

SENIOR DESIGN PROJECT: FUEL CELL TEST STAND ABSTRACT

In this project, our team was tasked with creating a vessel capable of testing a fuel cell and a fuel button cell. We were given free reign over the design of this vessel, but it had to meet certain parameters. We were given the CAD models of a previous vessel design, but it needed modifications in order to work for a button fuel cell. The operating conditions of the vessel that we designed were also different from this previous model. The vessel had to be able to handle an internal maximum temperature of 1,000°C without the outer vessel reaching a temperature above 250°C. The outer vessel had to withstand a maximum internal pressure of 2,300 psi due to the force that could be exerted by a stoichiometric combustion reaction. We decided to use a similar outer vessel design as the previous iteration, but we redesigned the inner vessel completely. To design the outer vessel, we started by hand calculating different affecting parameters such as temperature, pressures, and forces. After the initial calculations were completed, hand-drawn initial sketches were developed and presented. Once we settled on a design, we started modeling the inner and outer vessels in Solidworks. In Solidworks, we simulated a finite element analysis (FEA) of the outer vessel and bolts at maximum pressure to obtain information on the resulting stresses and reactions. We then designed a mechanical seal for the fuel button cells for easy assembly. After all simulations were completed, we started on our bill of materials. More testing of our simulations and approval from professional vessel designers are needed for the system to be completed. When the final product is completed, Tennessee Tech will be able to test the fuel cells for the Air Force.

Fuel Cell Test Vessel Design Team:

Christopher Edwards

Chandler Shelton

Colton Hudgens

Dylan Pearson