

Modeling a Submarine's Diesel Engine Lubrication System

Case Study Summary

Goal:

Quickly and accurately model the lubrication system of a 16-cylinder submarine diesel engine in AxSTREAM System Simulation

Requirements:

The necessary oil flow rate for adequate bearing, gear and piston cooling and lubrication was required in order to model the system.

Parameters:

$P_{total} = 2 \text{ bar}$
 $T_{total} = 60 \text{ }^\circ\text{C}$
 $\Delta T = 5 \text{ }^\circ\text{C}$

Constraints:

Overall friction power = 1625 W

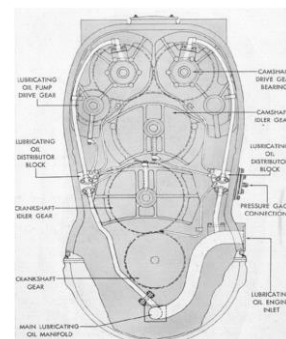
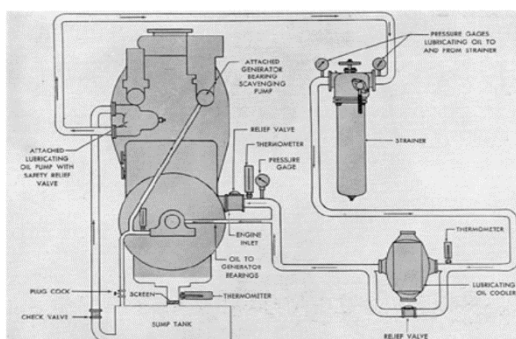
Results of the Study:

A hydraulic and thermal solution for the system was found using AxSTREAM System Simulation:

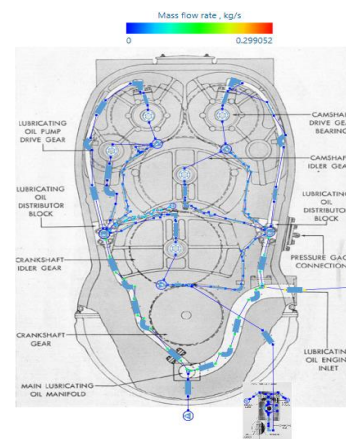
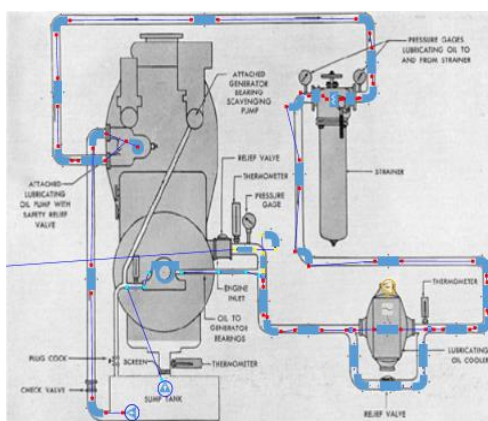
- The resulting total flow rate to ensure proper engine lubrication and cooling is - 0.30 kg/s;
- The cooler was designed to lower oil temp by 5 °C.

Lubrication System for a Submarine Engine

To prevent metal-to-metal contact between moving parts and remove excess heat from the engine, the lubrication system must be carefully considered to ensure a long, reliable life for the various components without wasting oil



For the purposes of this study, the system was divided into two parts: the inner engine lubrication system, which contains the bearings, gear components, pistons, cylinders and camshafts; and the oil supply system which provides oil pressure, filtration, and cooling.



The results from the study can later be used to create a digital twin and further investigate potential issues within the system such as pump aging, pipe clogging, lubrication substitution, component upgrade/replacement, heat exchanger performance, required oil sump volume, and fill level (just to name a few!)