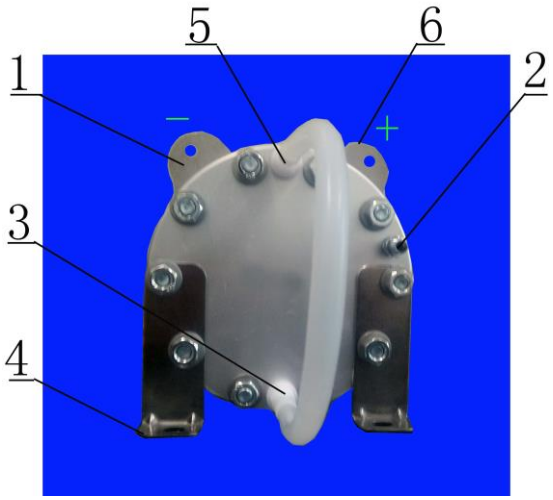
Titan EZ Series Electrolyzer Cell Stack

Operational Instructions (Titan EZ-1300)

1. Introduction

Titan EZ series electrolyzer cell utilizes a PFSA based solid polymer electrolyte membrane as the separator between the anode and cathode electrodes. The electrolyzer cell produces hydrogen (at the cathode) and oxygen gases (at the anode) by splitting the pure water molecules via electrolysis reaction over an oxygen evolution catalyst at the anode side. It features high current density, low electrolysis voltage, and high electrolysis efficiency etc.

2. Product



1.Negative Electrode

2.Hydrogen & Water Outlet

3.Anode Water Inlet

4.Support Frame or Mounting Plates

5.Anode Oxygen & Water Outlet

6.Positive Electrode

3. Instructions for operating the cell/stack

Step 1: Remove the sealing film and plastic pipe on the “Hydrogen & Water outlet” (labeled with 2 on the image above), “Anode Water Inlet” (labeled with 3 on the image above) and “Anode Oxygen & Water Outlet” (labeled with 5 on the image above). Then, position the electrolyzer stack in the vertical orientation where the mounting plates are making 90 deg (see image above) with the surface it is standing on (such as bench or table), there will be a small amount of liquid DI-water flowing out from either #2, #3, and #5 labeled ports.

Step 2: Fix the electrolyzer stack in a suitable position, which is the vertical orientation where the mounting terminals are pointing upwards and mounting plates

and #3 port is pointing downwards (as shown in image above). The physical orientation of the cell is critical in order to ensure liquid DI-water transferred to the anode is being fed from the bottom port (#3) and it is flowing towards the top position. This orientation would enable the liquid water to stay inside the cell at the anode side and keep the anode surface fully wetted and allow the O2 gas to escape from the top position.

Step 3: Connect the “Anode Water Inlet” port (labeled with 3 on the image above) with outlet of water tank with a soft or flexible silicone hose or silicone tubing (Φ6×9). If there are no fluidic pumps used by the operator, then keep water tank at a higher spot compared to the electrolyzer cell stack where the gravity and water pressure from the tank will bring the liquid water into the “Anode Water Inlet” port. Please ensure that anode side of this electrolyzer cell is not rated for any kind of backpressure or the anode side should never be pressurized internally to prevent damages to the electrolyzer cell and maintain a safe operation.

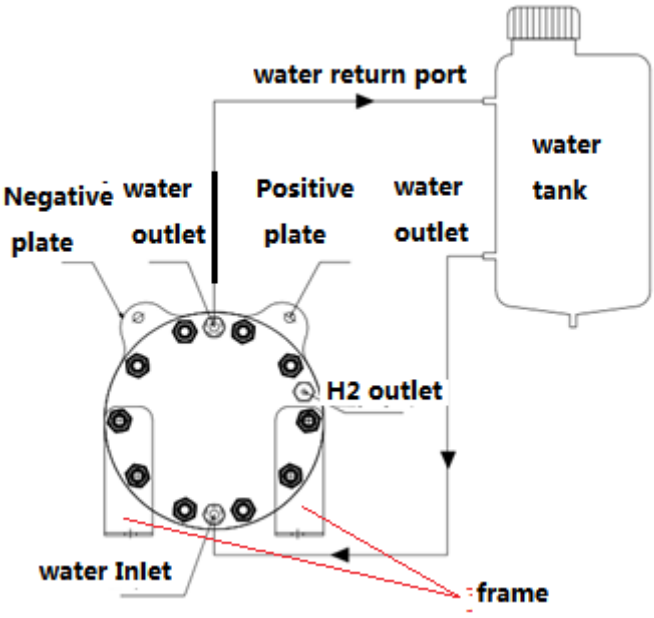
Step 4: Connect the “Anode Oxygen & Water Outlet” port (labeled with 5 on the image above) with top inlet of water tank with a soft or flexible silicone tubing or silicone hose (Φ6×9). This will enable the recovery of the unused or unconsumed water from the anode side back into the water tank for later use. Oxygen gas generated at the anode side can be vented out from the top venting port of the water tank or transferred to another device for its consumption. Anode side of this cell or stack should never be pressurized for its safe operation.

Step 5: Connect the “Hydrogen & Water Outlet” port (labeled with 2 on the image above) with the inlet of a user identified or user selected gas/liquid phase separator to separate hydrogen out from water or moisture on the cathode stream. The hydrogen port nut 1/8inch diameter size and it is user’s responsibility to establish a compatible transfer pipe or transfer tube to the outlet of the gas/liquid phase separator and then collect the dried hydrogen for storage in another vessel or directly consuming it in another device.

Step 6: Please ensure that the user-identified or user-selected DC power supply is completely turned off prior to making the electrical connections between the DC power supply and terminals of the electrolyzer cell/stack. Connect the “Positive Electrode” tab (labeled with 6 on the image above) with the positive lead of a user identified or user selected DC power supply and tighten it with a M6 screw or bolt. Then, connect the “Negative Electrode” tab (labeled with 1 on the image above) with negative lead of the DC power supply and tighten it with M6 screw. Please ensure DC power supply leads are well connected with the respective leads or terminals of the electrolyzer cell/stack so they are not loose at the connection point in order to prevent resistive heating and electrical burn out issues. It is always advised to operate the electrolyzer cell/stack under constant current mode.

Step 7: Add deionized water (16-18 MegaOhms for its quality) or distilled water (2 MegaOhms or higher for its resistance) to water tank and wait about 5 minute or until there is water coming out of the "Anode Oxygen and Water Outlet" port (labeled with 5 on the image above). The DC power supply should be energized after seeing water is coming out of the anode outlet otherwise, the membrane electrode assembly inside the electrochemical cell be damaged due to dry operation of the cell.

Image below is given as a reference of the users for how to make connections and placement of the water tank relative to the electrolyzer stack for gravity-fed operation.



4. Requirements for DC Power Supply and Water Supply

Product Model	Titan EZ-1300
DC Power Supply Current Range	1. A DC power supply with current capability of 0-50A would be sufficient to operate this product. 2. Operate the DC power supply in the CONSTANT CURRENT mode. 3. Input Electrical Current Range for Nominal Operation: 0 - 36A (DC current) 4. This cell is not rated to be operated at input current of >40A for safety reasons. The user is strongly advised to limit the electrical current at the power supply side to less than 40A in order to prevent complete damage to the cell and its components. The preferred nominal operating

	current range is 0 to 36A.
DC Power Supply Voltage Range	A DC power supply with voltage capability of DC 15-20V would be sufficient. *Voltage input to the electrolyzer cell stack needs to be limited to less than 2-2.1V per cell or 10V-10.5V for the entire stack.*
Stack Diameter	138mm
Working temperature range	5-40 deg C
Water requirement	1.Deionized water (16-18 MegaOhms for its resistance) or distilled water (2 MegaOhms or higher for its resistance) 2. From a conductivity aspect, Deionized water or distilled water with a conductivity less than 0.5µs/cm (microsiemens/cm).

5. Additional Notes

1. Use of other water sources other than deionized water (16-18 Megaohms for its resistance) or distilled water (2 Megaohms or higher for its resistance) is not recommended. For example, use of house water, tap water, reverse osmosis or RO water, drinking water, spring water, salt water, and any other water sources with high concentrations of minerals with this electrolyzer unit would permanently damage this electrolyzer cell/stack via poisoning of the anode electrocatalyst layer and non-proton based cation exchange of the membrane component.

2. Always make sure there is sufficient deionized water or distilled water in the tank and inside the electrolyzer cell/stack prior to biasing with a DC power supply. One way to make sure is to see a flow of liquid water coming out of the anode outlet (which is labeled with 5 on the image given in page 1 of this document).

3. When the electrolyzer cell or stack is not in use or being stored, the user should always add small amount of water into the cell to maintain the hydration of the membrane component, so it does not develop mechanical or physical tears. After injecting this small amount of water, a soft or flexible silicone tubing can be used to connect the anode outlet and anode inlet to each other. Please ensure that the cathode outlet (or hydrogen outlet) is also capped off with a capped plug or a stopper plug.

4. This electrolyzer cell/stack should be stored above freezing temperatures up to 40 deg C. Storing this product below freezing temperatures will permanently damage

the membrane component as a result of ice crystals forming physical tears inside the membrane itself.

5. During regular use, DI-water or distilled water sources should be drained completely in order to prevent ion build up inside the cell where the concentration would be detrimental to the cell components. On a weekly basis, the entire water volume in the tank and inside the cell need to be replaced with a fresh one.

6. During the operation of the electrolyzer cell/stack, the temperature of the electrolysis unit may increase (which would be a function of the current and water temperature, outside temperature, etc.). This device is rated to a max temperature of 45 deg C for its operation.

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