Prototype Design for an Oxygen Liquefier

Overview
The current methods of dealing with the failure of a Pressure Swing Adsorption or Vacuum Swing Adsorption system in an industrial gas plant are either expensive or time consuming. In an attempt to solve this issue, Solutionwerks, Inc. came up with an idea for how the oxygen within the PSA or VSA system can be stored while repairs are being made to the system, which is a unit that can liquefy and store the oxygen. Our task was to analyze their design for the Oxygen Liquefier to see if this idea was feasible as well as size the unit and find the major components that would be used in it.

Objectives
- Conduct a patent and prior-art search
- Create a process and instrumentation diagram
- Calculate heat and material balance
- Create 2D and 3D layout drawings
- Create a scaled model of the final product

Approach
- Reviewed relevant patents
- Analyzed related patents
- Calculated flow rates for oxygen and cooling fluid
- Performed heat and energy balance equation
- Developed a PID
- Developed 3D models
- Fabricated a scale model

Outcomes
- Our goal was to produce 50 gallons of liquid oxygen per day and our design will provide 50.16 gallons/day.
- Our entire system was found to fit a box of 5'x5'x5' which is smaller than expected.
- A finalized PID, shown on the right, explains where pressure release valves, thermocouples, and high/low switches are going to be used in the final product.
- Researching different patents, we did not find any exact matches, even though there were a very similar design.