

## Fuel Cell Heating Precautions

Revised October 16, 2006

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Most PEM and DMFC fuel cell research applications involve use of a heated cell fixture. This provides a temperature-controlled environment for characterizing fuel cell performance. Use of a heated cell fixture is fully supported for use with all 890 and 850C models. It is, however, important to use a cell fixture that provides proper electrical insulation between the 120 or 240 volt AC heater wiring and the fuel cell's current collector plates. If the heater wiring becomes electrically connected, even briefly, to the test station's main load terminals or sense leads, immediate and extensive damage to the electronics can result. This damage is readily identifiable at the factory and is not covered under warranty.

The diagram in Figure 1 shows the construction of one common type of fuel cell. The current collector plates also function as clamping plates and are fastened together using insulating hardware. An adhesive-backed flat heater is applied directly to each plate for the cell heater function. This type of cell has only one very thin layer of electrical insulation (part of the heater) separating the heater power wiring from the fuel cell's current collector plates. This insulation will degrade over time due to high temperatures and mechanical handling. Only a small spot with the bare heating element in contact with or close to the collector plate is sufficient to cause an arc onto the current collector. The use of multiple insulation layers or grounding mechanisms has been the basis of US and international electrical product safety standards for over thirty years. This cell design doesn't meet this design philosophy since a single fault in the heater insulation can cause a failure.

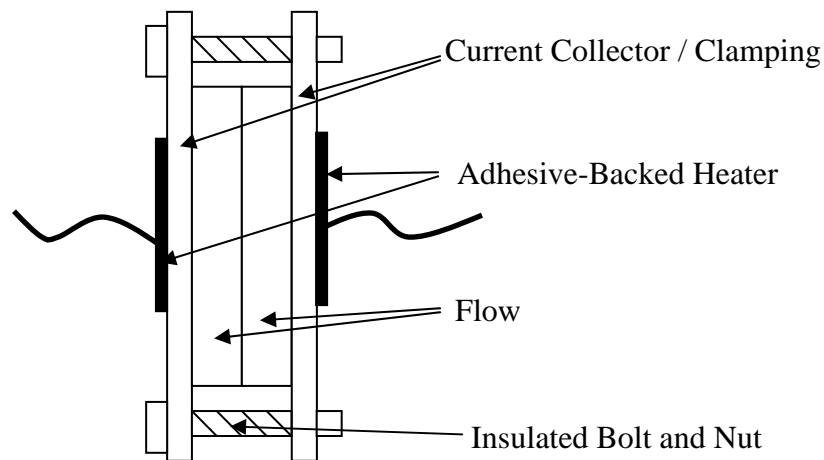


Figure 1 – Cell Design with Poor Heater Insulation

The fuel cell fixture constructed as shown in Figure 2 provides a much higher margin of safety to the user and equipment. Separate clamping plates are used, and these are electrically separated from the current collector plates by sheets of insulating material. This allows the clamping plates to be bolted together with standard, non-insulating hardware. Instead of flat adhesive-backed heaters, cylindrical cartridge-type heaters

are installed in holes drilled in the thick clamping plates. This provides a redundant insulation system protecting the system in case the insulation fails in the cartridge heaters. This is enhanced even further if the cartridge heaters have the outer shell of the heater connected to earth ground through a three-wire cell heater power cord. In this case, a failure in the heater insulation will immediately blow the AC power fuse for the heater circuit so that it is not even possible for the cell fixture to have live AC voltage on it. This type of cell construction with grounded heaters is recommended for all single-cell testing.

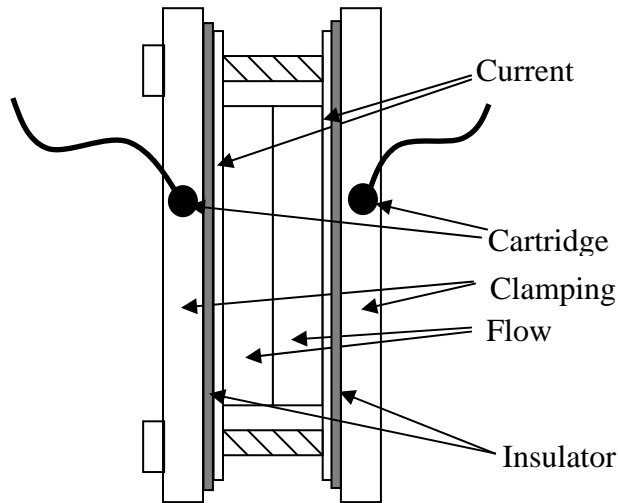


Figure 2 – Cell Design with Better Heater Insulation