

Analysis of Various Cylinder Fin Designs for a Small-Displacement Engine Used to Power the Superefficient Prototype Vehicle Eco Arrow 3

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Abstract:

The article presents the results of a simplified analysis of heat processes occurring in the engine of a prototype vehicle participating in an eco-marathon competition. Four fin configurations were examined: the original (75×75 mm), without fins, and two intermediate variants (70×70 mm and 65×65 mm). For the extreme cases, both experimental tests and numerical simulations were conducted, while for the intermediate variants only simulations were performed. The analysis considered solely the case in which airflow was not forced. The measurements enabled the determination of boundary conditions and improved the reliability of the calculations. The results demonstrated a significant influence of finning on heat accumulation, while showing no substantial cooling effect under the analysed conditions. The necessity of maintaining finning to prevent exceeding the critical temperature of 150 °C was confirmed, thereby disproving the assumption that its complete removal would be beneficial. The conclusions provide a basis for further work on optimizing engine design.

Keywords:

Internal Combustion Engine, passive cooling, numerical simulation, prototype ICE vehicle for eco-marathon.