Determining the Effectiveness Of Oleophobic Gaskets

Team 1: David Dawson, Heather Davidson, Daniel Elliott, Aruoture Egoh,
Norris McMahon, Erik Spilling

Purpose

Cummins Inc. has proposed a project to determine the effectiveness of oleophobic gaskets to reduce the measured leak rate at low pressure, large joints on engines compared to the current gaskets used on engines.

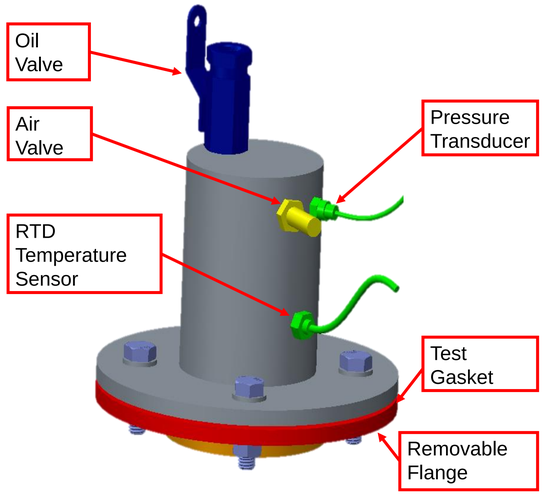
Background

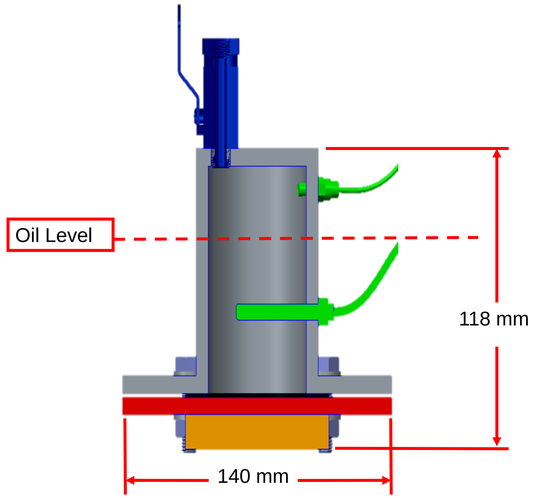
- Oleophobic items are items which repel oil by having a lower surface energy than the oil.
- A gasket is an item which is placed between two flanges to form a seal, which is meant to prevent oils from leaking to the opposite side of the flange.
- The theory behind the project is that if the gasket can repel the oil, it is less likely that oil will be capable of leaking past the gasket.
- Low pressure joints on engines include the oil pan, gear housing, and valve covers.
- Common gasket types that are used in this application include paper and rubber coated metal (RCM).

Objectives

- Research what causes items to become oleophobic.
- Create oleophobic gaskets using on market products.
- Create oleophobic gaskets using non-conventional gasket materials.
- Design and build the test rig to be capable of varying clamping pressure and temperature.
- Test oleophobic gaskets and currently used gaskets for leak rate and compare results.

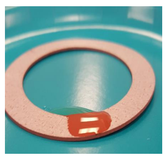
Test Rig Conceptual Design





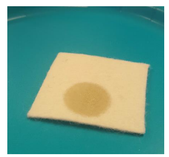
CAD model of the final design for the test rig.

Gasket Testing



Paper gasket before and after oleophobic spray treatment.

RCM gasket before and after oleophobic spray treatment.



High density felt before and after oleophobic spray treatment.

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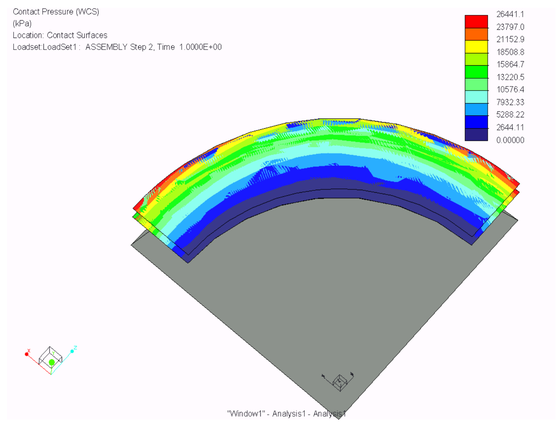
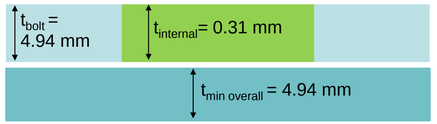
Design Analysis



Gasket clamping pressure distribution based on analysis results that ensures no leak paths running radially through the gasket.

- Flange material: A36 Steel
- Green section: internal stress limited ($\sigma_{max\ internal}$ = 2.5 psi)
- Blue section: clamping bolt pressure ($\sigma_{max\ bolt}$ = 10 MPa)



Minimum thickness calculation for bottom flange.

Future Work

- Compile all necessary drawings to send to the machine shop.
- Creating a standard method for making gaskets out of non-conventional materials.
- Determine optimum oleophobic solution application method across all mediums.