

DC2000



Kit DC2000. Installation Manual

Hydrogen on Demand Dual Fuel Generator Systems



HHO Plus
ALTERNATIVE ENERGIES



Eco-Friendly - reduces carbon emissions

Kit DC2000. Installation Manual

Hydrogen on Demand Dual Fuel Generator Systems

Safety Precautions	4
Important Information	4
Safety Equipment.....	4
Enjoy your new system	4
Installation of the mechanical components	5
General configuration of the system.....	5
Positioning the Generator Dry-Cell	5
Positioning the Water Tank.....	6
Positioning the water and HHO hoses	6
HHO injection point	7
Installation of the electrical components	8
General configuration of the system.....	8
Identifying the ignition source	8
Dry-Cell electric connections.....	9
Water and electrolyte setup	10
Principles of the electrolysis of water	10
Electrolyte concentration.....	10
Water levels in the tank	11
Amperage variation in the system	12
Changing the fuel injection in your car	13
Important Information	13

Old Cars with carburetor	13
Modern Cars with Electronic fuel injection.....	13
Installing the lambda sensor extender	15
Important Information	15
Lambda sensors	15
Locate the lambda sensors.....	16
Reset the computer ECU.....	17
Installing the extender	18
The need to treat also the downstream lambda sensor.....	21
Test run and checking your work	22
Maintenance.....	22
Check-list for HHO system debugging	23
Important information	23
Check-List	23
Parts positioning.....	26
HHO connection from the water tank to the air intake manifold	27
Water connections between the water tank and the dry-cell.....	28
Water connections between the dry-cell and the water tank.....	29
Electric connection from the battery to the relay (Position 30)	30
Electric connection from the ignition source to the relay (Position 85).....	31
Electric connection from the relay (Position 86) to the Ground	32
Electric connection from the relay (Position 87) to the dry cell	33
Electric connection from the dry cell to the ground.....	34



Kit DC2000. Installation Manual

Hydrogen on Demand Dual Fuel Generator Systems

Safety Precautions

Important Information

Read and follow these safety precautions to avoid hazards. If you do not understand these instructions or do not like to work on vehicles, please have a qualified mechanic do the installation for you. Incorrectly installing or using the Hydrogen on Demand Dual Fuel Generator System may result in serious damage to you and/or your vehicle.

It should take approximately 2,5 hours to install this unit, so ensure that you have enough time to complete the installation. Be sure to work outside, no smoking at any time during the installation; make sure the engine is off and very importantly, NOT HOT.

Your HHO Generator System does not store hydrogen, subsequently there is no fire hazard when installed properly. However water electrolysis generates Hydrogen, an explosive gas, which means ... **never light a match or smoke near or in front of the generators output** - the generator could explode!

Be careful with the generator working when the car is not moving. A small amount of hydrogen can accumulate in the air intake of the motor and could explode if you smoke or use an open flame near it.

Safety Equipment

Be sure to wear goggles and rubber gloves and only use professional tools; use common sense and general safety procedures used for any work carried out on automotive installations and maintenance.

Enjoy your new system

Be safe and enjoy your new Hydrogen on Demand Dual Fuel Generator System, read and understand these instructions before and during the installation and you will benefit from your new system for years to come.

Installation of the mechanical components

General configuration of the system

Please refer to the illustration below for typical configuration of the HHO system:



Positioning the Generator Dry-Cell

You will need to find a good place in the engine compartment to mount your new HHO Drycell. **It can be mounted in a horizontal position** (upright and level to the ground with the tube fittings facing directly upwards) **or in a vertical one**. Please remember that the water tank should be placed at least 10 cm above the generator Dry-Cell in order to guarantee a sufficient water head for the water to flow.

Install your new HHO Dry-Cell as far away from the heat of your engine as it is possible. Locate the coolest available place in the engine area, the most common place for the system is in the space between the front grill and the radiator as it is closest to the air entering the engine compartment and often the largest space available.

Make sure to install the Dry-Cell in a place that can easily be accessed and cleaned or inspected from time to time. It should be mounted and secured in such a manner as to ensure it does not move or bounce around while the vehicle is in motion, even over

rough terrain. Securing it with a permanent bracket (see photos below) should be sufficient to secure it to the engine chassis and to operate perfectly.



Positioning the Water Tank

Make sure that water tank is installed with the same care as described for the generator above. As mentioned before the tank needs to be placed higher than the HHO dry-cell to accomplish the gravity head needed for the water to flow into the generator.

Positioning the water and HHO hoses

Please refer to the illustration below for typical installation of the hoses:



HHO injection point

The system is operated by vacuum suction from your vehicle's air intake which takes the HHO directly to the combustion chamber mixing it with the air/fuel. The injection point must be done right **after the air filter box and, in modern cars, after the MAF sensor**, that measures the air flow going into the engine's chamber.



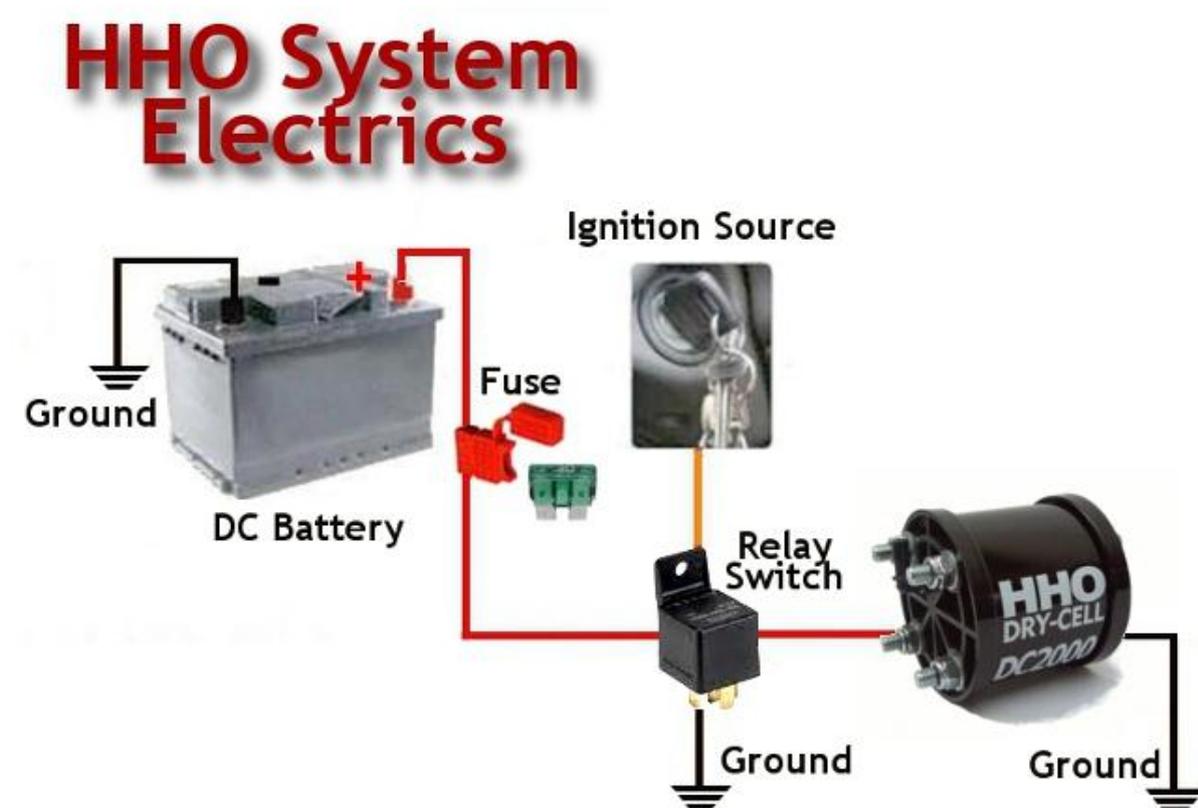
You will need to remove the air duct, to ensure that you do not leave any residue from the drilling you are about to do. Drill an 8mm hole close to the intake manifold. Clean out any drill shavings, insert the high pressure fitting using goop glue or teflon tape and tighten. Connect the high pressure hose.

Do not forget to install the security check-valve in the high pressure hose for protection in the correct position for the hydrogen flow.

Installation of the electrical components

General configuration of the system

For your new HHO system to be installed you will need to connect the system to the vehicles onboard 12 volt power supply (battery). Please refer to the illustration below for typical wiring configuration for powering of the system:



Identifying the ignition source

Identify a point in your vehicle's electrical system which has 12 Volts (red - positive) present **only when the engine is running** - circuit controlled by the ignition key (position 2).

The most secure connection is to excitement signal of the alternator. If you do not know how to do this connection please ask you usual mechanic to do it for you. Connect this electric source to the Relay Switch position 85. This circuit will control the HHO production.

Dry-Cell electric connections

Inside the Dry Cell the yellow connections are:

+ NNN – NNN + NNN – NNN +

N – neutral plate with no electric connection

Please check the plates with the yellow terminals in the dry-cell to make the electric connections as showed in the pictures below: The positive circuit (red wire) should be connected to the Relay Switch position 87 marked on the Relay. Some relays present the position 87a. Leave this connection with no connections. Connect the negative circuit (black wire) of the Generator to a good ground source near it.



Water and electrolyte setup

Principles of the electrolysis of water

Electrolysis of water is the decomposition of water (H_2O) into oxygen (O_2) and hydrogen gas (H_2) due to an electric current being passed through the water.

An electrical power source is connected to two electrodes, or two plates (typically made from some inert metal such as stainless steel) which are placed in the water. In a properly designed cell, hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode (the positively charged electrode). The amount of hydrogen generated is twice the number of moles of oxygen, and both are proportional to the total electrical charge.

Electrolysis of pure water requires excess energy in the form of overpotential to overcome various activation barriers. Without the excess energy the electrolysis of pure water occurs very slowly or not at all. This is in part due to the limited self-ionization of water. **The efficacy of electrolysis is increased through the addition of an electrolyte (such as a salt, an acid or a base).**

When applying a direct current to the HHO generator, a high resistance will be present in the water (electrolyte mixture). High resistance generates heat causing the water to heat up. As the temperature rises, the resistance in the water goes down, allowing more current/amps to pass through the fuel cell. By the end of the day, the current can easily be three times the amount than what you started with at the beginning of the day, possibly over heating the fuel cell and causing damage.

Electrolyte concentration

The electrolyte concentration to use in the system depends on the type of electrolyte and the purity of the product. The best electrolytes are KOH (Potassium hydroxide) and NaOH (caustic soda – sodium hydroxide).

Using KOH as electrolyte, with a 90% purity, we should use a concentration around 0,03% in the water solution (3 g/liter). However, **we advise you to start with only one coffee spoon and measure the current intensity going into the generator.** Our generator was designed to run cooler at 12A, and therefore you should have to put a little more electrolyte to bring your

IMPORTANT

Water is getting a brown color after only a few hours working?

You have a too high electrolyte in the system that is “eating” the generator plates too fast. Remove the water immediately and start all over again.

cell up to this operating standard.

Warning: Do not fall in the temptation of not measuring the current or increase the electrolyte concentration more than we advise, because in long term, the generator will not work properly and you will not save any fuel.

Also it is false to assume that a higher HHO gas production will mean a higher fuel saving. There is an optimum point for all internal combustions engines. The system should provide around 0,3 liter/min of HHO per each 1000 cm³ of engine displacement (ex: a 2800 cm³ engine will need around 0,84 liter/minute). You will be meeting this

IMPORTANT

The electrolyte should be added to the water only the first time that you use the system. After for refilling we only use distilled water.

standard running your generator with 12A.

Another thing that should consider is steam. Some of the early cell developers would run their units with so much amperage that the unit was producing more steam than anything else. If your unit runs hot to the touch, you must suspect that at least part of your output is steam. One way to test for steam is to run your gas outlet over some ice. If you get significant amounts of fog forming (water droplets), you know that at least part of your output is steam.

Water levels in the tank

Once you have your mixture ready, pour it into the top of the water tank , up to the water level line shown in the picture bellow. Try to only fill your unit about 70% full. This is imperative to allow the HHO produced to enter the gap left in the Tank and avoid any risks of some water getting into the engine.



The standard tank is a 1 liter unit which will provide you with approximately 800 kilometers of driving. Be sure to make your maintenance plan with that in mind and refill the tank every week.

Amperage variation in the system

When operating the system the water molecule will be “brocken“ into HHO gas and used by the engine. The water level in the tank will slowly go down but the electrolyte will continue in the system increasing the concentration and, therefore, the amperage being drawn into the generator. This means that when you start using the system, with the tank full (**Max level**), you have **12A** and after some time when the tank is at the lower point (**Min level**) you will have **15A**.

IMPORTANT

Try to refill your system as often as it is possible and at least once a week in order to avoid a high variation of the amperage in the system.

If you put too much electrolyte, there are a combination of heating factors at work and can cause a situation called **Thermal Runaway**, where an increase in ambient temperature combined with excess electrolyte mix leads to a overheating in the generator.

Changing the electronic fuel injection in your car

Important Information

When adding a HHO gas to the engine of an older vehicle that is carbureted, you will see immediate improvements in fuel consumption. However, this is not the case for some fuel injected vehicles equipped with an ECU, because the fuel burned inside the cylinders has significantly improved, but the lambda sensor is expecting the same amount of un-burnt oxygen to come out the engine onto the exhaust where it is monitoring the oxygen to fuel vapor. This causes a signal to be fed back to the ECU, increasing the air/fuel mixture (Richer), which counter acts the fuel gains you may have expected.

IMPORTANT

Normally, the only cars that need some modifications in order to increase fuel savings are all petrol cars, built after 1992, and modern diesels with Euro module IV and V.

Old Cars with carburetor

Like mentioned before, when adding a HHO gas to these cars we will see immediate improvements in fuel consumption. There are no special devices or requirements to fit the HHO System to these cars, **but to improve the fuel savings the injection rate of the fuel pump should be tuned to the new air/fuel mixture condition.**

Modern Cars with Electronic fuel injection

An Electronic Control Unit (ECU) controls the internal combustion operation of the engine. The simplest ECUs only controls the quantity of fuel injected into each cylinder per engine cycle. The more advanced ECUs also control the ignition timing, variable valve timing (VVT), the level of boost maintained by the turbocharger, and other engine peripherals. ECUs determine the quantity of fuel, ignition timing, and other parameters by monitoring the engine through sensors. These include normally lambda sensors (or lambda sensors), MAP/MAF airflow sensors and temperature sensors.

Before ECUs, most engine parameters were fixed. A carburetor or injector pump determined the quantity of fuel per cylinder per engine cycle. For an engine with fuel injection, an ECU will determine the quantity of fuel to inject based on a number of parameters. For example: If the accelerator pedal is pressed further down, this will open the throttle body and allow more air to be pulled into the engine. The ECU will inject more fuel according to how much air is passing into the engine.

A mass air flow sensor (MAP or MAF) is used to find out the mass of air entering a fuel-injected internal combustion engine. The air mass information is necessary for

the engine control unit (ECU) to balance and deliver the correct fuel mass to the engine. Air changes its density as it expands and contracts with temperature and pressure. In automotive applications, air density varies with the ambient temperature, altitude and use of a turbocharger and this is an ideal application for a mass sensor. (stoichiometry and ideal gas law.) There are two common types of mass airflow sensors in usage on automotive engines. These are the vane meter and the hot wire. Neither design employs technology that measures air mass directly. However, with an additional sensor or two, the engine's air mass flow rate can be accurately determined.

Both are used almost exclusively on electronic fuel injection (EFI) engines. Both sensor designs output a 0.0- 5.0 volt or a pulse-width modulation (PWM) signal that is proportional to the air mass flow rate, and both sensors have an intake air temperature (IAT) sensor incorporated into their housings. When a MAF is used in conjunction with an lambda sensor, the engine's air/fuel ratio can be controlled very accurately. The MAF sensor provides the open-loop predicted air flow information (the measured air flow) to the ECU, and the lambda sensor provides closed-loop feedback in order to make minor corrections to the predicted air mass.

IMPORTANT

We advise all our customers to install a HEC Chip in order to maximize the fuel savings in their modern cars.

There are several ways to overcome this situation:

- a) Change the charts in the software of the ECU;
- b) Install an Electronic Fuel Injection Enhancer (lambda sensor/MAP/MAF Enhancer);
- c) Install lambda sensor extender – supplied in the kit.
- d) Install a Warm air intake;
- e) Install a HEC Chip – HHO EFIE Chip.

We advise the installation of **lambda sensor extender** or the **HEC Chip**. Please consult us for full details (sales@hhoplusgas.com) or go to our store.

Installing the lambda sensor extender

Important Information

Lambda sensor extenders are used in conjunction with a supplemental gas system, such as our HHO Generators Kits. In this type of system the extenders effects a correction voltage back to the vehicle ECU, so that the ECU does not deliver excess fuel to the engine as it tries to compensate for the increase of oxygen in the exhaust-- which is a result of burning clean fuels, such as hydrogen.

In practice, this extender stands-off the Lambda sensor from its normal position. Thus the sensor is made less sensitive to the increased level of oxygen in the exhaust that results from the burning of supplemental (HHO) gas. Only Lambda sensors located between the engine and the first catalytic converter, in each exhaust pipe, needs to be fitted with an extender. Normally, sensors downstream of the converter(s) are of no concern here, as they simply monitor the effectiveness of the converters. V6 and V8 engines typically require two extenders, one for each cylinder bank. Many require four however.

You do not need to use a MAF/MAP/EFIE sensor enhancer with the extender because this extender accomplishes the exact same thing as the enhancer does, but for much less the cost and hassle. It also eliminates the risk associated with enhancers, which are problematic to adjust properly. The physical dimensions of this extender provide well defined parameters of operation, and the ideal air to fuel ratio needed by your vehicle in order to optimize fuel efficiency gains one could expect over the 14.7:1 air to fuel ratio in standard production vehicles.

Lambda sensors

Lambda sensor measures the amount of the oxygen in the exhaust gases. This information is used by the automotive engine computer system to control engine operation. There are few types of lambda sensors available, but here we will consider most commonly used - voltage-generating type.

Front (upstream) lambda sensor

Front or upstream lambda sensor located in the exhaust manifold or in the downpipe before catalytic converter. It monitors the amount of oxygen in the exhaust gases and provides the "feedback" signal to the engine computer. If the sensor senses high level of oxygen, the engine is running too lean (not enough fuel). The engine computer adds more fuel. If the level of oxygen in the exhaust is too low, the computer decides that the engine is running too rich (too much fuel) and subtracts fuel accordingly.

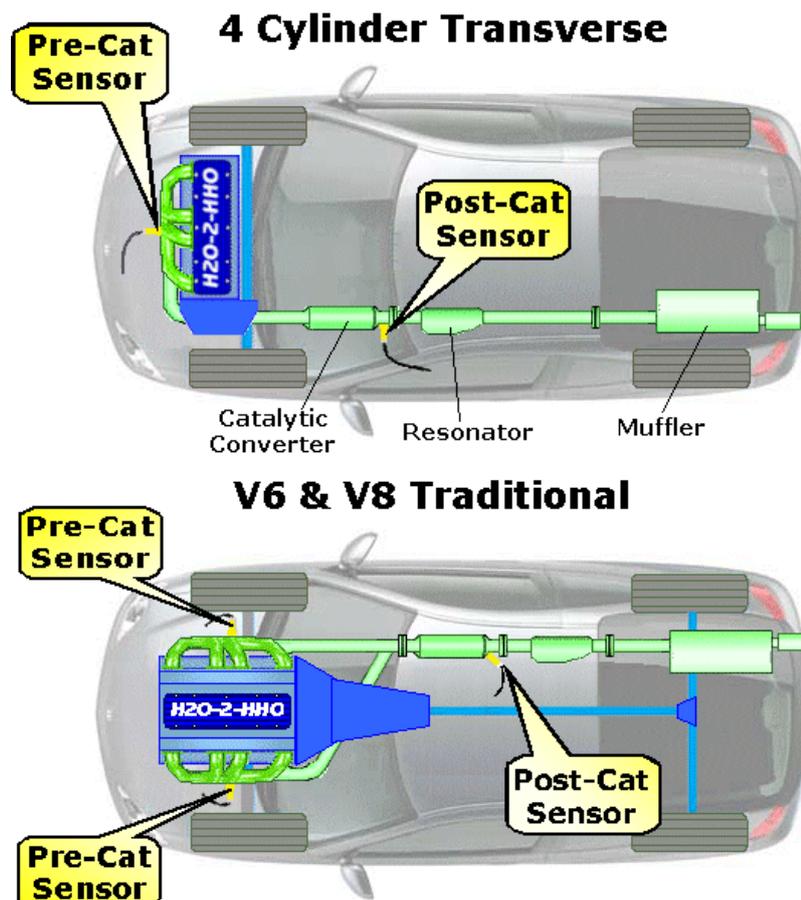
This process is continuous - the engine computer constantly cycles between slightly lean and slightly rich to keep the air/fuel-ratio at the optimum level. If you look at the front lambda sensor voltage signal, it will be cycling somewhere between 0.2 and 0.8 Volts (see lower picture)

Rear (downstream) lambda sensor

Rear or downstream lambda sensor is located after catalytic converter. It monitors the efficiency of the catalytic converter. The front oxy sensor should be the only one which needs to be altered. Check the installation steps next.

Locate the lambda sensors

The lambda sensors can be found in a variety of places, depending on the vehicle make, model and engine type. The accompanying illustrations depict some of the more common locations. As a general rule, each exhaust manifold has at least one pre-cat sensor. Most vehicles manufactured since the early 1980s are equipped with pre-cat sensors. With the advent of Onboard Diagnostic Systems II (OBDII) in the mid-1990s, Lambda sensors were positioned both upstream and downstream of the catalytic converter.



Reset the computer ECU

The ECU of your car is like its brain. For your car to deliver its best performance you have to keep it in a fit condition at all times. This is the only way to ensure that you get the best in both driving as well as handling. Modern day cars do not have manual controls. Nowadays sophisticated technology is being incorporated in the form of computerized controls that guide and ensure Engine performance. Whenever you make a physical intervention the data pertaining to such intervention gets recorded in the memory banks of your car's computer.

The computer uses the mapped data to work out the optimum control conditions in which the engine should function. The ECU shuffles through the tons of data that come to it in the form of readings to decide the course of action that should be taken by the engine to ensure an ideal drive. The ECU tells your engine not only what to do but also how to do it. Thus the ECU in order to make accurate diagnosis on engine control utilizes stored data.

IMPORTANT

We advise all our customers to reset the on board computer in order to maximize the fuel savings in their modern cars.

Even though you have made modifications in your car, the ECU still continues to get an input of the old data which is stored in its memory. This old data no longer is credible as it pertains to conditions that existed before the modification. The input data to the ECU should pertain to the post modification situation of the components and parts introduced, while making the modification. This means that you have to erase the old data from memory and new data pertaining to post modification should be logged into the ECU memory by mapping in new readings. **This is the reason why ECU resetting is essential for optimum performance after any modification has been carried out in your car.** The moment you have carried out the modification you should purge out existing data in your ECU's memory. You should then feed in fresh data pertaining to the conditions that have come into existence post modification. The ECU has to operate on the newly acquired data as this new data reflects the true conditions post modification.

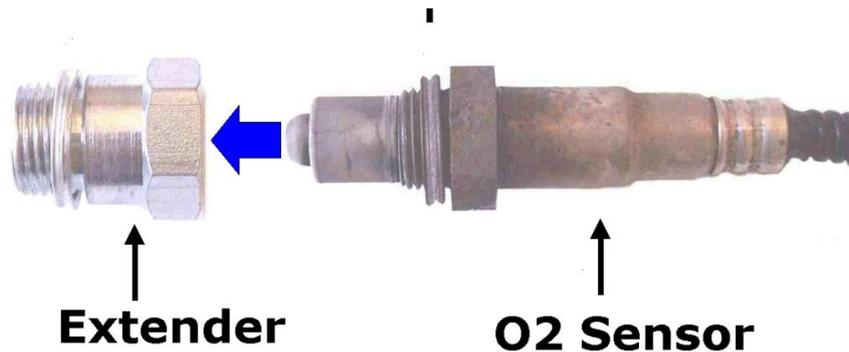
Resetting the ECU when you choose to boost Octane with HHO gas becomes necessary because your ECU has a memory bank for octane. This means that if you've been using lower octane, the response of ECU will correspond to lower octane with the booster matching lower octane performance. The ECU response will continue to correspond to lower octane even though you have started using higher-octane fuel. This is because the ECU has not been reset for higher octane. Thus even though higher octane is in actual use, the data in ECU memory still corresponds to that of lower octane. This mismatch affects performance,

as you are unable to derive the benefits of boosting the octane. Therefore you should reset your ECU periodically after filling up full tank in order to ensure that ECU adjustments for its octane memory are made afresh corresponding to the octane actually in use.

To reset the ECU you simply have to unplug the negative battery cable connection. Theoretically it is best to leave it in this disconnected condition for as long as you can. Practically leaving it disconnected overnight is more than enough. After having left the cable disconnected for sufficient time you have to connect back the cable. Start the car and keep it running so that it warms up. This would not take more than 10 minutes at the most in summers. Once you have done this you have accomplished the ECU resetting. Shut off the engine. You can now use your car whenever you feel like. ECU resetting is over.

Installing the extender

Each Lambda sensor upstream of the cat(s) needs to be mounted on an Lambda sensor extender as shown here.



Before installation of the extender you should disconnect the battery, making sure any radio and security codes are available to re-enable affected systems once power is restored. If unavailable, the codes are obtainable from a dealership. Disconnect the negative (black) cable from the battery like when you reset the ECU.



Unscrew the pre-cat Lambda sensor from the exhaust using an lambda sensor socket or a 22mm wrench. Be careful not to lose the compression washer. Apply penetrating oil around the threads to loosen a stubborn sensor. Inspect the sensor probe. If it is cracked or contaminated, replace it with a new one.



Thread the extender into the exhaust, in place of the sensor. Tighten to 50 Nm (37 ft-lbs) maximum. If a torque wrench is not available, tighten until the compression washer starts to crush.



Thread the sensor into the extender. Tighten to 50 Nm (37 ft-lbs) maximum. If a torque wrench is not available, tighten until the compression washer starts to crush.



Reconnect the negative battery cable. Re-enter any codes. It may take a few days of driving for the ECU to relearn the new sensor position. It is okay if the check engine light comes on while the ECU relearns.

Note: It is good practice to apply a small amount of anti-seize compound (available at most auto parts stores) to the threads of both the extender and sensor before



installation. Use great care in handling Lambda sensors to avoid damage; do not touch, or otherwise contaminate the sensor probe, or element, with compound, oil, etc. Proper sensor function is crucial to good performance and fuel economy.

The need to treat also the downstream lambda sensor

In the past, and in most cases the downstream sensors are not used in air/fuel ratio calculations. Therefore they do not need to be treated.

But we are finding quite a few cases where that's not true anymore. Dodge/Chrysler and Honda from about 2002 forward have documented that they are using the rear sensors as part of their air/fuel ratio calculations. Jeeps are doing this also. We have also debugged projects by treating downstream sensors on Ford F-150s and Mercedes, even though there is no documentation that the downstream sensors are used in air/fuel ratio calcs. It is now a primary suspect when fuel mileage is not being achieved when the steps above are all found to be in.

In these cases we need to install extender for the second lambda sensor.

Test run and checking your work

Start by checking all your connections. Make sure your inline fuse has been installed and the nylon check-valve is in the right position. Now start your vehicle. While it's running, watch for bubbling action inside the PVC crystal tubing coming from the Dry-cell and back to the water tank.

Now it's time to check how many amps your Generator is pulling. This Generator was made to run at 12 amps without overheating. If you have higher amperage your tank full you must remove some water+electrolyte and add only water to low the concentration and, consequently, the amperage.

If you have done everything right and you have a diesel car, within a short time, you will notice that the engine starts to sound different. It will sound smoother and quieter. Your RPM's may be unstable for a couple of seconds. This is normal, the HHO is starting to change the combustion cycle and the engine is now adjusting to the addition of the mixture. Your RPM's should now normalize after a couple of minutes.

Maintenance

Every week you should check the protection fuse (you should check it frequently in the first week after installation!), check the water level inside the water tank unit and generator. Fill it up only with water.

Every 3 months you should clean the transfer unit and remove all deposits.

Check-list for HHO system debugging

Important information

HHO will improve combustion efficiency. This is a scientific fact. When introduced into the engine along with the petroleum based fuel, it causes the flame speed to increase. This allows more of the petrol to burn during the power stroke. This will just happen. And it will be a dramatic increase over the combustion without the HHO. After the combustion efficiency is improved, the ECU is often fooled by the reduced quantity of unburned hydrocarbons and increased oxygen content, and often will add fuel to compensate. This can ruin your mileage gains.

The simplicity of what we have to do to have a successful HHO installation is get some HHO into the engine and adjust the sensor inputs as necessary so the ECU is not blocking the gains. That's all.

If we can do those 2 things, we will always get vastly improved fuel economy and vastly improved (decreased) emissions. While this checklist was written with HHO users in mind, it will work for any other technology that improves combustion efficiency. You will find that you can adapt many of these steps to apply to whatever technology you are using to debug your project. Other combustion technologies include (but are not limited to): water vapor injection, fuel preheating, fuel vaporizers/atomizers, fuel cracking technologies (using additives to break down the fuel), etc.

You should check out these items working from the top down. They have been ordered this way on purpose so that the most likely problems are higher on the list. Also, the problems that are the easiest to test appear higher on the list than those that are difficult and/or expensive to test for.

The thing you have to realize is that the technology works. And because it does, all vehicles can be solved. If you are having a hard time getting the results you should, you just need to go through these items and find the reasons your gains are being blocked. If you keep at it, you will find the problem and you will get the gains you are seeking.

Check-List

1. Is your device making HHO? The most common bug we encounter trying to debug systems is that HHO is not being produced, or is not getting into the engine for some reason. Check your system. Measure the output of your HHO cell by doing a water displacement test. Remember that the system should provide 0,3 liters/min of HHO per each 1000 cc in the engine. See if you are meeting that standard.

3. Is the HHO gas getting into the engine? We have seen cases where a leak in the system was keeping the hydrogen from getting into the engine. A split hose can cause this, or one that is not attached at all. A check valve oriented in the wrong direction can block the HHO from getting to the engine. One time we found that the lid to a dry cell's reservoir had a leak and when this was fixed the situation resolved completely. Spray your hoses and connections with soapy water to expose any leaks in your system. Fix any that you find.

2. Is the amperage on your generator to high? Another thing that should be checked here is whether your unit is making HHO or steam. Some of the early cell developers would run their units with so much amperage that the unit was producing more steam than anything else. If your unit runs hot to the touch, you must suspect that at least part of your output is steam. One way to test for steam



is to run your gas outlet over some ice. If you get significant amounts of fog forming (water droplets), you know that at least part of your output is steam.

4. Have you changed the electronic injection? Vehicles with carburetors and some diesels (Euros modules I, II and III) do not require any changes. But all other fuel injected engines will need to have it's electronics handled to get the gains of an HHO system installation. Usually the only sensors that require handling are the oxygen sensors that are upstream of the catalytic converter. Most V-6 and V-8 engines have two of these and most 4 cylinder engines have one.

5. Have you tuned the fuel injection pump rate? Vehicles with carburetors and some diesels (Euros modules I, II and III) do not require any changes except to tune the fuel injection rate to the new air/fuel mixture.

6. Have you reset your computer? Some computers are able to "learn" and adapt to the conditions that exist in your engine. Since you have made a major change by adding an HHO system and EFIEs, you may need to reset the computer to erase what it learned about the system when it was inefficient, and start over again with the new improvements installed. You can reset your computer by disconnecting your battery ground wire from the car, and leaving it off overnight, then reconnecting it again.

7. Do your lambda sensors need to be replaced? Lambda sensors wear out. I have seen estimates that say you should replace them after 50,000 km. In my experience they can get many more miles than this, but if you 100,000 km or more on your lambda sensors you must replace them. It is likely that replacing them will give you a good increase in fuel savings all by itself. We have seen a number of projects completely debug by doing this step alone.

8. Is there something else mechanically wrong with your engine? If your engine is working properly, adding an HHO system will not correct that. You will often find that if your engine is not working properly, just fixing it can give you a dramatic increase in fuel savings all by itself. If you had any kind of check engine light before starting the project, you should get this fault explored and handled. If you're not sure, reset your computer, turn off all of your HHO, extender and any other added modifications, and see if you still get a fault code. If so, get it fixed first, before adding your modifications.

9. Do you need to treat your downstream sensors? In the past, and in most cases the downstream sensors are not used in air/fuel ratio calculations. Therefore they do not need to be treated. But we are finding quite a few cases where that's not true anymore. Dodge/Chrysler and Honda from about 2002 forward have documented that they are using the rear sensors as part of their air/fuel ratio calculations. Jeeps are doing this also. We have also debugged projects by treating downstream sensors on Ford F-150s and Mercedes, even though there is no documentation that the downstream sensors are used in air/fuel ratio calcs. It is now a primary suspect when fuel mileage is not being achieved when the steps above are all found to be in.

10. Do other sensors need adjustment? After treating the oxygen sensors, the most likely sensor still needed to be treated is the MAF or the MAP. In most vehicles you have one or the other, but not both. In some vehicles you both, and when you do, you want to treat the MAF. There is a circuit that will work for this that can be found in A Simple MAF/MAP Enhancer. Note that Ford MAPs usually have a frequency type of output to the ECU. However, in these cases you will usually find they also have a voltage based MAF that you can treat. After treating the MAF or MAP, the other sensors that



can be tuned with profit are the IAT (Intake Air Temperature) and CTS (Coolant Temperature Sensor). These are even more easily tuned and this is covered in Tuning For Mileage.

To summarize, many cars only need to treat the upstream oxygen sensor(s). When this fails, we have found that most of the remaining projects will debug completely by treating the downstream oxygen sensor(s). In the rare cases where more tuning is needed then the MAF (or MAP if there is no MAF) has solved the case. We almost never need to treat the IAT sensor or the CTS. So treat the sensors in that order.

If this happens the best solution is to install the new HEC – HHO EFIE Chip . The HEC is a chip, with a 200 mhz microprocessor, It utilizes its high speed serial input/output to communicate directly with the ECU through the OBD-II port It has been specifically developed and tuned for the needs of HHO generator equipped vehicles. The HEC is dynamic - which means the HEC will consider oxygen levels in the exhaust, along with engine speed and load, intake air temperature and volume, and many other variables to determine the most efficient fuel delivery rate and timing at up to 256 separate load points.

When using HHO as a fuel supplement, the HEC will adjust fuel delivery and timing to optimize efficiency. When HHO is disabled, the HEC will automatically re-adjust and switch to highly efficient, non-HHO enhanced maps.

All vehicles can be solved. Some of them are a little tougher than others due to the way the ECU was programmed. But they can all be solved. The technology works. If you have gotten to this point and your vehicle is still not been solved, one of the above steps is still out. You need to find it and get it corrected. And then your results will shine through.

Parts positioning

HHO connection from the water tank to the air intake manifold

HHO System Schematics



Materials to make the connection



1

High pressure hose



1

Security check-valve



1

Barb to port fitting



1

Barb to port fitting threaded elbow

Sequence of parts to make the connection



Extra materials



Teflon tape



Plastic clamps

Water connections between the water tank and the dry-cell

HHO System Schematics



Materials to make the connection



1
Cristal pvc hose



1
Barb to port fitting



1
Barb to port fitting
threaded elbow

Sequence of parts to make the connection



Extra materials



Teflon tape



Plastic clamps

Water connections between the dry-cell and the water tank

HHO System Schematics



Materials to make the connection



1
Cristal pvc hose



1
Barb to port fitting threaded elbow with hose



1
Barb to port fitting threaded elbow

Sequence of parts to make the connection



Extra materials



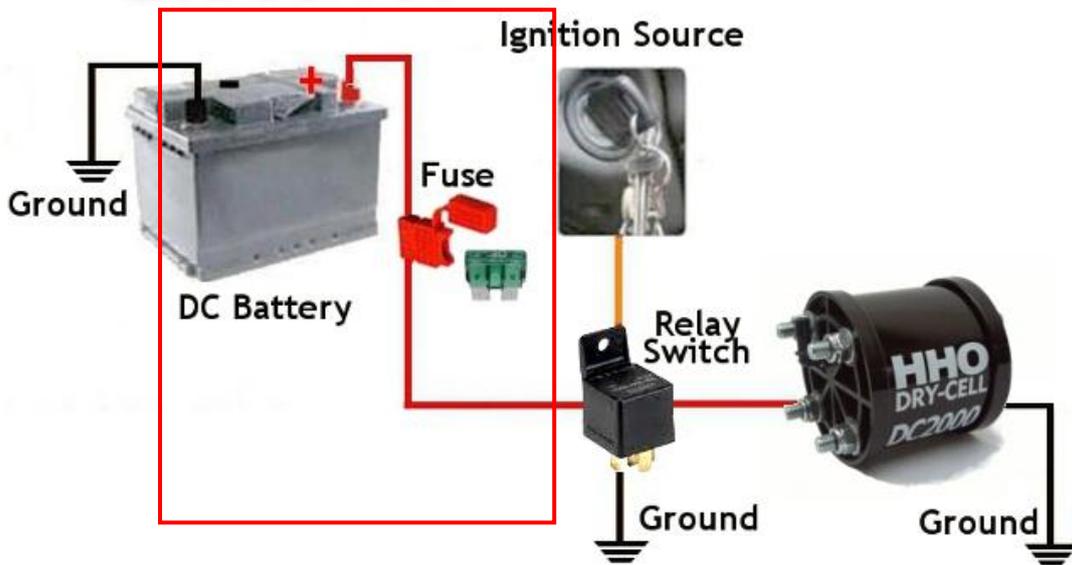
Teflon tape



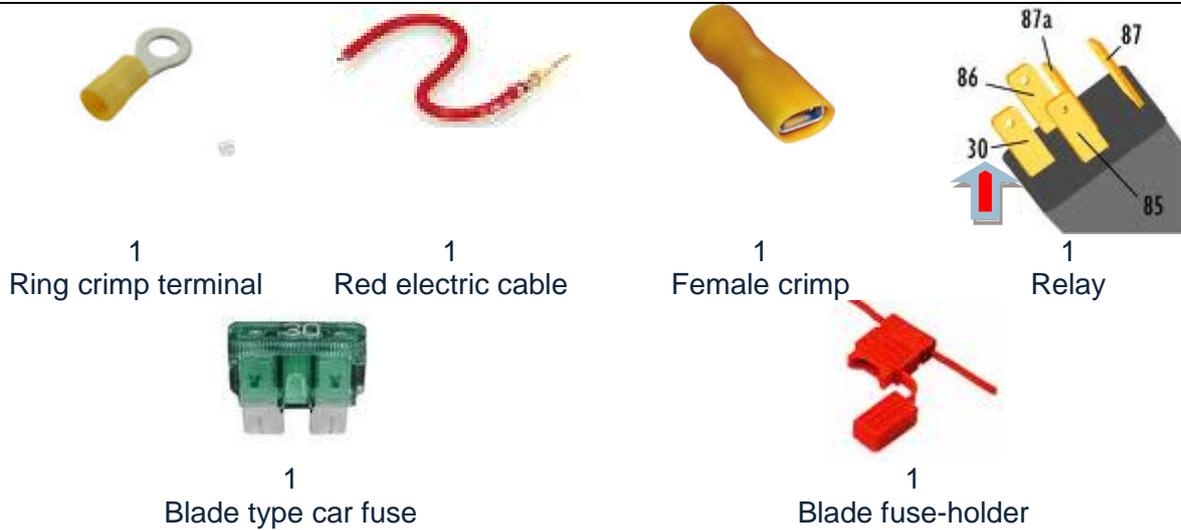
Plastic clamps

Electric connection from the battery to the relay (Position 30)

HHO System Electrics



Materials to make the connection

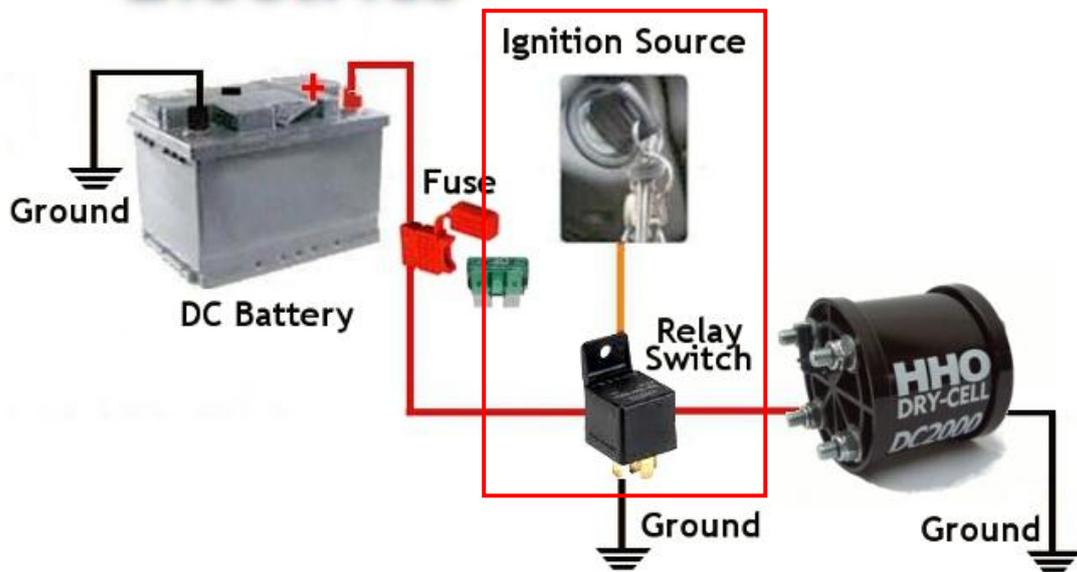


Sequence of parts to make the connection



Electric connection from the ignition source to the relay (Position 85)

HHO System Electrics



Materials to make the connection



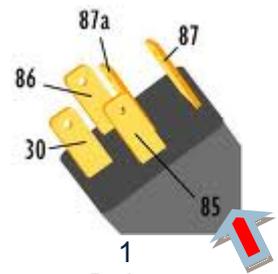
1
Female crimp
terminal



1
Red electric cable

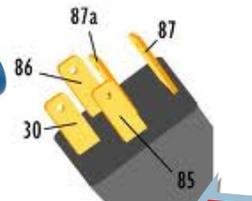


1
Female crimp
terminal



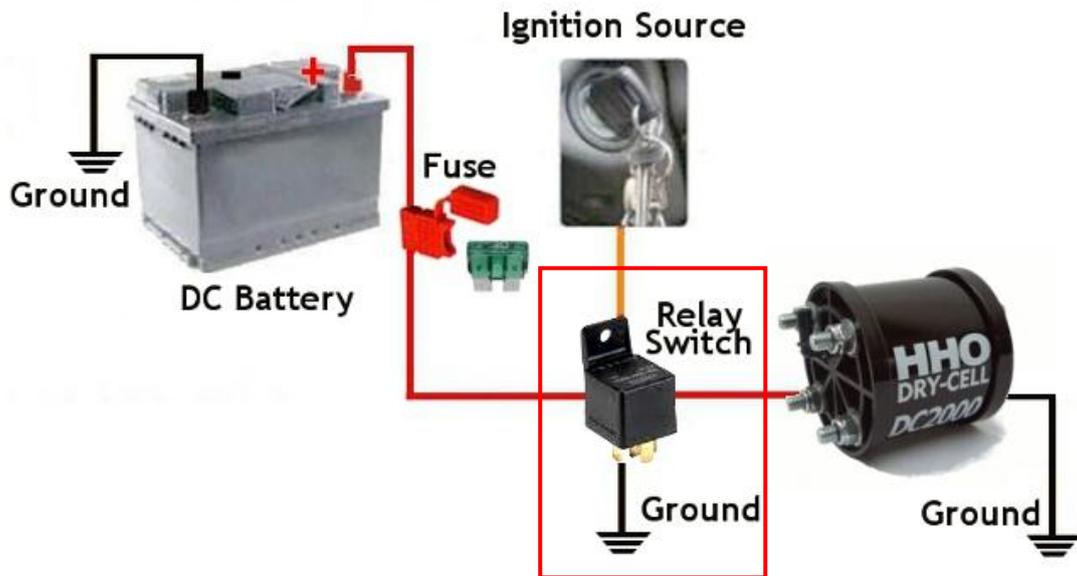
1
Relay

Sequence of parts to make the connection



Electric connection from the relay (Position 86) to the Ground

HHO System Electrics



Materials to make the connection

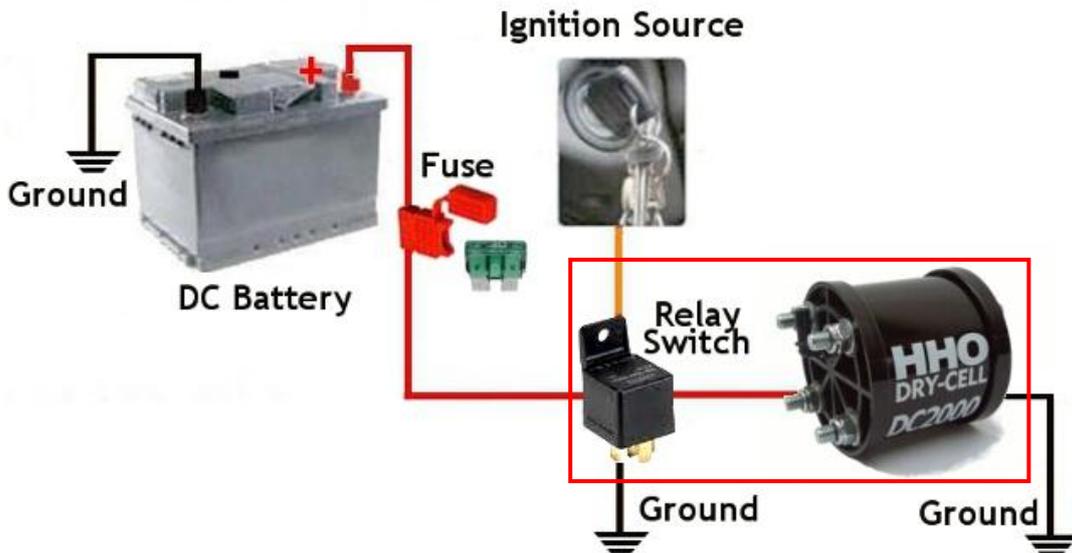


Sequence of parts to make the connection



Electric connection from the relay (Position 87) to the dry cell

HHO System Electrics



Materials to make the connection



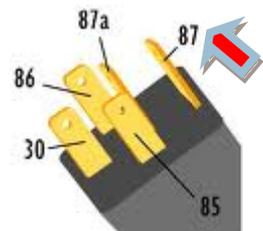
1
Female crimp
terminal



1
Red electric cable

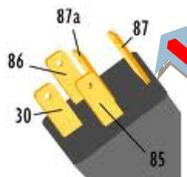


1
Snap lock splice connector



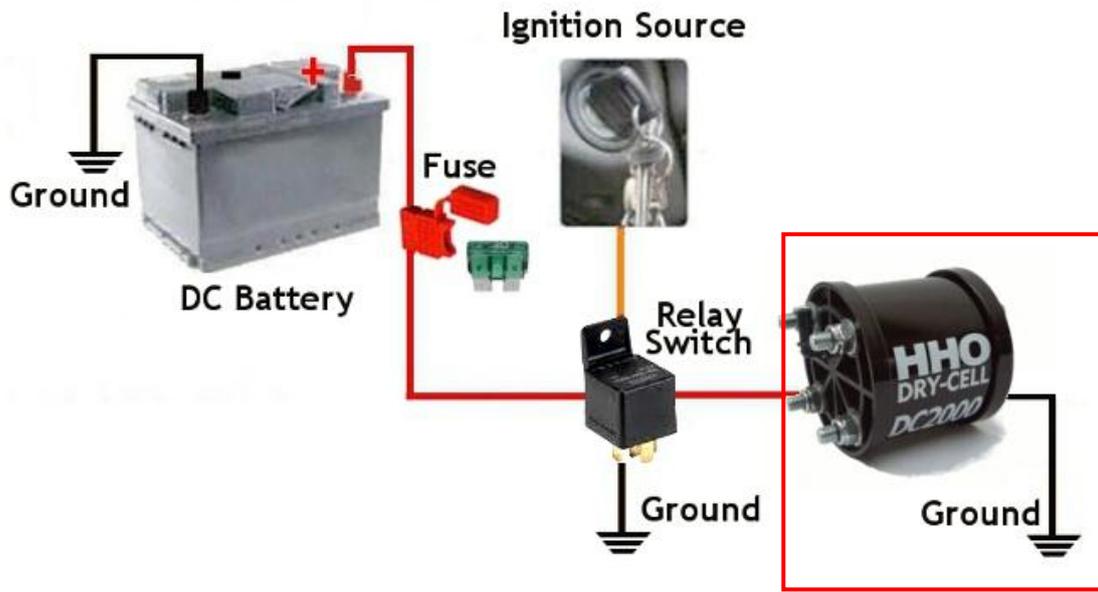
1
Relay

Sequence of parts to make the connection

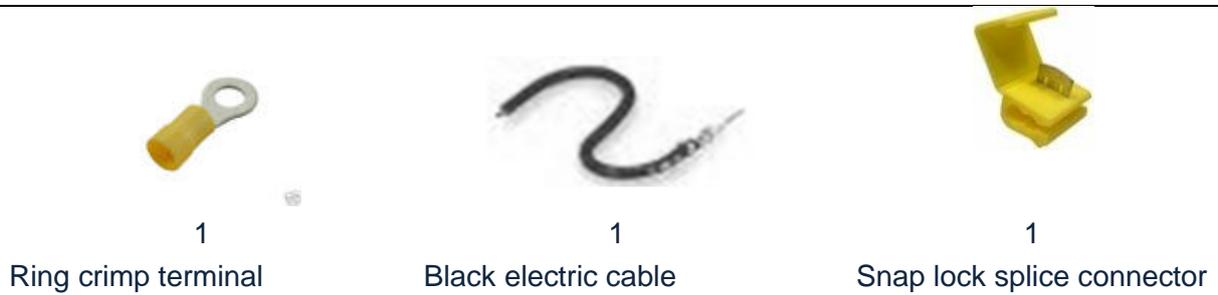


Electric connection from the dry cell to the ground

HHO System Electrics



Materials to make the connection



Sequence of parts to make the connection

