High Pressure Test Rig Case

Overview
The goal of this project was to design a high pressure test casing which will be used to test low flow coefficient centrifugal impellers. We chose to design an axially split design aimed to minimize the downtime associated with the interchanging of different impellers. The design supports radial flows, while also sealing against a discharge pressure of fifteen-hundred psi to two thousand psi.

Objectives
The main objective was to decide whether an axially split design or a barrel design would be most appropriate given that this is a test rig. Dresser-Rand doesn’t normally design axially split casings for the pressures given to us, which is why we chose this route. Because our goal was to minimize downtime, the axially split design seemed like the perfect design to take.

Approach
- Our team primarily had to decide which design would be better for our design, whether it would be a barrel design case or an axially split case.
- To figure this out, we kept in constant communication with our sponsor, Jim Sorokes, to figure out what exactly he expected out of our group.
- Various concept generation matrices were created including an analytic hierarchy process matrix and selection criteria. From this we saw the axially split design was the better choice.
- We examined a few existing patents and technical paper produced by Dresser-Rand.
- We were able to make an on-site visit to Dresser-Rand’s facility in Olean, NY to get a visual representation of existing designs and applications of compressors and their casings.
- Since we had decided to go with the axially split design, we began to simulate CAD models via SolidWorks to figure out how this design will actually work under its given specifications.
- Because the actual compressor would be far too large and expensive to manufacture, we had decided to create a wooden model of our casing to give a visual representation of what the casing will look like and how it is supposed to function.
- All the testing we did for our design was done in SolidWorks, since we could not possibly simulate in the real life.
- We tested and received values of stress and strain in reasonable levels with a factor of safety at approximately 1.7, which was within the range given by our sponsor; 1.5-2.5.

Outcomes
- The primary goal was to minimize downtime associated with the maintenance of swapping out components from the internal compressor.
- The axially split design costs about $225,000 which is about $55,000 more than the barrel design. Even though the cost is higher to manufacture, Dresser-Rand will still save money overall on the investment because the axially split design cuts down on the downtime by at least half.
- This was crucial for the casing’s testing purposes.