High Pressure Case End for Radially-Split Natural Gas Compressor

Overview
With an increased demand for natural gas, Dresser-Rand determined that it was necessary to design a compressor that operates at higher pressures than are currently supported by existing compressors. Currently, Dresser-Rand manufactures radially-split compressors that have a maximum working pressure of 15,000 psi. They determined it to be beneficial to design a compressor that can operate at a pressure of 18,000 psi. Our team was tasked with designing a case end and sealing solution for a radially-split, natural gas compressor that operates at a working pressure of 18,000 psi.

Objectives
Our main objective was to create a case-end seal joint design that would be able to maintain its structural and mechanical integrity when exposed to high pressures without changing the case thickness. Other objectives include FEA, plastic-elastic analyses, CAD drawings, alpha, beta, and gamma prototypes, and several reports that summarize our progress.

Approach
Completion of our design project occurred in the following order:
- Problem Background/Concept Research
- On-Site Sponsor Visit
- Patent Research/Existing Design Study
- Concept Generation
- Concept Evaluation/Selection
- Alpha Prototype Development/Testing
  - Accomplished with the use of SolidWorks
- FEA Research & Implementation
  - Accomplished with the use of SolidWorks Simulation
    - Transitioned from static to non-linear analysis
- Beta Prototype Development/Testing
  - Improved case end structural rigidity
- Gamma Prototype Development/Testing
  - Continued to improve case end rigidity/strength
- Final Prototype Development/Testing
  - Implemented and evaluated bolt loading and case seal performance
- FEA Evaluation Results/Final Seal Revisions
- Present Results Via Final Report & Design Showcase

Outcomes
In conclusion, the high pressure case end designed for Dresser-Rand by the team will effectively hold working pressures of up to 18,000 psi in radially-split natural gas compressors. The use of FEA software has allowed us to confirm that the case end will operate for its intended purpose. The pressure tests that were ran ensured that stresses and deformations did not exceed to the point of failure.