

## A Modelling of Main Bearings in the Two-Stroke Diesel Engine

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**Abstract :** This paper presents the results of the load simulations of main bearings in a two-stroke Diesel engine. A model of an engine lubrication system with connections of its main lubrication nodes, i.e., a connection of its main bearings in the engine block with the crankshaft, a connection of its crankpins with its connecting rod and a connection of its pin and its piston has been created for our calculations performed using the AVL EXCITE Designer. The analysis covers the loads given as a pressure distribution in a hydrodynamic oil film, a temperature distribution on the main bush surfaces for the specified radial clearance values as well as the impact of the force of gas on the minimum oil film thickness in the main bearings depending on crankshaft rotational speeds and temperatures of oil in the bearings. One of the main goals of the research has been to determine whether the minimum thickness of the oil film at which fluid friction occurs can be achieved for each value of crankshaft speed. Our model calculates different oil film parameters, i.e., its thickness, a pressure distribution there, the change in oil temperature. Additionally enables an analysis of an oil temperature distribution on the surfaces of the bearing seats. It allows verifying the selected clearances in the bearings of the main engine under normal operation conditions and extremal ones that show a significant increase in temperature above the limit value. The research has been conducted for several engine crankshaft speeds ranging from 1000 rpm to 4000 rpm. The oil pressure in the bearings has ranged 2-5 bar according to engine speeds and the oil temperature has ranged 90-120 °C. The main bearing clearance has been adopted for the calculation and analysis as 0.025 mm. The oil classified as SAE 5W-30 has been used for the simulations. The paper discusses the selected research results referring to several specific operating points and different temperatures of the lubricating oil in the bearings. The received research results show that for the investigated main bearing bushes of the shaft, the results fall within the ranges of the limit values despite the increase in the oil temperature of the bearings reaching 120°C. The fact that the bearings are loaded with the maximum pressure makes no excessive temperature rise on the bush surfaces. The oil temperature increases by 17°C, reaching 137°C at a speed of 4000 rpm. The minimum film thickness at which fluid friction occurs has been achieved for each of the operating points at each of the engine crankshaft speeds. Acknowledgement: This work has been realized in the cooperation with The Construction Office of WSK 'PZL-KALISZ' S.A.' and is part of Grant Agreement No. POIR.01.02.00-00-0002/15 financed by the Polish National Centre for Research and Development.

**Keywords :** diesel engine, main bearings, opposing pistons, two-stroke

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