Glass-Seal Test Vessel

Motivation
Create testing equipment and procedures to engineer sealing systems on the small particle heat exchanger receiver for high temperature Brayton cycles, it will be a device to transfer the heat of light to the fluid medium in a solar/turbine power plant. The topics that will be tested on various windows and window mounts are: friction coefficient of high temperature seals, hydrostatic pressure with and without heat loading, and heat flux loading.

Background
- A solar receiver transfers the thermal energy from the sun to the working fluid in a concentrated solar power plant.
- This project focuses on the window sealing system which is difficult due to the differences in thermal expansion.

Function and Design
- High-temperature Graphoil gaskets used to seal under heat loading.
- High-temperature and pressure feedthroughs used to pass power and sensing signals through pressure barrier.
- PID controlled heating system.
- ASTM A105 compliant pipe components for safety.
- Finned tube used to drastically decrease heat going through tube coming out of test vessel.
- Heavy insulation around the heating coil and inner chamber and natural convection keep outer surfaced safe at steady-state.

Actual built test vessel
- Test pressure vessel is made up of A36 steel pipe, flange and round plate that were TIG welded together.
- Top plate is a blind flange that has been modified to accommodate test window.
- 5 pipe fitting were TIG welded for electrical feedthroughs, thermocouples, and piping.
- Pressure and Thermal tests performed to validate CAD simulation

Acknowledgements
Dr. Fletcher Miller and the Solar Energy Lab
U.S. Department of Energy SunShot Award # DE-EE0005800