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Analysis of Power Demand for the Common Rail Pump Drive in an Aircraft Engine

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Abstract : Increasing requirements to reduce exhaust emissions and fuel consumption while increasing the power factor is increasingly becoming applicable to internal combustion engines intended for aircraft applications. As a result, intensive research work is underway to develop a diesel-powered unit for aircraft propulsion. Due to a number of advantages, such as lack of the head (lower heat loss) and timing system, opposite movement of pistons conducive to balancing the engine, the two-stroke compression-ignition engine with the opposite pistons has been developed and upgraded. Of course, such construction also has drawbacks. The main one is the necessity of using a gear connecting two crankshafts or a complicated crank system with one shaft. The peculiarity of the arrangement of pistons with sleeves, as well as the fulfillment of rigorous requirements, makes it necessary to apply the most modern technologies and constructional solutions. In the case of the fuel supply system, it was decided to use common rail system elements. The paper presents an analysis of the possibility of using a common rail pump to supply an aircraft compression-ignition engine. It is an engine with a two-stroke cycle, three cylinders, opposing pistons, and 100 kW power. Each combustion chamber is powered by two injectors controlled by electromagnetic valves. In order to assess the possibility of using a common rail pump, four high-pressure pumps were tested on a bench. They are piston pumps differing in the number and geometry of the pumping sections. The analysis included the torque on the pump drive shaft and the power needed to drive the pump depending on the rotational speed, pumping pressure and fuel dispenser settings. The research allowed to optimize the engine power supply system depending on the fuel demand and the way the pump is mounted on the engine. Acknowledgment: 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 Nation-al Centre for Research and Development.

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