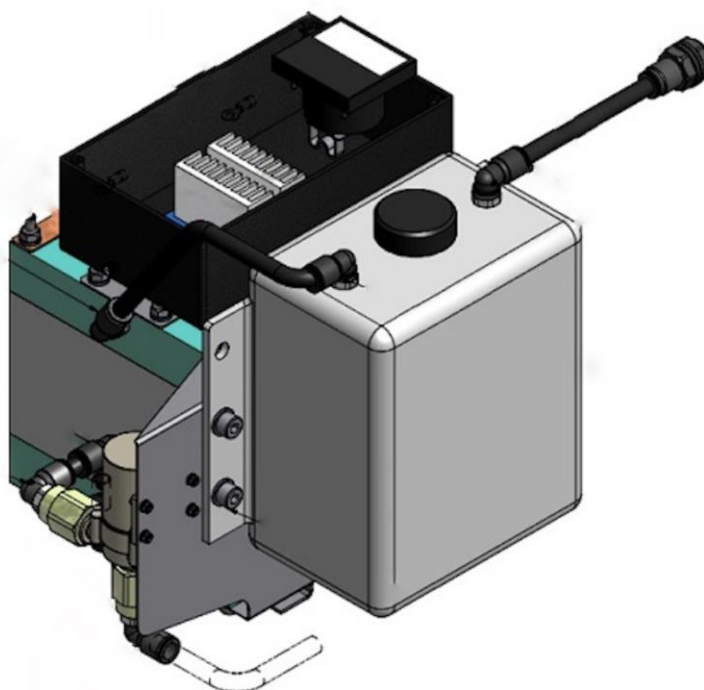


## INSTALLATION AND USER INSTRUCTIONS

---

# Knox Series Hydrogen Fuel Systems

**Knox 20, Knox 30 and Knox 40**



December 2022

Version 1.00



## **DISCLAIMER**

The information contained in this manual is provided for informational purposes only and is not intended to be a comprehensive guide to installing or operating the Knox Series Hydrogen Fuel Systems. It is the user's responsibility to read, understand, and follow all instructions, warnings, and safety guidelines provided in this manual and to seek professional advice if necessary.

The manufacturer of the Knox Series Hydrogen Fuel Systems and the authors of this manual assume no liability for any damages or injuries that may result from the installation or operation of the systems, whether direct, indirect, incidental, or consequential. The user is solely responsible for determining the suitability of the Knox Series Hydrogen Fuel Systems for their intended use and for complying with all applicable laws and regulations.

This manual is provided "as is" without any express or implied warranties, including warranties of merchantability or fitness for a particular purpose. The manufacturer and the authors of this manual reserve the right to make changes to the information contained in this manual at any time without notice.

Copyright © 2023 by KiTech Hydrogen Fuel Systems Pty Limited.

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher. For permission requests, write to the publisher, addressed "Attention: Permissions Coordinator," at the address below.

KiTech Hydrogen Fuel Systems Pte Limited  
contact@kihydrogen.com

## Table of Contents

1	PREFACE .....	5
1.1	... Description of the user .....	5
1.2	... Conventions used in this manual .....	5
1.3	... Explanation of safety warnings.....	6
1.4	... Retaining instructions .....	6
1.5	... Obtaining documentation and information.....	7
1.5.1	Internet.....	7
1.5.2	Ordering documentation .....	7
1.5.3	Documentation feedback .....	7
2	Description of the product.....	8
2.1	... Purpose of the product.....	8
2.2	... Technical data - Knox 20 (K20) Electrolyser .....	8
2.3	... Technical data – Knox 30 (K30) Electrolyser .....	9
2.4	... Technical data – Knox 40 (K40) Electrolyser .....	9
2.5	... Product Compliance .....	10
2.7	... Product elements .....	11
3	Safety instructions .....	12
3.1	... How to use the product safely .....	12
3.1.1	Safety information for Installers.....	12
3.1.2	Personal safety .....	12
3.1.3	Work area safety .....	12
3.1.4	Electrical safety.....	12
4	Preparation .....	13
4.1	... How to transport and store the product.....	13
4.1.1	Lifting, handing and transporting the product .....	13
4.1.2	Storing the product .....	13
4.2	... How to install the product .....	14
4.2.1	Packaging contents.....	14
4.2.2	Shippable Unit Contents:.....	14

4.2.3	Unpacking the product .....	14
4.2.4	Conditions for assembling .....	15
4.2.5	Installation of the product .....	16
4.3	<i>... How to commission the product .....</i>	26
5	Operation/Use .....	27
5.1	<i>... How to use the product.....</i>	27
5.1.1	Operational environment .....	27
5.1.2	Manual operating techniques .....	27
5.1.3	Manual/Automatic operation .....	27
5.1.4	Starting/Stopping the product's operation .....	27
6	Maintenance and cleaning.....	28
6.1	<i>... How to maintain the product.....</i>	28
6.1.1	Six months maintenance .....	28
6.1.2	Planned maintenance .....	29
6.2	<i>... How to clean the product.....</i>	29
7	Troubleshooting and repair .....	30
7.1	<i>... How to Identify and solve problems .....</i>	30
7.1.1	Troubleshooting and repair by non-skilled persons .....	30
	Appendix A. Supplied accessories, consumables and spare parts.....	31
	<i>Supplied accessories.....</i>	31
	<i>Consumables .....</i>	31
	<i>Spare/replacement parts .....</i>	32
	Glossary.....	33

# 1 PREFACE

## 1.1 Description of the user

This manual is intended for KiTech Dealers and customers who use KiTech Hydrogen Fuel Systems on their vehicles/ engines globally. Skilled workforce like installers, service staff and vehicle operators that use KiTech Products on their vehicles can take advantage of the information that is covered in this manual.

This manual should be used and followed by KiTech Certified and appointed dealers and their staff to train their users and customers.

## 1.2 Conventions used in this manual

The following style conventions are used in this document:

### **Bold**

Names of product elements, commands, options, programs, processes, services, and utilities

Names of interface elements (such windows, dialog boxes, buttons, fields, and menus)

Interface elements the user selects, clicks, presses, or types

### *Italic*

Publication titles referenced in text

Emphasis (for example a new term)

Variables

### `Courier`

System output, such as an error message or script

URLs, complete paths, filenames, prompts, and syntax

User input variables

< >      Angle brackets surround user-supplied values

[ ]      Square brackets surround optional items

|      Vertical bar indicates alternate selections - the bar means “or”

### 1.3 Explanation of safety warnings

**DANGER!** Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury

**WARNING!** Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

**CAUTION!** Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

**NOTICE** Indicates information considered important, but not hazard-related.

### 1.4 Retaining instructions

Read and understand this manual and its safety instructions before using this product. Failure to do so can result in injury and/or product damage.

Follow all the instructions. This will avoid fire, explosions, electric shocks or other hazards that may result in damage to property and/or severe or fatal injuries.

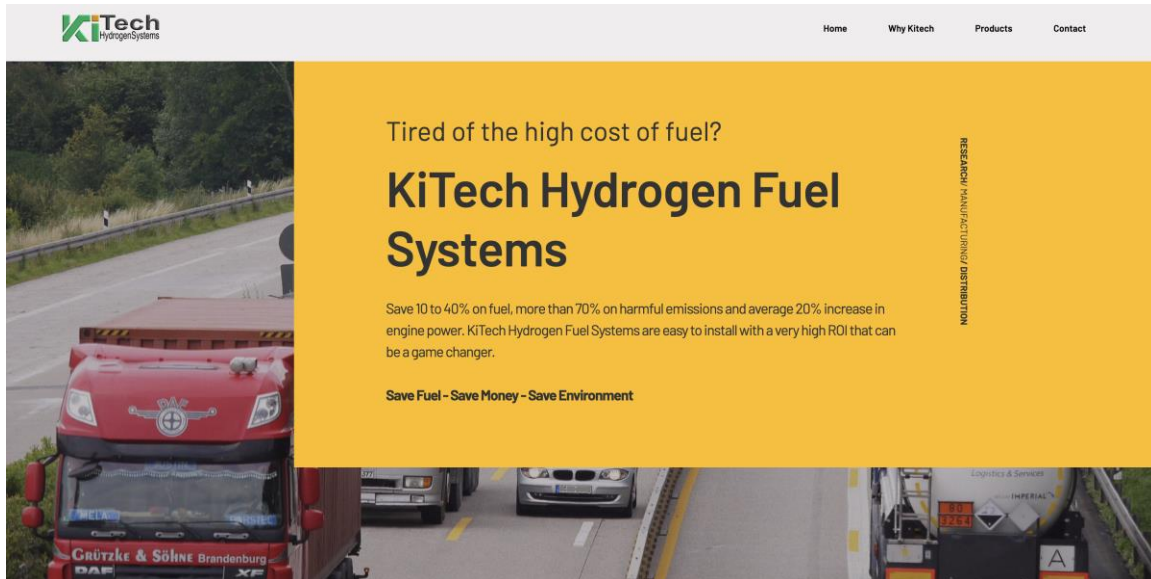
Keep all safety information and instructions for future reference and pass them on to subsequent users of the product.

## 1.5 Obtaining documentation and information

### 1.5.1 Internet

The latest version of the documentation is available at the following address:

<http://www.kihydrogen.com/help>



### 1.5.2 Ordering documentation

Documentation, user instructions and technical information can be ordered by sending email to [contact@kihhydrogen.com](mailto:contact@kihhydrogen.com).

### 1.5.3 Documentation feedback

If you are reading Kitech product documentation on the internet, any comments can be submitted on the support website. Comments can also be sent to [contact@kihhydrogen.com](mailto:contact@kihhydrogen.com).

We appreciate your comments.

## 2 Description of the product

### 2.1 Purpose of the product

KiTech Hydrogen Fuel Systems utilize patented technology to generate hydrogen gas (HHO) from a distilled water solution and potassium hydroxide (KOH). These systems are designed to be installed on a vehicle and use the vehicle's 12V battery power and alternator to power the electrolysis process. The resulting hydrogen gas is then introduced into the air intake of the engine through a pipe connected to the bubbler of the Hydrogen Fuel System (HFS). The complete Hydrogen Fuel System includes the following components:

1. **Electrolyzer:** One of three models, the K20, K30, or K40, which are named after their inventor, Gavan Knox. These models have similar designs but differ in their capacity to produce HHO gas.
2. **DC power supply:** Specifically designed for the system, this component provides the necessary stable power to the electrolyzer by reducing wastage & optimizing heat dissipation.
3. **Pump:** This component helps to circulate the water from the tank to the electrolyzer, increasing the production of HHO.
4. **Water tank:** Stores the distilled water solution used in the electrolysis process.
5. **Bubbler:** Connected to a pipe leading to the air intake of the engine, the bubbler helps to mix the hydrogen gas with the air intake.
6. **Sensors (optional):** These sensors can be added to monitor and optimize the performance of the system.

The use of hydrogen as a fuel additive can improve engine efficiency, resulting in increased power, improved fuel efficiency, and reduced emissions. Additionally, the long-term use of hydrogen has been shown to extend the life of an engine and reduce maintenance costs, in addition to providing direct fuel savings.

### 2.2 Technical data - Knox 20 (K20) Electrolyser

Parameter	Unit
Plates	10x10 cm Stainless Steel Plates with three cells in Double-Single-Double configuration having 11-10-11 plates each.
Power	500 W
Voltage	Constant 12 to 13.5 Volts DC (Vehicle Battery Voltage)
Weight (Empty)	8.5 kg
Starting Current	10 to 13 Amps
Current Cutoff	40 Amps
Operating temperature	Upto 70 °C (Water)

KiTech Hydrogen Systems Pte Limited (Singapore – India – Australia)



Hydrogen Production	2 to 4 Liters per minute. Stable after 30 minutes of charge.
Continuous running recommendation	8 hours in one cycle.
Water Solution	4 gm. KOH per liter of distilled water.
Electrolyser Cleaning	Once every 6 months or if the HHO production drops below the specified levels.

### 2.3 Technical data – Knox 30 (K30) Electrolyser

Parameter	Unit
Plates	15x15 cm. Stainless Steel Plates with three cells (Double-Single-Double) configuration having 11-10-11 plates each.
Power	600 W
Voltage	Constant 12 to 13.5 Volts DC (Vehicle Battery Voltage)
Weight (Empty)	13.5 kg
Starting Current	15 to 18 Amps
Current Cutoff	50 Amps
Operating temperature	Upto 70 °C (Water)
Hydrogen Production	3 to 6 Liters per minute. Stable after 30 minutes of charge
Continuous running recommendation	8 hours in one cycle.
Water Solution	4 gm. KOH per liter of distilled water.
Electrolyser Cleaning	Once every 6 months or if the HHO production drops below the specified levels.

### 2.4 Technical data – Knox 40 (K40) Electrolyser

Parameter	Unit
Plates	20x20 cm. Stainless Steel Plates with three cells Double-Single-Double configuration having 11-10-11 plates each.
Power	750 W

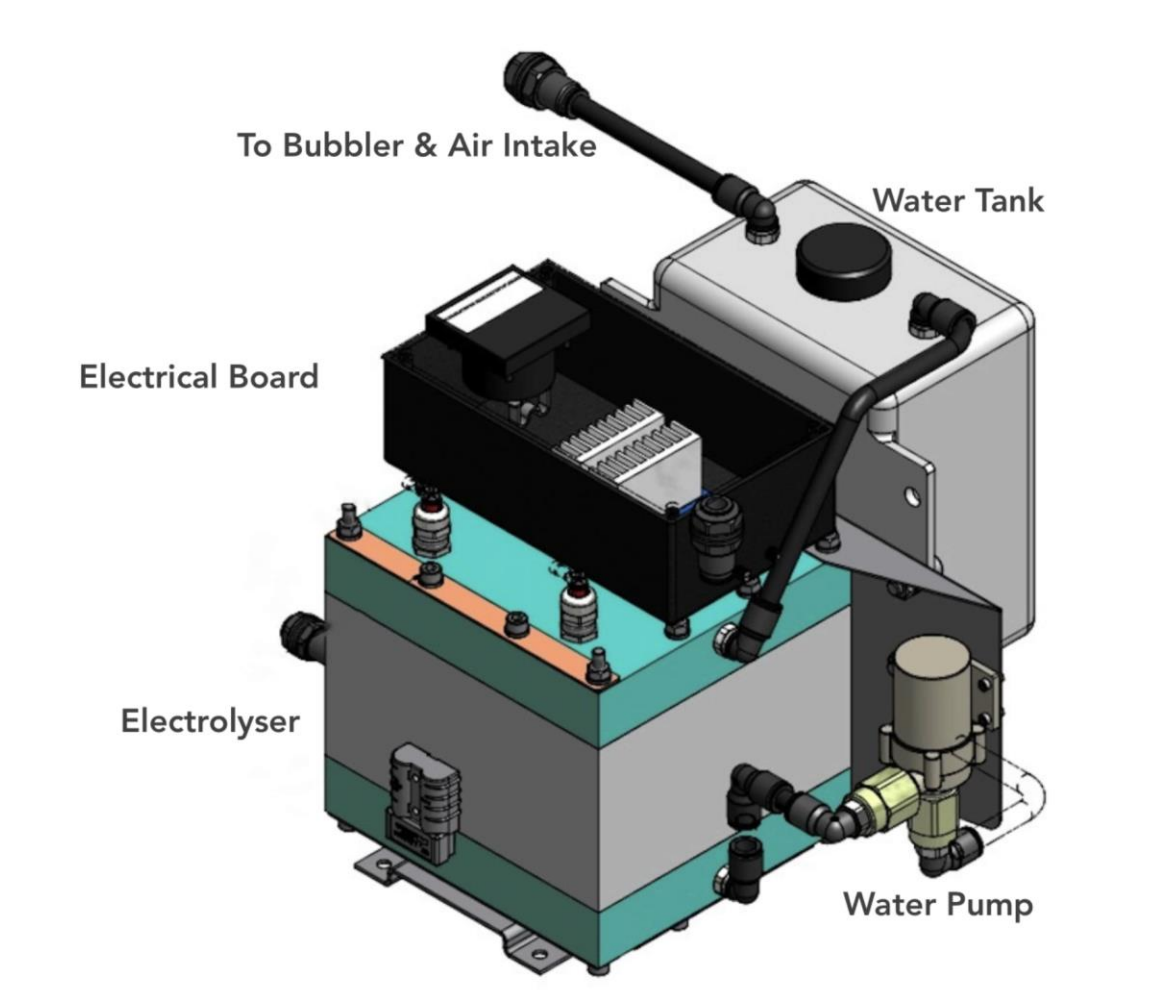
Voltage	Constant 12 to 13.5 Volts (Vehicle Battery Voltage)
Weight (Empty)	22 kg
Starting Current	18 to 23 Amps
Current Cutoff	60 Amps
Operating temperature	Upto 70 °C (Water)
Hydrogen Production	5 to 8 Liters per minute. Stable after 30 minutes of charge
Continuous running recommendation	8 hours in one cycle.
Water Solution	4 gm. KOH per liter of distilled water.
Electrolyser Cleaning	Once every 6 months or if the HHO production drops below the specified levels.

## 2.5 Product Compliance

Hydrogen Fuel systems are very recent invention and most of the governments have no product compliance regulations specifically created to address this set of products. KiTech products however follow ISO 9000 processes in their production & assembly process.

Product installation on vehicles however must follow local safety and vehicle safety regulations. Installers and Dealers of KiTech products should ensure compliance of the regulations while selling and installing these systems. Care to be taken to install the system along with the DC Power supply in rain proof box that protects the components of the system from water & dust in regular day to day operation.

## 2.7 Product elements



*Fig. 1 Concept diagram of KiTech Complete Hydrogen Fuel Systems (Complete system visual will differ installation to installation and model to model)*

- A. Electrolyser
- B. Water Pump with piping
- C. DC Power Supply (Electrical Board)
- D. Water Tank with Piping
- E. Bubbler with piping
- F. Sensors (Optional)
- G. Dashboard (Optional)

## 3 Safety instructions

**WARNING!** Loose connections may lead to overheating and fire. Ensure all connections are done with 10MM wire or bus bar.

### 3.1 How to use the product safely

#### 3.1.1 Safety information for Installers

- Electrolyzers are heavy and must be handled with care to prevent injury or damage.
- Use 4 AWG size wires or larger for installation to ensure proper current handling capacity.
- DC supply joints must be securely fastened to prevent loose connections.
- Potassium hydroxide (KOH) is a caustic chemical that can cause skin and eye irritation. Use gloves and eye protection when handling KOH.
- Check the heat on each electrode after installation. Overheating can indicate poor connections, excess KOH, or a faulty cell. Excessive heat can damage the electrolyzer.

#### 3.1.2 Personal safety

- Vehicle operators should turn off the Hydrogen Fuel System immediately if they notice a burning smell from the unit while it is in operation.
- Do not attempt to use water from the electrolyzer outside of the unit. Only a certified installer should handle this task. Caustic soda in the water can harm your skin and eyes.
- Only use distilled water in the system to prevent contamination and potential harm to the user.

#### 3.1.3 Work area safety

- The unit should be installed on the back side of the driver's cabin, or on vehicle rails with sufficient height to accommodate the unit's height. Low ground clearance with the HFS unit can damage the unit and introduce dust into the system, which can be harmful.
- Disassembly of the unit should only be performed by a certified technician.

#### 3.1.4 Electrical safety

- Install the system as close to the battery as possible to minimize voltage drop from long cables.
- The system does not produce high voltage that could cause shock. However, caution should still be exercised when opening the unit while it is in operation.
- By following these safety guidelines, you can ensure the safe and proper use of the hydrogen electrolyzer.

## 4 Preparation

### 4.1 How to transport and store the product

#### 4.1.1 Lifting, handing and transporting the product

##### 4.1.1.1 *To lift the product safely:*

1. K Series electrolyzers are 8.5 Kg to 22 Kg in weight. Along with the complete Hydrogen fuel system comprising of Power supply, Tank, Bubbler, Frame and other accessories the weight of the system can even double. Therefore the items will be sent to dealers in prepacked boxes with pallets in a group of more than two systems.
2. Handle with lifting devices like a forklift or if done by hand, exercise adequate caution.
3. While the packaging of the product will be adequate for shipment and rough handling, there is always a risk of product damage if it falls during handling.

**NOTICE** - Any damage to the product due to handling issue after it is picked up by the dealer or customer is not covered under warranty.

##### 4.1.1.2 *To handle the product safely:*

1. Use adequate handling devices
2. Use right tackles and keep the packaging intact unless it is required to be installed.
3. Avoid stacking heavy items on top of the product packings.

##### 4.1.1.3 *To transport the product safely:*

1. Keep the packing intact till you have the product in your warehouse or installation site.
2. Transport with enough care even though K Series systems are designed to handle high shocks.

#### 4.1.2 Storing the product

Store the product in a dry place. Power supplies and electronics of the system may malfunction if water enters the power supply and sensor unit.

## **4.2 How to install the product**

### **4.2.1 Packaging contents**

K Series products are shipped based on the demand of the customer. The items may be packed as a complete end to end Hydrogen Fuel System assembly, part HFS assembly or just electrolyser & pump assembly. The contents would be as follows based on what is being shipped.

### **4.2.2 Shippable Unit Contents:**

- A. Electrolyser & Pump Assembly
- B. Hydrogen Fuel Assembly without outer frame (With or without optional items like Sensors & Dashboard)
- C. Hydrogen Fuel System with outer frame (With or without optional items like sensors & Dashboard)

### **4.2.3 Unpacking the product**

Remove the packaging of the product and check for any anomalies or damage.

#### **Check the following:**

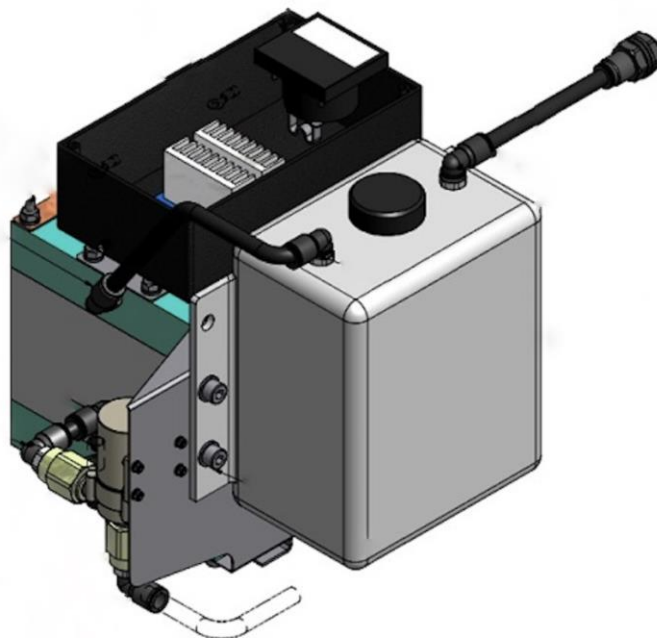
1. Open Water Tank (If that is part of the supply) and check for its cleanliness. If it has external objects and dust, clean it throughout using water and wipers.
2. Open Bubbler (If that is part of the supply) and check for its cleanliness. If external objects and dust is observed, clean it with water & wiper.
3. Check for the pipes and firmness of the installation. If you are not satisfied with the piping, you may install a new pipe at your discretion.

#### 4.2.4 Conditions for assembling

Kitech may ship only electrolyser & pump assembly or fully assembled unit to dealers based on the orders. Dealers may choose to make their own housing, tank and bubbler assembly based on the need of the end customer and tank capacity needed. Following must be ensured for all the assembly that is done on the vehicle.

##### Assembly instructions:

1. Electrolyser assembly fittings must not be overtightened. Electrolyser body is made of HDPC which is soft material as compared to the stainless-steel fittings. Excessive tightening may damage the fitting and render unit unusable.
2. All pipe fittings should be cross checked for leak proof fitment.
3. The Positive & Negative ends of electrodes must be tightly joined with min 10mm Copper cable with stainless steel nut & bolts to give a strong joining. Loose joints increase the danger of overheating the electrodes and damage the electrolyser.
4. Ensure all pipes and cables are well managed, not allowing any hanging cables & pipes.
5. Ensure that the water tank and bubbler tank are clean.
6. Ensure that outer housing is adequately hinged at appropriate location on the vehicle and keeps the assembly dust proof and rain/ Water proof.



*Fig. 5 K Series Assembly – This is a representation of one form of assembly. Installers can decide to use tank and bubbler to be installed based on vehicle requirements.*

#### 4.2.5 Installation of the product

Installation Instructions for cars, trucks and Gensets

Then send me a message a message to [gavan@kihydrogen.com](mailto:gavan@kihydrogen.com), to clarify any aspects of the Installation Instructions.

##### **Warning**

**Do not use a concentration of caustic higher than the recommended value ( as shown in the chart below) (Not more than 4 grams / liter ) as this may lead to excessive electrical energy being wasted as thermal energy and seeping of the caustic powder from the joints of the sealed unit.**

**Having a low concentration of caustic is ideal as more energy is used into the oxidation / reduction of water into hydrogen and oxygen, rather on the “redox”. of the caustic....**

**Greater efficiency = more gas with less electrical load**

##### *Getting started:*

*Note! If you are installing the “Hydrogen generator system” on a diesel engine you must route the Hydrogen transmission hose to a location **UPSTREAM** of the turbo, that is, on the **LOW PRESSURE** side of the turbo, in the air-intake cowl, or into the mouth of the air intake cowl, if you can access it.*

There are two configurations of Power supply .

##### Configuration 1

Materials required 40 amp circuit breaker, 40 amp relay unit, Bubbler Unit, 5 m length 10 mm pneumatic tubing, 5 m double insulated 8 mm twin core cable, 12 volt master switch, 4 gram potassium hydroxide/ liter of Distilled water.

- The latest configuration from November 2021 is a modified DC supply that does away with the PWM and uses the extra 1.5 volts used by the PWM to produce more Hydrogen gas.
- This new arrangement does away with controlling the current by the electronic circuit and only controls the current flow by adding pure water to the tank .
- This arrangement does away with controlling the current by the electronic circuit and only controls the current flow by adding pure water to the tank once the current reaches 35 amp or once the solution volume in the tank falls to 1 litre , This way there is



no wasted heat energy generated by the PWN, there is more gas produced and the systems run more efficiently.

- Fill the 3 litre tank to the 2.5 litre mark. If another tank size is used, fill 2/3rd to 3/4th of the tank
- Measure 10 grams of potassium hydroxide = two level teaspoon full and mix this with 100 mls of distilled water
- Switch on the system with the pump running and add the small amounts of the 100 ml mixture to the recycling tank.
- Watch the current rise over the next few minutes stop adding anymore mixture once the current reaches 12amp.
- The solution and system is now ready to use. As the system runs the current flow will increase and eventually reach 29 amp .
- After 12 hours of operation add distilled water to return the water level to the 2.5 Liter level
- 24 volt vehicles should reduce the voltage to the system to 12 volt output
- The system will consume 1 litre of water every 10 hours. After 10 hours of operation it is time to add water to the system. Adding water dilutes the solution and the current flow will return to 15 amp.
- In the case of you forgetting to add water, the auto reset 40amp circuit breaker opens the circuit and no current will flow telling you its time to add water. .

## Configuration 2

One of the advantages of using this system is that it can be provided to you preassembled with Power supply PWM, electrolyte storage cell, wiring, switches, ammeter, electrolysis cells and hydraulic / pneumatic tubing all connected and mounted.

This configuration is used with the Pulse width Modulator power supply, running at 12 volts.

The circuit / solution concentration is initially set to run 15 amp.

Your only task is to mount the wiring from the battery/ alternator to the cell enclosure and connect the delivery tubing from the cell enclosure to the air / fuel intake on the engine. After that you can move the cell assembly from one vehicle to the next etc. with ease.

The cell enclosure is available as an extra large marine battery box, Steel box or aluminium box

1. An extra large marine battery box and cover which can be placed and secured in any position in the vehicle ( often there is no room under the bonnet but room in the rear of the vehicle) – 41 cm x 21 cm x 35 cm high (Or as per the model chosen. K30 or K40 may need bigger boxes)

2. The Steel or aluminum box measure 43 cm x 30 cm x 25 cm high or as per the model type.

Because of the thousands of ever-evolving vehicle configurations in the marketplace, we cannot offer specific, detailed, instructions to precisely fit every possible installation. The following guide is designed to present a typical installation, which the installer can use as guidance in installing the device in his/her own vehicle. This is a relatively simple process and should be handled with ease by any professional mechanic or mechanically inclined individual with the appropriate tools.

## Setting up solution

- Fill the system so that the 3 liter recycling tank is holding 2.5 liters of distilled water.
- Measure 10 grams of potassium hydroxide and mix this with 100 mls of distilled water. (If you cannot exactly measure 4 grams of KOH per liter)
- Switch on the system with the pump running.
- Slowly add the 100 mls of electrolyte to the tank till the current reaches 15 amp.
- Adjust the current control to maximum and wind the current back 1/8th of a turn – 1 amp
- The solution and system is now ready to use. As the system runs the current flow will increase.
- The recycling 3 liter tanks is filled to 2.5 liters. The system will consume 1 liter of water every 10 hours.
- After 10 hours of operation, it is time to add water to the system. Adding water dilutes the solution and the current flow will return to 15 amp .
- In the case of you forgetting to add water , the auto reset circuit breaker opens the circuit and no current will flow telling you its time to add water. K20 Circuit break point should be at 40 amps, K30 at 50 amps and K40 at 60 amps.
- 24 volt vehicles should reduce the voltage to the system to 12 volt output. Directly passing 24 Volts to the system will result in excess heat & high current.

## Material required for a typical car or Truck:

- 1). 50 amp double insulated wiring;
- 2). 10mm Ø stainless steel air brake tubing; or 10mm Ø HDPE air brake tubing
- 3). One 40amp breaker/circuit breaker ;
- 4) One 40 amp relay switch
- 5). 10 inch Gas bubbler
- 6) three 10 mm x 1/4 inch BSP straight brass push lock fittings;
- 7). 500 grams Potassium hydroxide pellets (It comes in a pack of 500 gm. But you may not be using all of that)

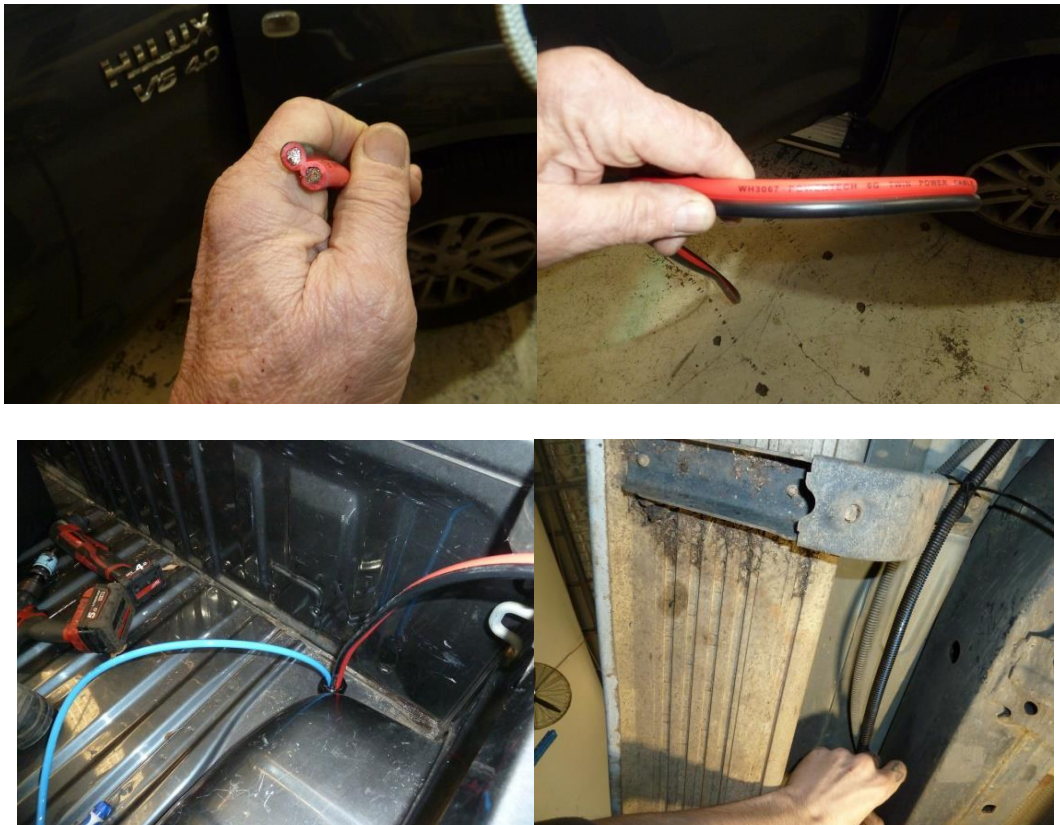
- 8) Distilled water (5 Liters minimum to fill electrolyser, 2/3 tank and ½ to 2/3 bubbler)
- 9) 80 amp double insulated wiring (double insulated , Twin core 8 mm cable)

---

## Installation

***Notice : This system is to be installed on a 12 volt system only. For Higher vehicle input voltage the input voltage must be reduced to 12 volts to be fed into the Hydrogen system.***

1. You can begin by determining where you want to locate Hydrogen generator system” in/on your path to route the Hydrogen hose and electrical wires from the system device to the engine compartment. You should remember that you will most likely want to run the hose and wires together along a frame member or other similar under-vehicle location where you can attach mechanic's wire or Metal cable ties to hold them in place. You MUST keep both the Hydrogen transfer hose and electrical wire at least 25 cm from the exhaust pipes and exhaust manifold to prevent them from burning, shorting, or melting
2. Decide where you want to locate the Hydrogen generator. Then determine a path to route the Hydrogen hose and electrical wires from the “generator” to the power supply in the engine compartment



You should remember that you will most likely want to run the hose and wires together along a frame member or other similar under-vehicle location where you can attach mechanic's wire or metal ties to hold them in place. You MUST keep both the Hydrogen transfer hose and electrical wire at least 25 cm from the exhaust pipes and exhaust manifold to prevent them from burning, shorting, or melting.

3. For inside-vehicle, in-trunk, in-truck-bed, or in-commercial-cargo-bay installations:

Once you have determined where you want to locate your “Generator” system, find a place hole for the Hydrogen transfer tube and for electrical leads (80 amp double insulated cable) to the engine compartment. Drill through the vehicle deck to the underside of the vehicle



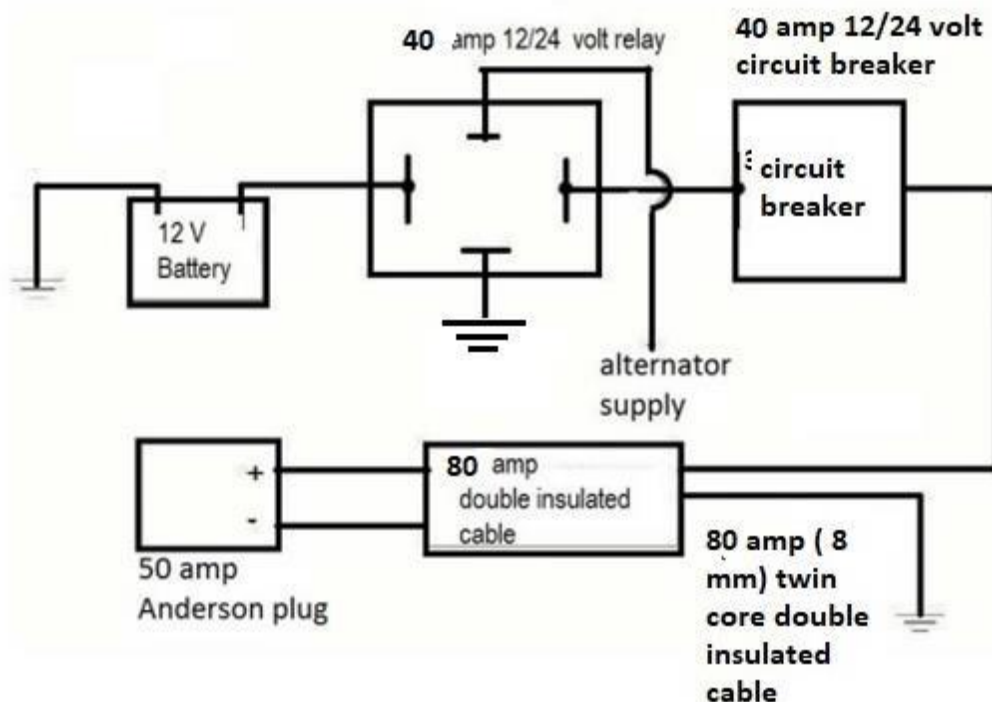
4. Make sure you stay clear of the fuel tank, brake lines, and any other obstructions which would make it difficult for you to push or pull the Hydrogen transfer hose and electrical cable through the holes you have drilled. Secure a Plastic protector into the hole as shown in the diagram.

Then either push or pull the Hydrogen transmission hose through the 3/4" hole you drilled, providing enough slack in the hose near the "Generator" system to push lock fitting on the outside of the system

5. . You might want to wrap the transmission Hose with duct tape or apply appropriate size split wire loom where it passes through the vehicle deck in order to reduce the possibility of eventual wear on the Hydrogen transmission hose. Alternatively push the tubing through 12 mm internal diameter reinforced water tubing and fix this water tubing to the underside of the vehicle with metal cable ties / connectors.

6. An experienced Automotive electrician should be used to connect the cable to the Battery /alternator so that it is activated from the alternator via a 40 amp relay switch . Thus when the engine stops and the alternator stops working , then the Relay supplying electrical Power to the Generator system , switches off. This prevents the system working if the engine is not switched on and running.

Diagram 1





7. Connect the (8mm ) 80amp double insulated cable to the battery positive cable via a 40amp circuit breaker and a 40amp relay unit.

a. Connect a length of red 80amp wire to the positive terminal lug. Connect the other end of the wire to relay terminal 30.

b. Connect relay terminals 85 to the ignition switch via the a) efie thermal switch, b) master switch and 10 amp fuse ( as shown in diagram 1). (This will only activate the relay unit when the engine is switched on.). Alternately connect terminals 85 to be activated by the vehicle alternator .

In the case of an efie not being used - Connect relay terminals 85 to the ignition switch via the master switch and 10 amp fuse ( as shown in Diagram 1). (This will only activate the relay unit when the engine is switched on.). Alternately connect terminals 85 to be activated by the vehicle alternator

c. Connect a wire from relay terminal 87 to the first terminal of the 30 amp circuit breaker. Connect the 2nd terminal of the circuit breaker to the red wire of the double insulated 30amp cable that takes power to the Anderson plug of the system

d. Secure the black cable from the (8 mm) 80amp cable to the body /earth of the vehicle  
-- -- --See diagram 1.

e. Connect terminal 86 with a 6 mm wire to the earth of the vehicle

8. Then push or pull the (8mm) 80 amp double insulated cable electrical wires through the 3/8" hole. Double insulated cable is used to protect them from possible wear and shorting. This cable is used to connect the Electrolysis system to the battery/ alternator in your vehicle engine bay.

9. Pass the double insulated cable through the vehicle cabin along the line of the wiring loom.

10. Attach the free end of the power cable to a 50amp Anderson Plug to connect to the HHO generator

11. Mount and secure the 10mm Ø air pipe to the underside of the vehicle using metal ties

12. Pass one end of the pipe through the floor of the vehicle rear to connect to the HHO generator 13. Locate an area on your air-intake cowling as near the air- intake termination at the throttle throat as you can conveniently access (On diesel engines, you MUST input the Hydrogen transmission hoses UPSTREAM from the turbo, on the LOW PRESSURE side of the turbo). Drill a 7/16" hole

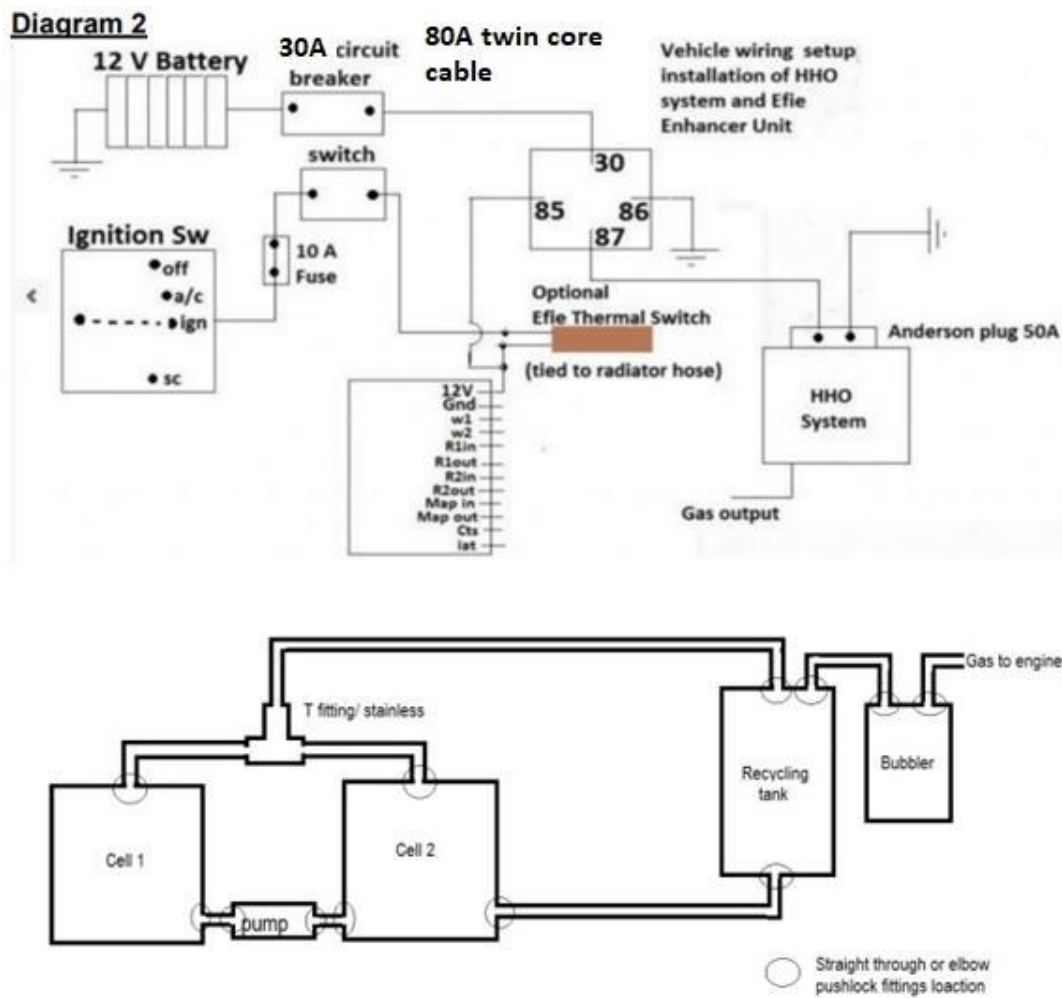
14. Remove the air-intake, or move it to a position where the drilling debris won't fall into the throttle throat or intake manifold. Reattach the air-intake cowling and screw a 1/4" BSPT

(threaded) x 10 mm Push lock fitting (provided with your hole you drilled in the air -intake. There is no need to over-tighten the fitting(s). If you strip the threads or have trouble satisfactorily affixing the fitting into the air-intake cowling, you can clean/de-grease the area around the hole(s) and use any good plastic glue epoxy, Sumo Glue, etc., to secure the fitting

15. Attach the Hydrogen transmission hose (10 mm trucking air brake tubing) to the Push lock fitting you attached to your air-intake . You might double-check to be sure you have chosen a route for the hose and wire that will avoid the hot exhaust manifold and exhaust pipes as well as avoiding any moving mechanisms that would entangle, crimp, or rub the hose. Again, it would be a good idea to follow the same path as the electrical Cable so the hose and the cable can be bundled with electrical or duct tape as you attach and support them with plastic ties and/or mechanics wire as they traverse along the vehicle framework generator” and the engine compartment

Diagram 2

Twin K Series systems mounted onto truck



## Setting up the bubbler

- Locate a suitable / strong mounting position for the “bubbler” unit that is close to the gas output connection on the electrolyte recycling tank. The bubbler unit “out” connection should be at the same level ,or above the gas outlet of the recycling tank.
- A 18 cm length of 15 mm OD reinforced nylon pipe is cut and fitted to the recess in the lid of the bubbler as shown in the diagrams below.
- Fill the “10 inch bubbler Unit” to a depth of 18 cm with distilled water.
- Connect a length of 10 mm pneumatic tubing from the output gas fitting on the hydrogen system to “push-to-connect” fitting on the “out” connection of the bubbler Unit.
- Connect a suitable length of 10 mm Pneumatic tubing from the “In” connection on the Bubbler unit to the gas input position chosen to supply hydrogen gas to the engine.
- The System is now ready to use.

## BELOW

Photos of Bubbler assembly with push to connect fittings and 15 mm OD hosing inserted into middle of underside of Bubbler top







*Fig. Bubbler assembly. Installers can create their own bubbler assembly based on the need of the vehicle. If not transparent plastic, it should be Stainless steel body with a visibility of water level inside the bubbler.*

### 4.3 How to commission the product

K Series Hydrogen Fuel systems must be installed & commissioned by certified installers and dealers of KiTech Hydrogen systems. Ensure the following:

1. Units are installed in box that make the unit safe from rains, direct sunlight, and dust.
2. Unit must be hinged properly ensuring weight of the filled-up unit is easily handled by the vehicle including jerks while travelling on uneven roads.
3. DC Supply is properly secured through alternator & battery and a switch off/on connection is routed to Driver's cabin.
4. All pipe fittings must be checked for water and gas leakage. Leakage of gas will severely compromise the ability of the system to deliver savings. Leakage of gas can happen from either bubbler or water tank from where the water is pushed in from the electrolyser and from where the gas is pushed into bubbler. Ensure the joints are properly sealed.
5. Ensure the HHO outlet to air intake of vehicle is fitted as per specifications.
6. All loose pipes and wires must be properly managed & secured.
7. Fill the tank as specified with Distilled water solution
8. Start the vehicle & see if the pump is operating properly and there are no leakage. If there are leakages, manage them by tightening the connections or fixing the leaks at electrodes using epoxy. If epoxy is used, it should be left for 24 hours before the unit is operated again. Caution – Epoxy should be used only at electrodes by expert technician.
9. Ensure that the tank lid is tightly closed. HHO gas leakage can happen from any loose point in the assembly.
10. Check the bubbler and see if HHO production is happening and water is getting circulated.
11. Check the current and see if the current is in specified range.
12. If any of the parameter is not in line, recheck the installation and correct till the issue is resolved and unit is working as specified.
13. Once the vehicle is taken out in field, ensure water is refilled as specified.
14. Caution – There might be situation where water turns orange while the machine is in operation. This happens only if there are ferrous impurities in the water or electrolyser. In such cases
  - a. Drain the water completely
  - b. Mix 5 ml Phosphoric acid in distilled water per liter of water and fill half the tank with that water.
  - c. Run the pump for 20 minutes and allow the water to circulate.
  - d. Drain the water & refill the KOH + Distilled water solution and start the system.
  - e. Water should remain clear. If still facing issue, report the matter to KiTech Dealer.

## 5 Operation/Use

### 5.1 How to use the product

#### 5.1.1 Operational environment

KiTech Hydrogen systems are designed to operate from Zero Degree Celsius to high atmospheric temperature like 50 Deg Celcius. In Sub zero weather where the electrolyte and water system can freeze, a new kit is being developed by KiTech. Till such time do not operate the system under subzero conditions.

#### 5.1.2 Manual operating techniques

Installer should be providing manual switch in the cabin of driver. In case Driver feels necessary, they can switch off the system completely. Such situations may arise due to lack of water availability or malfunction of the system.

Report the issue to the dealer from whom your purchased the unit.

#### 5.1.3 Manual/Automatic operation

DC Power supply has cutoff current setup which will ensure that if current crosses more than 60 Amps, the unit will automatically cutoff and restart after 10 minutes automatically. Optional sensor assembly provides alerts to the drivers of the health of the unit that can keep them updated and help them take informed decision on the operation of the unit.

*Note: The Automatic DC Power supply will be shipped by May 2023. Dealers to use locally available DC supply as per customer's need or book them with customers for later KiTech supply.*

#### 5.1.4 Starting/Stopping the product's operation

Product is connected to vehicle battery and alternator. As soon as vehicle starts, the unit also should start operating and at the same time, when vehicle is shut off, the unit also shuts down automatically.

Manual shut down option to given to the driver during the installation of the unit on the vehicle on demand.

## 6 Maintenance and cleaning

**NOTICE:** Ideally the water in the tank should be completely replaced and tank cleaned once in six months.

### 6.1 How to maintain the product

#### 6.1.1 Six months maintenance

##### 6.1.1.1 *Replacing the water*

##### To replace the water

1. Drain the system completely
2. Use optimal amount of distilled water and run the pump to rinse off any impurity present in the tank.
3. In case you see traces of ferrous in water (orange colour), add 5 ml Phosphoric acid in the distilled water and use that water to clean the tank by running the pump for 10 minutes.
4. Refill the tank with Distilled water & add KOH solution as per the startup process described in 4.2.5.

##### 6.1.1.2 *Reasons for lower HHO output in the system:*

It is possible that system starts performing bad and deliver lesser HHO or even you see water getting impure more often. Such cases happen due to many reasons

1. Customer has used any other water other than Distilled water. This results in electrodes getting coated with chemicals that reduce the efficiency of the unit significantly and it cannot be cleaned. The only option is to replace the unit with new one. In such situation, the warranty of the unit will not be entertained.
2. HHO Solution weak. Low KOH in water may also result in slow HHO production. You may try by changing the water as per 6.1.1.1.
3. Voltage drop – Due to long wires, voltage drops happen. By reducing the length of wires, you may get additional voltage and higher current which will produce more gas.
4. Faulty cell – Faulty cell will not only reduce HHO production but also will result in high current and high heat. In such a case, the unit must be repaired by the dealer.
5. Loose connections – While driving, vibrations may render some connections loose. This may not only cause high localized heat but also low gas production. If low quality and low gauge wires are used, this issue can reoccur.
6. Tank cap and bubbler cap if lose can also drain off the gas. They should be tightened up properly.

### Part replacement & repair:

Part replacement & repair must be done by qualified and approved KiTech Dealer. Under no circumstance Customer should carry out repairs themselves unless they are certified by KiTech for repair & maintenance of their units.

#### 6.1.2 Planned maintenance

Maintenance tasks shall be done according to the following plan:

Task	Frequency
Replacing the Water	Every 6 months
Unit Efficiency check	Every 6 months while replacing water
Fitment checks for leaks & cracks	Minimum every 30 days or as often as it is possible – Visual inspection
Bubbler water refill & replacement	Regular. Bubbler should be filled with distilled water upto minimum 40% and maximum 75% of the bubbler capacity. HHO inlet Pipe should always be below the surface of water.

*Table 5 Maintenance schedule*

## 6.2 How to clean the product

### To clean the product:

1. Dust settles in the product and that might interfere with the DC power supply. Inside the box, just clean the dust using air pressure jets. Do not use water to clean. Outer side of the box can be cleaned with water.
2. Tank and Bubbler Water cleaning should be as per schedule.
3. Bubbler water should be refilled as soon as the water level drops below 40% of the bubbler capacity and with water still above the HHO Input Pipe.
4. Ensure tank & bubbler are secured properly as any leakage due to loose couplings can drain HHO significantly.

## 7 Troubleshooting and repair

### 7.1 How to Identify and solve problems

#### 7.1.1 Troubleshooting and repair by non-skilled persons

**WARNING:** Repair must be done by qualified & approved Dealer or their technicians. Others must shut down the unit & bring to attention of the dealer. Unqualified person doing repair beyond refilling water will risk warranty getting null & void.

Error	Cause	Solution
HHO Gas generation is lower than expected	Detailed analysis n 6.1.1.2	See 6.1.1.2
Unit not operating	High current causing cutoff due to higher KOH solution concentration.	Refill the tank with distilled water by 2/3 <sup>rd</sup> level.
Unit not operating	Pump might have stopped working	Restart or Replace the pump as needed
Too much heat	High current due to High water concentration	Refill distilled water in tank
Too much heat with high current that is higher than usual.	Faulty cell	Repair the cell
Electrode having more than 100 Deg C temperature.	Loose connection on that electrode	Refit the connection with right wire or Bus bar. Secure tightly. Problem persists? – Report.
Wire getting too hot. Even burning smell at times.	Low quality wire used or loose connection.	Replace the wire with higher gauge and secure it properly.
Unit Not working	Faulty DC Supply or faulty cabling	Check & replace the DC supply / correct cabling.
Water getting drained off too often	Leaks in the system	Perform a complete check of leakage on all part of the unit for water. Repair & solve.

Table 6 Table of Trouble shooting tips

## Appendix A. Supplied accessories, consumables, and spare parts

### Supplied accessories

Accessory Name	Function	Supply Options
Advanced DC-DC Power Supply for KiTech HFS	This is specially designed DC-DC power supply made to reduce power wastage & enhance HHO production. Designed for high stress field operations with auto cutoff setting and Voltage enhancers.	DC Powr Supply under development. To be shipped by May 2023
Sensor Assembly	Sensors will help vehicle owners understand the system operation and savings it is bringing remotely.	Sensor assembly under development. Dates to be announced for release soon.
Installation Outer box casing	This box houses the entire HFS assembly and keeps it water and dust proof.	Dealer will develop it or order to KiTech based on the vehicle need. To be custom developed or locally procured.
Installation accessories	Cables, Power Points, Relay Switch, Cabin controlled Power switch, Anderson Plugs, etc. that are needed to complete the assembly.	These items will be supplied by Dealer locally. KiTech will include all these items in their Kit after June 2023 based on Dealer feedback.

### Consumables

Consumable Name	Description	Supply Options
Distilled water	Distilled water is the main consumable that needs to be filled in Water tank and bubbler from time t time	To be procured locally by the Dealer & customer.
Potassium Hydroxide	KOH pellets are needed once when system is primed. After that when	To be procured locally. KiTech can supply KOH

Pellets	water is changed, it is reused as per the instructions.	pellets to Dealer on demand.
---------	---	------------------------------

## Spare/replacement parts

All parts are covered under warranty for 12 months and any fault due to the fault of the unit or dealer will be replaced free of cost. No charges for service will be levied as well.

Repair of damage beyond the warranty terms, even within warranty period will be charged to the customer. This includes the service cost to repair the unit.

Customers can buy extended support from the dealer directly.

Spare Part	Description	Supply Option
Water Pump	In case the pump is not working	Free within Warranty
Electrolyser	K20, 30 & 40 electrolyser	Free within Warranty
Bubbler	In case bubbler is broken or leaking	Free within Warranty
Water Tank	In case the water tank is leaking or broken joints.	Free within Warranty
DC Power Supply	In case the power supply is faulty	Free within Warranty
Sensor Assembly	Optional item	Free within Warranty
Fittings	On demand	Free within Warranty



## Glossary

Term	Meaning
HFS	Hydrogen Fuel System
Unit	This is another term used for full functioning Hydrogen fuel system working as a unit.
V	Volts
Amps	Current in Ampere
KOH	Potassium Hydroxide
HHO	The gas that comes out from the electrolysis of water from the electrolyser. This consists of 67% of Hydrogen in volume and 33% of Oxygen and very small quantity of Nitrogen.
DC-DC Power Supply	Direct Current to Direct current. This refers to power supply that takes input from vehicle battery that is rated at 12V, but can fluctuate between 12 to 13.8 Volts during charging. The output is stable DC of 12 V or any other voltage that is set in the system without any fluctuations.
Electrolyser	It is the heart of the Hydrogen Fuel System that uses DC power supply to break Distilled water into Hydrogen & Oxygen.