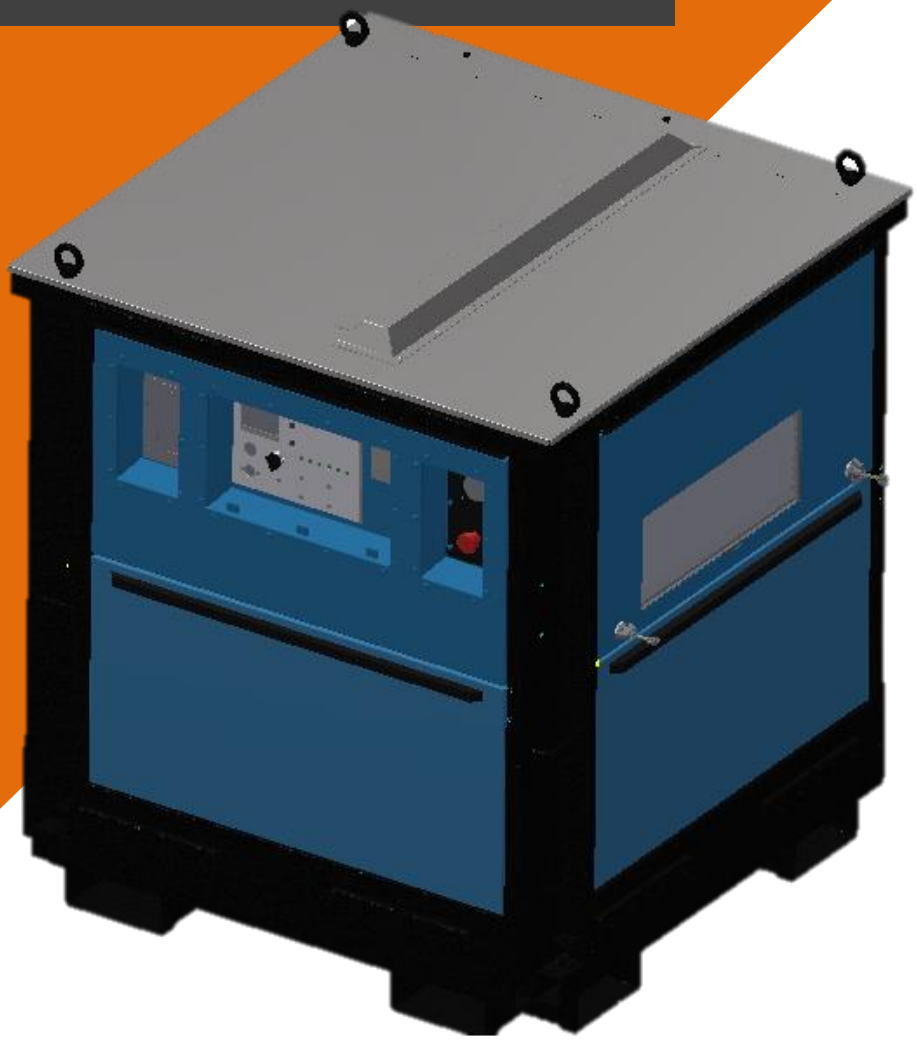
LIGHTGREEN POWER

USER MANUAL.

Product: **ECO GH_4**

Model: 48V DC, 175A (4 kW)



QUAYSIDE INDUSTRIAL PARK
BATES ROAD
MALDON, ESSEX
CM9 5FA

WARNING

This product generates voltages which can cause serious injury or death if proper precautions are not taken, or if used improperly.

This product should only be used by competent persons who have read and understood this user manual, and all instructions regarding its use and safety should be observed.

WARNING

FOR OUTDOOR USE ONLY. RISK OF ASPHYXIATION OR CARBON MONOXIDE POISONING. DO NOT OPERATE INDOORS

Do not use this portable fuel cell power system if any part has been immersed or flooded with water. Immediately call the manufacturer or manufacturer's representative to inspect the portable fuel cell power system and to replace any functional part that has been affected

WARNING:
FIRE OR EXPLOSION HAZARD
Failure to follow safety warnings exactly could result in serious injury, death or property damage.

- Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other appliance.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Keep this user's manual handy so that you can refer to it at any time. This user's manual is considered a permanent part of the ECO GH_4 and should remain with the ECO GH_4 if resold.

The information and specifications included in this publication were in effect at the time of approval for printing Light Green Power Ltd. reserves the right, however, to discontinue or change specifications or design at any time without notice and without incurring any obligation whatever.

Revision history

Version	
Issue 1.0	24th November 2023

CONTENTS

1 INTRODUCTION

Light Green Power Ltd (LGP) ECO GH_4 is an eco-friendly, robust and compact mobile hydrogen power generator. The ECO GH_4 contains a 4000W Fuel Cell to provide power in remote locations. The device can be used to supply DC power to battery packs for example combining with other LGP products such as the ECO Power Pack Range.

The ECO GH_4 is suitable for outdoor use. The rugged ECO GH_4 construction also makes it easy to maneuver and deploy.

1.1 INSTRUCTIONS FOR USE

This User's Manual is a vital reference source for new users and must be retained. When not in use the manual is stowed in the documentation tube clipped to the machine. Make sure that you read the operating instructions carefully before use. With proper care, this product will provide reliable, long-term service.

All information, illustrations and specifications contained in this publication are based on the latest product information available at the time of publication. LGP reserve the right to make changes at any time without notice. Continued improvement and advancement of the design may cause changes to the machine that may not be included in this publication.

PLEASE READ THE OPERATING INSTRUCTIONS CAREFULLY AND UNDERSTAND THEM BEFORE YOU OPERATE THE MACHINE.

1.2 IDENTIFICATION OF PRODUCT

This manual may refer to controls and equipment that are not present on your model. It is important that you become familiar with your machine and its equipment and how to operate it properly.

Information about the model and serial number is on the serial number plate on the side of the machine. Always quote the model and serial number in correspondence with your dealer or the manufacturer.

1.3 MODIFICATIONS TO PRODUCT

LGP may from time-to-time issue service bulletins. These will keep you up to date as to any improvements or changes that may take place on the complete assembly or component parts.

1.4 SPECIFICATION

LGP model	**ECO GH_4**
Overall length	1200mm
Overall width	1200mm
Overall height	1200mm
Gross weight	340kg
Lifting positions	4x Lifting eyes for machine lift
Output voltage	48V DC
Output power (max)	4000W

2 Safety Information

2.1 GENERAL

To prevent unexpected and unnecessary down time, report all malfunctions to LGP. Do not operate the machine until corrected. This manual describes general examinations and operations with the safety precautions required for normal operating conditions. It is not a guide however, for other than normal conditions or situations.

Users must be safety conscious at all times. Be aware of potential operating safety hazards and take the necessary precautions to ensure safe operation of the machine.

This ECO GH4 is designed for use with electrical equipment that has suitable power requirements. Other uses can result in injury to the operator or damage to the ECO GH4 and other property. Before using the ECO GH4, ensure an adequate risk assessment has been undertaken for the work task and the work environment.

Most injuries or property damage can be prevented if you follow all instructions in this manual and on the ECO GH4. The most common hazards are discussed below, along with the best way to protect yourself and others.

2.1.1 Operator responsibility

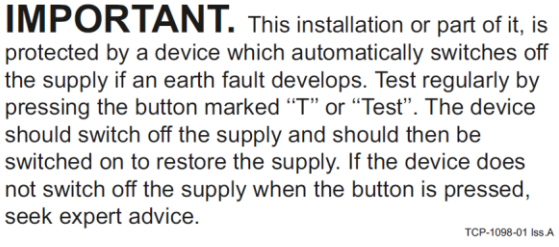
- Know how to switch off the ECO GH4 quickly in case of an emergency.
- Understand the use of all controls, output receptacles and connections.
- Be sure that anyone who operates the ECO GH4 receives proper instruction. Do not let any unqualified or untrained personnel operate the ECO GH4.

2.1.2 Electric shock hazards

- The ECO GH4 produces voltages sufficient to cause serious injury if misused.
- Only use the ECO GH4 with suitable cable and plug connected equipment, noting the rated power and voltage.
- Only use the ECO GH4 with equipment which is well maintained, and do not use with any equipment which is damaged.
- Do not use extension leads longer than 14 metres or splitters with the ECO GH4.
- Do not attempt to disassemble the unit except for the maintenance prescribed in this user's manual.
- Do not place the unit in pooled surface water, and avoid immersion and direct spraying with water. If the ECO GH4 has been partially or fully immersed in water, DO NOT USE. Return the ECO GH4 to your distributor for maintenance.

2.2 DECALS AND LABELS

Read and always obey the safety guidelines on the decals and labels attached to the ECO GH4. Failure to do so before you start the machine could result in personal injury or damage to the machine.



2.3 SAFETY MESSAGES

Before operating the machine, read, understand and obey the safety messages located throughout this manual.

General safety messages are in this section of the manual. Safety messages specific to a particular section are located at the front of that section. Safety messages specific to a particular task within a section are located before that task.

Safety messages that denote a warning or caution are preceded by a safety alert symbol ⚠ and a signal word.

A warning means that personal injury or death is possible if the instruction is not obeyed. The message identifies the hazard, explains the consequences if ignored and indicates how to avoid it. A caution means that damage to the machine is possible.

Additional safety alert symbols used to reinforce the worded message:

	Read documentation		Discharge static		Hard hat required
	Eye protection required		Gloves required		Foot protection required
	No smoking		No open flame		No flames
	Pressurised cylinder		Flammable gas		Explosion risk
	High voltage hazard		Watch your head		Hand crush hazard

3 Transportation

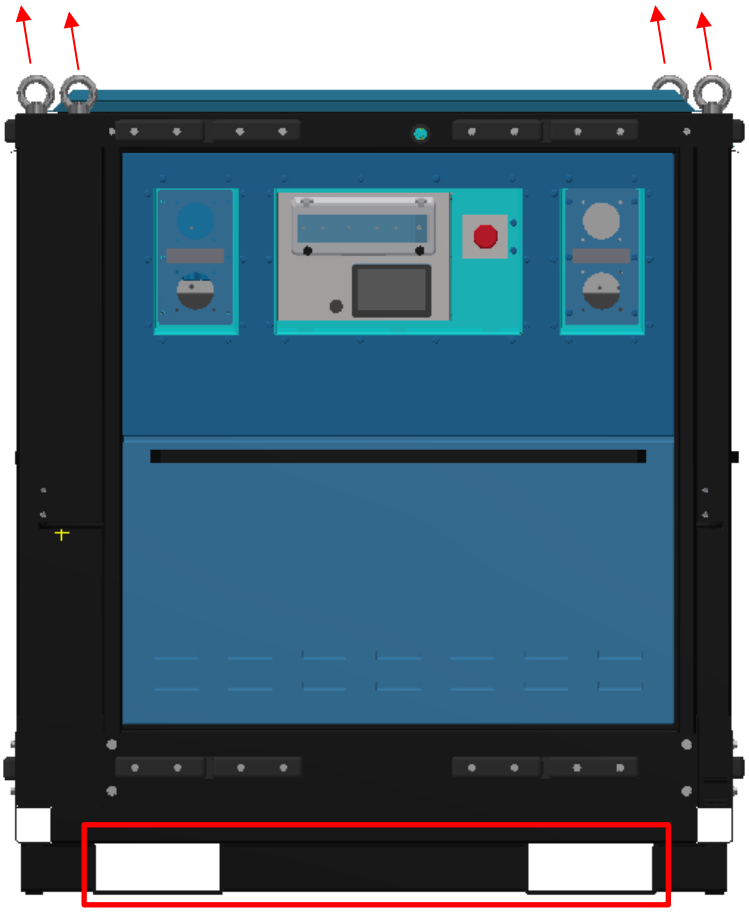
3.1 ECO POWER PACK 60K

⚠ CAUTION ⚠

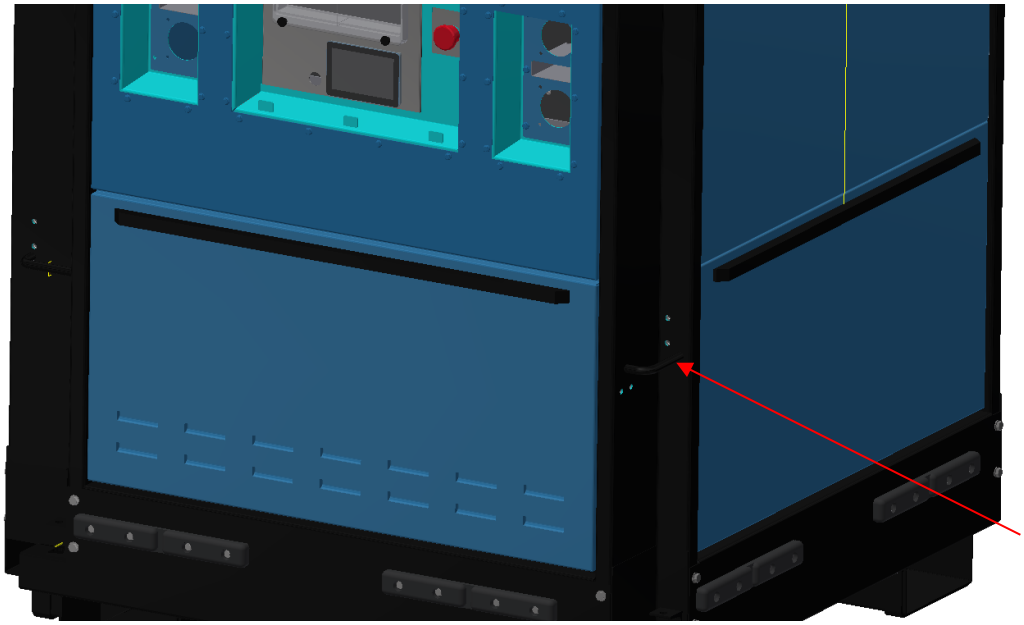
The machine is designed to be lifted by forklift using the pockets provided (highlighted in red in image below, from either side) or using the four lifting/hoist points which are clearly marked on the machine.

When hoisting, all four lifting points must be used. Any less will result in an unsafe, unbalanced load.

Always remain aware of the position of other people around you when you lift the machine.



For transportation, strap securely using the pull down lugs shown below.



Return this manual to the documentation tube for transportation with the machine.

3.2 CARE DURING TRANSPORT

When transporting the ECO GH4 observe the following instructions to prevent damage to the ECO GH4 or other equipment:

- Secure the ECO GH4 in a stable, level position to avoid damage from tipping or falling.
- Protect the ECO GH4 from impact during transport (e.g. securing other equipment being transported).
- Avoid exposing the ECO GH4 to excessive levels of vibration during transport to avoid mechanical damage to the ECO GH4.

3.3 SAFE HANDLING

3.3.1 Manual Handling

When moving the ECO GH4, observe the following instructions to ensure your safety:

- The ECO GH4 is heavy, and as such it is not recommended to be manually carried by any number of people. If the machine needs to be lifted this should be done by forklift or crane.
- Disconnect all loads and charging inputs from the ECO GH4 before moving and ensure that the DC output is switched off before carrying.

4 Site Deployment

4.1 SITE CONDITIONS

4.1.1 Safety Equipment

Know what safety equipment is required and use it. The minimum PPE when you deploy or operate the machine is safety glasses, protective gloves and safety footwear.

A hard hat, high visibility vest, respirator and earplugs may also be a site requirement.

4.1.2 Initial Machine Position

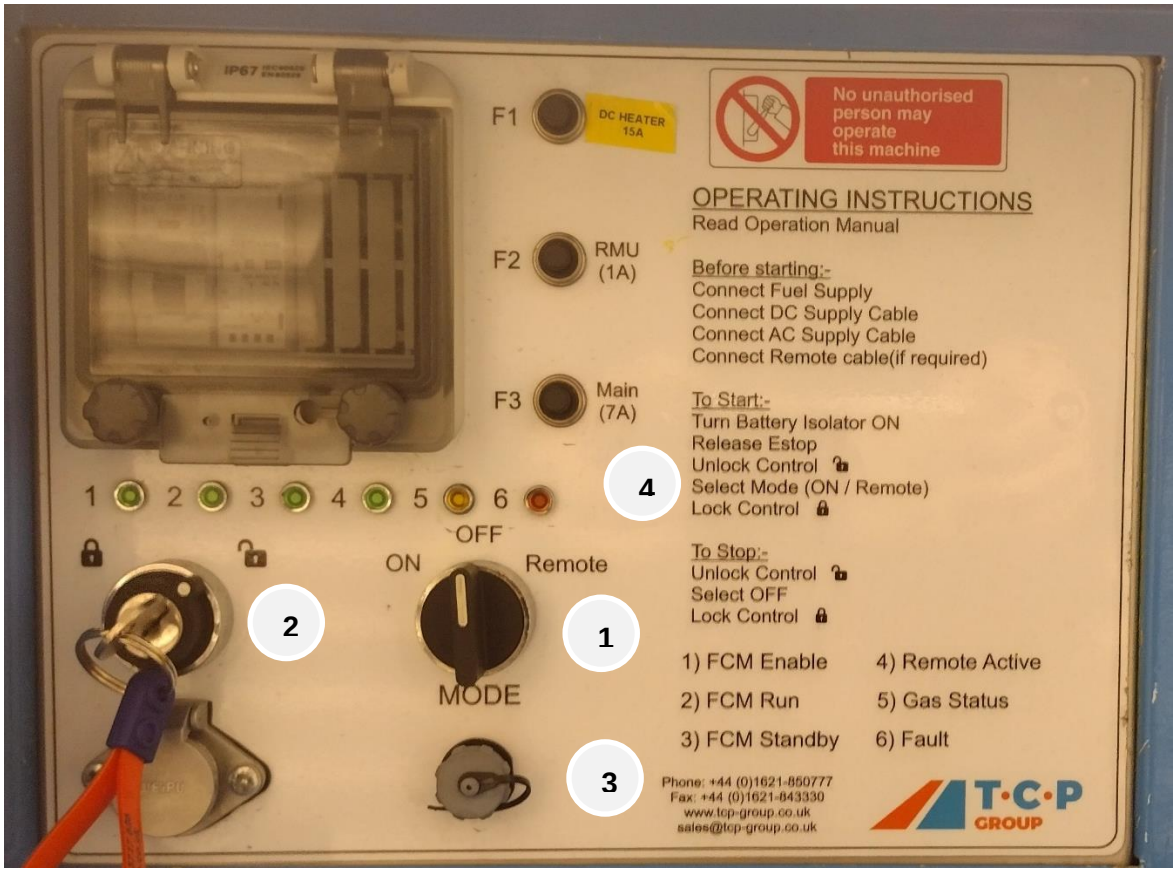
⚠ CAUTION ⚠

Make sure the machine is deployed on firm and level ground. Make sure that the area that immediately surrounds the machine is clean, neat and free of debris. The air supply to the GH_2 must be clean and free of debris. Excessive exposure of the fuel cell power system to contaminated air may result in safety and performance related problems. Contaminants

may include exhausts from engines running close by, exhausts from building service machinery or exhausts from other fuel cell machinery.

5 Controls and features

5.1 CONTROL PANEL COMPONENTS



1. Mode switch
2. Locking switch
3. Remote Start (For use with ECO Power Packs to remotely operate the ECO GH4
4. Warning Lamps (See Machine decal for key)

5.1.1 Power switch

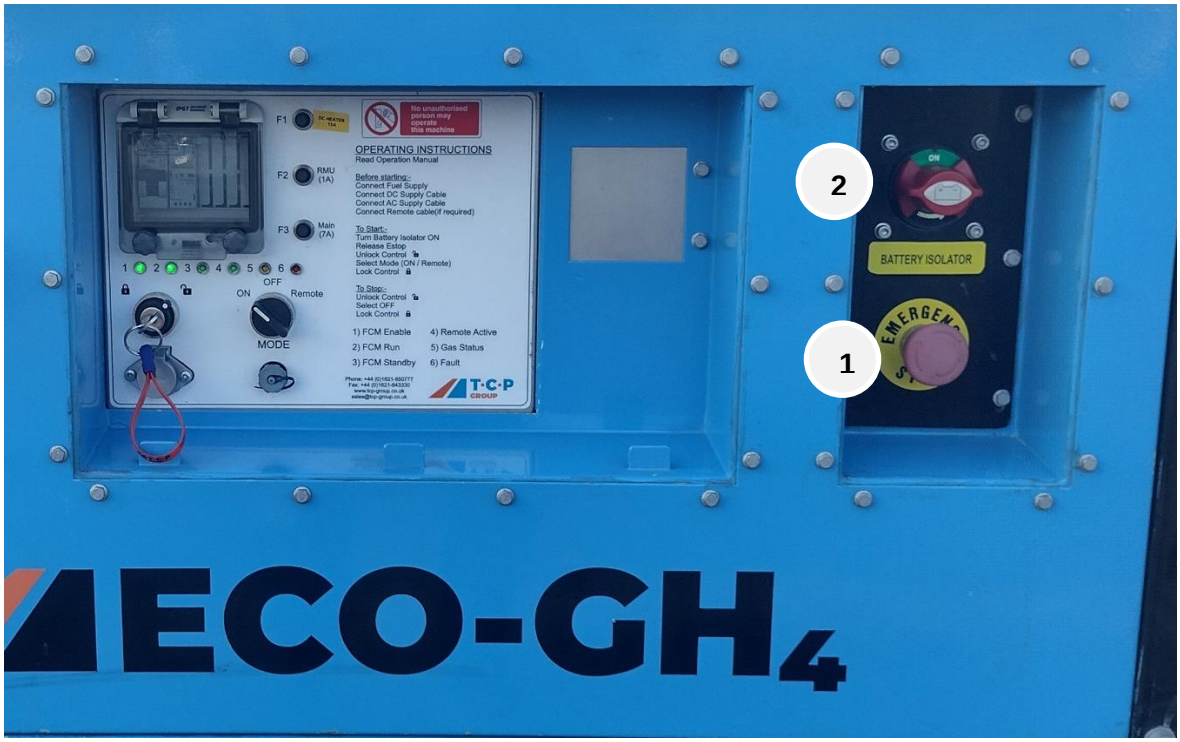
The power switch controls the operation of the ECO GH4:

OFF - Stops all operation of the ECO GH4.

ON - Starts the operation of the fuel cell and DC output when the fuel cell has completed its start-up procedure. (Note in cold weather the fuel cell may take longer to heat up before starting to produce power.)

REMOTE- Operates the remote Start such that an external system such the ECO Power Pack products can operation the fuel cell as its required.

5.2 REAR PANEL COMPONENTS

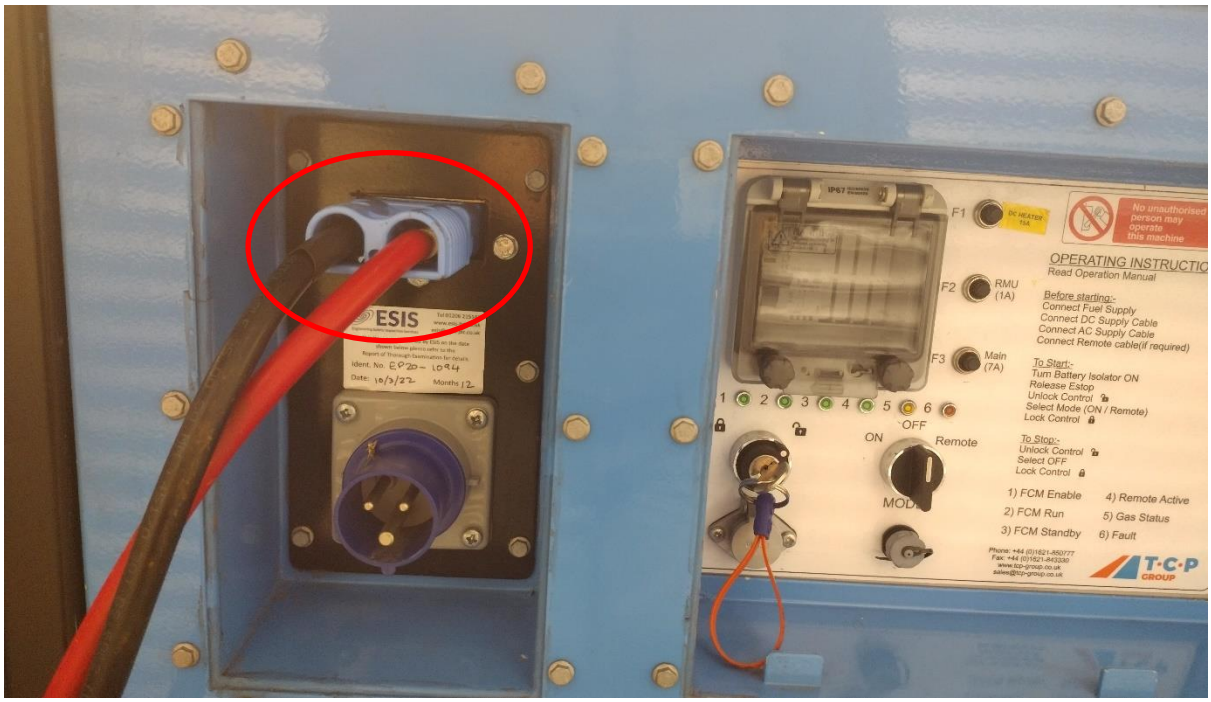


1. Emergency stop (shuts off the fuel cell and DC power to the outlet
2. Isolator (leaves the fuel cell running but cuts power to the DC outlet).

5.3 FEATURES

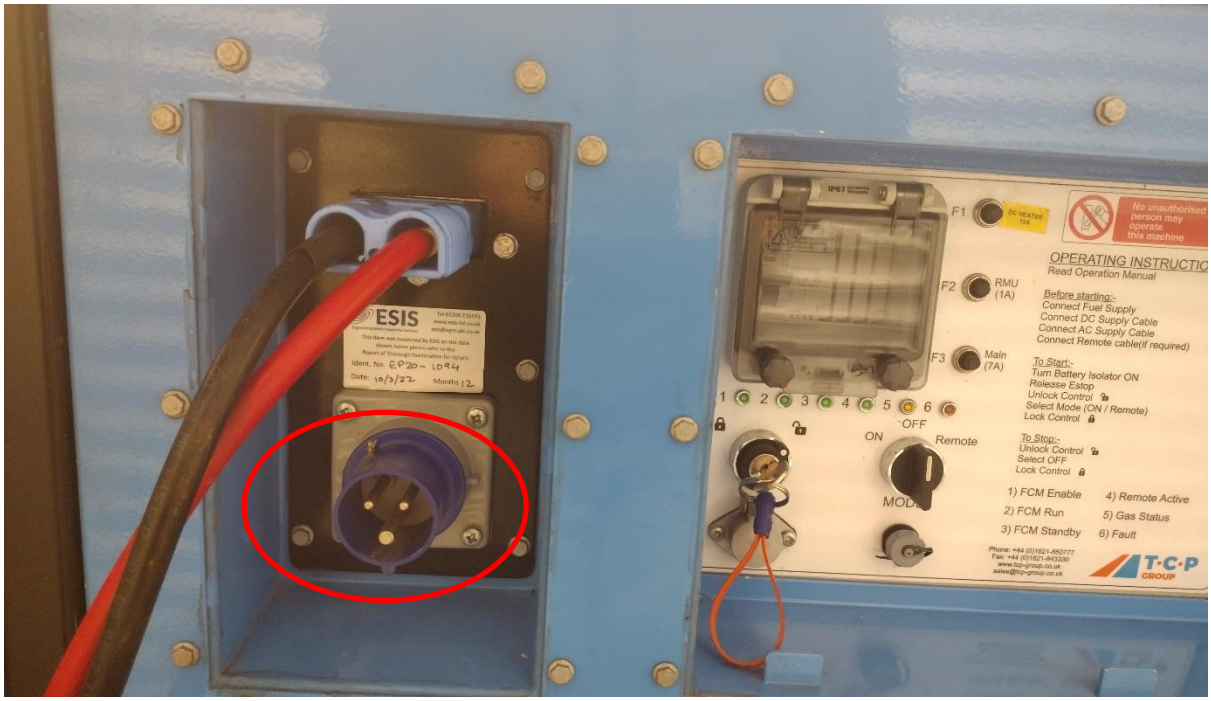
5.3.1 DC Outlet

The DC outlet is located on the front of the unit in the form of a SB175 Anderson connector. Voltage 48V, 175Amp Max combined.



5.3.2 AC Inlet

The AC inlet is a 16A socket which can be plugged into mains to power an 100W internal heater to give additional aid to cold starting. There is also an internal 180W DC heater which will automatically operates, should the ambient temperature be lower enough. The benefit of the AC heater is that is saves the DC load on a battery pack for example.



6 Before operation

6.1 ECO GH4 CONDITION

Always inspect the ECO GH4 before use to make sure that it is in good mechanical condition. Do not attempt to use a ECO GH4 that is damaged in any way, and do not use the ECO GH4 with any electrical equipment that is damaged or not functioning correctly.

WARNING

Use of a damaged or malfunctioning ECO GH4, or use of the ECO GH4 with damaged or malfunctioning equipment, can result in serious injury or death, or damage to property. Faults and error messages must be reported at the earliest opportunity, warranty issues must be reported within 48 hours. Failure to do so could void manufacturer's warranty.

6.1.1 Environmental conditions

The ECO GH4 should only be used in a suitable environment where the unit is not at risk of damage from the environment. Reasonable judgement of competent persons should be used to determine an appropriate environment, but as a minimum, the following should be observed:

- DO NOT cover the vents on the sides or top of the ECO GH4 during use
- DO NOT use the ECO GH4 in an excessively dusty environment.
- DO NOT use the ECO GH4 in an ambient air temperature of above 40°C
- Be aware of water pooling or splashing when using the pack in wet and rainy conditions (rated to IP23)
- DO NOT allow the ECO GH4 to be exposed to excessive mechanical vibration, impact or static force

WARNING

Use of the ECO GH4 in an environment which is unsuitable can lead to equipment malfunction, which can result in serious injury or death, or damage to property.

7 Operation

7.1.1 Preparation

⚠ WARNING

Do not start a machine that is in need of repair. A faulty machine may be hazardous and could cause personal injury. Contact the manufacturer or supplier.

Read the BOC *High Purity Hydrogen Safety Data Sheet* in conjunction with this procedure.

Put on appropriate PPE, i.e. hard hat, safety glasses, protective gloves and safety footwear.

⚠ WARNING

Do not smoke or use open flames within a 1 metre radius of the machine. Flammable hydrogen gas could be present during operation. To avoid risk of fire or explosion extinguish any source of local ignition.

Summary:

- *Read Hydrogen Safety Data Sheet*
- *Put on appropriate PPE*
- *Extinguish sources of local ignition*

7.1.2 Install the Regulators

⚠ WARNING

Do not release gas into the atmosphere from the cylinders at any point. Hydrogen gas will ignite easily. Avoid 'snifting' the gas cylinders at all times.

⚠ CAUTION

Make sure the gas cylinder valve is off when you install or remove the regulator and gas hose.

NOTE: *A regulator will be provided with gas cylinders.*

Obtain the regulator and examine the sealing O-ring for damage.

NOTE: *If the O-ring is damaged or missing, or if a leak is detected during use, contact the supplier or manufacturer.*

Remove the protective cap from the gas cylinder valve.

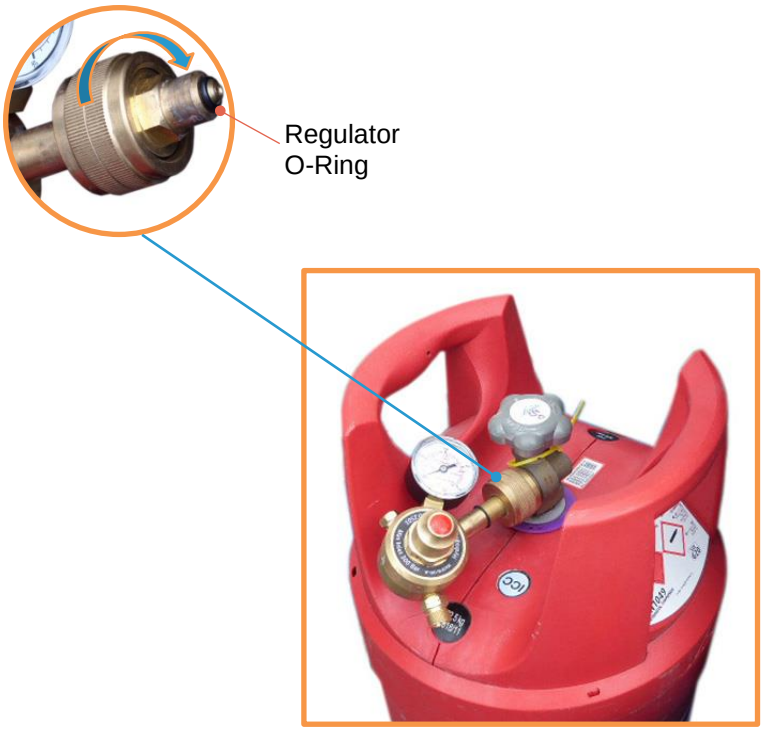
Connect the regulator to the gas valve.

Turn the connector in a counterclockwise direction and hand-tighten only.

Repeat the above procedure for the remaining three gas cylinders.

Summary:

- *Examine regulator O-ring*
- *Connect regulator to cylinder*



7.1.3 Install the Gas Hose

NOTE: *The manifold outlet (brass gas fitting) is connected to the gas supply hose.*

Examine the sealing O-ring on the gas hose for damage.

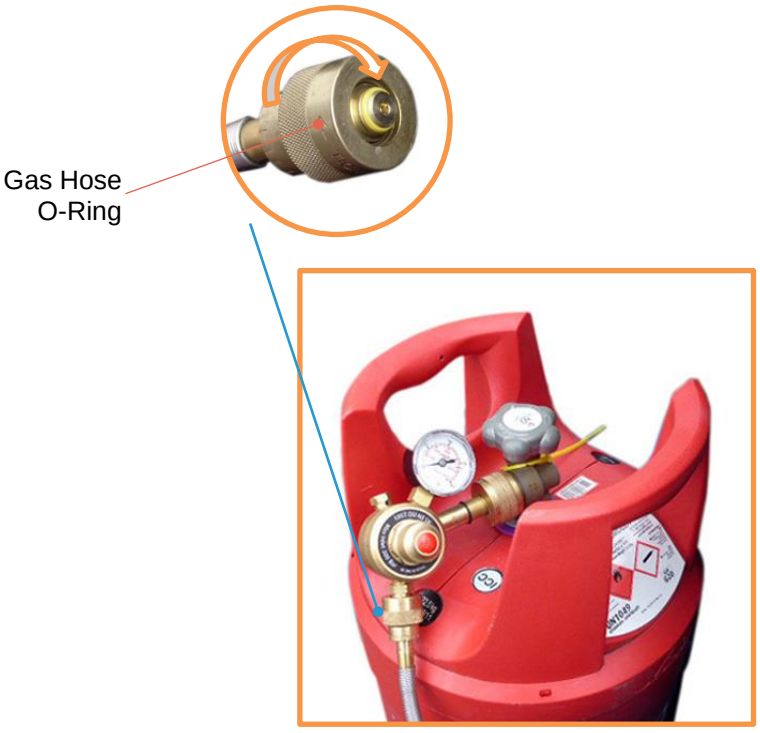
NOTE: *If the O-ring is damaged or missing, or if a leak is detected during use, refer to Section 4 before you attempt to replace it.*

Connect the gas cylinder hose to the regulator.

Turn the connector in a counterclockwise direction and hand-tighten only.

Summary:

- *Examine gas supply hose O-ring*
- *Connect hose to regulator*



7.1.4 Look for Leaks

⚠ WARNING

Do not damage the regulator when it is connected to the gas cylinder and the valve is open. A damaged regulator may lead to a hydrogen gas leak. In the event of a leak shut down immediately and contact the manufacture or supplier.

Open the gas cylinder valve fully and then back it off half a turn so that it feels loose. The valve should be opened at least a turn and a half.

Remove the 'Teepol' leak detector provided.

Spray each joint with the 'Teepol' leak detector supplied with the machine and look for bubbles that show a leak. Do this every time a joint is made.

⚠ CAUTION

Make sure that the gas cylinder has adequate content and is properly connected and secured before use.

NOTE: *The gauge on the regulator shows the gas pressure, and is used only to monitor the contents of the cylinder. When the pressure reads zero with the gas valve open, the cylinder is empty.*

Return the 'Teepol' leak detector.

Summary:

- *Open gas cylinder valve*
- *Look for gas leaks*

7.2 SAFE OPERATING PRECAUTIONS

Before connecting an DC appliance or power cord to the generator:

- Inspect cords and plugs and replace if damaged.
- Make sure that the appliance is in good working order. Faulty appliances or power cords can create a potential for electric shock.
- Make sure the electrical rating of the tool or appliance does not exceed that of the generator. Never exceed the maximum power rating of the generator.

7.3 TURNING ON THE GH4

The process to turn on the fuel cell to provide power to the outlet is as follows:

1. Ensure the emergency stop button is re-set to the operation position
2. Turn the power switch to on to safely start the fuel cell and begin producing power. In cold conditions the fuel cell may take longer to start while it internally heats up
3. To turn off, turn the switch back to the off position and the fuel cell will safely shut down. In an emergency the emergency stop button can be used which will remove power from the DC outlet and safely shut down the fuel cell.

If charging does not start:

- *Make sure that the front panel switch is in the 'on' position.*
- *Make sure that the cable is connected securely, and the mains is switched on.*
- *If the battery is too low, the inverter may not turn on, which will not allow the batteries to charge. Never allow the ECO GH4 Battery State of Charge to drop below 10%. The two green lights on the outlets indicate the inverter is running.*
- *If the ECO GH4 detects the supply is not clean AC, the inverter may not accept it.*

7.3.1 Rated power

The rated, maximum and surge power of the ECO GH4 are as follows.

RATED POWER (CONTINUOUS)	4000 W

- Rated power is the power for continuous operation

The total power requirements (VA) of all appliances connected must be considered. Appliance and power tool manufacturers usually list rating information near the model number or serial number

Do not exceed the rated power of the ECO GH4. Substantial overloading may damage the ECO GH4. Marginal overloading may shorten the service life of the ECO GH4.

7.4 CHANGE A GAS CYLINDER

7.4.1 Preparation

Read the BOC *High Purity Hydrogen Safety Data Sheet* in conjunction with this procedure.

Put on appropriate PPE, i.e. hard hat, safety glasses, protective gloves and safety footwear.

⚠ WARNING

Do not smoke or use open flames within a 1 metre radius of the machine. Flammable hydrogen gas could be present during operation. To avoid risk of fire or explosion extinguish any source of local ignition.

Change to a spare cylinder when the yellow LED (No. 5) on the control panel flashes to show there is 'No Gas'. The gauge on the empty cylinder will show no pressure.

Summary:

- *Read Hydrogen Safety Data Sheet*
- *Put on appropriate PPE*
- *Extinguish sources of local ignition*

7.4.2 Remove the Regulator and Gas Hose

⚠ CAUTION

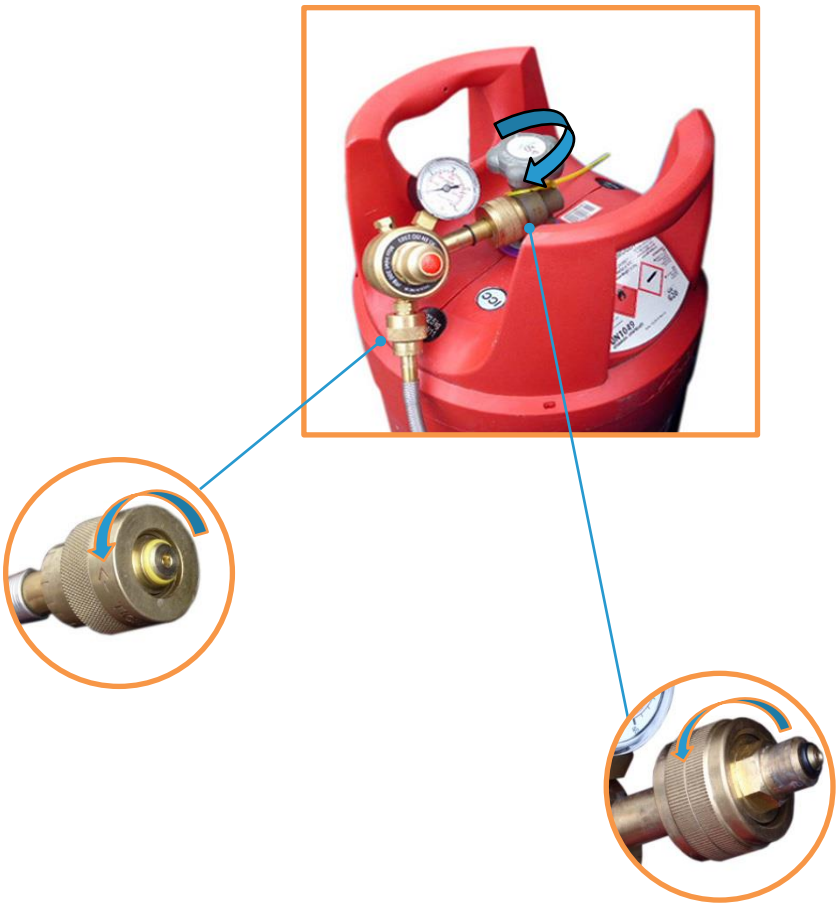
Make sure the gas cylinder valve is off when you install or remove the regulator and gas hose.

Close the gas cylinder valve fully to stop any gas flow and remove the gas pressure.

Remove the gas hose from the cylinder and then remove the regulator.

Summary:

- *Close gas cylinder valve*
- *Remove gas supply hose*
- *Remove regulator*



8 Service and maintenance

WARNING

This product generates voltages which can cause serious injury or death if proper precautions are not taken, or if used improperly.

Disassembly and/or maintenance as described in this user manual should only be attempted by competent personnel who have read and understood the instructions in this manual.

If any other maintenance is required which is not prescribed here, the ECO GH_4 should be returned to Light Green Power or approved distributer.

DO NOT attempt any repairs, maintenance or modifications . Such activities are potentially hazardous, and can result in serious injury or death and may result in a void warranty.

DO NOT attempt to maintain or repair damaged or malfunctioning equipment – the ECO GH_4 should be returned to the distributor.

The ECO GH_4 contains an air filter which must be replaced at a maximum interval of 2 months. In particularly dirty or dusty working environments, this interval should be reduced accordingly. This air filter must only be changed by a Light Green Power engineer due to having to remove the top cover and open the fuel cell.

The ECO GH_4 should be visually inspected before every use, paying attention to the general condition of the housing and damage to gas hoses and fittings. Any damage should be reported to Light Green Power and the machine not used until Light Green Power has deemed the machine safe.

8.1 INSPECTION

Do a thorough inspection of the machine and its component parts on a regular basis.

8.1.1 Regulators and Gas Hoses

Examine the regulators and gas supply hoses, with the connectors, for any damage that may cause a hydrogen leak.

Replace any missing or damaged O-ring seals.

8.1.2 Decals and Labels

Examine all chassis mounted decals and labels for damage.

The decals and labels provide important operating instructions and warn of dangers and hazards.

Replace any missing or hard-to-read labels.

Spares are available from Light Green Power.

Storage

Unlike conventional gasoline or diesel generators, the ECO GH_4 does not require special storage preparations or regular cleaning and servicing. However, observing the following instructions will maximise the service life of the ECO GH_4. The ECO GH should always be stored within a temperature range of 0-40°C.

9 MAINTENANCE

9.1 CLEANING

⚠ CAUTION
Make sure that the inlet and outlet vents are clean and free of obstructions when cleaning the machine. Make sure that all moving parts are clean and free of dirt and debris to prevent malfunction of the machine.

When you clean the machine on site, remove all external power cables.

Wipe over the machine surfaces with lint free cloth and a mild detergent solution.

Never wash the machine with a power washer or high pressure hose.

9.2 INSPECTION

Do a thorough inspection of the machine and its component parts on a regular basis.

9.2.1 Decals and Labels

Examine all chassis mounted decals and labels for damage.

The decals and labels provide important operating instructions and warn of dangers and hazards.

Replace any missing or hard-to-read labels.

Spares are available from LGP

10 Options

Not applicable to the ECO GH4 at the time of writing.