

## Proper Care of your Double Cell Reversible Fuel Cell

1. Use only **distilled or deionized water**.
  - a. Find distilled water at grocery stores
  - b. Find deionized water at auto supply stores
  - c. Purified water is **NOT** the same thing
  - d. Using water that is not distilled or deionized will result in poisoning the membrane in the fuel cell. It cannot be recovered after this has happened.
  - e. *Using water that is not distilled or deionized will void the warranty on the fuel cell.*
2. Never input more than **4.5 volts** into the fuel cell.
  - a. The optimal amount of voltage is actually 3.2 – 4.0 volts
  - b. 4.5 is a little beyond the recommended range, but it is convenient in that it can be achieved with 3 AA batteries
  - c. Using more than 4.5 volts may work a few times, but will progressively destroy the fuel cell.
  - d. *Inputting more than 4.5 volts into the fuel cell will void the warranty.*
3. For a longer life, store your fuel cell in a **sealed plastic bag** with a moist paper towel.
  - a. Once the membrane in the fuel cell has dried out – it will take longer to achieve optimal performance because the membrane will have to be rehydrated.
  - b. If your fuel cell has been sitting on the shelf for a few months, use the syringe to fill the chambers on both sides of the fuel cell and let it sit for an hour before you try to operate it.
  - c. Your fuel cell will receive **optimal performance after about 5-10 uses** or until the membrane is hydrated, so in competition you will do better if you use a fuel cell that has been run 5-10 times that day.
4. When in electrolysis mode, the **hydrogen should be able to flow freely** into your storage container.
  - a. If it is put under pressure, for example, pushing the plunger in a syringe, it may destroy the membrane.
  - b. Fuel cells operate under very low pressure – less than 2 p.s.i. The membrane is very fragile and even a small amount of pressure can cause permanent damage.
  - c. The gasketing on a fuel cell is manufactured with the assumption that pressure will not be applied to the fuel cell. Too much pressure can damage the gasketing.
  - d. *Using a storage system that requires the hydrogen to provide pressure will void the warranty.*

## Tips on How to Maximize the Power of your Fuel Cell

The fuel cell for the National Middle School Science Bowl is a four-cell fuel cell. You should receive a minimum of 2.8 volts and up to 4.0 volts when the fuel cell is providing electricity to the motor. You can check the voltage of your fuel cell by hooking the leads to a multimeter and take measurements. If you are receiving less electricity than this, try some of the following procedures.

1. During the electrolysis of the water the hydrogen and oxygen produced will displace the water in the fuel cell. Be sure you have allowed as much water as possible to be displaced in the fuel cell during electrolysis. When you begin using the fuel cell each day, it is important to fill the chambers next to the membranes with water. This hydrates the membranes so they can work efficiently and electrolyse. However, when you begin to use the fuel cell as an energy provider, having water on the membrane blocks some of the reaction. The excess water you put into the chamber initially results in a drop in the output of the fuel cell.

We recommend that the first time you use the cell each day, open the input valve that is used for purging (the one not connected to your storage) and electrolyse for about 10 minutes. You might see water coming out of the fuel cell. If you are going to use syringes as your storage container or some other storage that does not allow an overflow of hydrogen to bubble out, you might want to electrolyse for as long as 20 minutes before closing the system.

2. Do **not** add water each time you electrolyse. With this fuel cell it is possible to electrolyse for up to an hour continuously with no visible water in the cell. Only add water when you do not see any hydrogen or oxygen being produced when you connect the battery to the fuel cell. If it is electrolysing, it does not need additional water.
3. Be sure you use only Distilled Water or Deionized Water. Any other water will damage the membrane. Also, be sure that the storage you use is clean. If you use balloons, for example, they must not have any powder in them because the hydrogen will move the powder into the fuel cell causing damage. Make sure your hands are clean!
4. USE your fuel cell. Do not save it for race day. Fuel Cells take some time to become broken in – with all of the membranes saturated and working correctly. A used fuel cell is likely to have more power than a brand new fuel cell – as long as care has been taken to use only clean water and clean hydrogen and oxygen.