



Development of a Robust 2nd Stage Oil Sealing Device for Heavy Duty Engines

Cummins Inc. Super Seal

Team 1: Sean Casey, Christian Milione, Jonathan Strickland, Kyle Brooks, Olaniyi Ogunbanwo



Scope: Design a secondary sealing system to increase the robustness of a rear crankshaft seal for heavy duty diesel engines and test the concept through the fabrication of a custom test rig.

Project Background

- Oil repeatedly leaks past crankshaft seal from extensive wear.
- Oil can escape in the form of liquid or vapor.
- Costly to replace rear crankshaft seal in large diesel engines.



Figure 1: Visualization of a failed crankshaft seal.

Objectives

- Design an oil recapturing device.
- Design and develop a test rig to prove the effectiveness of the device.
- Choose a viable sealing option for long-life non-lubricated seal.
- Perform the 24 hour trial on sealing device as set forth by Cummins.
- Measure of success: volume of oil captured exceeds volume of oil escaped.

Test Rig Assembly

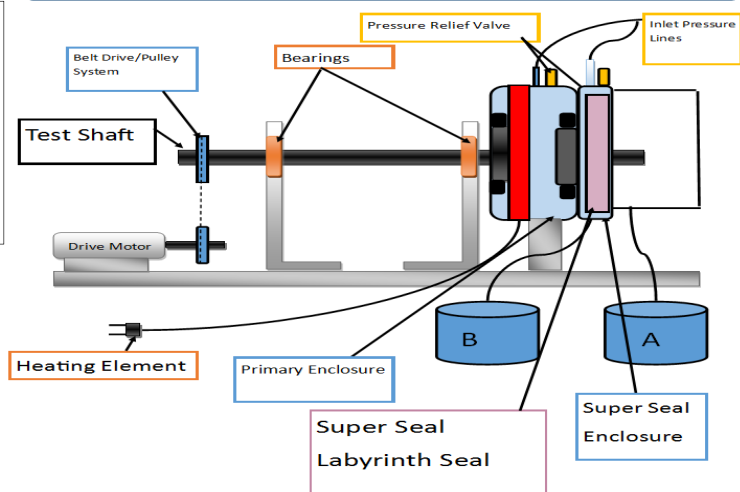


Figure 2: Macroscopic overview of test rig.

Design Concept

- Create a pressurized secondary enclosure with a positive pressure gradient around the rear crankshaft seal.
- Employ a 15 tooth labyrinth seal to ensure no oil leaks past the super seal.

Labyrinth Seal

- Type: non-contact seal.
- Internal teeth cause a pressure drop between each tooth to keep oil from leaking past the seal.

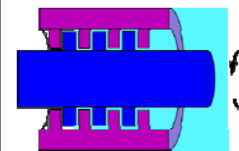


Figure 4: Interlocking labyrinth seal.

Summary

- A test rig was designed to simulate a 15 liter diesel engine.
- Team 1 designed a sealing hardware configuration to increase the robustness of a leaking rear crankshaft seal.
- A 15 tooth labyrinth seal was developed for long life to ensure no oil leaks past the super seal enclosure.
- Labyrinth seal has an air consumption rate to maintain proper chamber pressurization.
- A labyrinth seal designed with 15 teeth yields an air consumption rate of less than 1 liter/second.

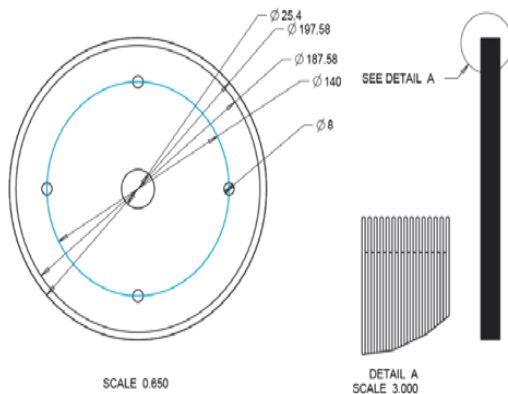


Figure 3: CAD rendering of labyrinth seal and assembly.