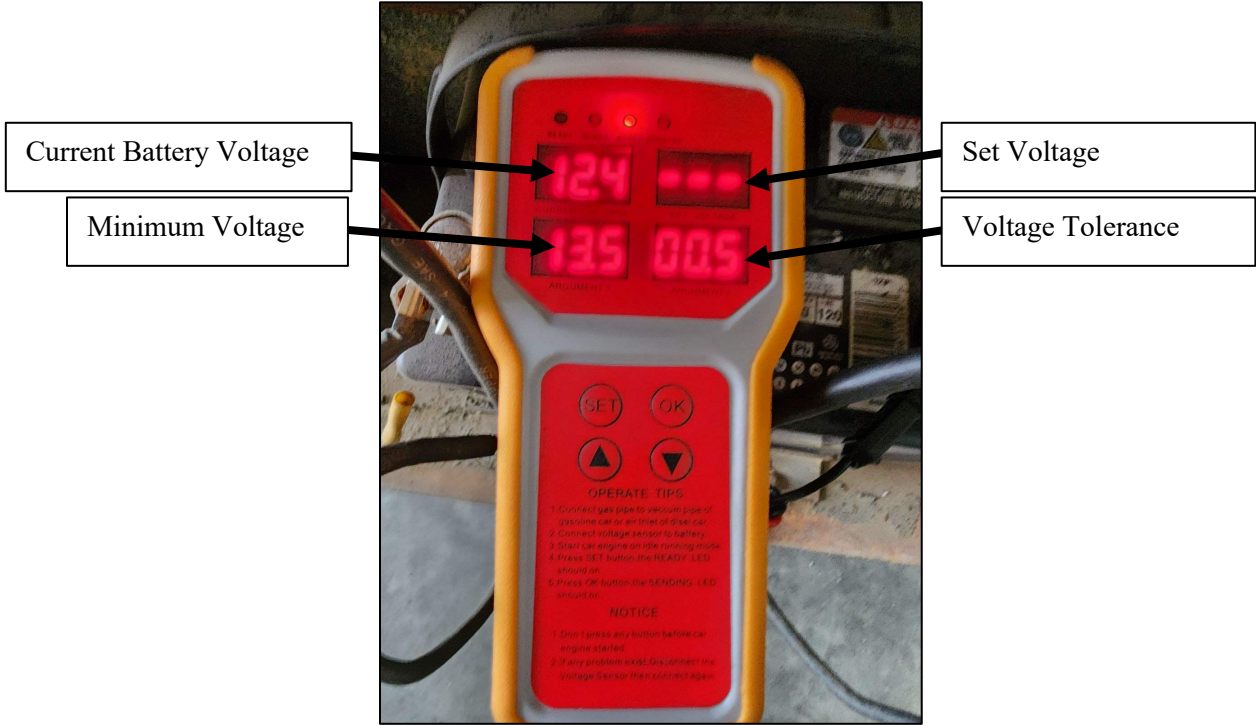




Image 19. Battery Sensor Tips and Notices



Image 20. Battery Sensor Command Structure

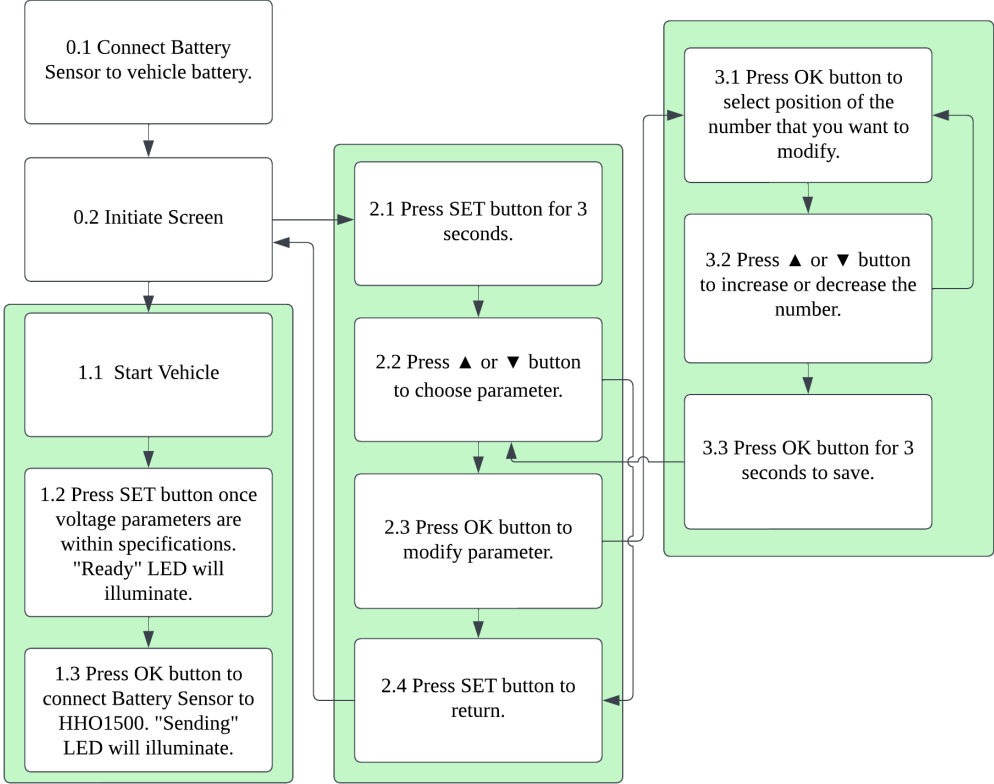




Image 21. FP8 Setting Screen

Eight-bit Floating-Point



VEHICLE CONNECTION POINTS

WARNING

Misplacement of connection point may cause a backfire or engine explosion causing injury to nearby individuals.

CAUTION

Ensure that the specialized fitting is fed downhill towards either the throttle body or exhaust side of the turbo (if one is present) so that moisture does not pool. Connecting anywhere before this point may cause moisture or oxyhydrogen gas to pool which may cause damage to the engine.



CAUTION

Not bleeding the hose of “water slugs” before a service may cause damage to critical engine components.

CAUTION

If the Graduated Fitting or Adaptors come in contact with the turbo or throttle body, it may cause damage the components.

CAUTION

If there is high traffic, dusty conditions, or any chance of debris, then do not remove air filter. Seal off your connection point with tape to remove chance of any foreign substances getting into the engine. Foreign substances can cause engine damage.

CAUTION

Kinks or obstructions to the Hydrogen Generation Hose can cause oxyhydrogen gas to pool which can cause damage to HHO1500.

NOTE

The specialized fitting tube may need to be cut to length to fit the length of the air filter connecting hose.

Although the connection points on gas or diesel engines are fairly consistent, how to access the engine compartment will vary. Accessing the engine varies from consumer vehicles to semis to agriculture equipment to construction equipment. If the user doesn't know how to access the engine compartment, the safest course of action is to ask the customer to demonstrate. Then document for future reference.

Internal combustion engines may be defined in three main categories: without a turbo, with a turbo, or twin turbos. The presence of the turbo is the main factor impacting the connection point for each service. Turbos are present on almost all diesel engines, and becoming increasingly more common on gas engines.



Image 22. Hydrogen Hose Fitting



Connection on Engine without Turbo:

Feed specialized fitting about two inches before the throttle body butterfly valve pointed downhill, without causing interference. If the hose has to be inserted longer than 12 inches, loosen the connection to the throttle body so that the user may visually verify that the tube will not interfere with the throttle body.

Image 23. Example 1 of Connection Point on Gas Engine



Image 24. Example 2 of Connection Point on Gas Engine

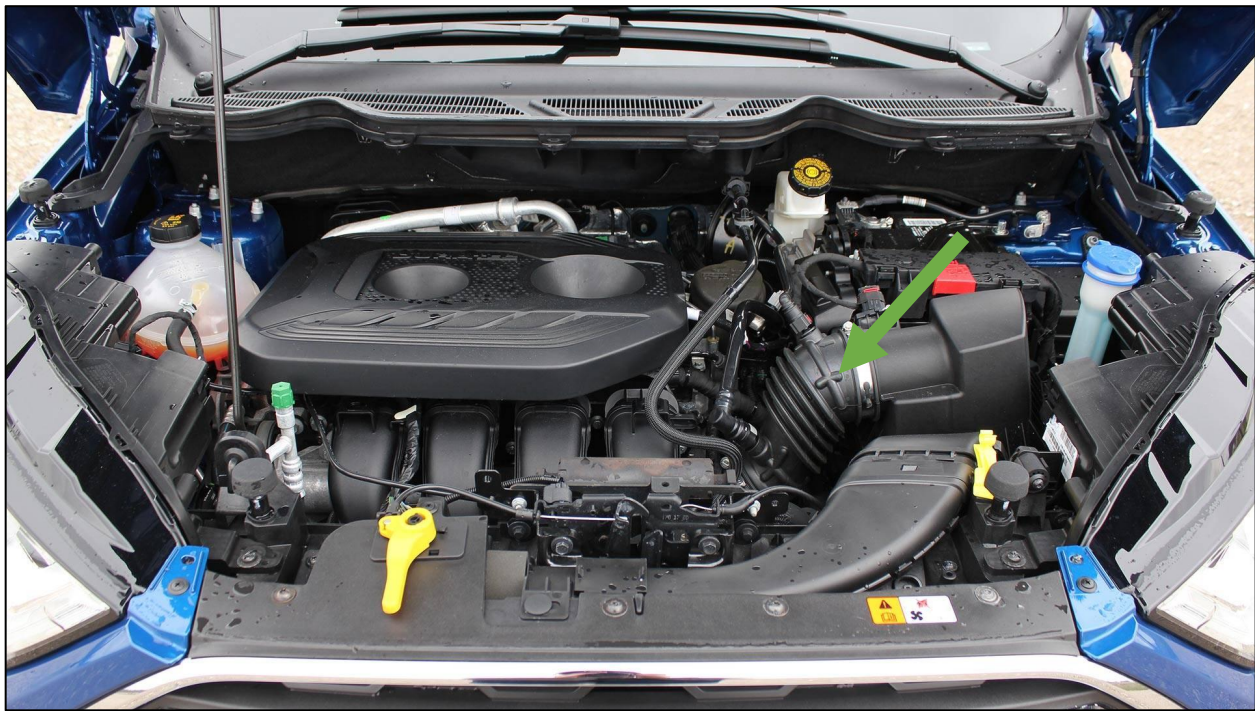
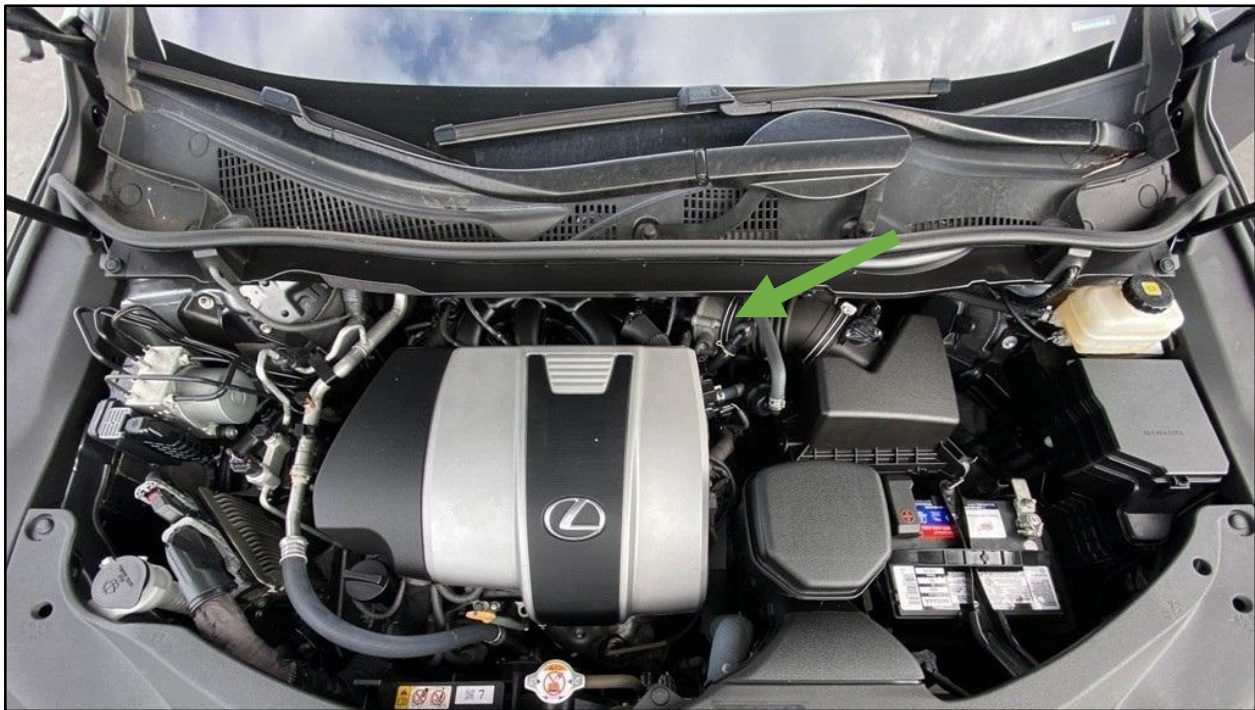


Image 25. Example 3 of Connection Point on Gas Engine





Connection on Engine with Turbo:

Feed specialized fitting within a couple of inches of the fresh air side of the turbo while aimed downhill, but not to interfere with the compressor wheel.

Image 26. Example 1 and 2 of Connection Points on Engines with Turbos.



Connection on Engine with Twin Turbos:

Feed specialized fitting within a couple of inches of the fresh air side of the turbo while aimed downhill, but not to interfere with compressor wheel. Switch at the midpoint of the duration of the service to the connection point near the second turbo because turbos may go into separate intake manifolds or engine cylinders.

Image 27. Example of Connection Point on Engines with Twin Turbo

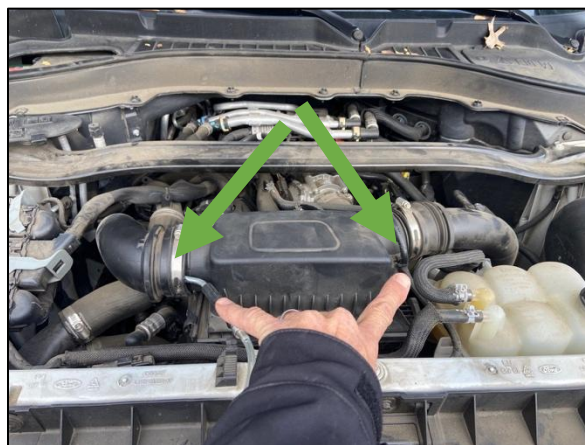




Image 28. Graduated Fitting Attached to Hose Adaptor



OPERATIONS AND PROCEDURES

The HHO1500 is designed to generate oxyhydrogen gas using electrolysis. It is utilized for hydrogen carbon cleaning services on petrol-fueled internal combustion engines. The operations in this manual guide include equipment inspection, exterior and interior inspections of vehicles to be serviced, Battery Sensor operations, HHO1500 startup procedures, engine connections, mid-service monitoring, after-service procedures, cold weather operations, and routine maintenance.

HHO1500 EQUIPMENT INSPECTION

HHO1500 Physical Inspection

- 1) Inspect HHO1500 exterior.
 - a) Check if the electrolyte solution needs to be replaced. (12 months or 1,000 hours to replace electrolyte solution, whichever is sooner.)
 - b) Confirm hoses are clean and clear.
 - i) If the temperature has been below freezing since the last inspection, make sure no ice accumulation inside of hoses.
 - c) Check the Control Panel for cracks or damage.
 - d) Check power cords to make sure secured and not frayed. Confirm no wires are exposed.
 - e) Verify overall condition is without damage.
- 2) Inspect the Refill Access Compartment.
 - a) Remove any standing water, as required.
 - b) Make sure both lids are present and can be loosed and tightened.
 - c) Visually check to see if the water level in the Electrolyte Cell is above half full. Do not fill the Electrolyte Cell without the HHO1500 being powered on. Accurate water level



- can only be confirmed by the Control Panel.
- d) Verify 17mm wrench is present either in the compartment or in a toolbox.
 - e) Close the compartment
- 3) Inspect the Main Compartment.
- a) Fill the Auxiliary Water Tank with distilled water, if less than full.
 - b) Inspect Electrolysis components for damaged or loose connections, and that components are fully secured.
 - c) Inspect Power Supply components for damaged or loose connections, and that components are fully secured.
 - d) Close the compartment
- 4) Inspect the Control Module Compartment for damaged or loosed connections, and that components are fully secured.

Power Generator Inspection (As Required)

- 1) Inspect the power generator per its operating manual.
- 2) Check fuel level and refill as required.
- 3) Inspect oil level and refill as required.

Service Vehicle Equipment Inspection (As Required)

- 1) Inspect the extra water tank's water level to supply the day's cleanings.
- 2) Inspect the extra fuel tank's fuel level to supply the day's cleanings.
- 3) Verify safety equipment in the vehicle.
 - a) Cones
 - b) Glasses
 - c) Hard Hat
 - d) Reflector vests
 - e) First Aid Equipment
 - f) Fire Extinguisher
- 4) Ensure hand tools are accounted for and secured.
- 5) Ensure hose adaptors are present and properly secured.
- 6) Ensure power tools are present.
 - a) Count batteries and charge level.
- 7) Ensure Battery Sensor(s) is present.

Equipment Functionality Inspection

- 1) Turn on the power generator to verify functionality and operation (as required).
- 2) Connect the Battery Sensor to your service van and turn it on.
- 3) Turn on HHO1500 to verify functionality and operation.
 - a) Verify that the HHO1500 passes self-test.
 - b) Check for warnings on the Control Panel.
 - c) Verify electrolyte solution level is full.
 - d) Confirm oxyhydrogen gas is flowing properly:
 - i) While holding onto the hose and pointing it down and away from the technician, set the flow rate for 1,200 L/Hr. This process removes water slugs or excessive moisture from the line. The process is called "bleeding the line."
 - ii) Once "Status Ok, Press ON to Start" is displayed, Press "ON" to start hydrogen



- generation.
- iii) Check for bubbles in the Auxiliary Water Tank.
 - iv) Rotate the hydrogen adjustment knob to 0 L/Hr and check to see if bubbling in the Auxiliary Water Tank has stopped. Then return the hydrogen adjustment knob to 1,200 L/Hr and inspect for an increased bubble rate.
 - v) Stop the oxyhydrogen gas generation.
- 4) Turn off the HHO1500.
 - 5) Turn off the power generator (as required).
 - 6) Secure vehicle.

CUSTOMER VEHICLE INSPECTIONS

While a hydrogen carbon cleaning service is effective and beneficial for internal combustion engines, not every vehicle should be serviced. There are occasions to NOT provide a service.

Preventative Criteria

WARNING

Do NOT Perform Service When any of the Following Conditions Occur. It may cause hazardous situations for people or equipment.

- Oil below the operational level
- Low or insufficient Diesel Exhaust Fluid (DEF)
- No personal protection equipment or safety equipment is available
- Thunderstorm/heavy rain if service is conducted outdoors
- Unsafe environment:
 - Unsafe location (i.e. if a vehicle's exhaust is in a position to cause damage to a building, or if there is an uncomfortable amount of traffic next to a highway or the vehicle is not fully pulled to the shoulder.)
 - Unsafe conditions (i.e. broken glass)
- If the customer is interfering with the service
- If the vehicle is not drivable or operatable before the service
- If the engine has not been utilized in the previous four weeks due to maintenance concerns or is not scheduled to be utilized in the foreseeable future because of maintenance concerns

If a technician does not feel safe performing the service for any reason, they are to contact their supervisor to discuss the situation and determine the best course of action.

Pre-Service Questions

- 1) "Has your vehicle been in the shop recently?"
- 2) "Is the vehicle experiencing any maintenance issues?"
- 3) "When was the last time this vehicle was used?"
- 4) "Has your vehicle had any engine or hood modifications?"
- 5) "Are you okay if we reset your trip gauges to see if there is an improvement in your fuel



- economy?”
- 6) “How often is your vehicle doing a regen?”
 - 7) “Is your engine in Derate?”
 - 8) “Do you use the same driver for the vehicle or do you slip seat drivers?”

Exterior Vehicle Inspection

- 1) Place Safety Equipment
 - a) Put on a reflector vest, safety glasses, hard hat (if on a construction site)
 - b) Place a minimum of 2 safety cones between the vehicles around the hose.
- 2) Visual Inspection of Vehicle Exterior
 - a) Look for any damage to the vehicle’s exterior. Take pictures as necessary.
 - b) Look under the vehicle for fluids.
- 3) Visual Inspection of Engine
 - a) Place hood clamp on a hood strut to prevent the hood from closing.
 - b) Note any loose or broken components, hoses, cables, or wires. Take pictures as necessary.
- 4) Check the oil level

NOTE

Manufacturers vary on if the engine needs to be warmed to get an accurate oil level. Check with the manufacturer's recommendations.

- a) Remove the dipstick.
- b) Wipe with a clean cloth.
- c) Replace and remove the dipstick again.
- d) Verify oil level is in the operational zone.

NOTE

If out of operational zone, take picture because a service cannot be conducted outside of operational conditions.

- e) Replace dipstick.
- f) Lower hood.
- 5) Log anything outside normal working conditions on the vehicle’s exterior, engine, or oil level.

Interior Vehicle Inspection

- 1) Ensure that the vehicle is in park, or has the parking brake on.



NOTE

Semis that have a manual transmission must be in neutral to start. They cannot start while in gear. Ensure that the parking brake is engaged.

- 2) Start the vehicle.
- 3) Log vehicle mileage and/or engine hours.
- 4) Log fuel economy. If permission was received to reset the fuel economy gauge, do so after logging the initial reading.
- 5) Check for engine faults. If no faults, continue to step 7. If the “check engine” light, “maintenance” light, or “DEF Warning” light are on:
 - a) Take picture
 - b) Connect the Scan Tool or Diesel Laptop and follow the instructions to read codes.
 - c) Log codes.
- 6) Allow the vehicle to warm to operating temperature. This can take between 5 and 30 minutes depending upon ambient temperature and engine type.

NOTE

Get vehicle to operating temperature before performing the service. Operating temperature is reached when the engine temp needle comes off lowest temperature setting and is between a quarter and a half way on the gauge.

- 7) Notify the owner of anything outside of normal working conditions, engine codes, or that would prevent the service.

CARBON CLEANING PROCEDURE

HHO1500 Start-Up Checklist

- 1) Ensure safety equipment is in place.
 - a) Put on a reflector vest and safety glasses. Put on a hard hat if on a construction site.
 - b) Place a minimum of 2 safety cones between the vehicles around the hose.
- 2) Turn on the power generator (as required).

NOTE

If power generator exhaust is not routed to the exterior of the vehicle, keep the door open that is next to the generator so that fumes do not accumulate in the vehicle.



- 3) Plug in the HHO1500 power cord using 220 V, single-phase electrical outlet.
- 4) Turn on the Main Power Switch to “ON.”
- 5) Complete the “Connect Battery Sensor to Vehicle” Procedure.
 - a) Verify the Battery Sensor has “Ready” and “Sending” LEDs illuminated.
 - b) Verify the HHO1500 has the Signal indicator illuminated.
- 6) Ensure the Auxiliary Water Tank is filled to the top with distilled water. If additional water is necessary:
 - a) Remove the Water Fill Tank Cap.
 - b) Fill the Auxiliary Water Tank with distilled water.
 - c) Replace the Water Fill Tank Cap.
 - d) Verify that the cap has been hand-tightened.
- 7) Verify Electrolyte Cell is filled by having 3 lights illuminated on the Control Panel. If less than 3 lights are illuminated follow the below steps:
 - a) Remove the Electrolyte Fill Tank Cap.
 - b) Fill the Electrolyte Cell with distilled water until 3 lights illuminate on the Control Panel. Check the status in 1-quart increments to avoid overfilling. Use a clean funnel.

CAUTION

Use the Control Panel to determine fill level. Determining fill level by viewing inside the cell will not determine the accurate level and can cause overfilling. If this tank overfills, then HHO1500 will push KOH solution through hose and into vehicles rather than oxyhydrogen gas. KOH can cause engine damage.

- c) Replace the Electrolyte Fill Tank Cap.
- d) Check that the cap has been hand-tightened, and secured with a wrench.

NOTE

Any water that is spilled in the Refill Access Compartment should be dried to prevent corrosion.

- 8) Set the “Worktime” duration of service.

Table 3. Length of Service Based on Engine Size	
Engine Size	Length of Service
Light or Medium-Duty (Gas or Diesel Engine Smaller than 7.3L)	35-minutes
Heavy-Duty Diesel (7.3L-15.0L)	45-minutes
Ultra-Heavy Duty (>15.0L)	See equation below



- a) Touch “Minutes” on the Control Panel touch screen. Adjust duration to align with vehicle type:
 - i) Light and Medium-duty diesel or gas engines (engines smaller than 7.3L) – 35 minutes.
 - ii) Heavy-duty diesel (Between 7.3L and 15L) – 45 minutes.
 - iii) Ultra-Heavy diesel (Larger than 15L engines) service length depends. Below is the equation to use to determine service length when a single HHO1500 is being used:

$$\{(X - 15L) / 4L\} * 15 \text{ min} + 45 \text{ min} =$$

Where “X” is the engine displacement greater than 15L. For example, an 18L engine:

$$\{(18L-15L) / 4L\} * 15 \text{ min} + 45 \text{ min} =$$

$$\{3L / 4L\} * 15 \text{ min} + 45 \text{ min} =$$

.75 rounds up to 1

$$\{1\} * 15 \text{ min} + 45 \text{ min}$$

$$15 \text{ min} + 45 \text{ min} = 60 \text{ min}$$

60 min service for the 18 Liter engine

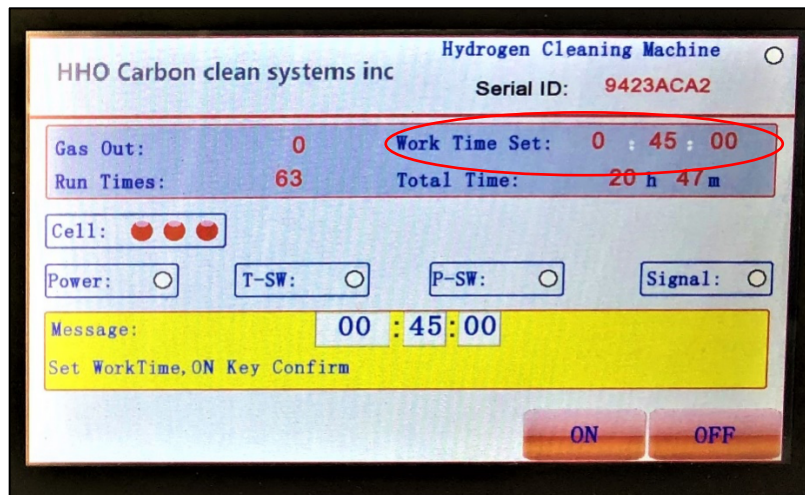
- b) Press “Ok.”

NOTE

Get the vehicle to operating temp before performing the service.

Operating temp is reached when the engine temp needle comes off the lowest temperature setting and is between a quarter and half way on the gauge.

Image 29. Work Time Set





- 9) Use the Hydrogen Adjustment Knob to set the flow rate of oxyhydrogen gas at a recommended 1,200 L/Hr.

NOTE

View the Auxiliary water tank to ensure bubbling while HHO1500 is operational. This confirms oxyhydrogen gas is flowing from the electrolyte cell.

NOTE

Operating the equipment at a max rate of 1,500 L/hr may cause equipment to deteriorate more quickly or cause KOH to lose effectiveness more quickly than prescribed.

- 10) Set the Water Adjustment Knob for the engine type being serviced.

Table 4. Water Adjustment Knob Setting Based on Engine Type	
Engine Type	Water Adjustment Knob Setting
Gas Engine	No Moisture. All the way off.
Diesel Engine	One water drop every 8-12 inches in hose.

- a) For gas engines, turn the Water Adjustment Knob all the way counterclockwise. Minimum to no moisture should be visible in the hydrogen hose.
- b) For diesel engines, water drops should be spaced every 8-12 inches.

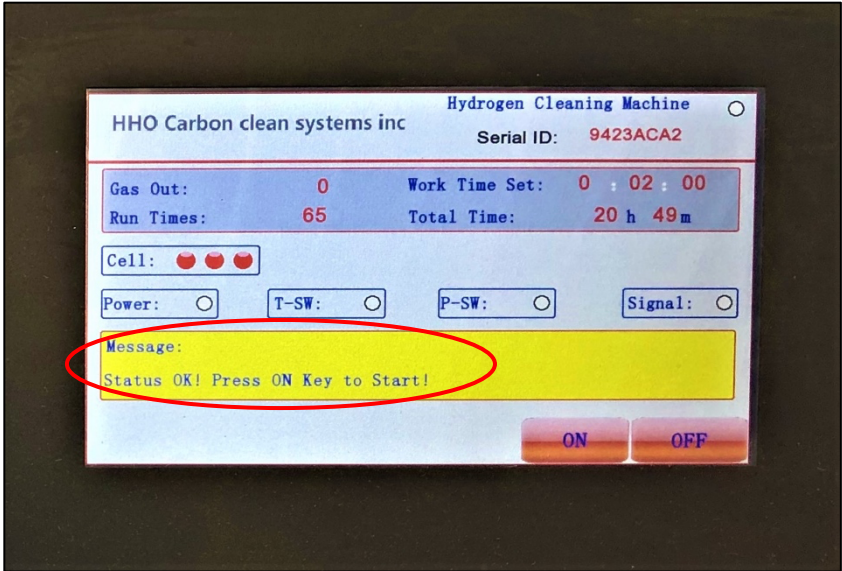
CAUTION

Too much moisture flowing into a gas engine may cause it to be hydrolocked. This causes severe damage to the engine and though it is repairable, it takes considerable time, effort, and cost.

- 11) Verify that the HHO1500 passed the self-test, the Control Panel will show “Status OK, Press ON Key to Start!”
- 12) Connect Specialized Fittings to Engine (See Connect Specialized Fitting Checklist). They Hydrogen Generator Hose should not be connected at this time.
- 13) Ensure there are no kinks or obstructions in the hose.
- 14) Check once more that all settings are correct and no warning indicators are lit. If all systems are in good working order, select “ON” to initiate the HHO1500 hydrogen generator.
- 15) Clear excess moisture from the hose.
- 16) Connect the graduated fitting end of the Hydrogen Generator Hose to the Specialized Fitting.



Image 30. “Status OK! Press ON Key to Start!”



Mid-Service Monitoring

HHO 1500 will operate autonomously during service. However, for safe operation, do not leave the vehicle while the service is being conducted. An alarm will sound and the HHO1500 will stop oxyhydrogen generation at completion of service time.

Mid-Service Rev Cycles

Perform rev cycles in accordance with the table below.

Table 5. Rev Cycle Instructions

Engine Type	Frequency of Rev Cycles	Recommended RPM	Max RPM	Notes
Gas Engine	At beginning of service and every 5 minutes	1,500-1,800 RPM	2,500 RPM	Never Redline. Perform Rev cycle slow and easy.
Diesel Engine	At beginning of service at every 10 minutes	1,500-1,800 RPM	Rev Limiter Never exceed 2,500 RPM	Perform Rev cycle slow and easy.



NOTE

Diesel engines have a maximum RPM while parked.
The engines should never be revved above 2,500
RPM.

NOTE

Do not leave the vehicle or HHO1500 unmonitored
while service is being performed.

- 1) Ensure the engine is in park and/or ensure the parking brake is on.
- 2) Conduct rev cycles slow and easy:
 - a) Slowly advance the accelerator over 1 second till the engine speed is at the recommended RPM, not to exceed 2,500 RPM. Hold for two seconds.
 - b) Release pressure on the accelerator halfway, and then slowly advance a second time to the recommended RPM, not to exceed 2,500 RPM. Hold for two seconds.
 - c) Release pressure on the accelerator halfway, and then slowly progress a third time to the recommended RPM, not to exceed 2,500 RPM. Hold for two seconds.
 - d) Release of accelerator back to idle.

After-Service Checklist

HHO1500's automated service will terminate and no longer produce oxyhydrogen when the service time is completed. An alarm will sound. The machine will clear any oxyhydrogen gas remaining in the line and display "Status OK".

- 1) Disconnect specialized fitting and roll up the hose in a manner that prevents kinks. Store hose on HHO1500 storage hook.
- 2) Reattach the vehicle's couplings securely as originally found ensuring no dust or foreign matter can make it into the engine.
- 3) Disconnect the Bluetooth Battery Sensor from the customer's battery and place it in the proper storage compartment.
- 4) Power off HHO1500 using the Main Power Switch.
- 5) Turn off the power generator (as required).
- 6) Place a service sticker in one of the following places:
 - a) The top left corner of the windshield
 - b) If the list of inspections is on the inside driver-side door, place the sticker next to it, or
 - c) Inside the engine compartment, on top of the plastic engine cover.
- 7) Return safety equipment to their storage compartments.
- 8) Inspect the area to ensure no components or tools are left in the area.
- 9) Turn off the customer's vehicle.



CAUTION

Ensure HHO1500 is turned off before the customer vehicle is turned off to ensure no remnant oxyhydrogen gas pools in the engine.

NOTE

If vehicle has a master switch to control multiple batteries, then turn off master-switch.

- 10) Return hood clamp to storage location.
- 11) Close the engine access compartment of the customer vehicle.
- 12) Inspect the customer's vehicle to ensure the vehicle is in its original condition.
- 13) Notify the customer that service has been completed and return keys.

COLD-WEATHER PRECAUTIONS

Water expands below freezing (32°F or 0°C). The HHO1500 is vulnerable to damage if ice forms inside tanks or hoses. The auxiliary water tank is more susceptible to damage because it is a smaller tank with only distilled water. The electrolyte cell has a higher tolerance because it is a metal container and contains the electrolyte solution. However, that does not limit the necessary precautions. Take these precautions when operating in temperatures below freezing:

- When the temperature is anticipated to be below freezing overnight where the HHO1500 is stored, drain the Auxiliary Water Tank, drain the Hydrogen Generator Hose, and disconnect the Hydrogen Generator Hose.
- Disconnect and clear the Hydrogen Generator Hose of any moisture after each service to prevent water from freezing in the hose.
- Use the insulated hose during service and disconnect after service.
- Use the heated blanket at the connection point to the customer's vehicle to prevent freezing at the exposed end of the adaptor.
- Use a space heater in the service van to keep HHO1500 above freezing temperatures, as required.

BATTERY SENSOR OPERATIONS

The Bluetooth Battery Sensor is critical to the safe operation of the HHO1500 and the customer's vehicle. Its purpose is to ensure that the engine being serviced is idling so that no oxyhydrogen gas pools or becomes trapped inside the engine.

Connect Battery Sensor to Vehicle

- 1) If the vehicle is turned off, power on the customer's vehicle.

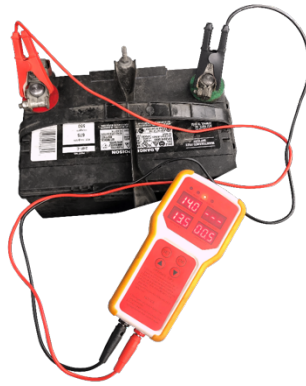


NOTE

Some heavy-duty diesels have multiple batteries and a master switch to turn on all the batteries. Ensure the master switch is turned on prior to service, if required.

- 2) Locate the battery of the customer's vehicle.
- 3) Connect Battery Sensor to customer vehicle.
 - a) Connect the black wire to the negative pole of the battery.
 - b) Connect the red wire to the positive pole of the battery.

Image 31. Bluetooth Battery Connection



- c) Mode 2 Indicator will illuminate when connected to the battery.
- 4) Press “Set” if voltage parameters are within vehicle specs. The “Ready” LED will illuminate. If voltage parameters are out of vehicle specs, reference the Battery Sensor Operation section.
- 5) Press “OK” to connect HHO1500 and Battery Sensor. “Sending” LED will illuminate.
 - a) HHO1500's “Signal” indicator turns red once connected to the battery.

NOTE

If an error on the Control Panel reads “Car Engine Stop” but the engine is still idling, adjust the Battery Sensor's Set Voltage, regain signal, and resume service.

If the customer vehicle has turned off during service, stop service, allow HHO1500 to drain hydrogen gas from hose, and let the engine sit for 10 minutes to naturally dissipate any hydrogen before resuming service.

Set Voltage Tolerance

- 1) Connect the Bluetooth Battery Sensor to the vehicle battery.



- 2) Press and hold the SET Button for 3 seconds until the Setting Screen appears.
- 3) Use ▲ or ▼ buttons to choose parameter.
- 4) Once the bottom right screen is blinking, press “OK.”
- 5) Use ▲ or ▼ buttons to adjust voltage tolerance.
- 6) Hold “OK” for 3-seconds to store info.
- 7) Press SET button to return to the home screen.

Dedicate Signal for Battery Sensor

- 1) Locate the Bluetooth Receiver in the Control Module Compartment on the HHO1500.
- 2) Remove Bluetooth Receiver face plate to reveal the Dial Switch.
- 3) Set Dial Switches to one of six unique combinations listed below by turning the dial switches “ON” or “OFF.” Combination “0” is the universal setting and is also the default setting within the Bluetooth Battery Sensor.

Image 32. FP8 Settings Screen

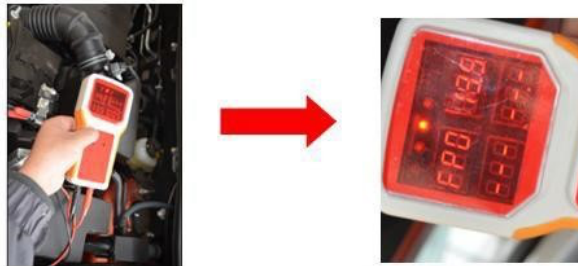


Table 6. Dial Switch Combinations

Battery Sensor FP8 Combination	Dial Switch Receiver Position			
	1	2	3	4
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON

- 4) Hold “SET” for 3 seconds on the Bluetooth Battery Sensor to navigate to the FP8 Settings Screen.
- 5) Set the FP8 Setting to the combination that was chosen in step 3 using the ▲ or ▼ buttons.
- 6) Hold “OK” for 3 seconds to store info.
- 7) The Bluetooth Battery Sensor will now only connect with the HHO1500 that uses the same corresponding combination.
- 8) Press SET Button to return to the main screen.



MAINTENANCE PROCEDURES

Refill Electrolyte Solution

KOH Electrolyte Solution is to be filled upon installation, and changed every 12 months or 1,000 hours, whichever is sooner.

CAUTION

Use of any electrolyte compound other than Potassium Hydroxide (KOH) will result in damage to the HHO1500. No damage caused by misuse is covered under HHO warranties or guarantees.

- 1) Put on Personal Protective Equipment.
- 2) Place an opened and empty 5-gallon KOH-safe container under the Electrolyte Cell Drain. The container needs to be able to hold the full 3.5 gallon cell capacity.
- 3) Open the valve and allow the electrolyte solution to drain until it is empty.
- 4) Close the drain valve. Close and set aside the KOH container.
- 5) Place a new and empty 5-gallon KOH-safe container under the drain.
- 6) Open the Electrolyte Cell cap.
- 7) Add approximately 3 gallons of distilled water into the tank.
- 8) Open the valve to drain the tank until empty.
- 9) Close the drain valve. Close and set aside the KOH container.
- 10) Repeat steps 5-9 two more times. This will flush and rinse the system 3 times.
- 11) Create 3.5 gal of new KOH solution.
 - a) Add 4.375 kg of KOH to the bottom of a stainless-steel bucket.
 - b) Add 3.5 gallons of distilled water to the KOH.
 - c) Stir until mixed.
 - d) Wait and allow KOH solution to stop boiling.

WARNING

The chemical reaction of KOH and distilled water will generate heat. It will boil almost immediately. This can cause bodily harm to the user.

- 12) Power on HHO1500 so that Electrolyte Cell levels are visible.
- 13) Pour KOH solution into the Electrolyte Cell using a clean funnel.
 - a) Remove the Electrolyte Cell cap.
 - b) Place a clean funnel into the opening.
 - c) Pour 3.5 gallons of KOH solution into the cell while watching the fill level on the Control Panel.
 - d) Remove funnel.
 - e) Hand-tighten the cell cap.
 - f) Secure the cap with a quarter turn of the wrench.
 - g) Clean and return KOH container to its safe storage location.



KOH Spills

If KOH is spilled or leaked, take the following steps:

- 1) Evacuate personnel. Secure and control the entrance to the area.
- 2) Eliminate all ignition sources.
- 3) Collect powdered material in the most convenient and safe manner and place it into a sealed containers for disposal.
- 4) Dilute KOH solution with white vinegar. Absorb it in vermiculite, dry sand, earth, or similar material and place it into sealed containers for disposal.
- 5) Ventilate and wash the area after clean-up is complete.
 - a) DO NOT WASH IN THE SEWER.
- 6) It may be necessary to contain and dispose of KOH as HAZARDOUS WASTE. Contact your State's Dept of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Regular Maintenance

Regular HHO1500 maintenance is essential for user safety, machine safety, and effective hydrogen carbon cleaning service. The maintenance operator should be a professional technician who has received the relevant equipment maintenance training for this machine.

WARNING

The power supply must be off before opening the compartments due to high voltage. High voltages can be very harmful to people.

Monthly or 250-hour Maintenance

- 1) Remove dust from inside the HHO1500 compartments with compressed air.
- 2) Check safety valves for gas leaks.
- 3) Ensure cooling fan is operational.

12-Month or 1,000-hour Maintenance

- 1) Follow the Refilling of Electrolyte Solution checklist.
- 2) Check interior components. Remove dust with compressed air.
- 3) Ensure the cooling fan is operational.

Long-Term Storage

For proper storage follow the instructions below:

- 1) Disconnect the power supply.
- 2) Drain Electrolyte Cell and Auxiliary Water Tank.
- 3) Put on Personal Protective Equipment.
- 4) Place an opened and empty 5-gallon KOH-safe container under the Electrolyte Cell Drain.
The container needs to be able to hold the full 3.5 gallon cell capacity.
- 5) Open the valve and allow the electrolyte solution to drain until it is empty.
- 6) Close the drain valve. Close and set aside the KOH container.
- 7) Place a new and empty 5-gallon KOH-safe container under the drain.



- 8) Open the Electrolyte Cell cap.
- 9) Add approximately 3 gallons of distilled water into the tank.
- 10) Open the valve to drain the tank until empty.
- 11) Close the valve. Close and set aside the KOH container.
- 12) Repeat steps 7-11 two more times. This will flush and rinse the system 3 times.
- 13) Remove Hydrogen Generator Hose.
- 14) HHO1500 should be packed securely in a suitable crate and stored upright only.
- 15) HHO1500 should be stored in an indoor, ventilated area free of corrosive materials.



TROUBLESHOOTING

Fault	Reason	Solution
Signal Interruption	An electrical wire connection between the circuit breaker, Circuit Control Module, or the power supply is loose.	Ensure power is off to the device and that it is unplugged. Resecure the wires on the circuit breaker, Circuit Control Module, and power supply control system.
The Control Panel shows normal operation, but no oxyhydrogen gas is produced, and the fan isn't running.	Shortage-phase running or the input voltage is lower than 220 V.	Power off and unplug HHO1500. Verify if the power supply providing 220 V. If not, change out power supply.
During carbon cleaning service, Bluetooth Battery Sensor indicates an error	Loose contact between the wires or battery	reconnect the Battery Sensor connection cables to the battery.
	Current battery voltage is lower than SET "baseline" value.	Turn on vehicle headlights or air conditioning for 3 minutes until the car battery reaches normal status, then complete service. If the current battery voltage remains low, then battery may need to be replaced.
	Signal Disruption	Change Battery Sensor HHO1500 position to establish a better Bluetooth connection.
No values display on the Battery Sensor after connected with the car battery	Battery sensor cables connected incorrectly.	Verify red cable is connect to the positive pole and black cable is connected to the negative pole.
	Battery sensor is broken	Replace Battery Sensor.
Sender doesn't show the car battery voltage	Current battery voltage is lower than the set Set Voltage	Reset the Battery Sensor parameters
P-SW light flashing	Too much pressure inside Electrolyte Cell	Unscrew the safety valve slowly to relieve pressure.
	Pressure sensor is broken	Change the pressure sensor
	The pressure sensor wire was loose or broken.	Resecure or change the pressure sensor wire.
Red T-SW Light indication or "ERROR: Cell Too Hot!" Displayed in work status dialogue box.	The power supply fan is broken	Follow on-screen prompts to troubleshoot and end alarm using ON Key. Replace the power supply fan.
	The temperature sensor is broken	Follow on-screen prompts to troubleshoot and end alarm using ON Key. Replace the temperature sensor.



Fault	Reason	Solution
Control Panel displays 0 gas output.	Shortage-phase running or input voltage is lower than 220 V	Power off and unplug HHO1500. Verify if the power supply providing 220 V. If not, change out power supply.
	The power supply was overheating. Device stopped production to prevent damage.	Turn device off. Allow to cool. Verify fan operational. Restart.
	The power supply is broken (the amber fault light on)	Repair or change the power supply.
Measured oxyhydrogen gas output is lower than machine is rated.	The KOH electrolyte solution has been degraded.	Refill the electrolyte solution.
Control panel “Cell” indicator shows 3 red lights, but no oxyhydrogen gas output	Auxiliary water tank is overfilled.	Drain excessive water from Auxiliary Water Tank.
Work Status dialogue box displays “ERROR: Car Engine Stop.”	Engine being serviced has breached the tolerance setting on your Battery Sensor or dropped below minimum voltage.	Vehicle has turned off and needs to be restarted.
		Car battery has died and needs to be replaced.
		SET battery voltage needs to be reset.
Work Status dialogue box displays “ERROR: Cell Lack of Water.”	The electrolyte solution level in the Electrolyte Cell is low and needs to be filled.	The “Cell” indicator will display the water level. Follow on-screen prompts, using ON Key to end alarm. To resolve, add distilled water as needed until 3 red dots appear beside “Cell” indicator.
White residue coming from hydrogen hose and appearing on components around connection points.	Electrolyte Cell was overfilled and KOH was pushed through hydrogen hose into engine.	KOH is highly corrosive and needs to be quickly removed from the connection point with a steel brush. To clean the HHO1500, follow the “Refill Electrolyte Solution.” Drain and refill the Auxiliary Water Tank.

<END>