



POCKET CHECKLIST

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1 VEHICLE CONNECTION POINTS

Warning:

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

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.

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.

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 the compressor wheel. Switch at the midpoint of the duration of service to the connection point near the second turbo because turbos may go into separate intake manifolds or engine cylinders.



2 HHO1500 EQUIPMENT INSPECTION

2.1 HHO1500 Physical Inspection

- 2.1.1 Inspect exterior.
- 2.1.2 Inspect the Refill Access Compartment.
- 2.1.3 Inspect the Main Compartment.
- 2.1.4 Inspect the Control Module Compartment.

2.2 Power Generator Inspection (As Required)

2.3 Service Vehicle Equipment Inspection

- 2.3.1 Inspect water supply levels.
- 2.3.2 Inspect fuel tank levels.
- 2.3.3 Verify safety equipment.
- 2.3.4 Ensure hand tools are accounted for and secured.
- 2.3.5 Ensure hose adaptors are accounted for and secured.
- 2.3.6 Ensure power tools are accounted for and secured.
- 2.3.7 Ensure Battery Sensor is present.

2.4 Equipment Functionality Inspection

- 2.4.1 Power on power generator (as required).
- 2.4.2 Connect Battery Sensor to vehicle.
- 2.4.3 Turn on HHO1500 and verify operation.
 - 2.4.3.1 Verify HHO1500 passes self-test.
 - 2.4.3.2 Check for warnings on Control Panel.
 - 2.4.3.3 Verify electrolyte solution level.



- 2.4.3.4 Confirm oxyhydrogen flow.
- 2.4.4 Power off HHO1500.
- 2.4.5 Power off power generator (as required).
- 2.4.6 Secure vehicle.



3 CUSTOMER VEHICLE INSPECTIONS

3.1 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 DEF fluid
- No PPE or safety equipment is available
- Thunderstorm/heavy rain if service is conducted outside
- Unsafe environment
- 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

3.2 Pre-Service Questions

- “Has your vehicle been in the shop recently?”



- “Is the vehicle experiencing any maintenance issues?”
- “When was the last time this vehicle was used?”
- “Has your vehicle had any engine or hood modifications?”
- “Are you okay if we reset your trip gauges to see if there is an improvement in your fuel economy?”
- “How often is your vehicle doing a regen?”
- “Is your engine in Derate?”
- “Do you use the same driver for the vehicle or do you slip seat drivers?”

3.3 Exterior Vehicle Inspection

- 3.3.1 Place safety equipment.
- 3.3.2 Visual inspection of vehicle exterior.
- 3.3.3 Visual inspection of engine.
- 3.3.4 Check the oil level.
- 3.3.5 Log anything outside normal working conditions on the vehicle's exterior, engine, or oil level.

3.4 Interior Vehicle Inspection

- 3.4.1 Ensure the vehicle is in park or has the parking brake on.
- 3.4.2 Start the vehicle.
- 3.4.3 Log vehicle mileage and/or engine hours.
- 3.4.4 Log trip fuel economy.
- 3.4.5 Check for engine faults.
- 3.4.6 Allow vehicle to warm to operational temperature.
- 3.4.7 Notify the owner of anything outside of normal working conditions, engine codes, or that would prevent the service.



4 CARBON CLEANING PROCEDURE

4.1 HHO1500 Start-Up Checklist

- 4.1.1 Ensure safety equipment is in place.
- 4.1.2 Turn on the power generator (as required).
- 4.1.3 Plug in HHO1500.
- 4.1.4 Turn on the Main Power Switch to “ON.”
- 4.1.5 Complete the “Connect Battery Sensor to Vehicle” procedure.
- 4.1.6 Ensure the Auxiliary Water Tank is filled.
- 4.1.7 Verify Electrolyte Cell is filled.
- 4.1.8 Set Worktime Duration of service.

Engine Size	Length of Service
Light or Medium-Duty (Gas or Diesel Engines Smaller than 7.3L)	35-minutes
Heavy-Duty Diesel (7.3-15.0L)	45-minutes
Ultra-Heavy Duty (>15.0L)	See Manual

- 4.1.9 Set Hydrogen Adjustment Knob to desired flow rate.
- 4.1.10 Set Water Adjustment Knob for the engine type being serviced.



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.

- 4.1.11 Verify HHO1500 passed self-test.
- 4.1.12 Connect specialized fitting to engine (See Connect Specialized Fitting Checklist). The Hydrogen Generator Hose should not be connected at this time.
- 4.1.13 Ensure no kinks or obstructions in hose.
- 4.1.14 Press "ON" to initiate the HHO1500 hydrogen generator.
- 4.1.15 Clear excess moisture from the hose.
- 4.1.16 Connect the graduated fitting end of the Hydrogen Generator Hose to Specialized Fitting.



4.2 Mid-Service Monitoring

4.2.1 Ensure the vehicle is in park and/or ensure the parking brake is on.

4.2.2 Conduct rev cycles.

4.2.2.1 Conduct rev cycles every 5 minutes on gas engines.

4.2.2.2 Conduct rev cycles at the beginning, middle, and end of service for diesel engines.

Note

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



4.3 Mid-Service Rev Cycles

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 cycles slow and easy.
Diesel Engine	At beginning of service and every 10 minutes.	1,500-1,800 RPM	Rev limiter. Never exceed 2,500 RPM.	Perform rev cycle slow and easy.

4.3.1 Ensure the engine is in park and/or ensure the parking brake is on.

4.3.2 Conduct rev cycles:

- 4.3.2.1 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.
- 4.3.2.2 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.
- 4.3.2.3 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.
- 4.3.2.4 Release of accelerator back to idle.



4.4 After-Service Checklist

- 4.4.1 Disconnect specialized fitting and roll up the hose in a manner that prevents kinks. Store hose on HHO1500 storage hook.
- 4.4.2 Reattach the vehicle's couplings securely as originally found ensuring no dust or foreign matter can make it into the engine.
- 4.4.3 Disconnect the Bluetooth Battery Sensor and place it in the proper storage compartment.
- 4.4.4 Power off HHO1500 using the Main Power Switch.
- 4.4.5 Turn off the power generator (as required).
- 4.4.6 Place a service sticker.
- 4.4.7 Return safety equipment to their storage compartments.
- 4.4.8 Inspect the area to ensure no components or tools are left in the area.
- 4.4.9 Conduct and save a Post-Cleaning Report from a data collection device, as applicable.
- 4.4.10 Turn off the service vehicle.
- 4.4.11 Close the engine access compartment of the service vehicle.
- 4.4.12 Inspect around the service vehicle to make sure the vehicle is in its original condition.
- 4.4.13 Notify the customer that service has been completed and return keys.



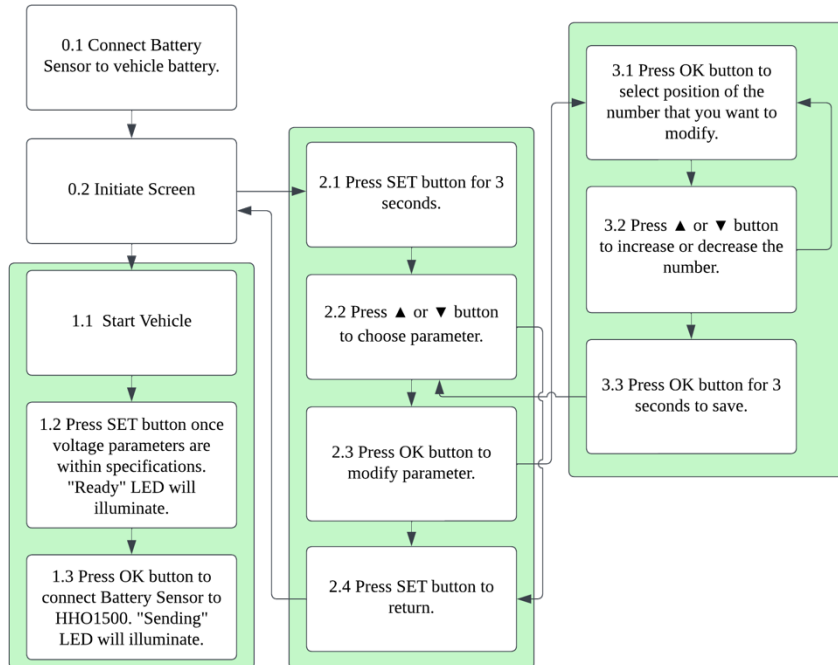
5 COLD WEATHER PRECAUTIONS

- When the temperature is anticipated to be below freezing overnight where the HHO1500 is stored, drain the ancillary 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 services.
- Use the heated blanket at the connection point to the customer 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.



6 BATTERY SENSOR OPERATIONS

Chart 1. Battery Sensor Command Structure





6.1 Connect Battery Sensor to Vehicle

- 6.1.1 Power on vehicle being serviced.
- 6.1.2 Locate the battery.
- 6.1.3 Connect Battery Sensor to battery – black to negative, red to positive.
- 6.1.4 Press “Set” if the parameters are within specs.
- 6.1.5 Press “OK.” Verify “Sending” LED illuminated.

6.2 Set Voltage Tolerance

- 6.2.1 Connect the Bluetooth Battery Sensor to the vehicle battery.
- 6.2.2 Press and hold the SET Button for 3 seconds until the Setting Screen appears.
- 6.2.3 Use ▲ or ▼ buttons to choose parameter.
- 6.2.4 Once the bottom right screen is blinking, press “OK.”
- 6.2.5 Use ▲ or ▼ buttons to adjust voltage tolerance.
- 6.2.6 Hold “OK” for 3-seconds to store info.
- 6.2.7 Press SET button to return to the home screen.

6.3 Dedicate Signal for Battery Sensor

- 6.3.1 Locate the Bluetooth Receiver in the Control Module Compartment on the HHO1500.
- 6.3.2 Remove Bluetooth Receiver face plate to reveal the Dial Switch.
- 6.3.3 Set Dial Switches to one of six unique combinations listed in HHO1500 Manual 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.
- 6.3.4 Hold “SET” for 3 seconds on the Bluetooth Battery Sensor to navigate to the FP8 Settings Screen.
- 6.3.5 Set the FP8 Setting to the combination that was chosen in step 3 using the ▲ or ▼ buttons.



- 6.3.6 Hold "OK" for 3 seconds to store info.
- 6.3.7 The Bluetooth Battery Sensor will now only connect with the HHO1500 that uses the same corresponding combination.
- 6.3.8 Press SET Button to return to the main screen.



7 MAINTENANCE PROCEDURES

7.1 Refill Electrolyte Solution

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

Warning:

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

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.

- 7.1.1 Put on Personal Protective Equipment
- 7.1.2 Place an opened and empty 5-gallon KOH-safe container under Electrolyte Cell Drain.
- 7.1.3 Open the valve and allow the electrolyte solution to drain until empty.
- 7.1.4 Close the drain valve. Close and set aside KOH container.
- 7.1.5 Place a new and empty 5-gallon KOH-safe container under the drain.
- 7.1.6 Open the Electrolyte Cell cap.



- 7.1.7 Add 3 gallons of distilled water into the tank.
- 7.1.8 Open the valve and drain the tank until empty.
- 7.1.9 Close the drain valve. Close and set aside KOH container.
- 7.1.10 Repeat steps 5-9 two more times. This will flush the system 3 times.
- 7.1.11 Create a 3.5 gallon of new KOH solution. Instructions are in HHO1500 Manual.
- 7.1.12 Power on HHO1500 so that Electrolyte Cell levels are visible.
- 7.1.13 Pour KOH solution into the Electrolyte Cell using a clean funnel.

7.2 KOH Spills

- 7.2.1 Evacuate personnel and secure and control the entrance to the area.
- 7.2.2 Eliminate all ignition sources.
- 7.2.3 Collect powdered material in the most convenient and safe manner and place it into a sealed container for disposal.
- 7.2.4 Dilute KOH solution with white vinegar. Absorb it in vermiculite, dry sand, earth, or similar material and place into sealed containers for disposal.
- 7.2.5 Ventilate and wash the area after clean-up is complete.
- 7.2.6 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.

7.3 Regular Maintenance

- 7.3.1 Monthly or 250-hour Maintenance
 - 7.3.1.1 Remove dust from inside the HHO1500 compartments with compressed air.
 - 7.3.1.2 Check safety valves for gas leaks.



- 7.3.1.3 Ensure the cooling fan is operational.
- 7.3.2 12-Month or 1,000-hour Maintenance
 - 7.3.2.1 Follow the Refilling of Electrolyte Solution checklist.
 - 7.3.2.2 Check interior components. Remove dust with compressed air.
 - 7.3.2.3 Ensure the cooling fan is operational.
- 7.3.3 Long-Term Storage
 - 7.3.3.1 Disconnect the power supply.
 - 7.3.3.2 Drain Electrolyte Cell and Auxiliary Water Tank.
 - 7.3.3.3 Put on Personal Protective Equipment (PPE).
 - 7.3.3.4 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.
 - 7.3.3.5 Open the valve and allow the electrolyte solution to drain until it is empty.
 - 7.3.3.6 Close the drain valve. Close and set aside the KOH container.
 - 7.3.3.7 Place a new and empty 5-gallon KOH-safe container under the drain.
 - 7.3.3.8 Open the Electrolyte Cell cap.
 - 7.3.3.9 Add approximately 3 gallons of distilled water into the tank.
 - 7.3.3.10 Open the valve to drain the tank until empty.
 - 7.3.3.11 Close the valve. Close and set aside the KOH container.
 - 7.3.3.12 Repeat steps 7-11 two more times. This will flush and rinse the system 3 times.
 - 7.3.3.13 Remove Hydrogen Generator Hose.
 - 7.3.3.14 HHO1500 should be packed securely in a suitable crate and stored upright only.
 - 7.3.3.15 HHO1500 should be stored in an indoor, ventilated area free of corrosive materials.



8 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.



Fault	Reason	Solution
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 recorded voltage	Reset the Battery Sensor parameters



Fault	Reason	Solution
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.



Fault	Reason	Solution
<p>Work Status dialogue box displays "ERROR: Car Engine Stop."</p>	<p>Engine being serviced has breached the tolerance setting on your Battery Sensor or dropped below minimum voltage.</p>	<p>Vehicle has turned off and needs to be restarted.</p>
		<p>Car battery has died and needs to be replaced.</p>
		<p>SET battery voltage needs to be reset.</p>
<p>Work Status dialogue box displays "ERROR: Cell Lack of Water."</p>	<p>The electrolyte solution level in the Electrolyte Cell is low and needs to be filled.</p>	<p>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.</p>



NOTES